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For Abstract Revisions

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\* The abstracts in the Supplement were prepared by the authors. Their styles and formats were only edited by the Committee. The accuracy, form of citation, nomenclature, and the like, all remain the responsibility of the author.

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## EDITORIAL

Dear Colleagues and Friends,

On behalf of Turkish Sports Medicine Association, we are proud to host 6th. EFSMA European Sports Medicine Congress in Antalya, Turkey; a country founded in Anatolia with a ten thousand year old cultural heritage, acting as a geographic and socio-cultural link between West and East.

The choice of Antalya as the venue of our Congress is to provide a unique ambiance with the incomparable historic presence, natural beauty and cultural charm of this part of Anatolia. We hope that this Congress in the land of pioneers of medicine such as Avicenna and Hipocrates inspires and stimulates you. Surrounded by amazing scenery of sharp contrasts, Antalya, Turkey's principal resort, is an attractive city with shady palm-lined boulevards and a prize-winning marina. Antalya has been continuously inhabited since its founding in 159 BC by Attalos II, a King of Pergamum, who named the city Attaleia after himself.

The Romans, Byzantines and Seljuks successively inhabited in Antalya before Ottomans ruled the territory.

Today, Antalya is a famous tourism center in Mustafa Kemal Ataturk's modern Turkish Republic, providing a premium touristic service mainly to Europe.

We would like to welcome you to share the recent scientific developments in the area of sports medicine. We believe this Congress provides a high quality scientific environment for the presentation of new research and exchange of information by all disciplines related to sports and medicine.

In recent years, the EFSMA has grown and developed into what is now a leading and dynamic force in Sports Medicine in Europe. It is with the same dynamism and expertise that are the hallmarks of a high calibre and carefully arranged scientific programme. A thorough discussion and critical evaluation of the latest advancements in sports medicine are key features of the scientific programme. The sessions, which will include educational courses, state-of-the-art lectures, panel and round table discussions and symposia, also provides an opportunity for all sports medicine health care providers to exchange views on current issues.

Besides the congress we assume that you would enjoy the land of sun, sea, history, culture, sports and humanity.

Abstract evaluation was a difficult task for referees. It showed that there was a great interest among sports medicine and sport science Family to the Congress. From over 400 abstract submissions, scientific commission has rejected 41 papers and sent 30 abstracts back for re-writing. 362 abstracts will be presented either orally or as posters during the Congress. This is the highest number of abstracts so far submitted for EFSMA Congresses.

We hope that the scientific level of the Congress, together with keynote speeches, panel discussions, workshops, courses and regular sessions, will be of satisfactory for all participants.

You will also find the texts of some invited speakers. We are grateful for the support of Scientific and Technological Research Council of Turkey for the publication of this supplement (abstract book) and Journal of Sports Science and Medicine for allowing it to be an indexed material. Our sincere thanks go to Pelin Adaylar for her meticulous desktop work.

Thanking for your interest and attendance.

On behalf of the Organizing Committee

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Congress Secretary  
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Scientific Program Coordinator  
Prof. Rüştü Güner MD

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## 1. INVITED SPEAKERS

### 12 Years impact to health and sport past – presence - future

#### Norbert Bachl

EFSMA-President, Faculty for Sports Science and University Sports, University Vienna

Since the European Federation of Sports Medicine was founded in 1997, EFSMA was developing both in the number of member countries and also in different wide spread sport medicine activities. EFSMA at the moment has 41 member countries, has excellent relations to FIMS, IOC, EOC, ECSS and other international federations and has organized through its member countries - including the European Congress in Antalya - up to now 6 successful European Congresses of Sports Medicine. One very important task is the cooperation with UEMS with the final goal to have sports medicine recognized as a specialty within the EU. EFSMA had applied to create a Multidisciplinary Joint Committee (MJC) of sports medicine within the UEMS and was successful. Then a curriculum for the education of sports medicine was worked out, which was recognized by all the sections and the respective board of UEMS. At the moment EFSMA is active to settle up all the necessary preconditions for the training centres and trainees. From the European perspective 20 European countries at the moment have sports medicine recognized as a specialty and 15 as sub-specialty, within the EU the numbers are 11 for specialisation and 7 for sub-specialisation. To be recognized within the EU, we need two fifths of the EU member countries with the specialty of sports medicine.

Following these achievements, challenges and perspectives for the future are discussed with regard to the areas research, practical sports medicine, education and international relations.

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### Carbohydrate metabolism and performance

#### Clyde Williams and Ian Rollo

School of Sport, Exercise and Health Sciences Loughborough University, UK

Most studies on carbohydrate metabolism and performance have used constant pace exercise. In contrast there are relatively few studies on the impact of carbohydrate nutrition on performance where the individual sets the pace e.g. time trials that simulate 'real life' competition. Therefore, we examined the benefits of ingesting carbohydrate-electrolyte solutions (CHO-E) on self-selected running performance using an automated treadmill that responds to the runner's change in speed without their intervention. In the first study experienced runners ran as far as possible in 1 h either ingesting a 6.4% CHO-E or the same volume of a taste and colour matched placebo. In the CHO-E trial they selected a slightly faster pace and completed a greater distance than during the placebo trial (Rollo & Williams, 2009). However, when the study was repeated after the runners had a high carbohydrate breakfast there was no difference in the self-selected running speeds between the two trials. It has been suggested that the brain monitors the glycogen stores of skeletal muscle by an as yet an unknown signalling mechanism which in turn influences the selection of exercise intensity (Rauch et al., 2005). To explore this idea we investigated the influence of simply mouth-rinsing a CHO-E on self-selected running speed at an exercise intensity equivalent to a rating of perceived exertion (RPE) of 15 and found that not only did the runners select a faster pace but that they 'felt better' (Rollo et al., 2008). Using the 1 h treadmill running protocol we also showed that mouth-rinsing a 6.4% CHO-E solution improves the distance covered by fasted runners (Rollo et al., 2009). Chambers et al. (2009) recently showed, using functional magnetic resonance imaging (fMRI), that mouth-rinsing a carbohydrate solution not only improved cycling time trial performance but also activated the reward centres of the brain. These studies add to the circumstantial evidence that the brain is actively involved in monitoring the carbohydrate status of the individual during exercise and appears to play a role in the self-selection of running pace.

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## Aviation medicine

### Antonio Dal Monte

Former Scientific Director of the Sport Science Institute, Rome, Italy

The Medicine of Aviation is of physiological origin and, curiously did born almost one century before the Aviation itself. The father of the Aviation Medicine is universally recognized the French physiologist Paul Bert (1870) for his experiments in balloon on the effects of barometric low pressure on the human body, but the research of the high altitude did start about at the end of the 18th century. Jaques Charles in the 1783, John Jeffries 1784, Robertson 1803, Gay Lussac 1804, Gustav Tissandier 1875 were only few of the many balloonist that did approach the physiology of the extreme altitude, more than 8000 meters over sea level, and the effects of the very low barometric pressure on the human body. The researches in Aviation Medicine did start with the studies on low atmospheric pressure, but about century later were followed by the other fundamental object of research, the variation of the “g” force. This very important field of research is represented by the variation, both in the reduction or in the increase, in some case very intense, of the gravity force. The experiments on the multiple of the ground gravity did start not in ballooning but with the heavier of the air, the aeroplane. The real aspect of the very severe variation in “g” force did not start for scientific reasons, but, for the pilots... by the need of survive. In fact it was during the first great war 1914-1918, that the aeroplane, few years after his invention (Wright brothers 1903), became a very effective weapon. With the increase of the sturdiness of the airplanes did start the aerobatics, very important in the air battles, and with the aerobatics the high number of “g force”. One of the relevant aspect of the Aviation Medicine is devoted to the study on the “g” force both to the limit of the human structure, as did the American major Stapp with rocket motorized sledge, or to study and realize the devices to help the anatomy of the pilots to withstand so high forces. And, in the same time of the Aviation Medicine, did start also the Sport Medicine with which there has many points of contact and objectives. Both the scientific disciplines does not are applied to sick people but to an healthy population to verify their capacity to comply with the very specific requirement of both the Sport or Flying activities. Another point of contact between the two science is that they uses more or less the same laboratory equipment. An almost new entry in the field of Aviation Medicine is the Antidoping control, according to the guidelines of the WADA, the ubiquitary World Anti Doping Agency. The application of the rules of the Antidoping Control to the aviation activities not is easy or fully applicable. Just an example: the oxygen supply in the Sport activities are absolutely forbidden. In Aviation the prohibition of oxygen condemn to death some kind of Pilots. This is the case of the gliders pilot that, if the meteo conditions are favorable, during their competitions, climbs very frequently at flight levels in wich, without the oxygen supply and without a pressurized cockpits, they cannot survive.

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## Bolt's and Phelp's performances – the attempt of a physiological explanation

### Ulrich Hartmann

Institute for Movement and Training Science in Sports, University of Leipzig, Leipzig, Germany

When looking through the available literature dealing with this topic, it is conspicuous that from an energetic point of view there is no exact knowledge of the stress profile and the energy provision in the various sport events and disciplines.

Based on those physiological coherences a very good assumption and a theoretical frame are given to recalculate the individual performance of an athlete by computer simulation. The 100m Beijing Olympics sprint of Usain Bolt as well as the 200m swimming record and the other competitive races of Michael Phelps are used to calculate and to remodel the physiological frame of Bolt's and Phelp's performance. – Based on video analysis the number, frequency and length of each single step for the 100m distance the Phelp's muscular power output is calculated by the simulation model written above. Also for Phelps the speed over the distance, the arm frequency and the propulsion per stroke was detected; following also for swimming a calculation was proceeded to explain the individual performance by computer simulation.

Assuming realistic variations of performance ability, the variability of the metabolic pattern will be demonstrated. - There is a relatively favourable result of the special metabolic performance ability at a relative oxygen uptake ( $VO_2\max$ ) or a relatively high glycolytic performance, depending of the event and discipline.

The differences between the reactions of the top-level athlete's organism show that a physiological performance assessment which is only based on performance, lactate and possibly  $VO_2\max$  is not very meaningful and can therefore lead to considerable misinterpretations. A sport specific and the metabolism representing simulation of the performance will be shown.

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## Integration of different technology systems for the development of football training

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Over the last few years, research in the field of Sport Science has incorporated the use of new technologies in order to advance the levels of specific knowledge and to find the most appropriate ways to reach the best performance possible. Within this context, and following the criteria of integration of new technologies for the development of training programmes, Real Madrid CF has launched as a top, strategic priority the development of the world’s leading training and performance centre. On the principles of this philosophy Real Madrid TEC-Sanitas, a High Performance Centre focused on innovation in the area of Sport Science using the latest technology and the collaboration of different expertises coming from all over the world, has been implemented with the goal of developing new approaches in the training methodologies area. This advance will produce a modern concept in the control of training with individualized programmes that will develop the performance and the longevity career of all Real Madrid athletes in order to remain competitive in today’s football and basketball landscape. The philosophy of TEC is based on the interconnectivity of different systems and the integration of the results produced by them. Real Madrid TEC-Sanitas is a multifunctional structure designed around different operating labs that through cross-platform activity and interchangeable data analysis optimize performance in the field by committing to the following:

- Submission of full cycle of functional evaluation monitoring the physiological characteristics of each athlete;
- Development of individual training programmes following different aspects (physiological parameters, anthropometric, age, player position, minutes played etc.);
- Convergence between scientific research and technological on-field practical application, in order to conduct athlete studies on all Real Madrid players (professional and youth).

Real Madrid TEC-Sanitas is comprised of the following operating laboratories: Biomechanics, Functional Evaluation, Neurophysiology, Image, Vision, Nutrition, Data Analysis Training Methodology and Research & Development. The Biomechanics Lab is composed by different systems of high technology fully integrated and synchronized between that allow a complete analysis of football player movements. It is composed by 12 cameras monitoring movement along 20 meters, and two high resolution cameras. In the Functional Evaluation Lab there are several systems for the evaluation: isocinetic, encoders, stability board, speed and agility system force platforms, wireless EMG and foot scan. The Neurophysiology Lab is based on Bio-feedback and Neuro-feedback systems. The Image Lab use the data collected from the video match analysis and is developing decision making systems. In the Vision Lab the visual skill training is the main priority through the use of different computerized systems. An intelligent data bases allows the Data Analysis Lab to cross-analyze information and to test correlations, and assess predictability among all parameters of performance. The development of cutting-edge instrumentation, end-user products and training methodologies will become the main objective of Research & Development Lab.

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## Patellofemoral pain: Philosophy behind the problem

M. N. Doral<sup>1,2</sup>, G. Dönmez<sup>2</sup>, U. Dilicikik<sup>2</sup>, Ö.A Atay<sup>1</sup>, A.H. Demirel<sup>2</sup> and D. Kaya<sup>2</sup>

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Patellofemoral (PF) disorders are among the most common problems seen by orthopaedists and sport physicians. But there is still no consensus in the literature regarding the terminology for pain in the anterior aspect of the knee. Thence many terms have been used to describe PF pain disorders including anterior knee pain, extensor mechanism dysfunction, medial facet syndrome, lateral facet syndrome, lateral compression syndrome, patellar malalignment syndrome, patellofemoral pain syndrome, patellofemoral stress syndrome, intra-articular patellar chondropathy, patellalgia and chondromalacia patella. Usually the clinical presentation of anterior knee pain is diagnosed as patellofemoral pain syndrome (PFPS). PFPS can be defined as anterior knee pain involving the patella and retinaculum that excludes other intraarticular and peripatellar pathology. PFPS remains a challenging musculoskeletal entity encountered by clinicians. The most frequently reported symptom is a diffuse peripatellar and retropatellar localized pain, typically provoked by ascending or descending stairs and squatting.

The exact cause and pathophysiology of anterior knee pain is not well-understood. Fulkerson described six major anatomic structural sources of PF pain: subchondral bone, synovial lining, retinaculum, skin, muscle, and nerve. It is accepted that PFPS is multifactorial in origin and many theories have been proposed. A combination of variables, including abnormal lower limb biomechanics, soft-tissue tightness, muscle weakness, and excessive exercise (overactivity theory) may alter tracking of the patella within the femoral trochlear notch contributing to increased PF

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contact pressures that result in pain and dysfunction.

The patellofemoral joint is considered to be one of the highest loaded musculo-skeletal components in the human body. Joint reaction forces that are created within the PF joint in compression and tension with normal activities of daily living are on the order of multiples of body weight. Forces on the patella range from between one third and one half of a person's body weight during walking to three times body weight during stair climbing, to 7 times body weight during squatting, and up to 20 times or more body weight with jumping activities. Therefore the articular cartilage of the patella is the thickest in the body and it can reach 7 mm in the central portion of the patella. However, patellar cartilage is more permeable and more pliable than other cartilage tissues in the body.

Patellofemoral pain has been attributed to excessive stresses associated with abnormal PF joint mechanics. Studies of PF joint biomechanics have focused on force analysis, joint kinematics, and articular contact forces, areas and stresses. Various biomechanical causes of PF pain have been suggested including: increased Q angle, genu valgum, femoral anteversion, external tibial torsion, tenderness of the lateral retinaculum, abnormalities of the shape of the patella, femoral groove morphologic features and forefoot pronation.

In addition, generalized ligamentous laxity, vastus medialis weakness or atrophy and decreased flexibility of the iliotibial band and quadriceps muscles also have been linked with PF pain. The vastus medialis obliquus (VMO) has primary importance, because weakness of the VMO allows the patella to track too far laterally, which increases PF joint stress and subsequent articular cartilage wear. Weakness of hip abductors and external rotators are also recommended to reveal factors contributing to PFPS. These muscles help to maintain pelvic stability by eccentrically controlling femoral internal rotation during weight-bearing activities.

Previously, patients with PF pain often were diagnosed with chondromalacia patellae. Chondromalacia is a degenerative condition of the articular surface of patella. It is not strongly correlated with patellar pain. Studies showed that numerous patients with symptoms consistent with PFPS had no arthroscopic evidence of articular cartilage damage.

Because of the multiple forces affecting the patellofemoral joint, the clinical evaluation and treatment of this disorder still remain the greatest enigma for the sport medical physicians and orthopaedic surgeons. This lecture will address the anatomical and functional biomechanical causes of PF pain.

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## **Patellar dislocations in sportsmen**

### **Ugur Haklar**

Acibadem University, Department of Ortophaedics, Istanbul, Turkey

Etiology of patellar dislocation is multifactorial. Patella alta, trochlear hypoplasia, lateral patellar tilt, TT-TG distance, generalised ligamentous laxity, tight lateral retinaculum, pes planus, decreased femoral anteversion and wide pelvis are among the most common factors. Hip internal rotation followed by tibial external rotation and knee valgus is the usual mechanism of injury. Diagnosis is very easy if patella is still dislocated. But for reduced dislocations anamnesis, physical examination, direct anteroposterior X-rays but more importantly MR imaging becomes more important. Location of pain especially on medial adductor tubercle or inferior lateral wall of lateral femoral condyle, presence of hemartrosis, painful range of motion are among some alerting findings. Whenever suspected primary care consists of immobilization, rest, cold application, elevation followed by removing player from the field. After initial management standart anteroposterior- lateral and Merchant views should be obtained, MR imaging should be completed for further evaluation. As Medial Patellofemoral ligament (MPFL) is primary passive soft tissue restraint to lateral patellar displacement MRI becomes more important for MPFL evaluation. Treatment consists of aspiration of hemartrosis followed by either surgical or conservative treatment. Conservative treatment has high failure rates because of inappropriate patellofemoral positioning it causes patellofemoral arthrosis. Still it can be used for patients with generalised ligamentous laxity. On the other hand surgical treatment is becoming more popular due to low recurrence rates. No standard surgical modality is advocated instead treatment should be individualised according to etiological factor and presence of osteochondral lesions.

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## **Alteration in EMG following angioplasty in a patient with peripheral vascular disease**

### **Yumna Albertus, Jeroen Swart, Robert P. Lamberts, Michael I. Lambert, Timothy D Noakes and Wayne E Derman**

UCT/MRC Research Unit for Exercise Science and Sports Medicine, Department of Human Biology, Faculty of Health Sciences, the University of Cape Town and the Sports Science Institute of South Africa, Cape Town, South Africa

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**INTRODUCTION** Peripheral Vascular Disease limits exercise performance due to claudication pain hypothesised to be caused by ischemia and increased blood lactate concentrations. However, no research has investigated the influence of central regulation and more specifically muscle activity on functional capacity. We report on a patient with a single tight stenosis of the femoral artery. We investigated changes in muscle activity, exercise performance and other physiological variables before and 3 days after angioplasty.

**METHODS** The patient performed maximal voluntary contractions on prior to walking on the treadmill until exhaustion using the Graded Treadmill exercise test (GTET) protocol (walking at a constant speed of 3.2 km·h<sup>-1</sup> starting at a 2 % gradient which was increased by 2 % every 2 minutes until exhaustion). Electromyography, heart rate, brachial blood pressure, rating of perceived exertion, pain score, oxygen consumption and blood lactate concentrations were measured during both trials.

**RESULTS** Most of the patients' measured physiological variables improved after angioplasty. Peak force produced during the MVC by the quadriceps and calf muscles increased by 24 Nm and 19 Nm respectively after angioplasty in the diseased leg. Blood lactate concentrations from the 3<sup>rd</sup> to 5<sup>th</sup> minute post exercise ranged between 2.00 - 1.75 mmol·l<sup>-1</sup> in the Pre - A trial and decreased to the range of 1.75 - 1.50 mmol·l<sup>-1</sup> in the Post - A trial. Muscle activity in the diseased leg was found to increase after angioplasty and to greater activity extent than the asymptomatic leg after angioplasty. Muscle activity in the diseased leg, increased after angioplasty in VL (85 % - 130% max EMG pre and post angioplasty) and LG (90 % - 180 % max EMG pre and post angioplasty), whereas MG remained similar over the trials.

**CONCLUSIONS** The alteration in muscle activity after angioplasty is a novel finding. It can be assumed that these changes in muscle activity could be seen as a readjustment of the central drive to the lower limbs and in the diseased state a possible regulatory mechanism to protect the body from harm.

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## Point-of-care athlete testing, a new approach of sport performance evaluation

**Ioan Stoian**

National Institute of Sports Medicine, Bucharest, Romania

Point-of-care testing is defined as testing performance at or near the sites of training or competitions, in the precise conditions likely to be really experienced. In sport science, usually such tests are not as reliable as laboratory tests, but often have greater validity because of their greater specificity. This is invariably difficult to achieve as there are numerous factors experienced in competition which are near to impossible to replicate in training or testing environment. A combination of regular field based testing (because of the practical, easy and immediate nature of the testing) together with occasional laboratory testing (because of accuracy, reliability and quality) is a good option for most sports.

From many parameters used to monitor trainings we chose acid-base status, for the relevance in reflecting in or post-exercise homeostatic changes. In sport performance, excessive efforts to maintain internal homeostasis in normal limits may have limiting even negative effects on performance capacities. It is possible to appreciate sport energetic requirements (energetic pathways contribution and efficiency in sustaining exercise), functional status in basal / rest conditions and exercise, exercise metabolic costs, post-exercise recovery evolution, using calculated functional indexes. Using an ABL microlab (Radiometer, Copenhagen) the following acid-base status parameters are determined: hemoglobin (Hb), acidity / basicity (pH), partial pressure of carbon dioxide in blood (pCO<sub>2</sub>), partial pressure of oxygen in blood (pO<sub>2</sub>), oxygen saturation (sO<sub>2</sub>), bicarbonate (HCO<sub>3</sub>), actual base excess (ABE), standard base excess (SBE), standard bicarbonate (SBC), alveolar-arterial oxygen tension difference (AaDpO<sub>2</sub>). Blood lactate values are also determined. Based on specific acid-base disturbances, we can appreciate performance capacity, reveal the metabolic costs, and also recovery drive.

The possibility (or ability) of point-of-care testing to be done in various conditions has demonstrated an significant potential to change the way of monitoring training and recovery. However, the lab cannot exactly reproduce the external environmental factors: run and bike – road conditions, weather, hills, wind resistance; rowing, canoeing – water conditions, current, weather, wind, boat friction / water resistance, that athletes experience in training and playing or training locations (even altitude campus). Based on these results, valuable coaching decisions could be taken. It is essential that the coach identifies a reliable, experienced support team of professionals that can manage the details of competition based testing leaving the coach free to coach. In trainings, competition or during rest periods, point-of-care testing can provide the coach and athlete informations about areas of weakness or limitation, about developing and improving performance. These kind of testing respect sport specificity and environmental factors, experience and training status, age and sex. Based on the testing results, it is possible to create the athlete's profile, for training to performance.

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## **Understanding the structure and the biological properties of the articular cartilage**

**Theodora Papadopoulou**

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The structure of mobile interosseal junctions mandatorily includes the articular cartilage (cartilago articulare). The latter has been marked off as an obligatory element in the human body descriptions by anatomists as early as Antiquity and Middle Ages. According to notions adopted at that time, it was described as avascular, inert and bradytrophic tissue incapable of recovery after being exposed to the effect of external factors with ensuing damage. During the current century, the ever increasing interest in researches into the articular cartilage is linked first and foremost to practical medicine – orthopaedics, sports medicine and rheumatology. Over the last decade, it has been constantly subject of unrelenting attention by morphologists, molecular biologists, biochemists, specialists in biomechanics and bionics. Such interest is further stirred up by the fact that it is a matter of structure fulfilling its functions, having an essential practical bearing on joint movements, without being endowed with a number of advantages, characterizing other tissues: e.g. it lacks innervation, blood vessels and lymphatic system. Its properties are based not on the peculiarities of individual cells, but rather on their production; on a complex network of giant molecules situated around the cells proper and building up the extracellular matrix, incorporating some of the longest protein chains produced by cells in nature.

The cartilage covering articular surfaces is mainly, but not exclusively of hyaline type. Its thickness varies depending on the topography, and diminishes with aging. In the small joints it measures about 1 - 2 mm, and in large ones – 4 – 7 mm. Articular cartilage is thicker in the zones of surfaces where the compression forces are strongest, usually in the central portions. In younger individuals, continuous movements result in cartilage thickening. It is avascular except for the deeper layers closer to bones; devoid of nerve branches; not covered by perichondrium or synovial membrane (except for the lateral portions). Normally, it never undergoes ossification, and is built up of cells (chondroblasts) situated within small cavities of varying size (lacunae), surrounded by intercellular substance – intercellular matrix. The intercellular matrix determines the mechanical properties of articular cartilage. During study with conventional light microscope it is homogeneous in appearance. The existence of collagen fibers has been definitely confirmed after the introduction of electron microscopy which contributes to differentiate two types of fibers – thick (with transverse diameter 600 nm) presenting transverse striation at periodicity 690 nm, and fine fibrils thick 400nm in diameter.

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## **Current state of the art and future directions in cartilage injuries**

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Although cartilage defects smaller than 2.5 cm<sup>2</sup> can be treated with conventional methods such as microfracture or mosaicplasty, larger defects require a more sophisticated approach. Autologous chondrocyte implantation and the utilization of mesenchymal stem cells are two avenues of treatment that have become increasingly popular. Although these treatment modalities are indicated for traumatic or osteochondritic defects in young adults, several centers have used these technologies in the treatment of early osteoarthritis. First generation autologous chondrocyte implantation (ACI) entails the transplantation of the patient's cultured chondrocytes in a suspension under a periosteal patch. 15 to 20 year data show a success rate of 73% in isolated chondral defects, most successful being in the femoral condyles, followed by the patella and tibia. Ankle, shoulder and elbow joint applications have been reported. The use of ACI in adolescents and patients with previously unsuccessful cartilage surgeries has also produced satisfactory outcomes. Problems of hypertrophy and delamination of the transplant occur in about 15-42% of the cases and may necessitate secondary surgeries. Second generation ACI utilizes a 3 dimensional resorbable matrix seeded with chondrocytes that can be shaped to fit the chondral defect. Although clinical results are similar, less secondary surgery, more evenly distributed cells, possibility of arthroscopic implantation and easier surgical handling are advantages of second generation ACI. 5-10 year results of second generation ACI are promising. The most frequently reported techniques have been MACI, Hyalograft C and CARES with around 85% good clinical results. Many improvements, mostly experimental, are being made in ACI to achieve better outcomes. These so called 3rd and 4th generation ACI techniques include selective culturing of cells, the addition of growth factors to matrices, use of hydrostatic pressure to improve cell quality, the use of fetal allogenic chondrocytes or mesenchymal stem cells in a matrix for a single stage surgery. The use of chondroinductive matrices to augment microfracture is also promising. The field of cartilage regeneration is evolving at a breathtaking speed and new technologies are constantly being introduced. The merits of each will become clear with increasing clinical follow-up with possible extension of indications to osteoarthritic joints.

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## **Polypharmacy in sport**

**Milica Sinobad, Nenad Radivojevic, Jelena Suzic and Nenad Dikic**

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Sport performance primarily depends on genetic characteristic of the athlete, but as well as morphological, physiological, psychological and metabolic sport specific characteristics. Optimal training can improve physical power, enhance mental strength and make competitive advantage. However athletes very often use different substances in order to achieve better physical fitness and sport performance. Implementation of Anti-doping rules decreases use of prohibited substances, but increases use of different dietary supplements. If we add irrational usage of medications, first of all analgetics, we can resume that polypharmacy is present in sport.

We analyzed data collected from athletes from competitions as well as from out-competition testing from 2005 to 2008. Among 912 athletes (age 23.9±6 years, 72 % male), 1.5% (14) of them (64.3% male (9) and 35.7% female (5) have used ten or more supplements and/or drugs.

These 14 athletes used between 10 to 17 products or 162 different products. Of that number 76.5% (124) were supplements and 23.5% (38) were drugs. In average 8.9 supplements and 2.7 drugs were used. Between 12 -59 single substances have been in products taken by athletes, in average 33.4 per athlete. Vitamins are the most presented substances, in some cases in dosage about 250 times greater than recommended. Most of these athletes took vitamins in 2 or more different products. Minerals, aminoacids and other substances were taken in dosages less then recommended.

Overuse of vitamins and suboptimal dosages of other supplements without clear indications and recommendation show us ignorance of athletes, coaches and medical staff involved in sport. Education, in first place of doctors, then coaches and athletes is a primary goal. But first step should be cooperation of medicine, pharmacy and sport science in order to make strategy and recommendations for use of supplements and drugs in sport.

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## **Nutritional supplements and medications in sport**

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Australian Institute of Sport (AIS) categorized nutritional supplements (NS) in four groups: group A - approved NS, group B - NS under consideration, group C - no clear proof of beneficial effects and group D - banned NS. There are many studies with aim to describe qualitatively and quantitatively NS and medications used by elite athletes. Our group did it in several big competitions, like FIBA Europe, University games, as well as in main international competitions in three years period. In that largest study we have analyzed data collected from athletes (n = 912; age 23,9 ± 6 yrs; 72% male) from national, international competitions and out-of-competition done by ADAS from 2005 - 2008. Among 2535 reported substances 69,7% (1767) were NS and 28,9% (734) medications. NS have taken by 74,6% (3,17 per athlete) and medications by 40,6% of athletes (1.98 per athlete). Almost 21,2 % of all users reported use of 6 or more different products and one athlete took 17 different products at the same time. In group A of AIS classification was 56,3% and from group B, C and D, 14,4%, 32,7%, 2,2%, respectively. Majority of athletes who reported use of medication used NSAID (n = 225, 66%; 24,7% of all examined athletes). More than one NSAID was taken by 22% (50) users. In addition, more frequent use of NS among younger athletes was observed (p <0.05). Our studies confirmed overuse of supplements and drugs by elite athletes. Fact that large number of athletes used supplements with no evident performance or health benefits, demonstrated the need for specific educational initiatives. Amount, quantity and combination of reported products raised concern about risk of potential side events.

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## **Submaximal muscle activity at exhaustion during incremental cycling**

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**INTRODUCTION** It is often assumed that all available motor units in exercising muscle are active at exhaustion, regardless of nature and duration of exercise activity. The aim of this study was to measure skeletal muscle activity during progressive cycling to exhaustion in 15 male trained cyclists during a peak power output (PPO) test.

**METHODS** Muscle activity was compared to that performed during 'maximum' sprint cycling. A further aim of this

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study was to determine if muscle activity at the point of exhaustion is repeatable.

**RESULTS** Skeletal muscle activity at exhaustion was submaximal as compared to EMG activity during a maximal sprint cycle. All six muscles measured in the study achieved peak activation of between 44 % - 65 % of that achieved during a 10 second all-out sprint (all  $P < 0.05$ ), Vastus Medialis (VM; 59 % - 65%), Vastus Lateralis (VL; 54 % - 60%), Rectus Femoris (RF; 44 % - 51%), Biceps Femoris (BF; 42 % - 45%), Medial Gastroc (MC; 40 % - 46%) and Lateral Gastroc (36 % - 44%). The intra-subject variability showed that only a few muscles had coefficient of variation (CV) values less than 12 % at exhaustion. Out of 15 subjects the number of subjects displaying CV  $< 12$  %; VM showed only 6 subjects, VL and MG only 5 subjects, RF, BF and LG only 4 subjects. This is an indication that muscle activity at exhaustion varies from day-to-day.

**CONCLUSIONS** These data suggest that muscle activity at exhaustion has a significant day-to-day variation. Furthermore, skeletal muscle activity is sub-maximal at exhaustion during PPO cycling. The findings support the hypothesis of a central regulation of maximal exercise and confirm that only a certain percentage of the limb muscle mass is active during maximal exercise. These findings are not compatible with the peripheral model of fatigue, as this model assumes that the total muscle mass is active at exhaustion.

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## Low back pain in athletes

### Tolga Saka

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Low back pain has been reported to affect approximately 85-90% of the population at least once during their lifetime. The incidence in the athletic population has been reported to be 1-30% and is one of the most common reasons for missed playing time in professional sports. Unfortunately, the specific etiology of the athlete's back pain often remains elusive. Muscle strain is the most common etiology of low back pain in adolescent, collegiate, and adult athletes. It is also the most common diagnosis in both acute and chronic low back pain.

Many conditions may lead to low back pain. Causes of low back pain include lumbar strains, sciatica, non-mechanical back and/or leg pain, mechanical back and/or leg pain, lumbar spine fractures, abnormalities of the hip joint, damage of nociceptive (pain generating) structures (nucleus pulposus, annulus fibrosus, facet joints, ligaments, muscles, nerve, synovium), intervertebral disk injuries, stress fracture of the pars interarticularis, sacroiliac joint injury/inflammation, lumbar instability, mainly. Malignancy, severe osteoporosis, gynecological and genitourinary conditions should not be missed.

The basic mechanism of injury causing low back pain produces a combined vector of force that may be difficult to analyze in a force diagram. The three basic mechanisms of injury to consider are (1) compression or weight loading to the spine; (2) torque or rotation, which may result in various shear forces in a more horizontal plane; (3) tensile stress produced through excessive motion of the spine. The compressive type of stress is more common in sports that require high body weight and massive strengthening such as football and weight lifting. Torsional stresses occur in throwing athletes such as baseball players and golfers. Motion sports that put tremendous tensile stresses on the spine include gymnastics, ballet, dance, pole vault, and high jump.

The lumbar spine is a highly vulnerable area for injury in a number of different sports. The reported incidence varies from 7% to 27%. Lumbar pain is a big part of many sports, but an organized diagnostic and therapeutic plan can prevent permanent injury and allow full function and maximum performance. With reference to lumbar spine injuries, gymnastics is probably the most commonly mentioned sport. We mostly face lumbar injuries in sports like ballet, water sports, pole vaulting, weight lifting, football, running. In addition, there is a high risk of spine injuries in rotational and torsional sports like golf, tennis and baseball.

Back pain is a common symptomatic complaint in the active and athletic population. An understanding of differential diagnosis, careful history and physical examination is obligatory to pinpoint the back problem. Prevention is very important. Applying this knowledge and experience to a preventative setting such as preparticipation evaluations may allow the clinician to positively impact the development of these often debilitating injuries through prevention.

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## Sport and male sexual function

### Luigi Di Luigi

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The possible links between male sexual function and physical training or sport have mainly been evaluated in terms of exercise-related modifications of the hypothalamus-pituitary-gonadal (HPG) axis and in terms of the possible effects of

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life style on sexuality.

In fact, the main relationships between exercise training, sport and male sexual function that should be discussed are:

- the role of sexual hormones in the adaptation to exercise-related stress;
- the effects of physical training or sport on HPG axis;
- the effects of physical training or sport on sexual health;
- the effects of sexual intercourse on sport performance;
- the effects of prohibited substances (i.e. doping) on sexual health;
- the sport eligibility in male athletes with andrological diseases (e.g. hypogonadism, etc);
- the sport participation and gender modifications;
- the sexually transmitted diseases in athletes;
- the role of sport medicine in the prevention of male sexual disorders in athletes.

It is known that the endocrine system is highly involved in the physiological adaptation to exercise-related stress. Depending on the characteristics of performed exercise and on individual responsiveness, many hormones mediate the adaptive response to exercise-stress (e.g. CRH, ACTH, cortisol, catecholamines, GH, PRL,  $\beta$ -endorphins, and so forth). Many of these also influence the HPG axis.

Whereas it is still not clear if a sexual intercourse can influence sport performance in male athletes, it has been fully established that a moderate training is useful in the prevention and treatment of sexual disorders in general population. Furthermore, increasing evidence points to high intensity endurance training (e.g. running) or specific sports (e.g. cycling) as having detrimental effects on the HPG axis and on male sexual function (e.g. reduced sexual desire, erectile dysfunction). Males chronically exposed to exercise-related stress may exhibit reduced serum testosterone, due to increased peripheral catabolism and/or to decreased production. Such an "exercise-hypogonadal male condition" is characterized by stable, reduced, serum free and total testosterone without concurrent LH elevation, and is reported as being detrimental to both health and performance. The reduced serum testosterone levels (e.g. male hypogonadism) can be associated to sexual and not-sexual symptoms in athletes (e.g. reduced sexual desire, erectile dysfunction, anaemia, osteoporosis fractures, depression, and so forth).

Apart from being a symptom of hypogonadism, an inhibited sexual behavior (e.g. decreased libido, loss of erection) in eugonadal athletes could be also considered as a physiological mechanism of adaptation to exercise-related stress and might represent one of the biological effects of stress hormone mediators involved in the endocrine response to training-related stress. Besides the exercise-stress related "physiological inhibition" of sexual arousal, the neuro-endocrine and metabolic modifications induced by intense exercise training, the effects of the type of sport on male reproductive axis (e.g. cycling on genitalia) and many prohibited substances (e.g. androgenic anabolic steroids, amphetamines, diuretics, beta-blockers, and so forth) can induce male sexual disorders in athletes (e.g. altered sexual desire, erectile dysfunction).

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## Tendon plasticity

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Tendons that provide movement by transferring the contraction force that have been emerged by muscle contractions, are consist of a systematic packed organization of connective tissue primarily by collagens type I foremost, type III and IV and extracellular matrix protein. While tendon is completely different from the muscle in terms of physiological and histological, it can not be considered as independent from the muscle and when it is evaluated they are assessed together with musculo-tendinous unite.

From the past to the current date, intensive studies were performed upon the physiology of the muscle and introduced how the muscle changes depend on mechanical loading, disuse and ageing. However, the data accumulation regarding tendon was extremely limited until the last 10-20 years and their results were in contradiction with each other intensively. The reasons that have been placed under this issue are, the studies were made usually in vitro and structural, mechanical and chemical features of tendon were evaluated one by one.

As a matter of fact, while very fast and specific responses exist in the muscle, which is the part of musculo-tendinous unite, to mechanical loading and unloading; it is impossible that tendon can stay without responding against this situation. Tendons do not have an inflexible structure like steel, and thanks to the included elastin they can stretch in specific measurements. Recently, evaluations, which were performed by ultrasonography (USG) and magnetic resonance imaging (MRI) as in vivo, introduce that some changes existed in tendons, similar to the muscles as response to the physiological changing.

Tendon morphology and compatibility have been studied as in vivo techniques (USG, MRI), recent years. These studies have increased in parallel to the development of space technology, and thanks to these studies it has been introduced that tendons are not stabile against exercise and zero gravity environment, and on the contrary they react.

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Although tendons react against these situations by changing their interior structure, especially suffering to exercise especially during the growth era, introduced that they could display hypertrophy. Under the lights of these studies, we have been realized;

1. Mechanic features, stiffness and Young modulus of tendon decrease by the affect of ageing, in other words tendon becomes more compliant,
  2. These changes that have been caused by ageing are prevented partially by performing exercises (up to 70%),
  3. Disuse and spinal cord injuries cause reducing of the mechanical features of tendon,
  4. Right after performing of acute exercise, synthesis of tendon collagen speed and collapsing increase. While this increasing is characteristic in males, it is limited in females.
  5. Estrogen hormone in females is the most important factor that pressurizes production speed increasing depends on exercise. Increasing of tendon diameter after menopause and decreasing of collagen production speed in females taking birth control pills, are the important indicators that support this situation.
  6. While tendon diameters are larger in males that perform regular exercise in comparison with the males, who do not perform regular exercise, the same situation can not be discussed in females.
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## **Immunological responses to exercise**

### **Maria João Cascais**

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The evidence of the changes in immune system with exercise is generally derived from two sources: laboratory based investigations and epidemiological studies.

For some years there is considerable evidence that exercise of high intensity and long duration is associated with adverse effects in immune function, and low intensity exercise appears to be beneficial for immune system.

Those observations were based in the results of laboratory evaluation of the number and qualities of the cells of the immune system, that appear to be enhanced by the exercise. That is to say, that the number of natural killer cells and circulating lymphocytes are augmented in low intensity exercise, and the high intensity exercise makes a decrease in circulating immune cells.

For a long time we have tried to explain the changes with other another view keeping in investigation the plasma glutamine and cytokines considering the exercise as a kind of inflammation, without all the deleterious effects of this particular aspect of our metabolic pathways.

The other face of exercise has to deal with mind and emotional changes we can see in our athletes through the seasons of training and competition and along the years as they grow, and somewhat, grow older too. This makes us understand that sports are much more than muscles, bones it takes a lot from brain also.

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## **Molecular basis of muscle hypertrophy and repair**

### **Geoffrey Goldspink**

Departments of Surgery, Anatomy and Developmental Biology, University College Medical School, Royal Free Campus, University of London. UK.

It has been appreciated for some time that skeletal muscle is a very adaptable tissue and that exercise training can be designed to produce greater muscle mass and strength and/or fatigue resistance. With the emergence of molecular biology methods it has been possible investigate the genes responsible for physiological changes when muscles are subjected to different types of activities. Shortly after the start of resistance type exercise the IGF-I gene is spliced to MGF (IGF-IEc in the human) and this involves a "reading frame shift" which results in a different C terminal peptide to other types of IGF-I but all have the main globular part of IGF-I. This unique MGF peptide acts as a separate growth factor which initially activates the muscle satellite (stem) cells to replicate. These are important because after embryological development there is no further increase in nuclei by mitotic division once the muscle fibres have formed. The extra nuclei required for muscle growth, adaptation and repair comes from the fusion of activated muscle satellite (stem/progenitor) cells with the muscle fibres. Following the initial splicing to MGF the IGF-I gene is later switched to IGF-IEa which is the main anabolic agent and initiates this fusion and the expression of myogenic genes. As well as replenishing the muscle stem cell pool the unique C terminal peptide of MGF has also been found have a role in limiting tissue damage including protective against oxygen free radical damage in non muscle tissues including the CNS. Unfortunately, as we grow older we become less able to produce MGF. Also in diseases such as muscular dystrophy and ALS there is impairment that results in the ability to produce MGF and to replenish the muscle satellite (stem cell) pool and maintain muscle and motor neurons. From a physiological point of view this is interesting as the

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initiation of the activation of the IGF-I gene and the switch in splicing to produce MGF must involve a mechano transduction system. The detection of mechanical strain is thought to involve focal adhesion kinases (FAKs). It seems that as we grow older that this system becomes less sensitive because of the decreased compliance of the tissue due to cross-linking in the connective tissues. In some animal experiments we showed that regular exercise improved muscle compliance during ageing but it was still not as good as in young mouse muscles. However there are good prospects for its use as a therapeutic compound for treating age-related muscle loss muscle as well as muscle cachexia in a range of diseases. Unfortunately, there seems to be more interest in its use as a doping agent as it is available over the internet and it is now being produced using recombinant E coli methods and therefore it will become relatively inexpensive.

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## **Entrainment with bio-informative time patterns to optimize tissue regeneration and performance**

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In the field of life sciences, the interaction of time and space pattern in living cells and its rhythmic order from macro scale to nano scale are in the focus since years. Inspired even by Albert Einstein "Life without rhythm does not exist." we asked from the clinical side:

1. How far tissue function is in general and especially tissue regeneration and performance dependent from the organisation of biological, body intrinsic time patterns (brain rhythms, breathing rhythms, heart-rhythm muscle rhythms, cell rhythms etc.)?
2. Are there specific rhythms in the body ordering and organising these 50 trillion cells of a human organism the whole life span.
3. Is it possible to entrain time pattern from outside the body for therapeutic reasons?

Regarding body rhythms as a result of coherent single cell function, we analyzed especially those of the skeletal muscle because it is with 45% mass the hugest organ of the body. Oscillating in the range of 8 -12 Hz (alpha-rhythm of the brain) the whole life span, we studied the physiological and pathophysiological meaning of pulsations and rhythms for muscle function down to the level of the environment of the cells, the Extracellular Matrix. [1, 2, 3, 4]

We found, that symptoms are correlated to a loss of order in time (rhythm) and space (morphological structure) pattern and can be seen as mismanagement of the "logistic processes" on the level of cells.

In consequence the idea was born, to construct an apparatus, to synchronize and to readapt harmonically the cellular processes to its normal from outside the body, similar to starter of a cars engine.

How tissue regeneration even in worst surgical cases as well as performance in sports increases by using this entrainment-method will be presented.

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## **Fatigue during exercise: Possible mechanisms and recovery strategies**

**Mitat Koz**

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Training in its simplest form represents acute challenges to the body intended to optimize chronic improvements in physiological capabilities. Today athletes in many sports carried out intense training 2-3 times per day. These trainings lead to fatigue and stress. Limited time for recovery between games and training can have a negative effect on

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performance. The repetitive and intense trainings, the hassle and stress of travel increase the risk of “over-reaching” or “burn-out”, whereby athletes lose “form” and enter an underperformance spiral.

Although athletes spend a much greater proportion of their time recovering than they do in training, recovery is one of the least understood and most underresearched constituents of exercise-adaptation cycle. Strategies that optimize recovery after physically intense competitions and trainings are essential to enhance, or at least maintain, performance in subsequent sporting events (training and competition). Different recovery strategies such as hydrotherapy, compression garments, exercise, massage, diet and ergogenics, and combined methods are investigated and now routinely implemented by teams and athletes after competition and training. Restoring of body fluids, minerals and energy sources via diet and ergogenics can aid recovery. Some relief from muscle soreness may be achieved by means of a warm-down or exercise. But there are studies that active and passive recovery yielded similar effects on performance too. Massage, cryotherapy and alternative therapies have not been shown to be consistently effective, but the potential psychological benefit of massage on recovery should not be discounted. Contrast water immersion has become one of the most common recovery modalities among elite athletes. Thus hydrotherapy regimens can replace conventional physical training in the days after competition or training.

Although recovery from training is one of the most important aspects of improving athletic performance effective training recovery strategies have not been fully elucidated, and may prove to be specific to the individual athlete and to the point in the competitive season. It can be concluded that optimizing recovery post-exercise depends on a combination of factors that incorporate consideration of individual differences and lifestyle factors.

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## **Vibration and performance**

### **Ayse Kin-Isler**

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In this paper the effects of vibration as an exercise and training method on human body will be evaluated. For this purpose responses of muscle spindles and motor units to vibration, effects of acute and chronic application of local and whole-body vibration on neuromuscular performance, flexibility and balance will be examined.

Vibrations are mechanical oscillations that is produced either by regular or irregular periodic movements of a body about its resting position. The extent of the oscillation determines the amplitude of the vibration which is the peak-to-peak displacement in millimeters (mm) and the repetition rate of the cycles of oscillation determines the frequency of the vibration in Hertz (Hz). Vibration applied to a muscle belly or tendon elicits a reflex muscle contraction named as the Tonic Vibration Reflex (TVR). When muscles are exposed to vibration, they exhibit TVR in the form of a gradually increasing involuntary contraction. A few seconds after the application of vibration, the involuntary contraction begins, increases gradually and stays at a relatively constant level until the vibration ends. TVR results mainly from the vibration induced activity of the muscle spindle Ia fibers.

There are two methods of applying vibration to the human body during exercises. In the first method which is called local vibration, vibration is applied directly to the muscle belly or tendon or the muscle being trained by a vibration unit. In the second method which is called whole-body vibration (WBV), vibration is applied indirectly to the muscle being trained. That is vibration is transmitted from a vibrating source away from the target muscle through part of the body to the target muscle. This method usually requires vibrating platforms for the transmission of the vibration.

In recent years, vibration has attracted a great deal of interest in the field of sport and exercise science as a special method of exercise or training. Some studies in the literature indicate that vibration exercise or training resulted in improved neuromuscular performance while others found no effect. The reasons for discrepancies between studies will be discussed with respect to different methods of vibration application (local vs WBV), vibration characteristics (amplitude and frequency) and duration of vibration (short vs long; acute vs chronic) within this presentation.

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## **Biochemical parameters in performance testing: Validity and limitations**

### **S. Oguz Karamizrak**

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Most research in sports medicine involves the analysis of biochemical parameters in a laboratory or field test setting. No consensus exists regarding the standardization of such tests. To further complicate the outcome, the variation in biochemical analyses is appreciable. Systematic causes of error will be discussed in this short presentation, with emphasis being given to lactate testing, overtraining assessment, and measurement of main metabolic parameters. A review of genetic markers is beyond the scope of the present analysis.

In general, the analytical processes are influenced at the biological material collection, storage, transport, and

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preparation stages. The sport biochemist should be aware of pitfalls in this phase, for parameters used in following training, diet, and performances of athletes, to avoid data misinterpretation. The right choice of anticoagulants, the preparation of specimens for hormone testing, and for labile molecules such as cardiac markers, lactate, cytokines, micronutrients and antioxidants is crucial. Influence of physical exercise, biological rhythm, overtraining and infection on biochemical parameters should be taken into account.

Plasma volume changes during and after exposure to severe exercise and environmental conditions might result in haemodilution or haemoconcentration. Thus, it becomes important to consider the level of these changes in assessing plasma constituents' levels as indicators of training adaptation. Acute long distance running, bicycle ergometry, and swimming exercises are known to cause haemoconcentration at the end. Endurance training has been shown to cause long term expansion of plasma volume. To further confound the issue, plasma volume changes are associated with heat acclimatisation, hydration state and physical training changes. It appears sensible to monitor blood haemoglobin, haematocrit, and plasma protein levels.

VO<sub>2</sub>max, LT, OBLA and VT correlate with endurance performance, and are used to prescribe training loads, and monitor adaptation. Tests differ in terms of starting and subsequent work rates, increments and duration of each stage. LT concepts are integrated within the 'aerobic-anaerobic transition' framework. They fall into three categories: use of a fixed BLA, detecting the first rise in BLA above baseline, and threshold concepts detecting either the MLSS or a clear change in the BLA curve. The analysis of BLA response to incremental exercise may vary due to the nature of blood sample and the treatment of data graphs. Peak power output is reduced in longer staged tests, whereas VT or LT occur at higher absolute work rates with shorter staged tests. Sports scientists should consider these factors, and use protocols mimicking the actual competition.

Over-trained athletes usually present an impaired anaerobic lactacid performance and a reduced time-to-exhaustion in high-intensity endurance exercise testing. Lactate levels are slightly lowered during submaximal performance, resulting in an increased AnT. Although measurements of resting blood urea, uric acid, ammonia, CK, and serum free testosterone to cortisol ratio may serve to reveal circumstances which impair exercise performance, they are not useful in the diagnosis of established overtraining. Chronic myocyte alterations may cause plasma myoglobin, troponin I and CK increases. Monitoring reactive oxygen species' activity might be a good tool for skeletal muscle metabolic stress level evaluation.

Metabolic schemes studied in relation to overtraining are linked to CHOs, BCAAs, glutamine, polyunsaturated fatty acids (PUFA), leptin, and proteins. A higher BCAA oxidation might favour free tryptophan's entry into the cerebral area, enhancing serotonin synthesis. BCAA supplementation before and after exercise decreases exercise-induced muscle damage and promotes protein synthesis. Higher circulating glutamine oxidation might cause immunosuppression. The amount of TAG produced is monitored by controlling the composition of fatty acids via stearoyl-CoA desaturase action, the control of this enzyme and lipogenesis by the inhibitory effect of dietary PUFA, and the interaction of PUFAs with specific transcription factors, which maintain the balance between oxidation and storage of lipids. There is some evidence that plasma leptin is more sensitive to training volume changes than specific stress hormones.

Exercise anaemia might also predispose the tired athlete to overtraining by lower inflammation reactivity of hepatic/muscular proteins. Iron in the body can be used as a marker of both adaptation to training and as an indicator of acute inflammatory response to exercise. Clinical measurements of serum iron, transferrin, ferritin and the acute inflammatory protein alpha 1-antitrypsin can be used to differentiate between an inflammatory response to tissue damage and infection.

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## **Do mouth guards have negative effects on athletic performance of athletes?**

**Cem Cetin**

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Many types of sports activities put participants at risk of orofacial injury and concussion. Epidemiological studies have reported sports activities as one of the main etiological factors for the dental trauma. Furthermore, the highest risk of dental trauma appears to occur to professional athletes. Maxillofacial injuries do not occur only during competition. Up to 25–30% of these accidents occur during training sessions.

Mouth guards have been determined to be the most effective way of preventing dental injuries. Three types of mouth guards are available: (i) stock mouth guards, which are prefabricated in different sizes; (ii) boil and bite mouth guards made from a thermoplastic material, and immersed in hot water and formed in the mouth of the athlete; (iii) custom made (CM) mouth guards made by dentists on a model of the patient's mouth.

The American Dental Association and the International Academy of Sports Dentistry currently recommends that mouth guards be used in 29 sport or exercise activities. These include acrobatics, basketball, bicycling, boxing, equestrian events, extreme sports, field events, field hockey, football, gymnastics, handball, ice hockey, inline skating, lacrosse, martial arts, racquetball, rugby, shot putting, skateboarding, skiing, skydiving, soccer, softball, squash, surfing,

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volleyball, water polo, weightlifting and wrestling.

Although mouth guards have been shown to protect against orofacial injury, many players do not wear them during training and competition. The major reasons cited by the athletes for this are discomfort and difficulty in verbal communication and breathing. Another worry is that mouth guards will interfere with their athletic performance.

From a psychological point of view, any protective device should not negatively affect maximum exercise capacity, i.e., the athletic performance. Effects of mouth guards on performance of athletes measured in various studies included muscle strength, visual reaction time; sprint and jumping ability, VO<sub>2</sub> max and arterial lactate etc... Most of the current studies about physiological effects of wearing mouth guards interested in effect of mouth guards to airflow dynamics and ventilation and oxygen consumption in low and high intensity exercise.

Published research consistently shows that wearing a CM mouth guard does not affect the main performance parameters generally associated with performance of athletes. It can be concluded that athletes can use CM mouth guards without any negative effects on their strength and aerobic/anaerobic athletic performance.

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## Treatment options of ACL injury at the medical center

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ACL is an important stabilising structure of the knee, preventing anterior translation of the tibia in relation to the femur. Rupture of the ACL is one of the most common sports injuries in active young people. Besides providing mechanical support, ligaments give dynamic reinforcement to the joint via their mechanoreceptors. Therefore, ACL injuries result in not only mechanical deficits, but also proprioceptive defects. But do not forget; there is no only ACL in the knee as a functional stabilizer.

Reconstructive ligament surgery is a common treatment method in the acute and chronic ruptures of the ACL. The major goals is to restore ligamentous functional stability, decrease the risk of articular cartilage deterioration, preserve menisci, and return patients to active lifestyles and sportive activities.

Various types of grafts and fixation methods have been employed in such surgeries. Current treatment options in ACL reconstruction include autografts, allografts, and synthetic grafts. Multiple allograft tissues are available including bone-tendon-bone patella tendon (BPTB), anterior and posterior tibialis, Achilles tendon, fascia lata, and hamstring tendons. BPTB graft (allograft or autograft) is the most frequently used graft for reconstruction of the ACL and provides bone to bone fixation options with flexibility in tunnel selection sizing. Studies have shown greater fixation strength, superior mechanical properties, and good long-term results with this technique. On the other hand many concerns have arisen with regard to donor- site pathology. These include; anterior knee pain, patellar fracture, patellofemoral pain/crepitus, kneeling pain, quadriceps weakness, loss of joint motion, and patellar tendonitis, tendinosis in a long term period or rupture.

Reconstruction using autogenous tissue as a primary reconstruction has emerged as the most popular method for reconstruction and has produced good clinical results. The use of allogenic tissues from cadavers has risen tremendously over the past decade because of their advantages of less donor-site morbidity, shorter operative time, availability of larger grafts, lower incidence of postoperative arthrofibrosis, and potential improvements in physical functioning and overall health-related quality of life. The disadvantages of allografts are; graft incorporation and functional ligamentization are slower for allografts when compared with autografts. However, several studies have shown that allograft ACL reconstruction is a sound alternative to autografts with no significant difference in postoperative symptoms, activity level, functional outcomes, or physical examination measures. In ACL reconstruction surgery, it is also important to fix the graft at the most convenient position with an adequate tension and soundness.

Finally treatment of the ACL injuries should be individualized because the patient's age, occupation, sports activities, and some knee-related and medical factors affect the surgical decision. Because in an elite competitive athlete torn ACL cannot heal (not demonstrated yet) with only conservative management. On the other hand, today there were %20 athletes w/o ACL, make a sports at the moderate level w/o any surgical treatment. Functional knee braces have been proposed to improve outcomes after ACL reconstruction especially by decreasing the strain on the reconstructed ligament and also by enhancing aspects of neuromuscular control.

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## Early inpatient physiotherapy

### Inci Yuksel

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Rehabilitation following ACL reconstruction is generally divided into four phases: • early postoperative , • subacute strengthening, • functional progression, • return to sports.

Early postoperative rehabilitation after anterior cruciate ligament (ACL) reconstruction plays an important role in the functional outcome of the knee. The main goal of immediate postoperative phase is to alleviate inflammatory reaction that takes place following surgical intervention. The orthopaedic surgeon and physical therapist are both concerned about controlling acute pain. Another goal of this early phase is to enhance range of motion (ROM) and progress to full weight bearing. The exercise program should be tailored according to the patient's needs. It is important to control external forces and protect the healing ligament during this stage. However, controlled motion should be allowed to nourish cartilage, decrease fibrosis, prevent stiffness and, stimulate collagen healing. Controlled loading may enhance ligament and tendon healing, while excessive loading can be harmful to the healing graft and lead to anterior-posterior knee laxity.

Rehabilitation of the patient should begin on the day of surgery . ACL reconstruction can cause severe postoperative pain. Improved control of postoperative pain facilitates more rapid achievement of functional outcomes. Postoperative pain can be controlled by using multiple techniques of analgesia. However, simultaneous application of cold and compression is still a valuable tool in postoperative pain alleviation. An increase in swelling causes a restriction in motion and exerts more pressure on nerve endings, which leads to additional pain . Cryotherapy also helps reduce swelling as well as pain in 48 hours following the surgery.

During the postoperative inflammatory phase, potential loss of function may result in scar formation which can restrict normal ROM of the knee joint. The knee should not be immobilized except during ambulation after the reconstruction. It is especially important to gain full knee extension in this stage. Early passive extension is important after every ACL repair so that the intra-articular notch is not allowed to fill in with scar tissue, thereby preventing full knee extension. Continuous passive motion (CPM) machines can restore mobility, also decrease postoperative hemarthrosis and edema. Besides CPM, patients should be encouraged to perform active-assisted range of motion exercises every hour that they are awake. Physiotherapists especially should on reflex guarding and spasm as well as inhibition of quadriceps muscle, because both of them results in the loss of function.

When using an ipsilateral patellar tendon graft, early patellar mobilization is necessary to prevent potential patellofemoral complaints. Quadriceps muscle contractions during weight bearing also pull the patella proximally and stretch the tendon. Quadriceps muscle strengthening is another important goal of early rehabilitation in ACL reconstructions.

To sum up, clinical milestones of early rehabilitation are reduction in pain and effusion, full knee hyperextension, 110 degrees of knee flexion, patellar mobility, ability to perform straight leg rises, partial weight bearing with at least 70% of body weight.

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## Out-Patient physiotherapy and returning to sports

### Defne Kaya, Gürhan Dönmez, Hande Güney, Haydar Demirel and Mahmut Nedim Doral

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Rehabilitation after surgery for an ACL tear is a lengthy process. Return to sports and activities takes months. Twenty years ago, rehabilitation programs included immobilization of the leg for 6 weeks or longer after an ACL reconstruction procedure while inflammation diminished and the graft healed. Biomechanical studies performed on animals have documented the adverse effects of immobilization of the knee on the articular cartilage, ligaments, capsular structures, leg musculature, and periarticular bone. This has led some authors to advocate early-motion rehabilitation programs that included guarded motion in a knee brace or continuous passive knee motion immediately after ACL reconstruction. Other studies revealed that early mobilization of healing ACL grafts, including immediate full weight-bearing activities such as walking, is possible without endangering the healing tissues. It is clear that immobilization after ACL reconstruction results in undesired effects; however, little is known about how much activity will promote adequate rehabilitation of an injured knee without permanently elongating the graft, producing graft failure, or creating damage to articular cartilage. This lack of knowledge may be explained, at least in part, by the fact that there is little information that derives from prospective, randomized, controlled studies of rehabilitation after ACL reconstruction.

Specific rehabilitation must focus on each individual athlete, and you must adhere to your own protocol. It is also important to note that timelines are a guide -- progression depends on completion of one step, before advancing to the next step.

Late Phases: The knee, and its range of movement, should now be essentially normal during everyday activities. This should be maintained during the late stage. Strengthening and proprioception exercises should be progressed and,



once the operated knee has achieved 90% of the normal leg in these aspects, functional activities can be undertaken. In a sporting individual, these activities consist of sport-specific drills and movements, the intensity, frequency and duration of which should be gradually increased until normal function is achieved. Early sports activities can be started and patients can often begin light jogging, cycling outdoors, and pool workouts. Side-to-side, pivoting sports -- such as basketball, soccer and football -- must be avoided. Toward the end of this phase, some athletes can begin shuttle runs, lateral shuttles and jumping rope.

**Functional Phases:** Emphasis of rehabilitation should be on sport simulating activities. These will include figure-of-eight drills and plyometrics, and over time will include sport drills. For example, a tennis player may start light hitting, a soccer player some controlled dribbling, etc. The progression to functional activities can begin once the player can jog without pain and is comfortable doing plyometric drills. The idea of this stage is to take the player from gentle exercise to the high intensity activity at which games are played. All exercises are preceded by a warm up. As each exercise is a progression, they should be completed at least one day apart.

**Return to Sports:**

Deciding when to return to unrestricted sports activities depends on a number of factors:

- **Functional Progression**  
The decision to return to sports must be based on each individual's progression through their therapy.
- **Graft Type**  
Surgeons may delay return to sports if the graft used to reconstruct the ACL came from a donor. Because these grafts are sterilized and frozen, there is a belief that they take longer to heal well inside the patient.

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## **Health benefit of activity of daily living (ADL) in children**

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Physical activity is essential for a balanced and healthy development in children. The structured days of children in western civilization gives only small room for free and spontaneous activities. In the international literature complains the decline in physical activity and the decline in physical fitness. The consequences for health are obvious, there is an increase in overweight and obesity in children. Physical activity is regarded as one mechanism of compensation and should be promoted especially in schools and sport clubs. Unfortunately whether the sport activities neither in schools, nor in sport clubs and even not in leisure time are sufficient to compensate the extent of inactivity. All day activities have to be taken into account.

New techniques in the registration of activity of daily living for example accelerometers allow a different inside view in physical activity in different settings. This allows the analysis of current status and the detection of strategies to promote physical activity. The Münster All-day Activity Study (MAAS) Project examined 1325 school children from the 1th to the 11th grade of school in the area of Münster in Germany. ADL was registered for one week by using the Step Activity Monitor (SAM).

The total amount of steps per day declined with age. International Guidelines demand 7500 steps per day or more than 600 steps per hour to be regarded as good for health. This amount was reached only in the 1th and 3th grade of school. The activity level in girls was always below the level of boys. The time in school is structured very strong. There are only few opportunities to be physically active. But even on this low level there is a decline with age. The activity level in the 9th and 11th grade of school must be regarded as low active or even sedentary. If schooldays are divided into small portions there are some elements to be found which contain a high potential for improving physical activity. Physical education has to be mentioned on the first place, but also the breaks between the lessons and the way to school are important sources of physical activities. The attractiveness of these opportunities for being physically active shows no decline even in higher grades of school.

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## **Obesity in childhood: Therapeutic options**

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Obesity is a chronic disease involving interaction between genetic and environmental factors. Considering the limited financial resources of our health care system, priority should be given to prevention, early identification and the treatment of risk groups (selective prevention), as well as early disease management in groups known to be particularly at risk. Considering the increase and degree of overweight and obesity, as well as the decrease in physical activity of today's children and adolescents, we must design new methods of treatment for a variety of risk groups and establish a

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network of appropriately trained physicians in clinics and universities. The degrees of overweight (overweight < 90th percentile, overweight between the 90th and the 97th percentile and obesity > the 97th percentile or adipositas per magna > the 99.5th percentile) correspond to preventive or therapeutic intervention levels. Patients should be treated according to the guidelines of the German “Konsensuspapier 2004”. An increase in central obesity combined with elements of the metabolic syndrome underline the quality of the disease. A network of outpatient and inpatient therapy centers should treat the individual needs of obese children. The Freiburg Intervention Trial for Obese Children (FITOC) consists of regular physical exercise (three times a week) plus comprehensive dietary and behavioral education. At four- to six-week intervals during the eight month program, seven information sessions with parents and seven with their children were held. At these meetings, staff members gave parents theoretical and practical information on obesity and nutrition, answered individual questions and work in behaviour training. Children were separately given the same basic information. Questionnaires concerning nutrition (food frequencies) and behaviour were regularly completed. Anthropometrical, biochemical and fitness data were collected. Measurements of body height and weight, fasting total-cholesterol, LDL-cholesterol, HDL-cholesterol and physical performance followed identical, standardized guidelines. Initial examinations of all 496 children (boys n=229; girls n= 267) were conducted. At the beginning of the program, boys were 10.6± 1.5 and girls 10.5 ± 1.6 years of age. Follow-up examinations after the intensive program were carried out 8.5 ± 1.2 months later. Results of the FITOC therapy programs ([www.fitoc.de](http://www.fitoc.de)), which strictly follow the AGA’s guidelines, have sufficiently demonstrated that those affected do not recognize obesity as a chronic disease despite a growing interest in this syndrome in society. A focus on sports during therapy and the counselling of daily activities appear to be key to the achievement of success. From the very beginning, one must obtain a clear statement of commitment from all participants (parents and physicians, as well as directors and teachers in kindergarten, day care centers and schools). If this strategy is then supported by public and private health insurance companies, it can successfully fight the obesity epidemic.

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## **Platelet rich plasma treatment in sports medicine**

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It is a fundamental fact that every athlete with a muscle, tendon or ligament injury wants to regain physical fitness as soon as possible. More and more attempts are being made to replace faster ‘tissue repair’ by faster ‘tissue regeneration’ to minimize sports disability and to allow early rehabilitation. The aim is to accelerate the natural processes without damaging the body. Platelet Rich Plasma (PRP) is obtained by centrifugation of autologous blood. Platelets are a source of growth factors, such as transforming growth factor beta, vascular endothelial growth factor, and platelet-derived growth factor, which are responsible for tissue repair and regeneration. Growth factors are biologically active polypeptide molecules that interact with specific cell surface receptors, leading to responses that are dictated by the receptor-mediated signal transduction pathways of the target cells. Growth factors are unique because they stimulate the growth or proliferation of these target cells. Chronic or acute tendinopathies, tendon ruptures, muscle ruptures, ligament ruptures, nonunions and stress fractures are the most important indications for PRP treatment. At our department many pilot studies have been performed. Importantly no patient was worse after treatment. After three weeks we observed marked pain relief and less swelling (in chronic tendinopathies). More controlled research has been planned and will be started soon.

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## **Local administration of growth factors and anti-doping aspects**

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The repair response of the musculoskeletal tissues generally starts with the formation of a blood clot and the following degranulation of platelets, which releases locally growth factors (GFs) and cytokines. This microenvironment results in chemotaxis of inflammatory cells as well as the activation and proliferation of local progenitor cells. Alpha granules are storage units within platelets, which contain pre-packaged GFs in an inactive form. The main GFs contained in these granules are: PDGF (Platelet Derived Growth Factor), TGF-β (Transforming Growth Factor-beta), FGF (Fibroblast Growth Factor), IGF (Insulin Like Growth Factor), VEGF (Vascular Endothelial Growth Factor) and EGF (Epidermic Growth Factor). It is widely accepted that GFs play a central role in the healing process and tissue regeneration being able of modulating the recruitment, duplication, activation and differentiation of cells involved in bone- and soft-tissue healing and the efficacy of those GFs should be, in theory, directly proportional to their local concentration. This observation is at the base of the use of preparation rich in growth factor (PRGF) in several circumstances, all of them

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characterized by the need of activating, modulating, speeding up or ameliorating the process of tissue repair. In this setting PRGF should be considered as highly safe autologous haemocomponents for non-transfusional use. With regard to sport medicine, doping related issues are still matter of debate when considering this therapeutic approach for the treatment of sport-related injuries, in particular because of the IGF-1 content in the platelets alpha granules. Indeed, the recent version of the World Anti-Doping Agency code prohibits all use of growth factor therapies in elite sport. Theoretically, there are two reasons that eliminate anti-doping concern from the therapeutic use of PRGF: 1) the PRGF content of IGF-1 is sub-therapeutic in terms of systemic anabolic actions by a factor of between 500 and 1000; 2) the availability of most IGF-1 is modulated by the IGFBP3 binding protein. Only 1% of the total IGF-1 released from the PRGF is unbound, and therefore biologically available. Additionally, the short half-life (10 minutes) of this unbound and active IGF-1 makes an alteration in systemic levels unlikely.

On the contrary, with particular regard to the muscle injection of platelets derived growth factors several issues still need to be clarified. Assuming that this technique, as it has been demonstrated by several studies, is able to ameliorate the muscle tissue repair processes, it is still unclear if the concentrated amount of growth factors injected into the skeletal muscles may affect the performances of the treated tissues.

Actually, in Italy, this technique may be used for the treatment of elite athletes following the approval of the appropriate therapeutic use exemption but other countries apply different approaches. Therefore, the author believe that it is necessary to clarify anti-doping regulatory guidelines and prohibited lists in order to avoid confusion and to promote an uniform approach given the awareness of the current clinical utility of these therapeutic approach.

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## **Visualisation techniques in athlete's early recovery after trauma and training**

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The need for quicker recovery after injuries or the pressure to obtain ever better results leads to the use of less frequently utilized methods such as visualization. Visualization is a natural process that allows a person to see pictures in their mind; the pictures can represent actual things in a person's waking life or things that are not actually present, things that a person would like to achieve. Most of the sport medicine literature presents the results in how to use visualization in mental training. However, visualization can also be used in early recovery after trauma. Visualization can reduce the recovery period by up to a third, depending on the number of sessions, their length and the personality type of the athlete. During the workshop the participants will be introduced to the concept of visualization, why, when and where it is used, the methods of building good imagery, the reason why sometimes visualization doesn't work, the most frequent mistakes that the author has met in her practice. The workshop is built in three parts: a very short initial one – with several theoretical concepts, a second part, with practical exercises, and a third one reserved for discussions and conclusions. The theoretical part of the workshop presents the author's experience with 48 athletes (male and female) from different sports, of different ages (from 8 to 49 years old); visualization is used in each case during early recovery after musculoskeletal trauma. The experience of other 97 athletes is also presented on whom mental training is used to prepare a competition. In the practical part, the focus is on the most successful techniques and methods that give results in real life. Finally, it is also important to present the limits of the method and the future possibility for future research: the type of imagery that can be used, the time when the method can be applied, and the type of the personalities on which it can be applied.

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## **Achilles tendinopathy: Diagnostic and treatment algorithm**

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Achilles tendinopathy is characterised by pain, impaired performance, and swelling in and around the tendon. It can be categorized as insertional and non insertional, two distinct disorders with different underlying pathophysiologies and management options. Other terms used as synonymous of non insertional tendinopathy include tendinopathy of the main body of the Achilles tendon (AT) and mid-portion achilles tendinopathy. The terms tendinitis, tendinosis, and paratenonitis, or an association of them, should be reserved to specific histopathological features of tendon conditions. We suggested that terms such as 'partial ruptures of' a given tendon not to be used to indicate intratendinous lesions of the tendon under study. We advocated the term tendinopathy as a generic descriptor of the clinical conditions in and around tendons arising from overuse. We challenged the common wisdom, intrinsic in the suffix -itis, that overuse tendinopathies are due to inflammation.

Although sound epidemiological data are lacking, Achilles tendinopathy is common in athletes, accounting for 6-17% of all running injuries, possibly because of the continuous prolonged intense functional demands imposed on the

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AT. However, it does present in middle aged overweight non-athletic patients without history of increased physical activity. To date, no data are available to establish the incidence and prevalence of Achilles tendinopathy in other populations, even though the condition has been correlated with seronegative arthropathies (e.g. ankylosing spondylitis).

The essence of tendinopathy is a failed healing response, with haphazard proliferation of tenocytes, some evidence of degeneration in tendon cells and disruption of collagen fibres, and subsequent increase in non-collagenous matrix. Tendinopathic lesions affect both collagen matrix and tenocytes. The parallel orientation of collagen fibres is lost, there is a decrease in collagen fibre diameter and in the overall density of collagen. Collagen microtears may also occur, and may be surrounded by erythrocytes, fibrin and fibronectin deposits. Normally, collagen fibres in tendons are tightly bundled in a parallel fashion. In tendinopathic samples, there is unequal and irregular crimping, loosening and increased waviness of collagen fibres, with an increase in Type III (reparative) collagen.

At electron microscopy, various types of degeneration have been described, namely (a) hypoxic degeneration, (b) hyaline degeneration, (c) mucoid or myxoid degeneration, (d) fibrinoid degeneration, (e) lipid degeneration, (f) calcification, (g) fibrocartilaginous and bony metaplasia. All can coexist, depending on the anatomical site and the nature of their causal insult. Therefore, tendinopathy can be considered the end result of a number of etiologic processes with a relatively narrow spectrum of histopathological features.

In tendinopathic tendons, tenocytes are abnormally plentiful in some areas. They have rounded nuclei, and there is ultrastructural evidence of increased production of proteoglycan and protein which gives them a chondroid appearance. Other areas may contain fewer tenocytes than normal with small, pyknotic nuclei, with occasional infiltration of lymphocytes and macrophage type cells, possibly part of a healing process associated with proliferation of capillaries and arterioles. Degeneration of the AT is usually either 'mucoid' or 'lipoid'. Collagen fibres that are thinner than normal, and large interfibrillar mucoid patches and vacuoles are seen. There is an increase in the Alcian-blue-staining ground substance. The characteristic hierarchical structure of collagen arrangement is also lost. Vascularity is typically increased, and blood vessels are randomly oriented, sometimes perpendicular to collagen fibres. Inflammatory lesions and granulation tissue are infrequent, and, when found, are associated with partial ruptures. Inflammatory cells and acellular necrotic areas are exceptional, and probably not typical of the tendinopathic process. On the other hand, mucoid degeneration, fibrosis and vascular proliferation with an inflammatory infiltrate may be found in the paratenon. Using common staining techniques, light microscopic degeneration was not a feature of tendons from healthy, older persons. Type I collagen is the main collagen in tendons; type III collagen is present in small amounts.

The diagnosis of Achilles tendinopathy is mainly based on history and clinical examination. Pain is the pivotal symptom. A common symptom is morning stiffness or stiffness after a period of inactivity, and a gradual onset of pain during activity. In athletes it occurs at the beginning and end of a training session, with a period of diminished discomfort in between. As the condition progresses, pain may occur during exercise, and it may interfere with activities of daily living. In severe cases, pain occurs at rest. In the acute phase, the tendon is diffusely swollen and edematous, and tenderness is usually greatest 2 to 6 cm proximal to the tendon insertion. A tender, nodular swelling is usually present in chronic cases.

Clinical examination is the best diagnostic tool. Both legs are exposed from above the knees, and the patient examined while standing and prone. The AT should be palpated for tenderness, heat, thickening, nodule and crepitation. The "painful arc" sign helps to distinguish between tendon and paratenon lesions. In paratendinopathy, the area of maximum thickening and tenderness remains fixed in relation to the malleoli from full dorsi- to plantar-flexion; lesions within the tendon move with ankle motion. There is often a discrete nodule, whose tenderness markedly decreases or disappears when the tendon is put under tension.

The management of Achilles tendinopathy lacks evidence-based support, and tendinopathy sufferers are at risk of long-term morbidity with unpredictable clinical outcome. The appropriate moment to switch from conservative to operative therapy remains unknown, as no solid data exist on the natural course of recovery. Non-operative care should be in general a minimum of three to six months prior to considering surgery since this condition usually resolves. However, each patient should be evaluated independently. Surgery is generally recommended to patients in whom conservative management has proved ineffective for three to six months.

Many common therapeutic options lack hard scientific background [64]. Rest, cryotherapy, pharmaceutical agents such as non-steroidal anti-inflammatory drugs and various peri-tendinous injections, training modifications, splintage, taping, electrotherapy, shock wave therapy, hyperthermia are used. Modalities tested using randomised controlled trials include nonsteroidal anti-inflammatory medication, eccentric exercise, glyceryl trinitrate patches, electrotherapy (microcurrent and microwave), sclerosing injections, and shock wave treatment.

In 24 – 45.5% of patients with Achilles tendinopathy, conservative management is unsuccessful, and surgery is recommended after exhausting conservative methods of management, often tried for at least six months. There is a lack of trials on surgical management of Achilles tendinopathy, and therefore the high success rate needs to be interpreted with caution. Surgical options range from simple percutaneous tenotomy (possibly ultrasound-guided, to minimally invasive stripping of the tendon, to open procedures.

The classical aim of open surgery is to excise fibrotic adhesions, remove areas of failed healing and make multiple longitudinal incisions in the tendon to detect intratendinous lesions and to restore vascularity and possibly stimulate the remaining viable cells to initiate cell matrix response and healing. However, there is no level I evidence

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that fibrotic adhesions should be removed, and the areas of failed healing should be excised, at least if the pathology does not involve the paratenon. Multiple longitudinal tenotomies trigger well ordered neoangiogenesis of the AT. This would result in improved nutrition and a more favourable environment for healing.

A more recent approach targets not the tendinous lesion itself, but the neo-innervation which accompanies the neovessels. New minimally invasive stripping techniques of neovessels from the Kager's triangle of the AT for patients with tendinopathy allow to achieve safe and secure disruption of neo-vessels and the accompanying nerve supply, producing a denervation effect. During open procedure, if more than 50% of the tendon is debridement, consideration could be given to a tendon augmentation or transfer.

In conclusion, Achilles tendinopathy gives rise to significant morbidity, and, at present, only limited scientifically-proven management modalities exist. The management of this condition remains a challenge, especially in athletes, in whom the physician often tries to be innovative. In many instances, this carries with it an unquantifiable risk. A better understanding of tendon function and healing will allow specific management strategies to be developed. Many interesting techniques are being pioneered. Although these emerging technologies may develop into substantial clinical management options, their full impact needs to be evaluated critically in a scientific fashion. Future trials should use validated functional and clinical outcomes, adequate methodology, and be sufficiently powered. Clearly, studies of high levels of evidence, for instance large randomized trials, should be conducted to help answer many of the unsolved questions in this field.

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## **Metabolic definition of the physiological background of high performance middle distance runners**

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When looking through the available literature dealing with this topic, it is conspicuous that from an energetic point of view there is no exact knowledge of the running performance profile and the energy provision. Therefore in the last 50 years basic and applied physiology have provided substantial knowledge, which allows to establish systems of equations describing the steady state and dynamic behaviour of the mentioned basic energy delivering processes for the purpose of mathematical simulation of the muscular energy metabolism as a function of power output and time. The differences in the simulation patterns are due to the difference of 3 components of ATP supplying reactions in the working muscle mass: 1. The concentration of creatine phosphate ([PCr]) (~alactic work capacity), 2. the content of mitochondria which determines the maximum of aerobic ATP production rate (aerobic power (~ $\text{VO}_2\text{max}$  (ml/min\*kg))) and 3. the maximal glycolytic ATP-production rate (lactic power (~ $\text{VL}_{\text{max}}$  (mmol/s\*1))). To apply to the human body the active muscle mass (25% to 35% of body mass) and the lactate distribution space (35% to 45% of body volume) have to be considered. As it is for practical purpose too complicated to re-simulate experimental results of the individual pattern of test results simplifying of the mathematical approach is needed, without a loss of accuracy. This seems to be possible regarding two principles: First: Efficiency of ATP-production is nearly constant at all levels of intensities which means  $1.0 \text{ mmol [ATP]} \cong [\text{PCr}] \cong 4.3 \text{ ml O}_2$ .

That means also that  $1.0 \text{ mmol LA} \cong 1.35 \text{ mmol [PCr]} \cong 5.8 \text{ ml O}_2$  at muscular level. This is a typical value for top athletes. As the lactate oxygen equivalent is constant at the ATP production level according to principle 1: the resulting oxygen equivalent related to BW varies according to the relation of active and passive lactate distribution space between 2.4 up to 3.0 ml O<sub>2</sub>. - 2: The rise of oxygen uptake in case of an escalating load is approximately mono exponential.  $\text{VO}_2\text{max}$  in skeletal muscle is direct proportional to mitochondria content (Mit.Vol.) and 1.0 ml Mit.Vol. can consume 4,3 up to 4,5 ml O<sub>2</sub>/min. A normal 3% Mit.Vol. results in a  $\text{VO}_2\text{max} = 4.5 * 30 = 135 \text{ ml O}_2/\text{min} * \text{kg}$  muscle. - A sportspecific simulation will be presented.

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## **Chronobiologic factors of performance**

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With pleasure we present you an overview of the work done on chronobiology/circadian rhythms in the laboratory of the university of Caen. In general biological rhythms are well known to follow the rhythm initiated by two internal clocks located in the pineal gland and the suprachiasmatic nuclei.

Both are subject to the influence of external synchronizer in order to stay within a 24h period. The physical performances follow also the pace of these clocks. This explains why alactic anaerobic muscle performance is always

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superior at 18h compared to those made at 6 o'clock, regardless isometric, concentric or eccentric contraction. The same is true for performances realized during the Wingate's test. For the anaerobic lactic process, superior performance is found (e.g. 11%) at 18h versus 6h for environmental actions.

With regard to forced gestures (repeated contractions), the difference goes beyond the 40th second. This difference between the two types of movement is probably related to the principles and mechanisms underlying muscle mechanics, for example nerve conduction. In other words, the spontaneous frequency of cycling is higher in the evening than in the morning. The other parameters (maximal oxygen consumption, maximal power output) remain the same during the day. However, up to 85% of maximal aerobic power, ventilation for a given power is greater at night as compared to morning. The rectangular test at 100% of maximal aerobic power exhibits a higher time limit in the evening with a gain of 16% during the day. The best performances are realized late in the day. Therefore the athlete needs to regulate him or herself and start warming-ups in time if top performances can be scheduled in the evening. For mental performance, we found a rhythm for vigilance with two peaks, one around 10 a.m. and another at 06 p.m. Variations are the same for the first stage of action, namely the identification. In contrast, no differences were noted for the decision stage. The third stage, or the programming, implements and improves executing motor tasks throughout the day. For these reasons, amongst others, the late morning (good psychomotor performance, poorer physical performance) should be dedicated to learning strategies and analyzing competition. Finally, in support of these results, we showed that the wake-up time and breakfast did not influence the data acquisition in the morning.

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## **Asthma and sport: Where did we come from and where are we now?**

### **J. Cummiskey**

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Where have we come from

- 1999 The 3 IOC, MC premises highlighted
- 2001 WADA aTUE for asthma
- 2002 International panel at an Olympic Games

PFT are now mandatory in asthma diagnosis. This clinical syndrome must have the clinical diagnosis of asthma supplemented with the addition of Pulmonary Function Tests (to ERS and / or ATS standards). The percentage changes in PFT are as follows:

- resting pulmonary function tests, (12% bronchodilation above the predicted or the athletes resting FEV-1)
- non-pharmacological challenge (10% bronchoconstriction) Exercise or Eucapnic Voluntary Hyperventilation tests
- pharmacological stimulation tests  
(20% bronchoconstriction at a Methacholine dose of < 4 mg/ml)  
(15% bronchoconstriction to a Mannitol test)  
(15% bronchoconstriction to a 4.5% saline challenge)

Where are we going with asthma

- 2008 Publish in 8.2008 IOC, MC consensus statement American JACI
- 2008/9 WADA scrapping a TUE
- 2008/9 WADA insisting on only the athletes on the registered testing pool of each IF having a full TUE for asthma
- 2012 Review the criteriae now in place
- 2010 Possible GINA consensus of asthma in high performance sport
- 2014 New advances in our understanding of asthma in 5 years

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## **Imaging of osteochondral lesions of the talus and anterolateral impingement**

### **J.L. Gielen, P. Van Dyck, F. Vanhoenacker and C. Venstermans**

University of Antwerp, Belgium

Both anterolateral impingement and osteochondral lesions of the talus are related to repeated inversion mechanism of ankle sprains. They are frequently encountered in soccer players. Radiological imaging has a role in the detection and staging of anterolateral impingement and osteochondral lesions of the talus especially in a preoperative phase. Anterolateral impingement is already described in the 1950 by Wolin as a meniscoid lesion of massive hyalinised and vascularised, connective tissue extending into the joint from the anterior inferior portion of the talofibular ligament

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Impingement during dorsiflexion can occur at the anterior inferior tibiofibular ligament, the lateral gutter and the anterior talofibular ligament. Four grades of anterolateral impingement are recognised depending on the association of the meniscoid tissue with bone and cartilage abnormalities. Both MRI and ultrasound can be used to detect the meniscoid tissue. Dynamic ultrasound examination is able to demonstrate the impingement during dorsiflexion of the talocrural joint. The purpose of this presentation is to illustrate the findings and grading system on US and MRI examinations. Osteochondral lesions of the talus are detected and staged by plain CT and or plain MRI. Four stages are recognised depending on the grade of detachment of the bone fragment. In all but stage 3 with an in situ fragment these plain techniques are sufficient. In stage 3 the differentiation of a loose or attached in situ fragment is only possible by CT-arthrography or MR-arthrography as the contrast infiltration in between the fragment and roof of the bony defect is proof of a loose in situ fragment. Preoperative MR imaging and/or CT-arthrogram can help to determine whether the lesion is loose or not.

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## **Persistent pain following lateral ankle sprains**

### **Halit Pinar**

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Persistent pain following ankle sprain may be due to one or more of the following conditions: a) Misdiagnosis (importance of differential diagnosis), b) Lesions developing at or following sprain, c) Chronic instability.

Acute inversion sprain is the most common sports injury (45% in basketball, 31% in football). Differential diagnosis is of great importance: Syndesmosis injury, rupture or dislocation of the peroneal tendons, fracture of the lateral malleolus, lateral talar process, anterior calcaneal process and base of the 5th metatarsal. Tarsal coalition and osteoid osteoma should be ruled out in every chronic sprain pain.

Most common lesions developing during or following ankle sprain are osteochondral lesions, osseous and soft tissue impingement syndromes, sinus tarsi syndrome and reflex sympathetic dystrophy. Lesions due to insufficient healing are chronic lateral instability (mechanical or functional), avulsion fractures or symptomatic ossicles, subtalar instability, and neural injuries.

In summary, a good knowledge of differential diagnosis is the key to lessen persisting symptoms following acute ankle sprain. Additional lesions that develop at the time or after the injury are treated properly.

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## **Cardiac emergencies in sports**

### **H. Löllgen**

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Cardiac emergencies and sudden death during physical activity remain a challenge in the general population and in athletes as well. Definition and epidemiology of sudden death will be given. Cardiac emergencies are mainly due to acute arrhythmias, myocardial ischemia or syncope. Causes of sudden death are complex ventricular arrhythmias due to structural heart disease. Coronary artery disease predominates in people over 35 years. In younger subjects (below 35 ys), especially in athletes, "electrical" abnormalities i.e. ion channel diseases such as Brugada-Syndrom, cardiomyopathy (ARVD, ALVD), WPW-Syndrom or long or short QT-syndrom predispose to threatening circulatory collaps. Diagnosis is based on history, including sports and family history, clinical examination, resting ECG (consensus recommendation). It is strongly recommended that expertise from sports medicine and cardiology as well is need for correctly interpreting resting ECG in athletes. Stepwise increasing diagnostic procedures include stress testing, echocardiography and analysis of autonomic function, MRI and invasive procedures, with MRI as the key diagnostic tool for analysis of structural heart disease even in myocarditis. Molecular autopsy is now the standard approach in sudden athlete's death of unknown origin. Possible diagnostics and treatments for survivors include: Cardiac catheterization, electrophysiological testing, bypass surgery or ballon dilatation (PCI), catheter ablation in special diseases (HOCM, WPW - Syndrom), drug therapy, and implantable cardioverter-defibrillator. In athletes, restriction to physical activity is sometimes recommended depending on the underlying disease (e.g. myocarditis). Prevention is the best approach using thorough history and clinical examination and ECG as a pre-participation screening. Recommendations from the German Society of Sports Medicine will be presented.

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## Gray zone in athlete's heart

### **Erdem Kasikcioglu**

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There is little doubt that vigorous physical exertion increases the risk of cardiac events in athletes with cardiovascular abnormalities. The increased risk of exertion has been documented in athletes in whom the risk of sudden death. Although hypertrophic cardiomyopathy is a major complex cardiac disease with a heterogeneous genetic, morphologic and clinical spectrum and it is the most important cause of sudden cardiac death among young athletes. The diagnostic criteria for hypertrophic cardiomyopathy includes a hypertrophic, but not dilated, left ventricle, in the absence of systemic disease or left ventricular hypertrophy due to left-sided obstruction. Some athletes develop substantial excessive left ventricular hypertrophy (13-15 mm) during intense physical training. In this situation, the differentiation between physiological and pathologic hypertrophy may be difficult, and this evaluation is important in determining the presence or absence of cardiac disease in athletes in order to prevent exercise-related sudden cardiac death.

At present, routine genetic testing is not a practical method for differentiating physiologic from pathologic left ventricular hypertrophy. Several echocardiographic and electrocardiographic features can help to distinguish between hypertrophic cardiomyopathy and physiologic left ventricular hypertrophy in athletes, but, inevitably, a small number of individuals fall into a gray zone where differentiation between the two entities, athlete heart and hypertrophic cardiomyopathy. Although the presence of septal thickness more than the ranges suggests the diagnosis of hypertrophic cardiomyopathy, some patients with the disease have mild hypertrophy within the same range as that observed in highly trained athletes. Approximately, 2% of elite athletes have a septal thickness of 13-15 mm. A number of clinical, electrocardiographic, echocardiographic and new imaging methods can assist in the identification of hypertrophic cardiomyopathy in an athlete in these circumstances. Hypertrophic cardiomyopathy is more likely in the presence of a positive family history of hypertrophic cardiomyopathy in a first degree relative, echocardiographic demonstration of a small left ventricular cavity dimension, large left atrial diameter, abnormal diastolic filling patterns and the presence of abnormalities on the electrocardiography. Echocardiography is a valuable non-invasive and frequently using method for differentiating cardiac pathologies than athlete's heart; however, it is accepted that the method is not cost-effective for screening. Although there are several limitations of echocardiography, it helps for the accurate diagnosis of hypertrophic cardiomyopathy and facilitates risk stratification. Furthermore, some scanning and imagine methods may facilitate for differentiating of two entities, hypertrophic cardiomyopathy and athlete's heart.

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## Preparticipation medical screening of athletes: The Italian experience

### **Fabio Pigozzi**

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Sudden cardiac death in athletes is an event that dramatically occurs more and more often. Up to 90% of these deaths are due to cardiovascular diseases, therefore referred to sudden cardiac death (SCD). The causes of athletic-field SCD are strongly related to the athlete's age. In young athletes (<35 years) the main causes are represented by congenital cardiac diseases, particularly hypertrophic cardiomyopathy, arrhythmogenic right ventricular cardiomyopathy and coronary artery anomalies. Conversely, in older athletes (>35 years) the high percentage of deaths is due to coronary artery disease.

Death is a natural and ineluctable event. However, when it occurs suddenly and unexpectedly in a trained athlete who represents in our minds the image of health, strength and invulnerability, is difficult to accept. Indeed, the sudden death of an athlete, while training or competing, is an infrequent but devastating event to all involved (patient, family, friends, team, and staff). The great interest of the mass media for this tragic event, especially when young or well-known athletes are involved, contributes to increase their shocking impact on the public.

Over the past two decades ample medical literature on the causes and the mechanisms of sport-related sudden death as well as on the screening strategies and disqualification criteria for competitive athletes, has been collected. Nevertheless, such catastrophes continue to occur. Sudden death is defined as a witnessed or un-witnessed natural death occurring unexpectedly within 6 hours of a previously normal state of health.

Though non-traumatic athletic-field deaths may recognize non-cardiac causes - cerebral aneurysm, heat-stroke, sickle cell trait, bronchial asthma, drug abuse -, more than 90% of these events occur in subjects with pre-existing, and usually clinically silent, cardiac abnormalities. For this reason, sport-related sudden death should be distinguished in sudden cardiac death (SCD) and death due to non-cardiac causes.

A primary goal for prevention should be to identify cardiac pathology through PPS. Recently, interest has been focused on the strategies and results of PPS in athletes as a valuable instrument of investigation for:

a) early identification of structural cardiac disease associated with sudden death

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b) reduction of the risk of disease progression associated with athletic training and competition.

Recommendations regarding eligibility to sport should be on precise guidelines, such as the ones set by the Bethesda Conference or the Italian Guidelines (COCIS).

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## **Update on strategic plan on IOC scientific activities Strategies in Sports Medicine - Contribution from IOC Medical and Science Department. An ounce of prevention?**

### **Lars Engebretsen**

International Olympic Committee, Oslo Sports Trauma Research Center, Department of Sports Medicine, Norwegian University of Sport & Physical Education, and 2Orthopaedic Center, Ullevaal University Hospital, Oslo, Norway

At a time when there is of an abundance of medical meetings, journals and papers, some might argue that the last thing we need is yet another field of research. What would justify such an emphasis on a new and developing research field in medicine such as prevention of injuries and diseases in high level athletes (1)? First, it must ask important questions not answered by others. Second, the new research field should have the potential to create truly new knowledge, lead to new ways of thinking and lay the foundation for improved health for our patients. Third, research results from the new field should be publishable in respected journals, recognized and cited by peers, presentable at high quality meetings and fundable on competitive grant review.

*Challenges and opportunities:* First, is injury prevention important? Epidemiological studies show that of injuries seen by a physician in Scandinavia, every sixth is sustained during sporting activity(2). Among children, every third hospital-treated injury is the result of sports participation. A research group within the English Football Association found that the overall risk to professional athletes is unacceptably high—approximately 1,000 times higher among professional football players than for high-risk industrial occupations (3).

The second issue relates to the potential for new ideas and improved health. When we started the Oslo Sports Trauma Research Center in May 2000, a PubMed search revealed that out of 10,691 papers on athletic injury, there were only 6 randomized controlled trials on sports injury prevention. However, a similar search of the literature now reveals that sports injury prevention research is emerging as a new field in medicine. While the number of papers on athletic injuries has increased by 26% over the last five years, clinical studies and RCTs related to sports injury prevention has doubled.

Sports participation is also important from a public health perspective. There is no longer any doubt that regular physical activity reduces the risk of premature mortality in general, and of coronary heart disease, hypertension, colon cancer, obesity, and diabetes mellitus in particular. The question is whether the health benefits of sports participation outweigh the risk of injury and long-term disability, especially in high-level athletes? Sarna et al. (4) have studied the incidence of chronic disease and life expectancy of former male world-class athletes from Finland in endurance sports, power sports and team sports. The overall life expectancy was longer in the high-level athlete compared to a reference group (75.6 versus 69.9 years). The same group also showed that the rate of hospitalization was lower for endurance sports and power sports compared to the reference group (5,6). This resulted from a lower rate of hospital care for heart disease, respiratory disease and cancer. However, the athletes were more likely to have been hospitalized for musculoskeletal disorders. Thus, the evidence suggests that although sports participation is beneficial, injuries are a significant side effect. To promote physical activity effectively, we have to deal professionally with the health problems of the active patient. This does not only involve providing effective care for the injured patient, but also developing and promoting injury prevention measures actively.

*Possible solutions:* Since 2007 the IOC is developing various programs for prevention of injuries and diseases in high level and recreational sports. This development is occurring with the cooperation of IFs such as FIFA, IHF, IAAF and FINA as well as with renowned research institutions world wide. The Medical and Science Department of the IOC is currently developing research in the prevention field with several major institutions to focus on research, education and implementation of the new knowledge to all NOCs around the world. Furthermore, special issues of the British Journal of Sports Medicine under the IOC leadership will disperse new knowledge to the scientific community which again will help IFs and NOCs to implement new knowledge to the practical athlete. The IOC will have yearly Advanced Team Physician Meetings to educate our colleagues and a major conference every third year where researchers from around the world will meet to discuss challenges and new results in the field of prevention of injuries and diseases. The IOC will continue the extensive publication of the Olympic Encyclopaedia and the more practical and very popular Olympic Hand Book in Sports Medicine. Every year at least two consensus conferences will be held - in 2009 one on Pre Participation Exams and on Age Determination in young athletes. The results from these conferences are spread to all NOCs and IFs. Finally, the IOC will develop an injury and disease surveillance system for the Olympic Games- the first successfully conducted in Beijing.

Through these initiatives, The International Olympic Committee (IOC) will increasingly emphasize the protection of the athletes' health and the prevention of injuries.

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## Assessment of balance: From theoretical background to practical applications

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Unlike a solid object in stable balance position, the human body maintains a dynamic balance by oscillating center of mass (COM) in all horizontal directions around a virtual central vertical line. In order to prevent toppling, vertical projection of COM, representing center of gravity (COG) must remain within the base of support. This is achieved by perpetual shifting of the body in horizontal direction by muscle contraction in the ankle and hip area. Such corrective movements, controlled by the central nervous system, are based on sensory feedback information from the muscle proprioceptors, vestibular apparatus, visual organ, and to some extent also from the skin receptor in the plantar area. Tightness of this feedback control reflects the quality of balance. Generally, poor balance is characterised by rather large excursions of COM and vice versa. The analysis of COM horizontal movements is utilised for the assessment of balance. COM projection on the supporting ground is defined as center of gravity (COG). Recording of its movements is usually based on the distribution of the gravitational force among the sensors in the corners of the force platform sampled at the rate of 100 Hz. Such an approach, in fact, does not display COG exactly. As it does not take into account only simple projection of COM on the horizontal plane of the platform, but also momentum forces resulting from corrective horizontal movements, parameter calculated is in fact center of pressure (COP). However, as the differences between COP and GOG are rather minor, COP is utilised for the assessment of balance. The methods of analysis of COP movements under various conditions, their reliability and practical application will complement the presentation.

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## Genetic risk factors for musculoskeletal soft tissue injuries

**Malcolm Collins**

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Acute and overuse tendon and ligament injuries are common as a result of participating in specific physical or workplace activities. Although the exact causes of these injuries are unknown, various intrinsic and extrinsic risk factors, including genetic factors, have been identified. Common musculoskeletal soft tissue injuries for which a genetic contribution has been proposed include the Achilles and rotator cuff tendons, as well as, the cruciate ligaments. Sequence variants within genes that encode for several collagens (COL1A1, COL5A1 and COL12A1) and glycoproteins (TNC), which are structural components of the basic building block of tendons and ligaments – the collagen fibril, have been shown to be associated with specific acute and chronic musculoskeletal soft tissues injuries. Recently variants within the enzymes (MMP3) that degrade the fibril have also been shown to be associated with chronic Achilles tendinopathy. Whether these variants are directly involved in the development of these musculoskeletal soft tissue abnormalities or linked with the actual disease causing variants remains to be established. The results of these initial case-control genetic association studies suggest that these injuries, like other more extensively investigated complex disorders, such as obesity, and type 2 diabetes, are caused by a complex interaction of multiple genetic and environmental factors. Developments in the identification of genetic risk factors for tendon and ligament injuries will be reviewed. It is proposed that eventually these and other specific genetic risk factors could be included in multifactorial models that will identify ‘high-risk’ athletes. It is conceivable that these models could in the future also be used by clinicians to develop personalised training programmes to reduce the risk of injury, as well as, personalised treatment and rehabilitation regimens for injured athletes. The ethical framework however in which this is done is not straightforward, need to be discussed and guidelines developed.

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## Genes and performance

**N. Bachl, B. Wessner and H. Tschan**

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Human physical performance is determined by a variety of environmental and also genetic factors. Several studies have revealed, that heritability is a strong component of endurance and strength phenotypes, but it is important to note, that beside the athletic performance capacity a lot of genes in the same way are responsible for the normal functioning of metabolic pathways and processes which are necessary for a healthy state of an organism. With regard to athletic performance, today more than 200 gene entries and quantitative trait loci have shown some associations of linkages with exercise related phenotypes. Some of these associations seem to be rather weak or need to be improved in larger populations, on the other hand, the impact of the R577X-single-nucleotide-polymorphism of the  $\alpha$ -actinin 3 (ACTN3) gene on elite performance has been confirmed in a series of studies. Similar results were found for the polymorphism of the Angiotensin converting enzyme (ACE), the Myostatin (GDF-8) and the Peroxisome proliferator activated receptor- $\gamma$  coactivator 1,  $\alpha$  (PPARGC1A) and other genes. However, it is very likely, that more than one genetic variant will be responsible for a complex trait such as athletic performance as well as for its components endurance capacity and strength, which also per se are polygenic. Therefore it seems to be necessary to look after optimum or favourable polygenic profiles, but taking into account that other polymorphisms yet are undiscovered as well as several other environmental factors may explain, why some individuals reach or don't reach the upper end of special performance capacity.

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## Genetic variability and training responses

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The HERITAGE (HEalth, RiSk factors, exercise Training And GEnetics) family study documents the role of the genotype in cardiovascular, metabolic, and hormonal responses to a tightly controlled 20 weeks aerobic exercise training program. One of the most interesting findings was that the training-induced changes in the outcome measures such as the maximal oxygen consumption varied widely, dividing the study participants in non-responders, medium-responders and high-responders (Skinner et al., 2001). Of course environmental factors such as age, gender and diet might have had an impact on the outcome variables. However, the variability within families was lower than the overall variability suggesting a genetic influence. At the latest since then numerous case-control, association or linkage studies tried to relate the individuals' genetic make-up with the adaptation to endurance or resistance training programs (Bray et al., 2009). When looking on muscle mass or strength genetic variants in the  $\alpha$ -actinin 3 (ACTN3), myostatin (GDF-8), ciliary neurotrophic factor (CNTF) genes seem to influence the response to resistance training (Gordon et al., 2005). The ability to enhance endurance capacity is modulated by polymorphisms in the angiotensin converting enzyme (ACE), peroxisome proliferator-activated receptor alpha (PPARA) and nitric oxide synthetase 3 (NOS3) genes. Even though this list is highly incomplete it seems to be clear that more than one polymorphism contribute to a complex phenotype such as the training response making it necessary to develop a polygenic profile rather than single associations (Ruiz et al., 2009). Although we are just at the beginning of understanding the impact of genetic variability future research on this topic should help us to develop personalized training programs by identifying personal strengths and weaknesses and therefore finding the "optimal" exercise.

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## Meniscal preservation: Current state of the art and future directions

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The menisci have important functions of load bearing and load sharing in the human knee joint. They also contribute to joint lubrication and act as secondary stabilizers in the event of ACL insufficiency. Loss of menisci leads to significant biomechanical and biochemical changes that ultimately lead to loss of cartilage and early onset osteoarthritis. Preservation of meniscal functions is an important goal in knee injuries especially in adolescents and young adults. As arthroscopic techniques have evolved, rim preserving partial meniscectomy has become the gold standard for irreparable meniscal tears. However, osteoarthritic changes still occur after partial meniscectomy depending on the amount of meniscal tissue removed and the disruption of circumferential collagen fibers. Meniscal repair is indicated for vertical longitudinal tears in the vascular 1/3 of the meniscus. These are usually acute tears in conjunction with an ACL injury and have the greatest chance of healing. Isolated tears have about 75% healing rate in stable knees. Recently the indications for meniscal repair have been extended to radial tears, tears in the avascular zone and more complex tears especially for the lateral meniscus. Enhancement of healing with a variety of techniques such as the fibrin clot, synovial abrasion, vascular access channels and microfracturing the notch may improve healing rates. Two options are available for younger patients with total meniscal loss; meniscal allografting and meniscal substitution with a scaffold. Meniscal allografts have shown pain relief and preservation of function in about 70-80% of the patients at 5-10 year follow-up. It is not clear whether the allografts can halt the progression of osteoarthritis at long term follow-up. Problems with sizing, logistics and the risk of disease transmission have prevented the widespread use of this technique. A variety of natural and synthetic materials have been tried to replace the meniscus. Most of them have been unsuccessful or have not reached clinical phase. A collagen meniscus implant acting as a scaffold has been used in a small number of patients with moderate success; however this implant is indicated for segmental meniscal defects and not total loss of meniscus. In conclusion, meniscal repair seems the best way to preserve meniscal function. Although suture techniques offer the strongest fixation, recent meniscal fixators offer the chance of an easier surgical technique. Prevention of meniscal injury and early treatment of ACL injuries before meniscal tearing, especially in adolescents are also important.

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## Sport therapy in patents with COPD

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**OBJECTIVE** The incidence of COPD in Germany is estimated between 8-15%. Improvement in pharmacological therapy as well as in non pharmacological therapies has lead to an augmentation in quality of life. One of the non pharmacological tasks is sports-therapy. Question arise can physical excises in a ambulatory group improve physical capacity in the amount of activity of daily living (ADL).

In a prospective controlled longitudinal study we included 29 COPD patients – 14 patients in a exercise group mean age  $67 \pm 7$  FEV 1 40-60%; 15 patients in a training group mean age  $61 \pm 8$  age FEV 1 > 60%. The patients were compared to 17 healthy controls mean age  $63 \pm 9$ . Before and after a six months trainings period spiroergometrie on a bicycle ergometer, 6-minute-walking-test, postural balance testing, sit-to-stand-test and dynamic valance test were performed. All this activities were measured by step watch activity monitor (SAM) for seven days. Quality of life was measured with special questionnaires.

**METHODS**  $VO_2$ max was  $18 \pm 3$  ml/kg in the excise group and  $20 \pm 4$  ml/kg in the training group. There was no difference between pre- and post-test. The distance in the 6-minute walking-test in patients of the exercise group was  $439 \pm 9$  m and  $491 \pm 26$  m in training group. This was 67% respectively 75% of the distance in controls. In the pos-test the level was augmented between three to five percent in both groups. After the training program there was a slide augmentation in force- and balance test to be found. The ADL level of the controls was 6500 steps per day and must be regarded as low active. The training group was 400 steps per day and the excise group 1000 steps per day below the level of the controls. The training program improved ADL level of excise group to the level of the controls and the level of the excise group was augmented 2000 steps and reached a level above that of controls. The quality of life was improved in all interven-tion groups.

**CONCLUSION** COPD patients, and especially the patients with low capacity, seem to achieve bene-fit from intervention in ambulatory COPD training groups.

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## Biomechanical modelling in sports medicine

### Serdar Arıtan

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**OBJECTIVE** Sports biomechanics suffers from one very serious limitation; in general it is impossible to measure forces inside the human body for technical and ethical reasons. In order to measure the force inside a human body requires an operation to implement a force transducer. In addition to technical complications and calibration problems of force transducer, the subject would also be at risk of surgical infections. Therefore, modelling in biomechanics works as an interface between the body and measurement settings.

In recent years biomechanical modelling has become very popular in the area of sports medicine. Recent developments in software and hardware in the computer technology can be the key explanation of this popularity. Developing a biomechanical model itself improves the understanding of the mechanical system's dynamics and the structure. On the other hand, most of the real-world biomechanical systems are so complicated that a satisfying modelling seems extremely difficult. One standard consequence is that the complexity can be reduced by cutting down the some part of the system to be modelled. A well prepared model is simple but also adequately detailed to precisely represent the system.

Considering the system components (i.e. limbs of the human body) as a rigid body, rather than deformable body is also helps to reduce the complexity of the model. Although, in reality, there is no body is absolutely rigid, deformation of limbs in sports movement can be ignored, when compared to the gross motion of the system.

**METHODS** Basically, there are two types of approaches in biomechanical modelling. The first one is inverse dynamics and the second one is forward dynamics or direct dynamics. Inverse dynamics calculation is used to determine joint forces and torques based on the physical properties of the system being modelled and a time history of displacements from experimental kinematic data, including velocities and accelerations. Ground reaction forces, mass and inertial characteristics of segments are also required in this method. In a forward dynamical analysis the joint torques are the inputs and the body motion is the output. It is critical to understand what generate this joint torques. Joint torques are the addition of internal body forces such as ligaments, joint constraints, and of course, muscle forces. Muscles are the actuator in this method. Therefore the correct input into the model is definitely neural input, which drives the muscles.

Whichever approach is used for modelling, first of all, the equation of motion has to be derived. The dynamics of biomechanical systems is based on classical mechanics. The simplest element of a multi-body biomechanical system is a free particle which can be treated by Newton's equations. The rigid body that is a key element in the modelling was introduced in 1775 by Euler. Thus the equations obtained are known in human-body dynamics as Newton-Euler equations.

**CONCLUSION** As indicated above the modelling is widely used in all fields of sports medicine from kinematics to dynamics. In fact, advanced biomechanical modelling requires sophisticated simulation tools which can model accurately enough the physical world at sufficient speed and allow user interaction.

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## Modeling of soft tissue mechanical behavior on computer

### Ergin Tönük

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**INTRODUCTION** Nearly all mechanical interactions of human body with the surrounding take place through soft tissues. Therefore, experimental determination of soft tissue mechanical properties and computer simulation of various mechanical interactions of human body with the environment received attention in biomechanics. There are different test equipment and protocols, each having its own advantages and disadvantages, that have been utilized till now to uncover soft tissue mechanical behavior for the purpose of constructing a material law that would model the mechanical behavior of soft tissues.

**METHODS** Because the aim is to model mechanical interaction with the surrounding, it is preferred to use in vivo experiments so that the tissue of interest would be in its natural environment with proper interaction with the surrounding tissues.

A soft tissue indenter, which is a noninvasive device, is utilized for the experiments. Although the primary mode of operation of the indenter is displacement controlled, with a closed loop control algorithm force control can also be achieved. The indenter tip that deforms the soft tissue has an ellipsoid shape to detect in-plane anisotropy. The indenter system collects simultaneous data of tissue reaction force, tissue displacement and time. With the utilization of inverse finite element method, this data is converted into stress-strain-time data which can directly be used to establish the

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material law (constitutive equation).

**RESULTS** Lower arm bulk soft tissues were tested using three different test protocols: cyclic loading, relaxation and creep. The results indicate that soft tissue behavior is nonlinear with stiffening behavior in increasing strain, considerably anisotropic, not fully elastic with considerable mechanical energy dissipation, relaxation is observed under constant displacement and creep is observed under constant load. There is preconditioning in maximum reaction force and in hysteresis magnitude in the first few loading cycles. It was further observed that the soft tissue mechanical behavior is personal, local in the body and even at the same location mechanical response changes in time.

**CONCLUSION** The experimental results reveal that unlike many engineering materials, soft biological tissues exhibit relatively complex mechanical material behavior. Computer simulation of mechanical interaction of human body with its surroundings requires the material model to reach a maturity for success.

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## Classification methods in biomechanical analysis

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**OBJECTIVE** Classification of human motion plays an important role in many application areas, such as surveillance, films, biomechanics, biometric person identification or the analysis of gait abnormalities in medicine. Most of the existing systems, description of human movement depends on variables that represent the kinetics and/or kinematics of the body segments. Increasing amounts of three-dimensional kinetics and kinematics data are available from commercial motion-capture systems. However the problem is not technological since recent advances have made data collection fast and efficient with sufficient resolution to provide meaningful measurements. A significant barrier to use of kinetics and kinematics information is the successful reduction and classification of this large data set.

**METHODS** Large data sets have orientated the researches to use different methods. Using multivariate statistical methods has become widely accepted technique among the many different approaches. Since the availability of statistical software packages to do the calculations has developed the use of linear techniques to describe human motion data has been employed in a number of studies. Principal Component Analysis (PCA) which is one of these linear techniques has been used as an evaluation and classification tool for kinematics and kinetics data of normal vs. pathological movement patterns. This approach allows one to identify components of low power that may be removed from the data set without significantly affecting the data, thus producing a dimensionally reduced form of the original data.

**CONCLUSION** Using linear techniques as a classification tool have become common within the animation and computer vision community. However there exist only few studies for biomechanical analysis in sport medicine. PCA can be used to classify the entire temporal movement pattern and can detect differences due to disease, gender and age as well as psychological attributes such as personality traits and emotions.

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## Gait analysis in healthy and operated subjects

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Quantitative gait analysis is an objective clinical tool to differentiate gait deviations, to measure and document neuromusculoskeletal functions in numbers and graphs, and to obtain accurate and precise measurements of human movement. It serves not only as a useful tool in planning treatment, but also a measure of treatment outcome. Although observational gait analysis has been used for many years in our daily practice, there are multiple reasons why it may not be adequate for the identification of more complex gait parameters. A more scientific evaluation can be provided by the use of three-dimensional (3D) quantitative gait analysis. The advance of 3D quantitative gait analysis, which includes kinematic, kinetic, and dynamic electromyographic assessment, has enabled clinicians to differentiate gait deviations objectively and understand the primary problem behind a complex disorder more accurately than can be done with observational analysis. A detailed history and physical examination of the patient combined with the gait data and the expertise of the team help in clinical decision-making in terms of antispastic drugs, orthotics and surgery.

A typical 3D quantitative gait analysis session starts with subject preparation and followed by data recording and data analysis. During subject preparation anthropometric data including height, weight, leg length and joint width of the knee and ankle are collected. After the subjects are instrumented with retroreflective markers, they walk barefoot or with shoes together with walking aids (if they need), at a self-selected pace, a number of times, over a 10-meter-long walkway during which time data collection was completed. Three to nine cameras record the quantitative spatial

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location of each marker as the subject walked. The trial in which all the markers were automatically and clearly identified by the system is determined the best data. Some laboratories average the trials they collected. Three components of the ground reaction force are collected by forceplates as the subject steps on them. Ground reaction forces (GRF) and kinematic data were combined with inverse dynamics to predict joint moments and powers of hip, knee and ankle joints in three dimensions. The recorded data is then processed for interpretation. The clinically validated biomechanical model combines the movement, force plate and EMG data with patient specific measurements to calculate the joint center locations, segment orientations, three dimensional joint angles and moments.

Three-dimensional quantitative gait analysis has advanced our understanding of normal gait, identified and quantified the biomechanical and motor control abnormalities of pathologic gait, and documented the usefulness of various therapeutic interventions. Further research are needed to show how gait analysis can improve patient care, evidences that 3D quantitative gait analysis studies can aid in the diagnosis and determination of the pathomechanics of some gait abnormalities.

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## **Skeletal muscle adaptation to increased activity level**

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Skeletal muscle is a plastic tissue capable of changing the type and the amount of protein under increased activity level. Increased activity induced adaptation in skeletal muscle involves a various of signalling mechanisms resulting in new protein synthesis. Endurance training especially targets to mitochondrial protein synthesis. On the other hand resistance training primarily stimulates the rate of myofibrillar protein synthesis and results in muscle hypertrophy. Hyperplasia has also been shown in some experimental conditions in animal subjects. Exercise training induced various metabolic and morphological changes are specific to the type of exercise. One of the important feature of the exercise training is transformation of the muscle fiber types. Although increased activity level results in fast to slow shift in myosin isoform, training duration, intensity and frequency play critical role in this transformation.

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## **Exercise-induced muscle damage and neutrophils**

### **Gülriş Ersöz**

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Trauma, mechanical stretch, exercise may cause muscle damage. All forms of exercise, if carried out vigorously enough, can lead to ultrastructural damage of muscle fibers but eccentric exercise, leaves stiff and sore the day afterwards. Muscle damage is characterized by ultrastructural changes to muscle architecture, damage-increased muscle proteins and enzymes in the bloodstream, loss of muscular strength and range of motion and muscle soreness.

The primary sequence of events leading to exercise-induced muscle damage is believed to involve initial mechanical disruption of sarcomeres, followed by impaired excitation-contraction coupling, disturbances in  $Ca^{2+}$  homeostasis. The activation of calcium-sensitive degradation pathways and inflammatory reactions are the subsequent steps and responsible for the delayed-onset muscular soreness (DOMS).

Inflammatory reactions within damaged muscle involves leucocyte infiltration and increase in proinflammatory cytokine production, systemic release of leucocytes and cytokines. Neutrophils and macrophages play dominant role in inflammatory responses. Neutrophil infiltration leads greater damage in muscles. Neutrophil activation cause increase in oxygen consumption. The "respiratory burst" result in release of reactive oxygen species (ROS). ROS are suggested to be responsible subsequent muscle damage. The neutrophil response to the exercise is dependent on the intensity and type of exercise, age and gender. There are limited data about the effect of antiinflammatory drugs and antioxidant supplements.

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## **Evaluation and diagnosis of isolated and combined knee ligament injuries**

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Recent interest in the anatomy and biomechanics of the knee joint, combined with the increased incidence of high energy knee injuries has led to an increased awareness and diagnosis of knee ligament injuries. Most isolated knee

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ligament injuries involve the medial collateral ligament (MCL) and/or the anterior cruciate ligament (ACL). They usually occur as a non-contact, low energy trauma during sports. Meniscal and chondral injuries usually accompany the ligamentous lesions. Diagnosis is usually straightforward with the typical history of sudden rotational trauma, followed by a pop and hemarthrosis. Tenderness along the MCL, frequently on the femoral insertion on the epicondyle, and a positive valgus stress test are the hallmarks of MCL injury. A positive Lachman test immediately after trauma is helpful in ACL injuries. As the swelling reduces and pain subsides a positive pivot-shift test clearly denotes the injury. Partial ligament injuries may occur. A positive Lachman test without a positive pivot shift test implies injury to the antero-medial bundle of the ACL, while the reverse denotes an injury to the postero-lateral bundle of the ACL.

Isolated injuries to the posterior-cruciate ligament (PCL) or the postero-lateral corner (PLC) are rare. These ligaments are usually injured during a high energy, contact trauma such as a motor vehicle or industrial accident and involve multiple ligaments. Associated injuries to the popliteal artery, peroneal nerve, impression fractures of the contra-lateral femoral condyles, tibial rim fractures, meniscal injuries and rupture of the patellar tendon may occur. Emergency evaluation of the soft tissue coverage and neuro-vascular status of the extremity should be carried out. Gentle examination of the knee reveals the magnitude of ligament injury. The posterior drawer, external rotation-recurvatum, dial and varus stress tests aid in the diagnosis. X-rays may reveal frank knee dislocation or avulsion fractures. MRI is the gold standard in the evaluation and surgical decision making of these complex injuries. Routine angiography is not mandatory if careful clinical and ultra-sound evaluation is available. Since surgery in the first three weeks after injury results in the best clinical outcomes, a treatment strategy should be formed early after injury. Combined ACL + MCL injuries may be addressed with a conservative treatment of MCL followed by reconstruction of ACL after adequate healing of MCL has occurred and knee range of motion has been restored. All other combined ligament injuries involving more than two ligaments should be treated surgically in the first 3 weeks following injury. Bony avulsions of ligaments can be internally fixed. Mid-substance cruciate ligament injuries are reconstructed with autologous or allogenic grafts. Primary repair of the collateral ligaments and capsular structures are performed if the tissues are of good quality. Chronic cases require reconstruction of all injured ligaments.

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## **Topographic and functional anatomy of the knee joint**

### **Konstantinos Natsis**

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The knee is the largest joint of human body. It is separated in two joints, the tibiofemoral and patellofemoral joints. The femoral condyles (FC) roll and slide on the tibial plateau. During flexion they slide anteriorly and roll posteriorly, while during extension they slide posteriorly and roll anteriorly. During lateral rotation, lateral FC moves anteriorly and medial FC moves posteriorly. During medial rotation, lateral FC moves posteriorly and medial FC moves anteriorly.

Concerning the tibial condyles (TC), during flexion they roll posteriorly and during extension they roll anteriorly. When the knee is rotated laterally medial TC moves posteriorly and lateral TC moves anteriorly. When the knee is rotated medially lateral TC moves posteriorly and medial TC moves anteriorly.

In the patellofemoral joint, as the patella moves vertically, along the trochlea during flexion. During knee flexion the patella and FC come closer, while during extension the patella and FC separate. During medial rotation, the patella moves medially and during lateral rotation it moves laterally.

The lateral meniscus (LM) covers about 80% of the lateral tibial plateau, while the medial meniscus (MM) covers about 60% of the medial tibial plateau. However not all knees are the same. When the knee is extended the menisci move anteriorly unequally, while when the knee is flexed they move posteriorly unequally. During lateral rotation LM moves anteriorly and MM posteriorly, while during medial rotation MM moves anteriorly and LM posteriorly.

The collateral ligaments of the knee, medial (MCL) and lateral (LCL) are responsible for the transverse stability of the knee during extension. According to relatively recent observations the MCL is divided into superficial and deep MCL, while the LCL sometimes may consist of two bundles. Both ligaments are taut during extension and slackened during flexion.

The anterior cruciate ligament (ACL) is divided into two parts, the anteromedial bundle (AMB) and the posterolateral bundle (PLB), while other authors have separated the ACL in three functional bundles (AMB, intermediate band, and PLB). However, the two bundle model has been generally accepted as the best representation to understand ACL function. The fascicles of the AMB originate at the most anterior and proximal aspect of the femoral attachment and insert at the anteromedial aspect of the tibial attachment. Conversely, the fascicles of the PLB originate at the posterodistal aspect of the femoral attachment and insert at the posterolateral aspect of the tibial attachment. When the knee is extended, the PLB is tight and the AMB is moderately lax. As the knee is flexed, the femoral attachment of the ACL becomes more horizontally oriented, causing the AMB to tighten and the PLB to loosen up.

The posterior cruciate ligament (PCL) can be partially separated into an anterolateral and posteromedial bundle. A more detailed subdivision of the PCL bundles separates it in anterior, central, posterior longitudinal and posterior

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oblique fibers. The anterolateral bundle is seen to be curved in the sagittal plane and therefore is slack in the extended knee. When the knee flexes this bundle becomes tight and also takes a steeper angle away from the tibial plateau. In deep knee flexion the anterolateral bundle comes to rest against the roof of the posterior part of the femoral intercondylar notch. The posteromedial bundle of the PCL is tight and aligned in a proximal-distal direction in the extended knee. The posteromedial fibers slacken as soon as the knee starts to flex. In deep flexion the posteromedial fibers' attachment moves anteriorly and also upwards away from the tibial plateau and as a result the posteromedial fibers then become tight.

In the PCL's complex we describe the anterior and posterior meniscomfemoral ligaments (aMFL and pMFL). In brief, the anterior and posterior meniscomfemoral ligaments attach respectively distally and proximally to the PCL attachment to the femur. These positions mean that the aMFL is slack in the extended knee and tightens with knee flexion, when it is well-aligned to withstand tibial posterior draw. Conversely the pMFL is tight in the extended knee and slackens with knee flexion, because its femoral attachment moves down towards the tibial plateau.

The major structures of the posterolateral corner (PLC) of the knee include: the iliotibial tract, the lateral collateral ligament, the popliteus complex consisting of both dynamic components (the popliteus muscle-tendon unit) and static components (the popliteofibular ligament, popliteotibial fascicle, meniscomfemoral ligament and popliteomeniscal fascicles), the middle third of the lateral capsular ligament, the fabellofibular ligament, the posterior horn of the lateral meniscus, the lateral coronary ligament, the arcuate ligament and the posterolateral part of the joint capsule. However, this anatomy can be quite variable.

Actually, all the muscles around the knee have a dynamic stabilizing role in the functional anatomy of the joint. One of the most important dynamic stabilizers, the popliteus muscle-tendon unit, slackens during knee flexion and lateral rotation and stretches during knee extension and medial rotation.

Knowledge of topographic and functional anatomy of the knee is very useful to explain the mechanism of injury and evaluate mainly the ligamentous injuries. To make these injuries understandable, the knee can be divided into sections. According to the traumatic mechanism (varus, valgus, or both), structures in different sections may be injured. Additionally, there may be associated injury of the central pivot. Multiple combinations of injuries can occur.

Structures of the anterolateral portion are the most frequently injured. These injuries are usually associated with damage to the anterior cruciate ligament. The injury is caused by varus force with internal rotation of the tibia. Most commonly, the posterior fibers of the iliotibial tract are damaged. An avulsion fracture of the Gerdy tubercle may also occur.

The mechanism of posterolateral injury is either direct varus force while the tibia is externally rotated or sudden hyperextension of the knee. Clinical signs may be subtle and might remain masked by the more extensive symptoms due to cruciate ligament damage. Practically all tears of the (LCL) are associated with damage to posterolateral knee structures: capsular tears, detachment fracture of the superior rim of the tibia (Segond fracture), biceps femoris tendon tears, popliteus tendon lesions, cruciate ligament tears, and so on. Instead of a (LCL) tear, an avulsion fracture of the fibular insertion of the (LCL) and biceps femoris tendon can occur. The majority of popliteus tears are extraarticular, involving the muscular or myotendinous portion, although they can be intraarticular at the level of the popliteal hiatus and at or near the femoral insertion. Such injuries can also be a mixture of intraarticular and extraarticular. Most popliteus muscle and tendon injuries are associated with damage to other knee structures: injury to other elements of the arcuate ligament complex, cruciate ligament tears, meniscal tears, bone fractures, and so on. Less than 10% of popliteus tears are isolated.

Concerning the stability of medial side of the knee three principal structural elements have been described: the superficial medial collateral ligament (sMCL), the deep MCL (dMCL), and the structures of the posteromedial complex (PMC). Several fibrous bands that form thickenings of the PMC have been described. These attach around the femoral adductor tubercle and pass posterodistally across the joint line, to insert on the rim of the tibial plateau; a central band among these has been called the posterior oblique ligament (POL).

The anterior translation laxity with free tibial rotation does not change significantly when the 3 medial structures are cut at any angle of knee flexion. Only at fixed tibial external rotation isolated cutting of the dMCL causes a small but significant increase in tibial anterior translation.

Posterior tibial translation does not increase significantly when the sMCL, dMCL and PMC are cut. At tibial internal rotation cutting the PMC alone and after cutting the dMCL and PMC, further cutting the sMCL in the extended knee, increases posterior laxity overall. Of course in severe trauma, all the stabilizing structures of the knee may be disrupted. In these serious situations, the common peroneal nerve and gastrocnemius muscle can also be injured.

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## **The Event Physician – Emergency Sports Medicine**

**David McDonagh**

Sports Medicine may have its origins in, yes, India - when the use of therapeutic exercises were described in the fourth Veda book Artharvaveda, written sometime between 900 and 100 B.C.

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Due to the popularity of sports and the increase in sports injuries, physicians were asked to attend sports fixtures to offer treatment to injured athletes. Later, the rehabilitation of athletes became a necessary function that has evolved into a large and sophisticated scientific field. The field of sports and exercise medicine has grown exponentially and now has practitioners and researchers from many scientific backgrounds, physiologists, nutritionists, physiotherapists, athletic trainers and physicians. The Federation of Sports Medicine (FIMS) was created in 1928 to assist the athletes at the St. Moritz Olympic Winter Games. Later, sports medical organisations have been established in almost all countries in the world.

But, despite all this development and research, little focus has been placed on the role of the Event Physician and the tasks he or she must confront.

Is it time to go “Back to Basics”.

Dr. McDonagh describes where emergency sports care is today. He will elaborate on the exciting new projects that are developing in the education of event physicians, with books, courses and research programs.

Dr. McDonagh is Chair of the International Bobsleigh Federation Medical Committee; the representative of the Olympic Winter Federations on FIMS; was team physician for several Norwegian national teams; was Deputy Chief Medical Officer at the 1994 Winter Olympic Games; has been advisor for 5 other Olympic Games; is a member of the Norwegian Antidoping Tribunal and the ICC (Cricket) Antidoping tribunal. He is an A + E consultant at the University Hospital, Trondheim and senior lecturer at the Norwegian University of Science and Technology, Trondheim, Norway.

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## Medical coverage in major sports events

**Carlo Tranquilli<sup>1</sup> and Francesca D’Alfonso<sup>2</sup>**

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Planning, organizing and carrying out medical assistance / emergency care for a major international sports event means providing adequate medical services to athletes, judges, referees, media, spectators, volunteers and all accredited individuals and groups. To that end, the role of sports medicine is of crucial importance and therefore must be of high quality for the participating athletes since the primary aim of the practice of sport is promoting health habits.

More specifically, health care management has the following aims:

- 1) Placing medical care units at training and competition venues, lodgings, accreditation and press centers thus providing medical coverage to athletes, managers, staff, media, volunteers, spectators, etc. This service will provide first aid care, basic and advanced cardiopulmonary resuscitation, ambulance transportation, any necessary complementary diagnostic tests, medical treatment or surgery by specialists and, if necessary, hospitalization.
- 2) Provision of appropriate equipment and adequate facilities for medical and health personnel of the participating teams for the performance of their duties.
- 3) Implementation of prevention and control measures of Public Health.
- 4) Implementation of prevention and control measures for veterinary care in equestrian competitions.
- 5) Implementation of preventive measures, emergency services and medical care for water sports competitions (both offshore and small lakes).
- 6) Supervision of diet and nutritional quality of meals for the participating athletes, taking account of hygiene and health issues and respecting cultural and religious peculiarities.
- 7) Managing and carrying out doping controls in accordance with WADA regulations.
- 8) Producing manuals for medical health care for athletes and delegations (Medical Guide, Drug Formulary Guide, Doping Control Guide)

In terms of structures and responsibilities, every international sports event will be organized into three main areas of health care: Sports Medicine, Public Health and Doping Controls.

These structures strictly depend on the management of health services operations: a person responsible for each area will be appointed to facilitate the work of coordination.

Sports medicine aims to provide responsible medical attention to athletes in accordance with criteria established.

Its main areas of action are:

- Management and Administration
- Sports Medicine for competition and training venues
- Polyclinic at the Athlete’s Village (outpatient services, trauma services, laboratory analysis, conventional radiology services, CAT, MRI, ultrasound, physiotherapy)
- Sports Nutrition

Public Health covers three distinct areas:

- Primary care and ambulance transport service (competition venues, residential venues, media center, accreditation centers, official events)
  - Intensive care units and emergency care service
  - Public Health
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Doping controls are carried out through the following ways:

- Doping controls are organized at all competition and training venues and at the Polyclinic Medical Center.
- Preparation of sites in compliance with WADA regulations
- Determining and training of DCOs and “chaperones”
- Organizing doping controls and chain of custody with the accredited anti-doping laboratory

At the end of the sports event a report on all health activities should be prepared in order to document the management of the organizational arrangements and report on issues regarding health care services.

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## Yachting Injuries

**Kirill Micallef-Stafrace<sup>1</sup>, Andrew Decelis<sup>1</sup>, Nicola Micallef-Stafrace<sup>2</sup> and George Buttigieg<sup>3</sup>**

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Historically sailing medicine has been mainly undertaken by doctors that were themselves sailors. However, with the increase in popularity of sailing events such as the America’s Cup, The Volvo Ocean Race and the Olympics sailing programme, a significant effort is being made to maximise the potential performance of the sailors. Over the last few decades millions, if not billions, of Euros have been poured into the development of the sailing boats, yet little thought had been spent on ensuring the physical and mental performance of the sailors themselves. This has now all changed. Sailors have been recognised as being athletes themselves and ameliorating their performance will automatically lead to better results. This applies to all levels of sailors, across all the classes, even the weekend ‘warrior’. Some little attention can ensure injuries are avoided and when they do happen that they are sorted out as soon as possible. Another aspect is how to better ones physical and mental performance, but that will be tackled in another issue.

As we all know, injuries are far from being a rarity in sailing. Sailing is one of the few sporting disciplines that the athlete in question is never in complete control. The elements have a nasty habit of reminding us of this. The type of injury is often related to the class of boat and the function of the sailor within the crew. They can be caused by poor athletic conditioning, overtraining or improper training and the more obvious direct trauma. In sailing all of them are a common occurrence, although this might not be apparent to a non sailor. Sailing involves a series of complex physical manoeuvres which are often repetitive, yet at the same time can be sudden. To compound matters they are often undertaken in awkward positions and on a platform that has the unerring capacity of being unstable. Repetitive powerful movements such as hiking or main sheet handling can lead to back, knee or upper body ailments. Muscle imbalances are often found in sailors due to the often unilateral physical effort imposed on them and if not identified early can cause or aggravate musculoskeletal problems.

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## Hyperthermia and soccer

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Only about 20-25% of the energy released by muscle metabolism during exercise is used to do work, with the remaining 75-80% appearing as heat. An increase in body temperature is therefore a normal response to exercise. Elevation of body core temperature can be compensated through the evaporation of sweat from the skin surface, but this increase in sweating rate may eventually cause dehydration during prolonged exercise. Therefore, performing physical activities during a sportive event in a hot and humid environment without proper hydration can be a significant threat to health and performance.

In Europe the regular soccer season typically begins in August and in some parts temperature may exceed 30 oC with a relative humidity of 50% (www.bbc.co.uk/weather). Thus, climatic heat stress can be a problem for soccer players. Although reports of serious heat illness are rare and deaths are extremely uncommon in soccer, they do occur. Thermoregulatory responses during exercise in different environmental conditions have been studied extensively. However, because of the unique nature of soccer, the physiological and physical challenges of a soccer game cannot be replicated in a laboratory, though attempts have been made to simulate this activity pattern. Therefore, studies performed during a soccer match played under extreme heat conditions are extremely important to evaluate the physiological strain of the soccer players that they have to cope with. In fact in a match played at 36 °C with a relative humidity of 61% had shown that average body core temperature reaches to values of 39.5 °C with an heart rate value over 180 beats/minute. Moreover the average sweating rate reached nearly to value of 2 liter/hour during the game. The volume of sweat loss, possible changes of plasma electrolyte balance and osmolality together with hyperthermia would

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seriously impair athletic performance capacity and thermoregulatory mechanisms.

Prophylactic interventions such as acclimatization, different cooling strategies and hydration before, during, and after the sportive event are extremely important to prevent athletic performance capacity. It is also important to remember that together with these interventions, extensive health screening is important to protect soccer players from the undesired occasions related with physical activities.

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## Effects of a single session of resistance exercise training on specific cardiac and oxidative stress markers

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**OBJECTIVE** In the past the fear of damage to the cardiovascular system has led exercise specialists to urge against high intensity resistive exercise. Strength training has been associated with an abrupt increase in blood pressure, wall stress, increased myocardial oxygen demand, myocardial ischemia, and left ventricle dysfunction. The present study was designed to investigate whether the stress of a high intensive strength training session can induce myocardial cell injury in trained weightlifters as assessed by post exercise plasma concentrations of cardiac specific and nonspecific biochemical markers. A further aim of the study was to examine if this intensive training session would result in an elevation of cell-free plasma DNA or an elevation of reactive oxygen intermediates (hypoxanthine, xanthine).

**METHODS** 12 healthy, national class weightlifters performed 6 sets of 6 lifting exercises at 5 RM each, including isometric stabilization and the Valsalva Maneuver. Blood samples were drawn and urine samples were obtained from each subject 1 hr before the training, as well as immediately after finishing the exercise test and 2 hrs post-exercise. For detection of myocardial and skeletal muscle damage cardiac troponin I (cTnI), total creatine kinase activity (CK) and myoglobin (Myo) were measured. Serum concentrations of cTnI and myoglobin were measured by immunoassays – CK activity by routine photometric assay. For detection of myocardial overload NT-proBNP was analyzed using electrochemiluminescence immunoassay. The amount of cell free plasma DNA was measured using fluorescence signal detection and oxipurine levels were analysed using HPLC technology. A one-way ANOVA with repeated measures was used to detect changes over time. The Tukey HSD post-hoc test was used to determine the location of differences when significant main effects were detected.

**RESULTS** Beside cTnI all markers showed significant elevations ( $p < 0.05$  to  $p < 0.001$ ) over the time course of the 3 blood draws and urine measurements respectively. Most laboratory markers were outside the reference ranges. However the sensitive and specific biochemical markers for detecting myocardial damage (cTnI and NT-proBNP) stayed within the reference ranges and tended to decrease toward baseline levels already 2 hrs after finishing exercise training again. Markers of oxidative stress and cell free plasma DNA showed the same tendency with significant elevations ( $p < 0.01$ ) immediately following strength training but no significant differences compared to baseline 2 hrs after finishing the training session.

**CONCLUSION** From the present study it would appear that heavy resistance exercise is well tolerated by experienced weightlifters without showing any evidence that lifting tasks damages the myocardium. The elevation of non-specific markers (CK and Myo) may reflect a mild tissue trauma of the skeletal muscles. The transient elevation of cell free plasma DNA and of the oxipurines might be caused by short episodes of ischemia of the skeletal muscles resulting in an elevation of reactive oxygen intermediates.

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## Phosphodiesterase's inhibitors and physical activity

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Phosphodiesterases (PDEs) catalyze the hydrolysis of cyclic adenosine monophosphate (cAMP) and cyclic guanosine monophosphate (cGMP), to the corresponding 5' nucleotide monophosphate (19). Currently, eleven different PDEs families have been found throughout the body, each family containing sub-families and multiple splice variance; they differ in selectivity for cyclic nucleotides, sensitivity to inhibitors and activators, physiological roles, and tissue distribution.

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Nowadays, million of individuals of different ages take phosphodiesterase's inhibitors (e.g. PDE-5i) daily, not only as therapeutic agent to treat erectile dysfunction (ED), but also for non-therapeutic purpose (e.g. recreational use). Interestingly, there are many anecdotal reports of the use of PDE-5i to increase performance in sports, both in humans and animals.

Experimental studies have indicated that sildenafil, the firstly used PDE-5i, positively influences exercise capacity in subjects affected by cardiopulmonary diseases (e.g. pulmonary hypertension) and in healthy subjects in hypoxic conditions. Some Authors also hypothesized that subjects with particular responsiveness to the exercise-enhancing effect of PDE-5i, in hypoxic condition, exist. In contrast, other Authors observed that the evaluation of the effects of sildenafil on exercise capacity at a simulated altitude did not provide conclusive data.

In healthy male athletes we observed that, compared to placebo, a single tadalafil (i.e. a long-term PDE-5i) administration significantly reduced systolic BP before and after exercise, decreased O<sub>2</sub>/HR at individual ventilatory threshold (IVT), but did not influence individual O<sub>2</sub> max, IVT, and individual anaerobic threshold. Furthermore, we observed that, compared to placebo, tadalafil administration was able to amplify the mean salivary C and T responses to a maximal physical exercise, with concomitant further decrease of salivary DHEAS/C and T/C ratios. We hypothesized that in our experimental conditions, tadalafil could have: a) influenced the CNS sensitivity threshold to exercise-related stress, and/or, b) maximized, at different levels, the HPA and HPG response to physical stress, and/or, c) influenced the cytochrome P450 (CYP) 3A-mediated steroids metabolism.

Athletes taking PDE-5i, and also their physicians, are still unsure whether PDE-5i in some sports might negatively influence performance or whether specific health risks, related to the interaction between intense physical activity and PDEs inhibition, exist.

The observed effects of PDE-5i on exercise performances may be relevant not only in terms of therapeutic use of PDE-5i for diseases other than ED, but, if further confirmed, also in terms of their possible fraudulent utilization to influence exercise performance in sports, raising the difficult question of whether, particularly in some circumstances (e.g. high altitude and/or induced hypoxia), the PDE-5i might be considered as "prohibited substances" (i.e. doping) in athletes. Moreover, very few investigations are actually available when the effects of PDE5i on sport performance are concerned. Particularly, it remains to confirm if a non-therapeutic PDE5i administration in athletes at higher doses (i.e. non-therapeutic) or a prolonged use influences sport performances in field conditions.

Studies to verify the effects of different PDE5i treatments on both athlete's health and exercise performance, and to explore all the pathways involved are warranted.

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## **Upper extremity problems in children (Maladaptation and chronic syndromes of the shoulder)**

**Vuslat Sema Ünal**

Ankara Numune Eğitim ve Araştırma Hastanesi, Ortopedi ve Travmatoloji Kliniği, Ankara

Pediatric participation in sports increases each year. Sports injuries in children becomes an important topic consequently. A considerable percent (%32) of serious injuries in children (5-17 years) occurs during sports and/or recreational activities. Girls are effected less than boys. (%20, %40 respectively).

Chronic Sports injury in a child is caused by chronic submaximal trauma repeating over the healing capacity of the body (microtrauma, overuse, misuse) and comes to stage as tendinopathy, stress fracture, osteochondritis, traction apophysitis, maladaptation (flexibility and strength). The deforming forces either acute or chronic has effects on growth plate, apophysis, immature muscle development may cause permanent damages if not prevented and/or treated.

Shoulder maladaptation and chronic injuries in children are common in sports with repeating overhead movements. Chronic shoulder injury in a child can occur because of internal factors like; immature musculoskeletal system, poor dynamic shoulder stabilization, improper technique. There may also be external factors as; level of competition, quality of the sports, improper sportswear and protective equipments, frequent competitions, and improper training program.

Chronic injury of a child may come to scene as rotator cuff injury or SLAP lesion which is easier and more effective to prevent than treat. For prevention we have to be aware of two important concepts of the body motion.

The first one is 'anticipating postural adjustments' (APA). This can be defined as the position, body takes during kicking, throwing, and running to provide the balance and keeps on with programmed muscle activations. The muscle activations generate and control forces by providing interactive moments and loading the joints.

The other concept is kinetic chain segment activation (KCSA). This term is the description for core activation for distal force development. The force is generated at the gravity center of the body (core activation) and transferred to the related extremity through the joints by muscle interactions to do the intentional movement (distal force development). As a matter of fact shoulder motions are not created by the periscapular muscles but the whole body. APA and KCSA, provides body stability proximally while performing the activity distally in maximum strength.

Chronic injuries in children occurs due to technical and structural deficiencies in APA and KCSA. Kinetic chain

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segment activation is different in children. So should be the APA. Therefore to diagnose and treat the weak ring in the chain will prevent the forthcoming shoulder injury in pediatric athletes.

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## **Driver's physical condition, physical training a WTCC experience**

### **Ignacio Muro**

Sports medicine, SeatSport WTCC team doctor, TMEH Centro Médico Teknon, Barcelona, Spain

An explanation of the fundamentals of how a WTCC Racing Team prepares and maintains its pilot's physical condition. Includes detailed explanations of what the driver's job is, his physical necessities, how to adapt a personalized training program to improve the driver's results and how to structure a recovery or recuperation program after a race or accident.

Motor Sport competitions vary, from cars to motorbikes, but the basics of the physical training for drivers are common for all. A motor sport team needs the contribution of a large number of members and all the efforts are focused on improving the performance of the car and the driver. The mechanical parts of the car are looked after by engineers and technicians, the driver is looked after by a doctor, a physiotherapist and a physical trainer. Not only does the driver travel around the world for demanding races and tests, but he also attends manufacturer's and press events.

Driving a car is an aerobic activity, although it may become anaerobic, especially when fighting to win. The driver needs to resist high temperatures wearing an overall, fireproof underwear, balaclava and helmet. In addition to the stress of the race, car control requires a huge muscular effort in an oppressive position which produces high levels of peripheral and central fatigue.

### **OBJECTIVE**

1. General Endurance; Resilience to long-journey duress. (heat, cold)
2. Muscular Endurance and Balance: Permanent and complete car control.
3. Body Composition; Ideal balance between body weight, fat percent and muscular percent.

Basic and Functional training.

Basic training is focused on general endurance. Even if drivers enjoy sports training, time limitations require that all the training sessions be previously scheduled. Physical activity should be fun, and for drivers this implies "wheels and engines" such as: cycling, motor bikes, snow and water bikes, skiing, ice hockey, beach volley. Balanced nutrition guidelines should be established and body composition monitoring should be effected monthly.

Functional training enhances proprioception skills and enables the driver's ability to fully control body movements even when the car is shaking during a crash. Balance training is presented as a challenge, starting from a basic level the driver increases the difficulty of the exercises on a weekly basis using fit-balls, bosus, elastic bands, balls, and bars. The driver's strength is increased but not his weight or volume.

Complete recovery after a hard day of racing and testing is just as important as pre-race training. Drivers are instructed in stretching and yoga techniques to relax their muscles. They get physiotherapy treatment to prevent and treat muscular soreness and joint swelling, particularly the cervical area which is difficult to stretch individually. Spa bath and sauna sessions are used when available.

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## **Prevention of dental trauma in contact sports**

### **Ayse Diljin Kececi**

Süleyman Demirel University Faculty of Dentistry, Head of the Department of Endodontics, Isparta, Turkey

In contact sports, players physically interact with each other, trying to prevent the opposing team or person from winning. Contact sports such as rugby, hockey, boxing, basketball or martial arts belong to the high-risk sports. A blow or kick from the rival most often causes injury to one tooth, while a fall or blow from a hard object often results in injuring more than one tooth. Enamel fracture, crown fracture with or without pulp exposure, root fracture, luxation injuries, avulsion and fracture of the alveolar process are types of dental trauma. Dental damage following these injuries is usually irreversible and can cause functional, esthetic and psychological impairment.

Prevention of these injuries must be the prime emphasis of sports dentistry. With the introduction of mouthguards at about the turn of the century and their widespread use, there has been a reduction in sports-related dental injuries. Mouthguards have a significant role in absorbing and dissipating very important part of the energy in the impact zone. Its main functions are reduction of the impact of direct and indirect contacts resulting in the orofacial injuries, soft tissue lacerations, temporomandibular joint damage, concussion, and mandible fractures.

It must be kept in mind that various mouthguards have, to some degree, an injury-preventing effect. Many sports-related dental and orofacial injuries can still occur regardless of whether a mouthguard is worn or not. The obvious cause of injury in mouthguard-wearing cases is when the impact force far exceeds the protective capability of a mouthguard. However, the ordinal impact power in sports is estimated to be smaller than that found in traffic accidents

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and mouthguards are found to be the most effective way of preventing dental injuries.

It is usually found difficult to wear the stock or boils-and-byte type of mouthguards, because of oral dryness, nausea, instability, difficulties in breathing and speaking. New studies report that such kind of problems and the performance of the athlete are not negatively affected, when a custom-made type of mouthguard is used.

Over the recent years, there has been an increasing interest in studies related to the protective properties of mouthguards like reinforcement by various techniques for better shock absorption, better adaptation and some other details for athletes' satisfaction, which will be focused on in this lecture. Besides the importance of sports dentistry and the role of sports institutions on increasing the awareness of mouthguard use will be emphasized.

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## **Stretching: Effects of strength and injury prevention**

### **Ufuk Sekir**

Medical School of Uludag University, Department of Sports Medicine, Bursa, Turkey

Many athletes use some type of pre-participation warm-up routine to prepare themselves for athletic practice or competition. Traditionally, these warm-ups have included some form of stretching, and stretching has been commonplace in a multitude of sports. Many athletes, athletic trainers and other rehabilitation professionals believe that stretching promotes better performance and/or reduce the risk of musculoskeletal injury during strenuous exercise or strength assessment tests by improving flexibility or pain-free range of motion about a joint. Athletes and coaches use many different types of stretching that are usually based only on their personal preference, but no optimal type or amount of stretching has been identified. There are various techniques of stretching, including ballistic, proprioceptive neuromuscular facilitation (PNF), static, and dynamic stretching. Among these, static stretching is widely used because its application is easy and safe. Recently, numerous studies have examined the effects of static or dynamic stretching on maximal isometric, concentric, or eccentric dynamic muscle strength. Typically, it was shown that pre-exercise static stretching may temporarily compromise a muscle's ability to produce strength either isometrically or isokinetically. In contrast, some evidence exists indicating that dynamic stretching exercises may improve muscle strength performance. This has implications for athletes involved in sports that require high levels of strength and force production. Some researchers have proposed that static stretching prior to competition may hinder performance and prompted recommendations that static stretching be omitted or replaced by dynamic stretching during warm-ups. On the other hand, stretching is commonly perceived as an important way to prevent injury by the public, sports coaches and sports medicine professionals. However, in the literature, conflicting data have been reported concerning the relationship between flexibility and athletic injury. The literature reports opposing findings from different samples. A number of reviews of the stretching literature exist, in which authors advocate stretching as an important part of an injury prevention program, although these conclusions are not based on any clinical evidence. But, at the same time, other numerous recent systematic reviews on this matter have shown no evidence that stretching does, in fact, reduce injury risk. Therefore, no definitive conclusions could be drawn as to whether stretching reduces the incidence of exercise-related injury due to the heterogeneity and poor quality of the studies. Consequently, based on the studies in the literature, there is not sufficient evidence to endorse or discontinue routine stretching to prevent injury among competitive or recreational athletes. Better research is needed to determine the proper role of stretching in sports, especially as there are increasing numbers of athletes and growing recognition that all people need to increase their physical activity to improve their health and quality of life.

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## **Prevention of football injuries**

### **João Pereira de Almeida**

SLB Medical Doctor, Portugal

A program of sport injury's prevention is mandatory in medical support to sport activities. Working in a club with more than 150.000 affiliated and with a sport activity more than 2500 a day, we have to plan a program that can reduce the number of injuries. Twenty years ago European Council organized a program of Sport injury's prevention and in the following years different sport organizations adapted those recommendations. In our Club, SPORT LISBOA AND BENFICA - SLB, we organize the program in classic items.

Primary prevention: Characterize the risk factor (intrinsic and extrinsic)

Secondary prevention: Correction of risk factors

Tertiary prevention: treatments of dysfunctions

The medical department is multidisciplinary; we have sport medicine doctors and orthopedics and other specialties physiotherapists, psychologists, nurses, physiologists, nutritionist, homeopaths and administrative support. Organize a program in different sports is difficult and we began with soccer and we are now speeding to basketball

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futsal, volleyball, handball and roller skating. In the beginning we have a deep dialog with all the staff (technicians, coaches etc.). In the material support we have to “built” new gymnasium and to organize the training camps and in the stadium, new methods of registration of the mobility of the players. For each player we have a registration of medical condition, psychological, nutritional conditional capacities and we evaluate cardiac and biochemistry adaptations every training and game. Special program of UEFA, surveying of sport injuries is already available. We asked to be included in that program. After two years working with the program or sport injuries prevention we have in season 2008/2009 very good results.

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## **Workshop ultrasound of the wrist and hand**

**JL Gielen**

University of Antwerp, Belgium

The wrist and hand have a very complex anatomy that is well demonstrated on modern high resolution ultrasound. The first part of this workshop will refresh relevant anatomy, the second “hands on” part will demonstrate these anatomic peculiarities, where as in the last part the relevance of this anatomy will be demonstrated in pathological cases. The regions that are addressed are the dorsal hood and extensor mechanism, the flexor tendons, the ulnar collateral ligament of the thumb with special interest in the detection of Steners lesion. The ulnar nerve and Guyon’s canal. And the extensor compartments with special focus on the first (De Quervain’s) compartment and the sixth or ECU compartment.

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## **Olympic performance: beyond genes & genome**

**Vassilis Klissouras**

Professor of Ergophysiology, University of Athens, Athens, Greece

My main argument in this presentation is that the traditional dyad of genes and environment, as a cause of top sport performance, may require revision to consider epigenetic influences which play a crucial role in regulation of genotypic functions of complex human traits, and hence, we need to go beyond gene and genome to understand the nature of Olympic performance.

**Genetic influences.** Heritability estimates for phenotypes related to sport performance is in the 50-90% range. Findings from twin studies lead to the conclusion that genetic influence is so ubiquitous and persuasive in sport performance that we now ask: not what is heritable, but what is not heritable. During the past decade, Quantitative Genetics and Molecular Genetics have began to come together to identify specific genes responsible for substantial heritability of determinants of sport performance, although so far no definite evidence was found that DNA sequence variants in a given gene is reliably associated with performance variation.

**Environmental influences.** A high heritable attributes does not mean that it is unaltered, fixed and predetermined and the environment has no effect. It only indicates that observed individual differences in the given attribute are due to genetic differences and are highly predictable. Genetic potential is not a passive possibility, but an active disposition, actualized through laborious effort and the sweat of the brow. However, training can exert its profound effect only with the fixed limits of heredity.

**Epigenetic influences.** The picture emerging is consistent with the notion that superior sport performers are endowed with high genetic potential for their specific sport, actualized through hard, prolonged and prodigious effort. Yet, there is an increasing body of experimental evidence suggesting that epigenetic influences may play an important role in superior performance. The process of epigenesis mediates variations in gene expression that occur in response to changes in a person’s internal and external environment. It has been shown that young identical twin pairs are essentially indistinguishable in their epigenetic markings, in various tissues including muscle, whereas older identical twin pairs exhibit remarkable differences in their overall content and genomic distribution of 5-methylcytosine DNA and histone acetylation, affecting their gene – expression profile.<sup>1</sup> Findings we obtained from identical twin athletes of Olympic level are consistent with an important role of epigenetic alterations in both biological and behavioral phenotypes. Apparently such alternation inevitably mold our DNA, silencing some genes and promoting the expression of others, thereby facilitating cognitive, emotional and behavioral changes that empower the athlete to push himself to his limits.

### **Reference**

1 Fraga MF, Ballestar E, Paz MF, Ropero S, Setien F, Ballestar ML, Heine-Suner D, et al. Epigenetic differences arise during the lifetime of monozygotic twins. *Proc Natl Acad Sci USA*. 2005; 102:10604-10609.

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## Can supplements increase performance? Should they be on the list?

### Anton JM Wagenmakers

Professor of Exercise Biochemistry, School of Sport and Exercise Sciences, University of Birmingham, Birmingham B15 2TT, United Kingdom

Recent reports show that between 70 and 100% of all athletes use nutritional supplements. Total global consumer spending on nutraceuticals (dietary supplements for sport and health reasons) is estimated at \$187 billion and still rising with 6-7% per annum.

Nutritional supplements among others are used by athletes to enhance energy supply and performance, to enhance recovery from exercise and anabolic effects in muscle, to enhance immune system function, and to enhance performance via effects on the central nervous system. Properly designed scientific studies for many popular supplements have failed to confirm the effects claimed by suppliers. This review lecture will focus on creatine, caffeine, and bicarbonate: 3 supplements for which hard scientific evidence has been generated that they have an ergogenic effect using properly designed performance tests in several laboratories and confirmed by evidence on the underlying mechanisms. Creatine improves high intensity intermittent exercise performance in laboratory conditions. This effect is not of particular practical relevance in athletic events, but is most useful in soccer, hockey etc, that is in events that depend on outrunning members of the other team in repeated sprints. As 1-3 kg weight gain is a side-effect and as there is no effect on endurance performance, its use is better avoided by endurance athletes. No evidence has been published for its claimed muscle anabolic effect in humans. Caffeine improves exercise performance in events lasting > 60 sec, but its effect on sprinting performance is inconclusive. Ingestion of 5-6 mg/kg bw (3-6 cups of coffee) can improve performance; ingestion of more does not lead to larger effects. Caffeine has central effects, but the exact mechanism still is not known. Caffeine potentially reduces muscle glycogen breakdown, but there are many studies that have failed to find this effect. Bicarbonate (NaHCO<sub>3</sub> 300 mg/kg) ingestion 1-3 h before exercise improves performance in events lasting 0.5 to 7 min, but may lead to nausea, gastro-intestinal discomfort and diarrhoea. The effect is most likely due to increased efflux of intracellular lactate and H<sup>+</sup>, leading to a delay in a critical decrease in intramuscular pH that impairs metabolic and contractile function. Finally some critical notes will be made on the excessive use of sports drinks containing antioxidants as several free radicals play important roles in exercise induced microvascular recruitment and training adaptation.

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## Why anti-doping? The need for an operational ethics

### Hans Hoppeler<sup>1</sup> and Sigmund Loland<sup>2</sup>

<sup>1</sup>University of Berne, Switzerland, <sup>2</sup>Norwegian School of Sport Sciences, Norway

During the last decades there has been a steady increase in the kinds and numbers of bio-chemical and bio-technological means for physical and mental enhancement. International surveys show that attitudes towards such means seem to change in a liberal direction. The heated debate over WADA's whereabouts system may be an indication of more serious public challenges to anti-doping in the time to come. Anti-doping needs a clear and operational ethical justification that is easy to communicate in convincing ways.

In the WADA Code, doping is defined as fundamentally contrary to 'the spirit of sport'. 'The spirit of sport' is explained as '...the celebration of the human spirit, body and mind and is characterized by the following values: ethics, fair play and honesty; health; excellence in performance; character and education; fun and joy; teamwork; dedication and commitment; respect for rules and laws; respect for self and other participants; courage; community and solidarity'.

Although these are key values in sport, the references are of a general kind and hard to apply when it comes to concrete cases. Some values, such as fairness and health, can also be twisted in the direction of a more liberal doping policy. By combining a view of sport as the 'virtuous development of talent' (Tom Murray) with biological insights, an outline will be given of an operational interpretation of 'the spirit of sport'. Such an interpretation holds that the development of talent towards sporting and human excellence implies utilizing the adaptive responses of the human organism as developed through evolution, and not overruling such responses with external means. This view will be elaborated, and an argument will be given that an operational anti-doping ethics can be communicated to the public in simple and convincing ways.

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## The 2010 prohibited list – open questions

### L Horta

Conselho Nacional Antidopagem (CNAD) – Lisbon, Portugal

The World Anti-Doping Program is composed by three levels of documents. At the first level we have the most important document - the World Anti-Doping Code, describing the major principles of the fight against doping. At the second level we have five international standards, describing different practical procedures to be followed by all anti-doping organizations worldwide. At the third level we have the model guidelines, that are very pragmatic documents, and not mandatory as the previous ones.

The Prohibited List is a level two document that defines the prohibited substances and methods. The Code defines the criteria that must be fulfilled to determine the integration of one substance or method in the List: 1 - Medical or other scientific evidence, pharmacological effect or experience that the substance or method has the potential to enhance or enhances sport performance; 2 - Medical or other scientific evidence, pharmacological effect or experience that the use of substance or method represents an actual or potential health risk to the athlete; and 3 – WADA's determination that the use of the substance or method violates the spirit of sport described in the introduction to the Code.

The Prohibited List is revised at least once a year. The annual revision of the Prohibited List is an elaborate and dynamic process involving international scientific experts and the solicitation of input from stakeholders so that changes are founded on expanding anti-doping knowledge and trends. The development of the Prohibited List begins with the circulation of a draft to stakeholders. Comments received are considered by WADA's List Committee, who then presents its conclusions to WADA's Health, Medical and Research Committee. This Committee submits its final recommendations to the Executive Committee, who discusses the recommendations and makes a final decision at its September meeting. The Prohibited List is published in the WADA's website at October 1st, in order to allow the anti-doping organisations (international federations and national anti-doping organisations) to inform their affiliates about the new Prohibited List that will be in force in January 1st.

The construction and the revision of the Prohibited List represents a very difficult task taking in consideration the huge amount of prohibited substances and methods and also the complexity of the scientific methods involved in their detection. To increase even more the complexity of detection some prohibited substances are also produced endogenously.

The objective of this presentation is to underline some open questions concerning the Prohibited List and the inherent detection methods in the following sections:

S1. Anabolic Agents – the limitations of IRMS analysis and the importance of endogenous steroid profiling in the endocrinological model of the Athlete's Passport;

S2. Peptide hormones, growth factors and related substances - The use of hypothalamic releasing factors, the development of new erythropoiesis-stimulating agents and the enhancement performance properties of different route of administration of platelet-derived preparations (e.g. Platelet Rich Plasma, "Blood Spinning");

S3.  $\beta$ -2 Agonists – Need to determine a threshold level for the detection of formoterol and terbutaline;

M1. Enhancement of Oxygen Transfer - Difficulties to detect autologous blood transfusions and erythropoiesis-stimulating agents with very narrow windows of detection and the importance of blood profiling in the blood model of the Athlete's Passport;

M2. Chemical and Physical Manipulation – The inclusion of proteases as an example in the prohibited list;

S6. Stimulants – Scientific bases for the reintroduction of pseudoephedrine;

S9. Glucocorticosteroids - Difficulties in establishing the way of administration of glucocorticosteroids taking in consideration the detected urinary concentrations and need to define different threshold levels for detection.

Finally we underline the importance of the WADA's program for financing research projects in order to revise the Prohibited List and improve the methods of detection. WADA committed more than US \$ 44 million to that program since 2001.

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## Should oxygen be on a prohibited list

### Nenad Dikic

Anti-doping agency of Serbia (ADAS), Republic of Serbia

In the draft of the 2010 prohibited list for the first time is prohibited the use of hyperoxic conditions, except for medical emergencies and in those sports where the use of supplemental oxygen is mandated as a safety requirement (aeronautic, mountaineering). This raised attention of various groups of experts, as well as athletes. There are no clear definitions of hyperoxic conditions, but one of the definitions for hyperoxia is a condition characterized by greater oxygen content of the tissues and organs than normally exists at sea level (Merriam Webster dictionary). In reality, we could make greater

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oxygen content in our body by breathing pure oxygen from the bottle, by using hyperbaric therapy or using different kinds of hypoxic devices, including living in the hypoxic environment. All methods are providing more oxygen in our tissues. Does it mean that all those methods are forbidden? For example hypoxic training is frequently used by competitive athletes to improve sea-level performance, but benefits are controversial. Hypoxic exercise may increase the training stimulus, thus magnifying the effects of endurance training, but conversely, hypoxia limits training intensity, which in elite athletes may result in relative deconditioning. Even modern approach of living and training at altitude have not been proven to be advantageous compared with equivalent training at sea level. Totally the opposite hyperbaric oxygen (HBO) therapy is defined as a medical treatment in which the patient breathes 100% oxygen intermittently while inside a chamber at a pressure greater than 1 atmosphere absolute. The Undersea and Hyperbaric Medical Society currently approves 13 medical indications for treatment with HBO. But certain sport experts try to direct professional and college athletic teams to use HBO to treat sports injuries, to speed recovery after exercise, and as an ergogenic aid to enhance performance, but without real proof of the oxygen activity. Finally, bottled oxygen is the most frequently accessible method by many athletes. When is acceptable and justifying using that kind of oxygen and other methods, it is the open question which should be discussed. There are many guidelines for using the oxygen and only WADA seeks international harmonization to prohibit it. Oxygen should not be added to the list, since there is no clear evidence that enhance performance, has negative health effect and it is against the spirit of sport, which means that doesn't fulfil the criteria for doping substance.

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## **The role of exercise in osteoporosis management**

**Kirill Micallef-Stafrace<sup>1</sup>, Andrew Decelis<sup>1</sup>, Nicola Micallef-Stafrace<sup>2</sup> and George Buttigieg<sup>3</sup>**

<sup>1</sup> Institute of Physical Education and Sports (IPES), University of Malta, Malta, <sup>2</sup> Medik Healthcare Services Ltd, Malta,

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Osteoporosis is a condition of decreased bone mass which leads to an increased risk for fractures. It is a predominantly silent disease that has become a major public health problem in Europe and the rest of the world, especially amongst the elderly populations. By the year 2050 it is estimated that over one third of the European population will be over 60 years of age with the concomitant increase in the incidence of osteoporosis. In fact fractures of the hip are expected to double over the next 50 years. This will lead not only to a decrease in the quality of life of our elderly population but also of a significant increase in health care costs. Physical activity as part of a healthy lifestyle has an important role to play in the prevention and management of the osteoporotic patient. Exercise at a young age will help maximize the bone mineral density and if continued lifelong will continue to stimulate bone formation, strengthen muscles and improve balance and coordination. These are all important elements, not only to aid in the management of osteoporosis but also to reap multiple other health benefits. The chosen exercise ideally should involve weight bearing physical activities such as running and jumping. However, all forms of physical activity can benefit the osteoporotic patient since they contribute to an avoidance of falls and thereby decreased fracture incidence.

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## **Hemodynamics of swimming in health and disease**

**H.Löllgen<sup>1</sup> and Ruth Löllgen<sup>2</sup>**

<sup>1</sup> Med.Dept., Municipal Remscheid Hospital Germany, <sup>2</sup> Dept. of Pediatric Disease, Hopital Cantonal, CH- Geneve, Switzerland

Swimming is a special kind of head out water immersion. Based on own results, this presentation demonstrates studies of central hemodynamic (heart rate, stroke volumen, cardiac index, Frank-Starling Diagram) response during stepwise increasing head out water immersion. In addition, respiratory function with respiratory mechanics, respiratory gas exchange and ventilatory control are shown with different depth of water immersion. These changes also do occur in patients.

Water immersion and training in water has to be critically seen in patients with high blood pressure, unstable coronary artery disease, heart failure or pulmonary hypertension. So-called swimming testing with telemetric ECG transmission is strongly recommended in patients with cardio-pulmonary diseases.

A some more moderate form of training is the newly developed aqua-riding. Aquajogging may be prescribed when legs cannot be used after sports injury but endurance training should be done.

Today, the effect of regular training swimming as an approach to primary prevention has not been demonstrated by an evidence based investigation. Prospective cohort studies are required to answer this question. In osteoporosis, swimming is without effect.

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## **Proprioception: Definition, clinical importance and evaluation methods**

**Defne Kaya, Uğur Dilicikik, Hande Güney, Haydar Demirel and Mahmut Nedim Doral**

Hacettepe University, Ankara, Turkey

The ability that transmit the sensation of body position, perception and interpretation of this data and giving an conscious or unconscious reaction resulting in approximate posture and movement is called proprioception. Proprioception is a specialized variation of the sense of touch that encompasses the sensations of joint motion (kinesthesia) and joint position (joint position sense). Mechanoreceptors are the sensory receptors located in soft tissue articular structures. Three distinct morphological types of mechanoreceptors are situated within ligamentous tissue (Ruffini endings, Pacinian corpuscles, and Ruffini corpuscles), and two types of mechanoreceptors appear in the musculotendinous tissue that surrounds the joint (muscle spindles and GTOs). Mechanoreceptors function by transducing some form mechanical deformation into a frequency modulated neural signal which is transmitted via afferent and efferent pathways. The disruption of muscle and joint mechanoreceptors from physical trauma results in partial deafferentation of the joint and surrounding musculature, thus resulting in diminished proprioception. The results of current investigations indicate the need for proprioceptive training during any rehabilitation program designed to return athletes to preinjury levels of activity following ligament and muscle injuries. A lot of measurement methods of proprioception have been defined in the literature. Based on these measurements, scientists comment the proprioceptive status in some specific conditions. Has the proprioception influenced by braces, elastic bandages, surgical or conservative treatments, has the increased proprioception decreases the incidence of injury, enhances the sportive performance and the other questions about the proprioception aimed to be answered by measuring the proprioception with different methods. However, to measure the proprioception is difficult and cannot be done directly. Thus, the testing conditions are not the same with the instant of injury. Patients are usually in supine position, and their extremity is positioned in a computerized system for proprioceptive measurements. Non weight-bearing and static positions are not relevant to the injury position in the real life. Hence, it is doubtful that the existing measurement techniques and their results can reflect the real status of proprioceptive level in injured or uninjured persons. Another important issue on testing methods of proprioception is that they are not specific to a tissue, a ligament, capsule or a joint. For example, during a knee joint evaluation, the test results may be influenced by the pathologies of hip joint and/or ankle in almost all measurement techniques. Thus no test method can evaluate the proprioception separately when accompanying lesions are found in the same joint.

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## **Sports traumatology, sports medicine and proprioception**

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The primary function of proprioception is prevention of both traumatic and overuse related sports injuries. Other tasks of proprioception include providing the athlete return to sport activities safe again with reduced, or even without injury risk following injury or surgery and enhancing the sports performance of the athlete. It has been shown in a study that the majority of injuries during soccer occurred in the lower extremities with 81%. The most common injury type within these injuries was ankle sprains (17.2%). The authors concluded that the cause for this high ratio may be insufficient ankle joint stability and/or sensorimotor deficiency. In parallel some authors suggested that ankle sprains can be prevented by external ankle supports and proprioceptive/coordination training, especially in athletes with previous ankle sprains. Training of neuromuscular and proprioceptive performance as well as improvement of jumping and landing technique seems to decrease the incidence of severe knee and ACL injuries. Such prevention programs are likely to be more effective in groups with an increased risk of injury. A study regarding this issue exhibited with stretching, strengthening, plyometrics, proprioception, and sports-specific drills an 88% decrease following 1 year, and 74% reduction following 2 year in ACL injuries. Alike, it was stated again that using a neuromuscular training program may have a direct benefit in decreasing the number of ACL injuries. A recent article recommended as the most important initial treatment approach in patients with ACL injuries improving dynamic single-limb stance balance and training threshold for detection of passive motion (kinesthesia) proprioceptive ability. On the basis of, that osteoarthritis is associated with decreased proprioception, incorporating a multi-station proprioceptive exercise program also in patients with bilateral knee osteoarthritis exhibited 30-40% improvements in sensorimotor tests following proprioceptive and balance training. On the other hand, it was signified that subjective knee function is related to proprioception. This means, patients with ACL rupture having symptoms possess more proprioceptive deficits compared to asymptomatic patients. Besides, abnormal knee joint proprioception was also established in individuals with patello-femoral pain syndrome (PFPS) and authors advised here also that proprioceptive rehabilitation techniques should be incorporated into the treatment of PFPS. Differently, it was demonstrated that isokinetic exercise in rehabilitation protocols of

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patients with PFPS also has a positive effect in improving knee joint proprioceptive acuity. Regarding the role of proprioception in sports performance, a recent study emphasized that rhythmic gymnasts have developed abilities in postural stability, balance, and “transfer” to bipedal postural sway, especially in medio-lateral displacements and that these capabilities constitute an important role in their successful sports career. In conclusion, sensorimotor system is important in terms of preventing injuries and improving performance. It is crucial to evaluate, reinforce, and develop the sensorimotor system for scientists coping with sports injuries and sports performance.

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## **New challenges for detection of doping in sport**

### **Geoffrey Goldspink**

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The inevitable use of growth factors for enhancing muscle strength and athletic performance is a major concern of the World Anti-doping Association as well as the antidoping agencies in individual countries. Although this now involves expert scientists with powerful analytical methods, the so called “counter culture” also includes well trained scientists, team doctors and coaches who are under pressure to ensure their sports people succeed. The Olympic Games as well as being known for what city they were held in have also somewhat cynically be named after the prevalent type of doping that has been used. We have had for example, the beta agonist, the EPO, the steroid games etc. Based on the present interest and the next games retrospectively, may be called the “growth factor games”. Recently, much effort has been expended on developing a treatment for muscle wasting associated with a range of diseases as well as in ageing. Emerging molecular techniques have made it possible to gain a better understanding of the growth factor genes involved and how they are activated by physical activity in young individuals. In addition to hGH and IGF-I two factors some growth factors such as MGF a type of IGF-I which is a very positive regulator of muscle hypertrophy and strength and strategies for reducing the negative effect of myostatin, will be described. As well as an initial method for screening large numbers of sports people it is necessary to have at least one confirmatory test that will stand up in a Court of Law to convince the Judge that a substance had been taken to alter the individual’s physiology advantageously. Developments in mass spectrometry combined with robotics and analysed by powerful computer programmes such as neural networks allow hundreds of blood and urine samples to be analyses within a day or so, to detect a changed metabolic profile to be detected. This is the new branch of chemistry known as “metabolomics”. In order to establish these methods, collaborative work was carried out with analytical chemists at Nottingham Trent University and the race horse testing laboratories at Newmarket UK. This initial screening approach enables hundreds of blood samples to be analysed within a day. We used blood from samples from mice and also human volunteers that had been “doped” using hGH and were used to determine abnormal patterns of metabolites such as leucine rich glycoprotein (LRG) which are good indicators of doping. Following this those suspected of doping are subjected to confirmatory tests which are more expensive in time and money but which is physiologically based and could lead to a conviction in a Court of Law. One confirmatory test that was established in the author’s laboratory will be described.

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## **Results Management – from a reprimand to a life ban**

### **L Horta**

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The revised World Anti-Doping Code that entered in to force last January 1st 2009 introduced more flexibility and proportionality in the sanctioning system of anti-doping rule violations. The article 2.1 “Presence of a Prohibited Substance or its Metabolites or Markers in an Athlete’s Sample” and 2.2 “Use or Attempted Use by an Athlete of a Prohibited Substance or Prohibited Method” defines two of the more important and frequent anti-doping rule violations. The Prohibited List defined two types of prohibited substances: the specified and non specified substances. The specified substances are those substances that can be used for therapeutic purposes and have low enhancement performance properties and most times the anti-doping rule violations concerned with these substances are due to negligence of the athlete rather than a real doping purpose.

As the general rule for anti-doping rule violations concerned with non specified substances, the period of ineligibility imposed for a first anti-doping rule violation shall be in general two years, unless the conditions for eliminating or reducing the period of Ineligibility or the conditions for increasing the period of ineligibility are met. For violations involving specified substances the period of ineligibility shall be for a first violation at minimum, a reprimand and no period of ineligibility from future events, and at a maximum, two years of ineligibility.

For multiple violations the Code defines a very broad spectre of sanctions, depending on the kind and seriousness of the anti-doping rule that were committed.

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The objective of this presentation is to demonstrate, giving examples, the importance of the scientific expertise to support an ideal proportionality in sanctioning anti-doping rule violations:

Case one – a rider that participated in an international event had two adverse analytical findings for a glucocorticosteroid (betamethasone) and claimed that the results were covered by an abbreviated therapeutic use exception (ATUE). The scientific expertise demonstrated that the concentration profile of the concerned specified substance in the urine along the event couldn't be explained by the ATUE;

Case two - a football player had an adverse analytical finding for a glucocorticosteroid (methylprednisolone). The athlete and team physician claimed that the result was covered by an ATUE for Methylprednisolone, where an intra-articular administration of 20 mg of that compound was declared 38 days before the in competition test and that the fact of a previous surgery on that joint could explain the delay in the urinary excretion. The delay could be explained to a chronic inflammation of the synovial membrane after surgery. The scientific expertise demonstrated that the concentration profile of the concerned specified substance in the urine couldn't be explained by the ATUE;

Cases three and four – two athletes, one a football player and the other a rally pilot, had adverse analytical findings for cannabis – a specified substance. The first one was sanctioned with a reprimand and the obligation to be submitted to tests for detection of social drugs lasting a minimum of six months and the second one was sanctioned with two years of ineligibility taking in consideration the risk of accidents caused by that administration to the pilot itself, to the co-pilot, to other competitors, officials and public.

Case five – a shooter had an adverse analytical finding for an anabolic agent (clembuterol), a non specified substance. The athlete and its defence claimed that the result was originated by an intake of meat in a “Rodizio” restaurant in Rio de Janeiro. The scientific expertise demonstrated that the concentrations of the substance found in the urine couldn't be explained by the ingestion of such a meal.

Case six – a rider had an anti-doping rule violation due to the fact that proteases were found in his urine. The purpose for it to be found there was to manipulate the detection of EPO. In this case the athlete used a strategy to deceive the anti-doping laboratory in the detection of EPO – this fulfils the conditions for increasing the period of ineligibility.

In conclusion, in the results management of some anti-doping rule violations, the scientific expertise can be decisive to fulfil the proportionality of the sanction.

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## **Femoroacetabular impingement: Anatomy, pathophysiology and radiological imaging**

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Femoroacetabular impingement has recently been recognised as a cause of early osteoarthritis. This impingement is particularly frequent in sports activities with forceful flexion activities at the hip as is the case in soccer players. Two mechanisms of impingement are recognised. Cam type is caused by a non-spherical head where as pincer type is caused by excessive acetabular cover. Both types of bone deformities are frequently encountered, in the series of Beck et al over 12 % of individuals were involved, cam type being almost twice more frequent than pincer type. Both deformities may exist together. These two types of bone deformities cause different types of articular damage. In cam impingement the cartilage is sheared off the bone during flexion, by the non-spherical femoral head while the labrum remains untouched. This separation between labrum and cartilage is located at the anterosuperior acetabular cartilage. In pincer the impingement is caused by excessive cover of the head of the femur by the acetabulum. During flexion the labrum is crushed between the acetabular rim and the femoral neck causing degeneration and ossification of the labrum. Standing antero posterior plain radiographic examination of the pelvis is accurate for the detection of femur head and acetabular bone deformities that are responsible for cam and pincer impingement respectively. Labral and hyaline cartilage damage is responsible for the typical C pain at the hip region during the FADDIR (flexion, adduction and internal rotation of the hip) impingement test. The cartilage and labral lesions are best demonstrated on MR-arthrographic examination. The purpose of the presentation is to illustrate the pathophysiological mechanism of femoroacetabular impingement, to give diagnostic clues for the radiographic identification of the responsible bone deformities and to demonstrate the spectrum of cartilage and labral abnormalities that are encountered on MR-arthrography.

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## Arthroscopic treatment of FAI (femora-acetabular impingement)

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**WHAT IS FAI?** Impingement itself is the premature and improper collision or impact between the head and/or neck of the femur and the acetabulum

**TYPES** 1-Cam-type : Excessive bone (bump) over femoral head and neck causes friction/ impingement.

2-Pincer-type : Overgrowth of the acetabular rim and acetabular version problem cause friction/ impingement.

3-Combined (Mixed) type: Cam + Pincer

When the extra bone on the femoral head and/or neck hits the rim of the acetabulum, the cartilage and labrum that line the acetabulum can be damaged

**SYMPTOMS** • Groin pain: Sports including repetitive hip hyperflexion and external rotation can cause intra-articular hip problems( soccer, ice skating,hockey,tennis,golf). Labral and chondral lesions can be seen in agility sports (runners). • Pain during prolonged hip flexion and torsions (standing up from sitting position, wearing socks, putting on shoes , going up & down). • Walking uphill is also found to be difficult. • The pain can be a consistent dull ache or a catching and/or sharp, popping sensation. • Pain can also be felt along the side of the thigh (L3 dermatome) and in the buttocks. • Byrd – C sign

**DIFFERENTIAL DIAGNOSIS** • Back pain, • Arthritis, • Apophyseal avulsions, • Pubalgia, • Avascular necrosis, • Benign Tumors (Osteoid osteoma, Osteochondroma), • Chondral lesions, • Dysplasi, • FAI, • Gastrointestinal or genitourinary problems, • Gluteus medius syndrome, • Hernia, • Hip joint instability, • Iliopsoas snapping hip, • Iliotibial band snapping hip, • Intrapelvic disorders, • Labral tears, • Legg-Calve-Perthes disease, • Ligamentum teres rupture, • Loose body, • Musculotendinous sprains, • Osteitis pubis, • Osteochondritis dissecans, • Pigmented villonodular synovitis, • Piriformis syndrome, • Sacroiliac disorders, • Sialgia, • Septic arthritis, • Slipped capital femoral epiphysis, • Stress fracture, • Synovial Chondromatosis, • Synovitis, • Trochanteric bursitis,

**DIAGNOSIS** • Physical examination : Impingement test (+) : Pain during flexion+adduction+internal rotation of the hip joint in the intra-articular problems, • X-Rays: Standard AP and Frogleg (Abduction+external rotation) x-ray: (Femoral bump, Acetabular rim overgrowth, Calcified labrum, Acetabular cross-over sign can be seen), • ArthroMRI: MRI taken after injection of intra-articular solution of 0.2cc Omniscan + 20cc SP + 6cc Citanest + 8cc Omnipaque under fluoroscopy (Acetabular labral tear and chondral lesions can be visualized Decrease or loss of the pain after injection in 4-5 minutes means intra-articular problems.

**CONSERVATIVE TREATMENT** • Rest, • Activity modification (restriction of activities which includes hip flexion over 80 degrees like squatting,cycling,leg press, backward running...etc), • NSAID, • Postural rehabilitation( to decrease pelvic inclination), • Restoration of pelvic ring reclination with abdominal and gluteus maximus muscle strengthening + iliopsoas and paravertebral muscle stretching which can decrease anterior coverage of femoral head

**SURGICAL TREATMENT** • Open Surgery (with safe dislocation): Increased avascular necrosis risk, Morbidity of Trochanteric osteotomy , Prolonged rehabilitation period, Cosmetic problems.

**ARTHROSCOPIC TREATMENT OF FAI** Under general anesthesia with the traction table and fluoroscopy control, hip arthroscopy is started from anterolateral portal. Then anterior portal is opened. Depending on surgeon needs, additional portals ( proximal-distal anterolateral portals) can be placed. With these portals, central compartment arthroscopic procedures can be done (Acetabular rim (pincer) resection, labral excision or labral repairs with anchors).After central compartment arthroscopy, the traction is released and hip flexion up to 45 degrees and portals are replaced from the same skin incision to femoral neck region for peripheral compartment arthroscopy. With these position and portals, femoral neck bump (cam) resection can be done.

**POSTOPERATIVE TREATMENT**• 1-2 days hospitalisation, • Mobilisation with crutches (30-50 % weight bearing), • Full weight bearing after 2 weeks, • Leave up crutches after 3 weeks, • Non-weight bearing for 6 weeks after microfracture procedure, • Running after 6-8 weeks, • Return to sports after 3-4 months, • Studies have shown that 85-90% of hip arthroscopy patients return to sports and other physical activities at the level they were at before their onset of hip pain and impingement

**COMPLICATIONS** • Numbness on groin region (excessive and prolonged traction causes temporary nerve paralysis), • Temporary impotence in males (traction can cause pudendal nerve neuropraxia), • Stress fracture of femoral neck (excessive femoral neck resection), • Decubitus lesions over scrotum,perineum,labia depending on traction, • Retroperitoneal fluid extravasation, • Iatrogenic chondral and labral lesions, • Intra-articular breakage of guide pin/ surgical equipments, • Heterotrophic ossification, • Avascular necrosis of femoral head, • Infection, • DVT, • Hip instability( excessive capsular release).

**CONCLUSION** Hip arthroscopy is indicated when conservative measures fail to relieve symptoms related to femoro-acetabular impingement, a condition that has been poorly understood and under-treated in the past. Advances have made hip arthroscopy a safe and effective alternative to open surgery of the hip, a tremendous advantage in treating early hip conditions that ultimately can advance to end-stage arthritis

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## EMG applications in sports medicine

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Earlier studies have proven that high-level athletes have a different activation-relaxation and/or co-contraction strategies than that of middle class or beginners. These findings motivates the researchers to concentrate on defining certain strategies for given sports branches. The purpose of the current paper is to share the latest findings of high-level athletes in archery, female volleyball and soccer.

The findings that will be presented in this session have been gathered by using basically Electromyography (EMG). So, the current manuscript tries to define both some certain muscular activation-relaxation and/or co-contraction strategies in given sports branches and mention the importance of EMG findings in evaluating high-level performance.

The first findings will be from sport archery and the muscular activation strategies during the release of the bowstring. Two different muscular activation strategies have been defined in the literature. In the first strategy, archer releases the bowstring by actively contacting the forearm extensor and gradually relaxing the forearm flexor muscles. The archer releases the bowstring with clear relaxation of forearm flexors and without active involvement of forearm extensors in the second strategy. The second strategy is known to decrease the lateral deflection of the bowstring, which is reputed to increase the score on the target.

As for the studies related with male soccer, the findings have demonstrated that high level soccer players show more agonistic activation during forward swing and ball contact phase and less antagonistic activation during follow through; whereas middle class soccer players demonstrated less agonistic activation during forward swing and ball contact phase and high antagonistic activation during follow through phase during the kicks to a stationary ball. It has been concluded that to increase ball speed on target; one should (1) increase the contraction values of Vastus Lateralis (VL) and Vastus Medialis (VM) during forward swing and ball contact phase, and (2) decrease contraction values of Gastrocnemius (GAS) during backswing and follow through phase.

The results that were related with high-level female volleyball players have shown that agonist-antagonist contraction ratios and coordination, landing technique and intramuscular coordination are the important factors for countermovement jump. Having high GAS activation values during landing may be explained by landing technique. VM, VL, GAS, GM and BF muscles are activated before ground contact in order to stiffen the joint in preparation for touch down. It can be said that pre-activation is important for the jumping performance. For the female volleyball players, it has been concluded that high level volleyball players showed higher muscular activation during propulsion phase, but lower during landing and post landing phases compared with control group.

In conclusion, high-level sportsmen have different contraction-relaxation and/or co-contraction strategies. These strategies may be used for; 1. Selecting talented athlete for given sport branches, 2. Decreasing the occurrence rate of any type of injury and 3. Monitoring the athlete's development.

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## The hazards of DXA, BMI and other golden standards

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Human Body Composition (BC) is characterized by data acquisition techniques classified in various models (morphological and chemical). For adiposity matters, single measures, indexes and prediction formulae have been validated using a variety of "golden standards". Hypothetically, different techniques should provide the same outcome. However, preliminary work indicates, the opposite.

Different techniques provide exact, identical and reproducible values, or, are these values simulations, approximations or predictions? Fact is that all in vivo techniques deliver indirectly obtained values. Fact is that many of these indirect techniques have been validated against other indirect techniques. Fact is that some golden standards never were validated against direct data. Fact is that for the clinic and public health, accuracy and precision are essential. Fact is that these issues have become manufacturer-dependent and not always quality controllable. The borderline between assumptions, predictions and accurate precision has become too vague and is too often ignored. The purpose of this work is to verify the value of 3 (indirect) standard BC systems, against direct values. The quality control of BMI, DXA and hydrodensitometry, respectively, will be dealt with separately.

### I. The Quetelet index (1832-1972) or the BMI (1972-...).

The use of BMI as an indicator of BC is based on its correlation with indirectly obtained values of adiposity.

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Direct evidence for the validity of BMI as an adiposity index is lacking. The relationship of BMI with total body AT and other BC constituents is explored in human cadavers (N=29). Correlations between BMI and BC constituents were calculated and prediction equations with BMI as the dependent variable and all BC constituents as independent variables were developed. BMI was moderately related to AT but much stronger to bone mass. AT, nor its BC constituents improved the prediction. BMI is not an appropriate adiposity index in particular for elderly persons. The high proportion of unexplained variance between BMI and direct adiposity mass limits its use as a BC index. BMI might be an index for bone mass rather than for adiposity, and is not an indicator for stress, cancers, cholesterol, diabetes or obesity. The use of the BMI as measure of adiposity is not justified.

### **II. DXA, DEXA ... Dual Energy X-Ray Absorptiometry.**

Reviewing the literature of DXA application, one cannot avoid obtaining a controversial impression of this method of choice. Some studies support the DXA technique as convenient for % Fat, Lean Body Mass (LBM) and Bone Mineral Content (BMC) measures. Other studies suggest a violation of basic biological assumptions. Twelve porcine carcasses, viscera included, were measured with DXA and CT before dissection into its major components. Soft tissue samples allowed for chemical and hydration analyses and the complete skeleton was ashed for BMC. Part of the problem results from erroneous terminology. The predictive character of DXA is good. Significant differences indicate that clinical precision is at risk.

### **III. Hydrodensitometry.**

Hydrodensitometry combines hydrostatic weighing and the calculation of (i) the body volume and (ii) density. This density is used to calculate % Body Fat. Hydrodensitometry was previously a golden standard, but has been criticized suggesting a violation of basic assumptions underlying its use. Despite numerous signals of error hydrodensitometry is used to day in sport medical laboratories still. Fat prediction anomalies in combination with in vitro information of bone densities and hydration should reinforce earlier criticism. In studies of middle-distance, marathon runners and professional football players 10 had negative AT with 2 subjects estimated at -12% AT. Biologically, this is impossible. Direct anatomical cadaveric data confirm a high inter- and intra-individual bone density hydration variability, re-confirming that the 2-component hydrodensitometry model is invalid and that it has been an erroneous reference for many in vivo BC studies in the past.

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## **Methodological problems in body composition evaluation**

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This paper attempts to give a brief overview of methodological problems in assessing athletes body composition measurements in field and laboratory settings. There are number of different methods available for field and laboratory settings. The available methods are based on concepts driven from five level, and two, three, four, and multiple compartment models of analysis of human body. Majority of the body composition contents are based on some assumptions, comparisons, calculations, and estimations. As the number of estimated compartments or contents of body composition increase, the amount of inherited error of calculation in the mathematical assumptions increase. Therefore, most of the body composition methods used have some inherited errors, based and assumptions of measurements and calculations. Using above mentioned basic concepts, there are number of widely used methods available in laboratory and field settings. Some of these methods are named as direct and some as indirect methods. Direct methods are used on human and animal cadavers with some chemical approaches in order to determine the amount of different tissues in the body, and, therefore, they are not used on living bodies. In some cadaver based studies the number of cadavers from which the mathematical modeling is driven can be the source of error. For example in Brozek et al, (1963) modelling there were only 3 cadavers on whom the density equations were driven for fat mass and fat free mass. Despite this direct methods are considered to have high validity, and are used to validate indirect methods. Among indirect methods hydrostatic weighing, anthropometric methods, bioelectric impedance methods, infrared interactance, and some part or whole body counter methods such as dual-energy x-ray absorptiometry are used.

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## **The skinfold: Myth and reality (revisited)**

### **Jan Pieter Clarys**

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More than 10,000 studies and over 450 formulae using skinfolds to predict body fat reflect the extent of its popularity. Basic assumptions to understand the skinfold measure are tested with dissection data of 3 different cadaver collections.

**Assumption I.** A calliper produces a constant skinfold compressibility at all sites of the body? Skinfold thickness,

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direct depth measurement of the subcutaneous adipose tissue (AT) layer and radiographic depth, skinfold compressibility could be obtained for each site. It was found that skinfold compressibility is by no means constant.

**Assumption II.** Skin thickness is a negligible part or a constant fraction of the skinfold? All skinfold measurements contain a double layer of skin of unknown thickness. Skin thickness was most marked at subscapular level, where it accounted for 28.1% of the skinfold reading (34.0% for males, 23.9% for females). The subscapular and triceps sites are most commonly used for predicting AT but have quite different proportions of skin. Skin thickness can lead to 30% error of the AT patterning.

**Assumption III.** AT patterning is constant (equal) all over the body? The patterning of subcutaneous AT exhibits large variations between individuals. To assess the value of various sites within the same individual, correlations between the calliper and incision thickness with the dissected subcutaneous adipose tissue mass are needed. Of the six best sites, all but one were on the lower limb. The triceps, a highly favoured site for 'fat' prediction ranked (a poor) eleventh. The best predictors were front thigh, medial calf, rear thigh and supra-spinale. But AT patterning is under no circumstances equally divided over the body.

**Assumption IV.** Predicting fat of the human body is conditional to the fat content within the AT? The assumed constancy of the 2-compartment model is no longer valid. Reported values range from 5.2 to 94.1% (generally in the range 60-85%). The fat content of AT increases with increasing adiposity. 'Fat' is ether-extractable, e.g. lipids, whereas 'adipose tissue' is a morphological entity. Confusing the two has become colloquial and should be avoided.

**Assumption V.** Skinfold callipers are only able to estimate subcutaneous adiposity? In order to estimate total body adiposity some assumptions must be made about the relation between internal and subcutaneous AT. Proportionality provides a rationale for the use of skinfolds, unless internal AT should be negligible, again providing justification for the use of callipers. Data suggest a good correlation between external and internal mass in both men ( $r=0.72$ ) and women ( $r=0.86$ ).

**Assumption VI.** Having rejected the concept of the prediction of body fat, we consider instead if total body adiposity can be confidently predicted from skinfolds? With a strong relationship between subcutaneous AT and total body adiposity, skinfolds should have the same relation with subcutaneous and total AT in men and women. A strong significant correlation between these entities was found in men ( $r=0.82$ ), but not in women ( $r=0.56$ ), reflecting gender-associated different tissue masses distribution. This difference in basic relations jeopardises the use of skinfolds. 'Skinfolds for men only' seems somewhat obtuse.

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## 2. ORAL PRESENTATIONS

### Heart rate dynamic during an exercise test in heart failure patients with different sensibilities of the carvedilol therapy

Vitor Carvalho, Edimar Bocchi and Guilherme Guimaraes

Heart Institute (InCor HCFMUSP)

**OBJECTIVE** Some trials suggest that the titration of Carvedilol is based on rest heart rate from 50 to 60 bpm and a target daily dose of 50 mg/day. Aim: To evaluate the heart rate dynamic in heart failure patients with different sensibilities of the Carvedilol therapy during an exercise test.

**METHODS** Patients were divided into four groups and submitted a treadmill cardiopulmonary exercise test: heart rate >60 bpm and Carvedilol 60 bpm and Carvedilol  $\geq$ 50 mg/day (19 patients) (non-optimized low-sensibility); heart rate between 50 and 60 bpm and Carvedilol  $\geq$ 50 mg/day (16 patients) (optimized); heart rate between 50 and 60 bpm and Carvedilol <50 mg/day (10 patients) (optimized high-sensible group).

**RESULTS** The heart rate peak and the percentage of the peak heart rate in relation with the maximum heart rate predicted for age during the cardiopulmonary exercise test were the same between the non-optimized (128 $\pm$ 13, bpm; 74 $\pm$ 7%) and non-optimized low-sensibility (136 $\pm$ 20,bpm; 78 $\pm$ 8%) groups, and between the optimized (105 $\pm$ 25, bpm; 60 $\pm$ 13%) and optimized high-sensible (108 $\pm$ 16, bpm; 62 $\pm$ 8%) groups.

**DISCUSSION & CONCLUSION** The heart rate dynamic was almost the same between groups with rest heart rate <60 bpm and between groups >60 bpm, independently of the Carvedilol dose. Based on these findings, we propose a new method to titrate carvedilol therapy by the cardiopulmonary exercise test.

**KEY WORDS** heart rate, exercise, carvedilol

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### Heart rate dynamics in heart transplantation patients during a treadmill cardiopulmonary exercise test: A pilot study

Vitor Carvalho, Lucas Pascoalino, Edimar Bocchi and Guilherme Guimaraes

Heart Institute (InCor HCFMUSP)

**OBJECTIVE** One way of defining an individual's maximum heart rate to be expected given their age is by the formula (220-age), but the reinnervation seen in patients who have received heart transplants makes for different calculations from patients who have suffered heart failure. The purpose of this study is to evaluate heart rate dynamics (basal, peak and percentage of predicted heart rate for age) in heart transplant patients compared to optimized beta-blocked heart failure patients during a treadmill cardiopulmonary exercise test.

**METHODS** Twenty two (81% male, 46  $\pm$  12 years) sedentary heart failure patients and 15 (47% male, 44  $\pm$  13 years) sedentary heart transplant patients performed a treadmill cardiopulmonary exercise test between 10 am and 3 pm. Heart failure optimization was considered 50 mg/day or more of carvedilol, with a resting heart rate of between 50 and 60 bpm.

**RESULTS** Basal heart rate was lower in heart failure patients (58  $\pm$  5 bpm) compared to heart transplant patients (93  $\pm$  11 bpm;  $p$  < 0.0001). Similarly, the peak heart rate (percentage of the maximum predicted for age) was lower in heart failure patients (60  $\pm$  13%) compared to heart transplant patients (80  $\pm$  12;  $p$  < 0.0001). Maximum respiratory exchange ratio did not differ between the groups (1.05  $\pm$  0.06 in heart failure patients and 1.11  $\pm$  0.1 in heart transplant patients;  $p$  = 0.08). Moreover, the heart rate reserve between heart failure (49  $\pm$  22) and heart transplantation (46  $\pm$  16%) was not different ( $p$  = 0.644).

**DISCUSSION & CONCLUSION** No patient reached the maximum heart rate predicted for their age during a treadmill cardiopulmonary exercise test. The heart rate reserve was similar between groups. A heart rate increase in heart transplant patients during cardiopulmonary exercise test of more than 80% of the maximum age-adjusted value should be considered an effort near the maximum.

**KEY WORDS** Heart Transplantation, heart rate, exercise

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### Validation of the London Chest Activity of Daily Living scale (LCADL) in heart failure patients

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**OBJECTIVE** The Minnesota Living with Heart Failure Questionnaire (MLHFQ) is a well validated commonly used tool to assess quality of life in people with heart failure. However, the tool lacks specific information concerning breathlessness during daily activities. The London Chest Activity of Daily Living scale (LCADL) is a tool initially validated to measure breathlessness during daily activities in patients with severe Chronic Obstructive Pulmonary Disease. However, since this tool is not specific to patients with COPD and due to the lack of current tools to properly assess activities of daily living in patients with heart failure, the LCADL could also be applied in this population in order to provide important information concerning their breathlessness and functional activity. The evaluation of these outcomes may enable the development of further intervention strategies to address breathlessness during activities of daily living in this rather disabled population.

**METHODS** Forty-seven heart failure patients (57% males, 50±9 years, left ventricle ejection fraction 29±6% and New York Heart Association (NYHA) functional class I-III) were included in this study. Firstly, all subjects performed a cardiopulmonary exercise test to determine objectively the exercise capacity. Then, patients responded to the LCADL and the MLHFQ, instructed by the same investigator. The LCADL's retest was applied one week later. An analysis of the LCADL scores stratified by the patients' functional limitation according to the NYHA classification was performed.

**RESULTS** The MLHFQ was highly correlated with LCADL. MLHFQ and LCADL were also highly correlated with exercise capacity variables. There was a statistically significant difference in the LCADL scores between NYHA functional classes I and II, as well as classes I and III, but not between classes II and III. Despite of this, LCADL total score ( $r=0.68$ ), and sub-scores self care ( $r=0.65$ ), domestic ( $r=0.69$ ), physical ( $r=0.67$ ) and leisure ( $r=0.60$ ) correlated with NYHA functional class ( $p<0.0001$  for all). The LCADL was strongly reproducible in all domains. Total score showed a Cronbach's alpha of 0.99,  $r_i$  of 0.98 (0.92 to 0.97 of CI); self-care domain showed a Cronbach's alpha of 0.97,  $r_i$  of 0.95 (0.92 to 0.97 of CI); domestic domain showed a Cronbach's alpha of 0.99,  $r_i$  of 0.97 (0.95 to 0.98 of CI); physical domain showed a Cronbach's alpha of 0.96,  $r_i$  of 0.91 (0.85 to 0.95 of CI); leisure domain showed a Cronbach's alpha of 0.98,  $r_i$  of 0.96 (0.93 to 0.97 of CI)

**DISCUSSION & CONCLUSION** The LCADL showed to be a valid and reproducible measurement of dyspnea during daily activities in heart failure patients. This scale could be an additional important tool for the assessment of patients' dyspnea sensation during activities of daily living and to discriminate/categorize patients with different functional impairments.

**KEY WORDS** lcadl, heart failure, daily activities, quality of life

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## Prevalence and clinical significance of aortic root dilatation in highly-trained competitive athletes

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**OBJECTIVE** Few data are available addressing the impact of athletic training on aortic root size. We have investigated the distribution, determinants and clinical significance of aortic root dimension in a large population of highly-trained competitive athletes.

**METHODS** Echocardiographic aortic root dimensions were assessed in 2,317 athletes free of cardiovascular disease, aged 24.8 ± 6.1 (9-59) years, 56% male, engaged in 28 sports disciplines including participation in Olympic Games and World Championships.

**RESULTS** In males, aortic root was 32.2 ± 2.7 mm (range 23-44); 95th percentile, 37 mm, and in females was 27.5 ± 2.6 mm (20-36); 95th percentile, 32 mm. Aortic root was <40 mm in 2,300 athletes (99%), and > 40 mm in only 17 (1%), all males. In this subset, aortic dimension increased over a 8 ± 5 year follow-up (40.9 ± 1.3 to 42.9 ± 3.6 mm;  $p<0.01$ ), including 3 former athletes in whom aorta became dilated (to 50 mm, 50 mm and 48 mm) after 15-17 year follow-up, in the absence of symptoms or evidence of systemic disease. Multiple regression and covariance analysis showed aortic dimension was largely explained by body surface area, LV mass and age ( $R^2=0.61$ ), with sports participation having lower effect.

**DISCUSSION & CONCLUSION** Dilatation of the aortic root (>40 mm) is rare in highly-trained athletes, and is not a feature of physiologic athlete's heart. Longitudinal assessment of athletes with aortic root >40 mm showed further dimensional increase, which occasionally was marked, underscoring the importance of close clinical surveillance to reduce the risk associated with accelerated aortic enlargement.

**KEY WORDS** aortic root dimension, athlete's heart, echocardiography

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## Different presentation of bicuspid aortic valve in 169 sportsmen

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**OBJECTIVE** Bicuspid aortic valve (BAV) is the most common congenital cardiac anomaly (1-2%) in the general population. Aims of our study were: 1) to evaluate the different patterns of presentation of BAV; 2) to compare different BAV morphological phenotypes.

**METHODS** Since 1986 to 2009, 169 sportsmen with BAV (mean age  $22\pm 10.4$ , range 7-67 years), were evaluated for different reasons in our Institution. Each subject underwent a thorough cardiological evaluation comprehensive of clinical examination, resting and exercise ECG, echocardiogram, 24h-Holter monitoring and, when indicated, magnetic resonance imaging of the heart and/or angio-CT of coronary arteries.

**RESULTS** BAV was associated with cardiac pathologies/abnormalities in 46/169 (27%) sportsmen. After excluding subjects with significant cardiac pathologies (10 cases), aged <12 or >50 years (8 cases), the remaining 151 were classified in 4 groups: group 0, (22 cases, 14.6%) with an "almost normal valve"; group 1, (94 subjects, 62.2%) with regurgitation; group 2, (16 cases, 10.6%) with stenosis; group 3, (19 subjects, 12.6%) with isolated aortic dilation. Moreover, taking into account BAV morphology, 109 cases (72.2%) showed antero-posteriorly (AP) and 42 (27.8%) latero-laterally (LL) oriented cusps. Sportsmen with AP-BAV showed larger aortic diameter ( $34.7\pm 5.9$  vs  $31.7\pm 6.1$ ) and a greater proneness to progressive dilation during follow-up ( $+0.04\pm 0.08$  vs  $+0.02\pm 0.05$  mm/year).

**DISCUSSION & CONCLUSION** As other cardiac pathologies/abnormalities are frequently observed in sportsmen with BAV, a thorough cardiological investigation must always be carried out. Several patterns of BAV presentation exist, possibly with different outcome. Valve morphology, finally, seems to be a predictive factor for its prognosis.

**KEY WORDS** Bicuspid aortic valve, sportsmen, echocardiogram, morphological phenotypes, aortic diameter, progressive dilation.

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## Endobutton fixation of lateral end clavicle fractures in cyclists

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**OBJECTIVE** The aim of our study was to determine the outcomes following open reduction and internal fixation of acute displaced lateral end clavicle fractures in cyclists.

**METHODS** A prospective study was conducted over a 27 month period from January 2007 to April 2009. We adopted a standard protocol of treating all acute lateral end clavicle fractures in cyclists by open reduction and internal fixation with 2 endobuttons attached with 6 ply orthocord suture in a pulley configuration through bone tunnels in the clavicle and coracoid. We reviewed these patients at 3, 6 and 12 months after surgery, with sequential radiographs and evaluation of functional outcomes.

**RESULTS** A total of 16 patients were included in the study. The mean age was 38 years with a range from 16 to 57. At one year follow up the median Constant score was 93 points, the median DASH score was 5 points, the mean forward flexion was  $180^\circ$ , mean abduction was  $180^\circ$  and the mean external rotation was  $110^\circ$ . 13 patients returned to cycling within 6 months after the operation. 2 patients had complications in the form of fibrous non-union and capsulitis which responded to distension arthrography. There were no re-operations.

**DISCUSSION & CONCLUSION** We describe a novel method of operative fixation of lateral end clavicle fractures which produces good functional and radiological results, with a relatively low rate of operative complications. We recommend this technique for the displaced lateral end clavicle fractures in cyclists.

**KEY WORDS** lateral end clavicle fractures, cyclists, endobutton fixation

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## Pseudo-winging following midshaft clavicle fracture in cyclists

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**OBJECTIVE** The aim of our study was to determine the incidence of pseudo-winging after midshaft clavicle fracture and correlate it with the functional outcomes in cyclists.

**METHODS** A prospective study was conducted between September 2008 and April 2009. Scapulothoracic movement was recorded for all the patients with clavicle fracture after union and reviewed by 2 blind observers. The functional

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outcomes were assessed by using validated Disabilities of the Arm, Shoulder and Hand questionnaire.

**RESULTS** There were 36 patients (33 males and 3 females) with mean age of 29 years. All patients had a pain free full range of motion of their shoulder girdle. 25 patients (70%) had non-operative treatment of their clavicle fracture which resulted in malunion. 15 patients (60%) had scapular prominence and 15 patients (60%) had pseudo-winging in the non-operative group. 8(53%) patients had mild, 8(53%) had moderate and 1(6%) had severe pseudo-winging. 11 patients had primary operative treatment of their clavicle fractures. 2 patients (18%) had scapular prominence and 3(27%) had pseudo-winging in the operative group. The median DASH score was 2.5 with a range from 0-66 for the patients with pseudo-winging and 2.5 with a range from 0-34 for the patients without pseudo-winging.

**DISCUSSION & CONCLUSION** We concluded that there was a high incidence (60%) of pseudo-winging after non-operative treatment of midshaft clavicle fractures in cyclists. There was no statistically significant difference in the incidence of pseudo-winging between the operative and non-operative groups. There was also no correlation between the pseudo-winging and the functional outcomes.

**KEY WORDS** Midshaft clavicle fracture, pseudo-winging, cyclists

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## Supraspinatus muscle belly tenderness: diagnostic value for supraspinatus pathology

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**OBJECTIVE** This study aims to determine the usefulness of supraspinatus muscle belly tenderness (SMBT) upon palpation in determining supraspinatus pathology.

**METHODS** Twenty five patients who presented with shoulder pain were included in the study. They provided a history of their present illness and underwent focused physical examination of the shoulder (palpation of the supraspinatus belly and tendon, Empty can test and Drop arm test) prior to undergoing MRI. Results were organized into group 1 (supraspinatus tendinosis/tendinitis) and group 2 (supraspinatus tears) which was further divided into group 2A (partial thickness tears) and group 2B (full thickness tears). Diagnostic values were determined for each test in each group as well as in combination.

**RESULTS** SMBT showed a high specificity (100%) in diagnosing supraspinatus pathology. In group 2, SMBT exhibited a good specificity (80%) but only had a 50% sensitivity. SMBT was also noted to be better in determining partial thickness tears (sensitivity 80% / specificity 80%) rather than full thickness tears (sensitivity 20% / specificity 65%). SMBT likewise showed the highest post test probability (73%) and likelihood ratio in the group 2A. With regards to combination of SMBT with the other test, it showed improvement in its diagnostic value with the highest being in the group of supraspinatus tears and the subgroup of partial thickness tears.

**DISCUSSION & CONCLUSION** SMBT on palpation provides a simple, inexpensive, non-invasive confirmatory tool for supraspinatus pathology. It is also of particular value in detecting partial thickness supraspinatus tears especially if combined with the other special tests.

**KEY WORDS** Supraspinatus muscle belly, palpation, diagnostic value, tenderness

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## Arthroscopic bankart repair and capsular shift for traumatic anterior shoulder instability

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**OBJECTIVE** Most studies on arthroscopic treatment of anterior – inferior glenohumeral instability are focused on the repair of lesions of the anterior – inferior aspect of the labrum (Bankart lesions). Arthroscopic treatment of anterior shoulder instability is reported less successful than open techniques with failure rates up to 50%. This study demonstrates that anterior – inferior instability is associated with multiple lesions and the treatment of all these lesions can increase success rates.

**METHODS** The study group consisted of 96 patients who had a mean age of 27 years (range, 15 to 60 years) at the time of the operation. There were 74 athletes, 30 patients with more than five dislocations and 7 patients had a little bony fracture. All shoulders underwent arthroscopic capsulolabral repair with suture anchors. Additionally, 27 plications with sutures, 45 capsular shifts, 16 closures of the rotator cuff interval and 8 rotator cuff repairs were performed.

**RESULTS** At a mean of 16 months postoperatively occurred two traumatic redislocations. In the athletes group 57/74 (77%) returned to the preinjury and 12/74 (16,2%) to lower sports level, while 5/74 (6,8%) gave up sport activities.

**DISCUSSION & CONCLUSION** Arthroscopic treatment of anterior shoulder instability has evolved tremendously

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over the last decade. However, the variety of the available arthroscopic instruments and techniques shows the complexity of the intra-articular tissue fixation, which includes anchor placement, suture passing, and knot tying. We believe that the improved rate of success is the result of repair not only of the anterior – inferior (Bankart) lesion, but also (where necessary) of associated lesions and especially of the significant volume decrease of the capsule.

**KEY WORDS** shoulder instability, bankart lesion, arthroscopic repair, capsular shift,

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## **Muscular strength and activity of deltoid muscle during specific exercises in impingement syndrome**

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**OBJECTIVE** Deltoid muscle plays an important role in normal shoulder function as well as scapular rotators. Although there are some studies evaluating deltoid muscle activity, most of them focused only the middle part. The aim of this study was to evaluate muscular strength and activity of deltoid muscle during specific exercises have been using commonly in rehabilitation of impingement syndrome.

**METHODS** 20 subjects who were suffering from impingement syndrome (Grade I and II) and 18 healthy subjects were included in the study. The study group was consisted of 13 female and 7 male with mean age of 44.05±8.95 years. The mean age of the control group (13 female and 5 male) was 41.06±15.01 years. All the subjects have been evaluated for muscle strength using dynamometer and Cyriax isometric muscle test. Surface EMG has been used for assessing the muscle activity. Shoulder ladder, shoulder wheel, isometric and isotonic shoulder exercises were chosen as specific exercises during EMG measurements. All the results taken from the measurements in the study group have been compared with the control group.

**RESULTS** There was significant difference in dynamometric measurements of 3 parts of deltoid muscle between the study and the control group. Dynamometric measurements were lower in the study group than the control group ( $p<0.05$ ). Strength of deltoid according to Cyriax muscle test in the study group significantly decreased ( $p<0.05$ ). EMG activities of anterior part in maximum work and power during isometric flexion exercises have reduced in the study group ( $t_1=-2.388, t_2=-2.730, p<0.05$ ). Power of anterior part in the study group during isotonic flexion exercises ( $t=-2.290, p<0.05$ ) and during shoulder ladder exercises ( $t=-2.151, p<0.05$ ) was also diminished. EMG activity of middle part of the deltoid in the study group was decreased only during isotonic abduction exercises ( $t=-2.051, p<0.05$ ). However there was significant difference in maximum work and power of posterior part between the study and the control group during shoulder wheel exercises ( $t_1=-2.777, t_2=-2.653, p<0.05$ ).

**DISCUSSION & CONCLUSION** The strength of the deltoid muscle was diminished in impingement syndrome. The most aggressive exercises for deltoid muscle were shoulder wheel and shoulder ladder exercises. Isometric exercises and isotonic exercises below than 90° were the least loaded exercises. The most influenced part of the deltoid was the anterior part. These results could be taken consideration in planning of the exercises regarding of deltoid muscle activity and loading. It should be keep in mind that shoulder wheel and shoulder ladder exercises must be used carefully in rehabilitation programme.

**KEY WORDS** Impingement syndrome, deltoid muscle, muscle strength, muscle activity

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## **Oxygen uptake kinetics in swimming: New findings**

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**OBJECTIVE** Understanding the principal determinants of oxygen ( $VO_2$ ) uptake kinetics is fundamental to improve human performance in sport. Indeed, there are some swimming related studies that focus on the relationship of the  $VO_2$  response at different constant work-rate exercises (e.g. moderate, heavy and severe intensities) and swimmer's performance. For instance, our group observed the existence of a slow component of the  $VO_2$  kinetics, superimposed to its fast phase, during a time to exhaustion test at the swimming velocity corresponding to  $VO_{2max}$  ( $TL_{lim}VO_{2max}$ ). It was observed, inclusively, that the  $VO_2$  slow component was one of the major  $TL_{lim}VO_{2max}$  determinants. However, it was not tried to relate the  $VO_2$  kinetics parameters with swimming competitive events. The purpose of this study is to observe if the  $VO_2$  kinetics parameters determined at a  $TL_{lim}VO_{2max}$  intensity are related to the 400m front crawl, a typical aerobic power event.

**METHODS** Seven high trained front crawl swimmers (17.4±1.4 years old, 63.5±8.7 kg and 168.8±7.3 cm) performed

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an individualized intermittent incremental protocol for  $v\dot{V}O_{2\max}$  assessment, with increments of 0.05m/s each 200m stage and, 30s intervals, until exhaustion.  $\dot{V}O_2$  was directly measured using a breath-by-breath portable gas analyzer (K4b2, Cosmed, Italy) connected to the swimmers by a respiratory snorkel/valve system. Velocity was controlled using a visual pacer (TAR.1.1, GBK-electronics, Portugal).  $\dot{V}O_{2\max}$  was considered to be reached according to primary and secondary traditional physiological criteria and  $v\dot{V}O_{2\max}$  was accepted as the velocity correspondent to the first stage that elicits  $\dot{V}O_{2\max}$ . Forty-eight hours later, subjects swam until exhaustion at their pre-determined velocity, to assess  $TL_{\text{lim}}v\dot{V}O_{2\max}$ . The  $\dot{V}O_2$  kinetics parameters for each phase of the  $\dot{V}O_2$  response (td1, tau1, A1, td2, tau2 and A2, i.e., time delay, time constant and amplitude for the fast and slow component, respectively) were assessed by mathematical modelling (the cardiodynamic component was not taken into consideration).

**RESULTS** Velocity of the 400m front crawl event ( $1.51 \pm 0.07$ m/s) was related with A1 ( $39.4 \pm 7.5$  ml/kg/min;  $r=0.79$ ,  $p=0.04$ ), none existing other significant relationships: td1 ( $18.4 \pm 9.5$ s;  $r=-0.56$ ), tau1 ( $15.9 \pm 4.8$ s;  $r=0.15$ ), A2 ( $5.9 \pm 3.4$  ml/kg/min;  $r=-0.12$ ), td2 ( $104.5 \pm 6.5$ s;  $r=0.49$ ) and tau2 ( $34.7 \pm 20.6$ s). V400 presented also an elevated relationship with  $\dot{V}O_{2\max}$  ( $63.4 \pm 6.7$  ml/kg/min;  $r=0.93$ ,  $p=0.03$ ) and  $v\dot{V}O_{2\max}$  ( $1.43 \pm 0.07$ m/s;  $r=0.97$ ,  $p<0.01$ ).

**DISCUSSION & CONCLUSION** Higher amplitude of the fast component of  $\dot{V}O_2$  kinetics seems to be directly related to best performances in the 400m front crawl event. This result seems to confirm that  $\dot{V}O_{2\max}$  plays a central role among the energy-yielding mechanisms in middle distance swimming and that aerobic power is important in swimming performance.

**KEY WORDS** Swimming,  $\dot{V}O_2$  kinetics, fast component, 400m front crawl

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## Index of Coordination assessment in young swimmers: comparison between breathing and non breathing cycles

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**OBJECTIVE** The index of coordination (IdC) aims to assess the continuity of swimming propulsion, measuring the inter-arm lag time between propulsive phases. The three patterns of arm coordination described in the swimming specialized literature are the catch up (IdC < 0), the superposition (IdC > 0) and the opposition (IdC = 0) modes. No IdC related studies were conducted in swimmers during the childhood period, despite the importance of the development of the coordinative abilities, namely the bimanual coordination, the movement's dissociation and the rhythm, in the "basic training" phase. Knowing that children are not mini-adults, the purpose of this study was to assess the IdC in young swimmers, trying to observe differences between breathing (to their preferential side) and non-breathing cycles.

**METHODS** Subjects ( $n = 15$ ;  $10.7 \pm 0.7$  years old;  $149.3 \pm 7.1$  cm height;  $41.1 \pm 7.5$  kg weight and  $5.3 \pm 2.0$  years of training background) performed 2 x 25 m front crawl at high intensity, with rest intervals higher than 20 min. Swimmers were monitored by two underwater video cameras (Sony® DCR-HC42E) in the sagittal and frontal planes. Descriptive statistics and Wilcoxon test were carried out (a significance level of  $p < 0.05$  was accepted).

**RESULTS** The mean  $\pm$  SD, minimum and maximum values for the IdC taking into consideration the breathing and non-breathing cycles, were, respectively,  $-20.4 \pm 3.4$  (ranging between -25.8 and -13.6) and  $-17.8 \pm 1.6$  (ranging between -19.8 and -14.5) (with significant difference between trials,  $p < 0.01$ ). These IdC values indicate a preference of the children for the catch up mode, with high lag times between propulsive arm actions, which is not in accordance with the literature for adult swimmers performing at high intensities (values situated between -5 and 0). This fact suggests that our understanding of the skills in the adulthood period should not just be scaled down and applied to children. Moreover, it seems that the process of growth and maturation interfere in our understanding of the inter-arm coordination phenomenon in swimming.

**DISCUSSION & CONCLUSION** Complementarily, the higher IdC observed, when comparing breathing and non-breathing cycles, is justified by the increasing discontinuity in the arms propulsive actions in the cycles when the swimmer breathes. In fact, in the literature, it is considered that the duration of the non-propulsive phases (entry/catch and recovery) is higher in the breathing cycles, being also observed an inverse correlation with IdC.

**KEY WORDS** Swimming, index of coordination, breathing cycles

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## Relationship between anaerobic power and sprint ability in football players

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**OBJECTIVE** In many sports short bursts of high intensity power production play a major role in performance

especially in team sports like football. Therefore, anaerobic and sprint performances are very crucial and fundamental activities for these types of sports. Hence, the purpose of the present study was to examine the relationship between anaerobic power and sprint ability in football players.

**METHODS** Fifteen male football players participated in this study voluntarily (Mage: 23.06±1.98 yrs, Mheight: 173.52±5.80 cm, MBW: 72.91±9.99kg, Mfat: 10.03±4.82 %). Vertical jump of football players was determined by squat and counter-movement jump tests and anaerobic power was calculated by Lewis nomogram. Sprint ability was determined by 20m sprint test and 12x20m running repeated sprint ability tests. After repeated sprint ability test, best time, total sprint time and percentage of decrement were determined and calculated.

**RESULTS** Pearson Product Moment Correlation analysis indicated significant correlations between anaerobic power of squat jump and total time at 0-10m ( $r = .584$ ;  $p = .022$ ), 10-20m ( $r = .708$ ;  $p = .003$ ), 0-20m ( $r = .682$ ;  $p = .005$ ), performance decrement 10-20m ( $r = .589$ ;  $p = .021$ ) and 0-20m ( $r = .649$ ;  $p = .009$ ). In addition anaerobic power of counter-movement jump was significantly correlated with total time at 10-20m ( $r = .643$ ;  $p = .010$ ), 0-20m ( $r = .611$ ;  $p = .016$ ), performance decrement at 0-10m ( $r = .644$ ;  $p = .010$ ), 10-20m ( $r = .686$ ;  $p = .005$ ) and 0-20m ( $r = .750$ ;  $p = .001$ ). No significant correlation was observed between anaerobic power of squat and counter-movement jumps and 20m sprint performance and the best time performances of running repeated sprint ability tests ( $p > .05$ ).

**DISCUSSION & CONCLUSION** As a conclusion it can be said that anaerobic power but not vertical jump, is highly related with total time and performance decrement in repeated sprint ability, however is not related with 20m sprint performance in football players. Lack of association between anaerobic performance and single sprint performance indicated that factors other than anaerobic performance might lead to single sprint performance in this group of football players.

**KEY WORDS** anaerobic performance, sprint ability, football players

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## The evaluation of training effects in professional soccer players by monitoring the changes of $VO_{2max}$ , AnT and creatine kinase

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**OBJECTIVE** Increasing  $VO_{2max}$  during the soccer training process is imperative, but reaching the highest anaerobic threshold (AnT) is connected with top level performance. On the other side, some data suggest that plasma concentrations of creatine kinase (CK) could be a better indicator of training adaptation than LDH and blood lactates. The aim of this study is to evaluate the soccer training effects by monitoring the changes of  $VO_{2max}$ , AnT and CK.

**METHODS** This study included 30 professional football players from one of the teams of the first football league. The investigations were made at three points: in the beginning of the preparation period, after the preparation period, and after competition period. Each of the investigations was performed in three phases. The following parameters had been determined: indirect  $VO_{2max}$  (ml/kg/min) during a maximal treadmill test; AnT with Conconi treadmill test and plasma concentrations of CK by DEROM method. Plasma concentrations of CK were measured before (CK1) and after (CK2) maximal treadmill test. Exercise induced answer of CK was taking account as a difference between CK1 and CK2.

**RESULTS** After the preparation period, there were significant increases of  $VO_{2max}$ . At the end of competition period there were significant decreases of  $VO_{2max}$ , plasma concentrations of CK and exercise induced CK answer. The AnT was statistically unchanged during the whole training process. There was significant negative correlation between  $VO_{2max}$  and exercise induced CK answer after the preparation period.

**DISCUSSION & CONCLUSION** The increase of  $VO_{2max}$  after the phase of preparation, connected with a decrease of exercise induced CK answer, was a result of an adaptation of muscle cell membrane on increased volume of training in the phase of preparation. Taking account the decrease of  $VO_{2max}$  at the and of phase of competition, together with the decrease of plasma concentrations of CK and exercise induced CK answer on the one side, and unchanged AnT during the whole training process, on other side, it was indicated that this soccer training process was ineffective and connected with some signs of fatigue and disadaptation at the end of the phase of competition.

**KEY WORDS** soccer players,  $VO_{2max}$ , AnT, creatine kinase, training effects

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## Physiological responses and energy expenditure during water cycling

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**OBJECTIVE** Equipment that was used to improve physical fitness on land are being adapted for water, such as the bicycle. The aim of this study was to compare the energy cost of submaximal cycling at different intensities, performed during cycling in an aquatic-specific bike (CW) and on land stationary bike (CL).

**METHODS** Fifteen trained male subjects (mean  $\pm$  SD: age 21.73  $\pm$  2.84 years; weight 70.33  $\pm$  5.33 kg; height 175  $\pm$  06 cm; fat mass percentage 15,09  $\pm$  3.13; VO<sub>2</sub>máx 50,96  $\pm$  5,51 ml.kg<sup>-1</sup>.min<sup>-1</sup>; FC 182,64  $\pm$  12,35 bpm). Each subject completed in a randomized order a 6 min exercise bout at the cadence of 60, 80 and 100 bpm, either on a CL and a CW, with 48h separating each exercise bout. Oxygen uptake (VO<sub>2</sub>), energy expenditure (EE) and the heart rate (HR) were continuously collected, respectively, with a portable gas analyzer K4b2 (Cosmed, Rome, Italy) and by a transmitter unit attached to K4b2. Rest metabolic rate were measured before each trial. The ANOVA test was used for repeated measures and Bonferroni post-hoc test as well as the paired t-test (p<0.05).

**RESULTS** The VO<sub>2</sub>, EE and HR increased with the cadences in both exercises conditions and were significantly higher (p<0.05) when during CW.

**DISCUSSION & CONCLUSION** The increased of VO<sub>2</sub> and HR in the water exercise showed a direct relation with the speed of cycling at higher cadences. In conclusion, different intensities may be used in water exercises with the advantages of smaller joint overload.

**KEY WORDS** water cycling, oxygen uptake, heart rate

## Effects of different rest intervals during resistance training on growth hormone, testosterone and blood lactate

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**OBJECTIVE** Resistance training stimulates the release of different anabolic hormones, specially growth hormone (GH) and testosterone (TS) (1,2,4,5). The acute hormonal responses due to resistance training (RT), reinforces the access to muscle strength, following the chronic training (3). Aim of the present study was a comparison among three different rest intervals on growth hormone (GH), testosterone (TS) and blood lactate and training volume.

**METHODS** Therefore ten male athletes (Mean  $\pm$  SD, age=20.37 $\pm$  2.24 years, body mass= 65.5  $\pm$  26.70 kg) voluntarily participated in four sessions with 48 h rest interval who were performing different resistance trainings (RT). At the first session, one repetition maximum (1RM) of participants evaluated. The subjects from the second session up to the fourth, each session, performed four sets of squat and bench press until exhausted with 85% of 1RM and one of rest intervals of 60s, 90s and 120s between the sets used randomly and then the number of repetitions in each set was recorded. Also, there were taken three blood samples from the subjects before (T0), immediately after (T1) and 30 min after (T3), to determine the GH, TS and blood lactate serum concentrations.

**RESULTS** Based of the results, there wouldn't observe a significant difference in GH, TS and blood lactate serum concentrations in T0. It was observed a significant increment of 64 percent in GH concentration through using the 60s rest intervals in comparison with 120s rest between sets in T1. Besides, there was observed a significant increment of 65 and 67 percent in TS concentration through using the rest intervals of 90s and 120s compared to the 60s rest interval in T1. It wasn't observed a significant difference among the three programs in lactate concentration. Although, the ability of keeping the repetition (training volume) by using 90s and 120s rest intervals has been more than that of 60s, but statistically it wasn't observed a significant difference in training volume.

**DISCUSSION & CONCLUSION** The results of the present study support rest period in RT sets as an important variable to increase the anabolic hormone concentrations and it should be mentioned that 60s rest interval has caused more increase in GH concentration compared with 120s rest. But TS response has been larger in the program with 120s rest interval between sets. In summary, the results of this investigation indicate that serum GH and TS concentrations were dependent to the length of the rest interval between sets in heavy RT program. The primary finding of this study was that the patterns of GH and TS responses were dramatically different to the length of rest interval between sets in heavy resistance training. Heavy resistance training with short (60 s) rest interval between sets resulted in greater acute GH responses than long (120 s) rest interval between sets. But acute TS responses after heavy resistance training with long rest (120 s) showed great increase than heavy resistance training with short (60 s) rest interval between sets

**KEY WORDS** Growth hormone, testosterone, resistance training, rest interval

## **A new hamstring test for measuring active flexibility before return to sport after injury**

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**OBJECTIVE** Passive flexibility tests are often used for establishing criteria for safe return to sport after hamstring strains. The aim here is to introduce an active hamstring flexibility test and to evaluate its reliability and applicability on injured athletes.

**METHODS** Eleven healthy subjects (28y) were tested on repeated occasions and 11 athletes (21y) with MRI-verified acute hamstring strain were tested when clinical examination revealed no signs of remaining injury. Flexibility, i.e. highest range of motion of 3 consecutive trials was calculated from electrogoniometer data during maximal voluntary and passive hip-flexions in a supine position. A VAS-scale (0-100) was used to estimate experience of insecurity during active tests.

**RESULTS** No significant test-retest differences were observed. Intra-class correlation coefficients ranged 0.89–0.97 and coefficients of variation 1.9-3.2%. Active flexibility was greater (23%) than passive flexibility. In the athletes, the injured leg showed smaller active, but not passive, flexibility than the uninjured leg. Average insecurity estimation was 52 for the injured and 0 for the uninjured leg, respectively.

**DISCUSSION & CONCLUSION** The new active hamstring test showed good reliability. Furthermore, it seems to be sensitive enough to detect differences both in active flexibility and in insecurity after acute hamstring strains, where the commonly used clinical examination fails to reveal injury signs. Thus, the active hamstring test adds discriminative power and could provide useful additional criteria for minimizing the risk for re-injury upon return to sports in athletes.

**KEY WORDS** hamstrings, test, strain, flexibility

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## **Effects of FIFA'S "The 11+" injury prevention program on isokinetic strength**

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**OBJECTIVE** This study intended to evaluate whether knee extensor and flexor muscles strength could be improved in response to an injury prevention program.

**METHODS** Twenty players (aged 22.3±4.2 yr) performed the "11+", an injury prevention program developed by FIFA's medical assessment and research centre. Players trained 3 times per week during 10 weeks. Isokinetic strength was evaluated on knee flexor and extensor muscles at concentric 60°.s-1, concentric 180°.s-1 and eccentric 30°.s-1 angular velocities. Reciprocal strength differences, and conventional and functional hamstring:quadriceps peak torque ratios (H/Q ratio) were considered. Descriptive statistics were calculated and comparisons between pre- and post-intervention scores were conducted using paired-sample t-tests. Significance was set at 0.05.

**RESULTS** Peak torque moments increased for all angular velocities. Regarding knee extensors strength changes, significant differences were only found for concentric exertions at 180°.s-1 on the dominant limb (p=0.05). Major improvements were registered in hamstring concentric exertions only: dominant limb at 60°.s-1 (p=0.14), non dominant limb at 60°.s-1 (p<0.001), and non dominant limb at 180°.s-1 (p=0.004). No significant changes were found during eccentric exertions. Conventional H/Q ratios improved in all velocities, despite reaching significance at concentric 60°.s-1 (p=0.046) on the non dominant limb only. No significant differences were found on the functional H/Q ratio.

**DISCUSSION & CONCLUSION** The "11+" seems to improve concentric but not eccentric strength. Reciprocal muscle balance appears not to change due to the program, but players improved concentric hamstrings strength, mainly on the non dominant limb. We suggest that higher training volume and intensity should be considered when performing the injury prevention program.

**KEY WORDS** soccer, training, muscle balance, hamstrings

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## **Isokinetic strength evaluation can predict muscle strains in professional soccer players. A prospective study.**

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**OBJECTIVE** Soccer players tend to use their preferred lower extremity for most of the soccer activities and especially for controlling and kicking the ball. Theoretically, this leads to asymmetrical adaptations of the musculoskeletal structures and consequently to muscle injuries. The purpose of this prospective study was to investigate the isokinetic myodynamic profile at the lower extremities of soccer players and to establish an association between possible strength asymmetries with the development of muscle strains.

**METHODS** One-hundred professional soccer players (age 23.4 years, weight 73.3, height 177.6) were tested isokinetically for concentric and eccentric strength of the knee flexors and extensors and of the ankle dorsal and plantar flexors. Knee flexion and extension was tested at 60°, 180° and 300°/sec for the concentric mode of contraction and at 60° and 180°/sec for the eccentric. The ankle joint was tested at 60°/sec for both the concentric and eccentric mode of contraction. Identical protocols were applied to both body sides (left, right). A lower extremity strength asymmetric profile was then created using selected cut-offs for bilateral strength differences of 15% or more in a total of 14 measurements (concentric and eccentric evaluation of knee and ankle joint). Players were followed prospectively for the next 11 months and 31 strains in the muscles of their lower extremities were recorded.

**RESULTS** Soccer players suffer many strength asymmetries at their lower extremities. These asymmetries were most prevalent in the eccentric function compared to the concentric (Wilks'  $\lambda=0.70$ ,  $F=4.75$ ,  $P=0.000$ ). Players with concentric asymmetries didn't not present significant higher incidence rate of muscle strains compared to players with no concentric asymmetries (Pearson  $\chi^2=0.18$ ,  $p=0.67$ , Odds ratio=0.12). In contrary, the incidence rate of muscle strains increased significantly in players with pre-season eccentric strength asymmetries (Pearson  $\chi^2=7.78$ ,  $p=0.005$ , Odds Ratio= 6.91). Furthermore, grouping of players according to the number of isokinetic asymmetries revealed that players with many concentric/eccentric asymmetries presented also significant high epidemiology in muscle strains (Pearson  $\chi^2=9.42$ ,  $p=0.024$ ).

**DISCUSSION & CONCLUSION** The outcome of this study confirms the hypothesis of asymmetrical myodynamic adaptations of the knee and ankle joint in soccer players. Our findings clarifies the influence of bilateral isokinetic strength asymmetries on muscle strain at the lower extremities of professional soccer players. Isokinetic evaluation during the pre-season period can predict and thus decrease the incidence rate of muscle strains in soccer.

**KEY WORDS** soccer, injury prediction, strength asymmetries

## **Isokinetic strength profile of quadriceps and hamstrings in elite male volleyball players**

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**OBJECTIVE** Knowledge of lower-extremity strength can be used in injury prevention, conditioning and rehabilitation of volleyball players. The goals were: (1) to describe the concentric and eccentric quadriceps (Q) and hamstrings (H) muscle function in volleyball players, (2) to evaluate the differences in Q and H strength, strength ratios and bilateral strength asymmetry among age groups, playing positions and playing levels, (3) to compare bilateral strength asymmetry in Q and H muscles in two different contraction modes.

**METHODS** 95 professional male volleyball players were tested on an isokinetic machine at 60°/sec to assess concentric and eccentric Q and H strength. We also calculated strength ratios and bilateral strength asymmetries. MANOVAs indicated significant main effect of playing level on relative PT ( $p=0.001$ ) and strength ratios ( $p<0.05$ ).

**RESULTS** International-level players had significantly ( $p<0.05$ ) higher H strength and dynamic control ratio (DCR) of the right leg compared to the 1st and/or 2nd national division players. There were no signs of bilateral strength asymmetry regardless of muscle group tested and contraction mode.

**DISCUSSION & CONCLUSION** Our results suggest that right H strength and DCR could be important for successful volleyball performance. Descriptive data about Q and H muscle function can be used as guidelines for coaches and therapists during training and rehabilitation of male volleyball players

**KEY WORDS** volleyball, isokinetic strength

## Normal values of left ventricular remodelling in elite athletes, as assessed by three-dimensional echocardiography

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**OBJECTIVE** Aim of our study was to assess the normal values of left ventricular (LV) remodelling, as assessed by three-dimensional echocardiography (3DE) in a large population of elite competitive athletes.

**METHODS** A study population of 426 elite athletes engaged in different sports disciplines (41 skill, 100 strength, 127 combined and 158 endurance) and 62 sedentary controls underwent 3DE for assessment of LV end-diastolic volume (EDV), systolic volume (ESV), mass (LVM), which were normalized to body surface area, and ejection fraction (EF).

**RESULTS** EDV was larger in athletes engaged in strength ( $77\pm 14$  ml/m<sup>2</sup>;  $p<0.001$ ), combined ( $77\pm 11$  ml/m<sup>2</sup>;  $p<0.001$ ) and endurance ( $91\pm 13$  ml/m<sup>2</sup>;  $p<0.001$ ), but not in skill ( $70\pm 11$  ml/m<sup>2</sup>) disciplines compared to controls ( $63\pm 11$  ml/m<sup>2</sup>). Also, ESV was larger in strength ( $29\pm 7$  ml/m<sup>2</sup>;  $p<0.001$ ), combined ( $29\pm 6$  ml/m<sup>2</sup>;  $p<0.001$ ) and endurance ( $35\pm 7$  ml/m<sup>2</sup>;  $p<0.001$ ), but not in skill ( $26\pm 6$  ml/m<sup>2</sup>) disciplines compared to controls ( $23\pm 5$  ml/m<sup>2</sup>). LVM was significantly greater in strength ( $78\pm 13$  g/m<sup>2</sup>;  $p<0.001$ ), combined ( $79\pm 11$  g/m<sup>2</sup>;  $p<0.001$ ) and endurance ( $91\pm 14$  g/m<sup>2</sup>;  $p<0.001$ ) but not in skill disciplines ( $69\pm 10$  g/m<sup>2</sup>) compared to controls ( $61\pm 10$  g/m<sup>2</sup>). No significant differences were identified for EF between skill ( $63\pm 5\%$ ;  $p<0.001$ ), strength ( $63\pm 9\%$ ;  $p<0.001$ ), combined ( $62\pm 5\%$ ;  $p<0.001$ ), endurance disciplines ( $62\pm 5\%$ ;  $p<0.001$ ) and controls ( $63\pm 5\%$ ).

**DISCUSSION & CONCLUSION** LV remodelling as assessed by 3D is related to type of sport participated, with endurance athletes showing the most marked increase in EDV, ESV and LV Mass; instead, no significant LV morphologic changes were observed in skill athletes. Regardless the extent of LV remodelling, the systolic function remained within normal limits in all athletes.

**KEY WORDS** athletes, three-dimensional echocardiography, left ventricular remodelling

## Left ventricular mechanical systole in elite athletes assessed by 3D echocardiography.

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**OBJECTIVE** We sought to evaluate left ventricular (LV) systolic time interval (STI) comparatively in elite athletes and sedentary controls by 3-dimensional echocardiography (3DE).

**METHODS** 426 athletes, involved in skill (n=41), strength (n=100), combined (n=127), and endurance (n=158) disciplines and 62 sedentary controls, matched for age, underwent 3DE examination. By off-line analysis, LV volume-time curve was generated; time from the beginning of the QRS complex to the minimum systolic volume was considered to be the systolic time interval, this interval was also expressed relatively to the length of the hearth cycle (STI %). The systolic flow rate (SFR) was calculated as the ratio between stroke volume and STI.

**RESULTS** Heart rate was lower in athletes engaged in skill ( $61\pm 12$  bpm;  $p<0.001$ ), strength ( $58\pm 10$  bpm;  $p<0.001$ ), combined ( $57\pm 10$  bpm;  $p<0.001$ ) and endurance ( $53\pm 10$  bpm;  $p<0.001$ ) sports compared to controls ( $75\pm 12$  bpm). LV end-diastolic volume was larger in strength ( $150\pm 35$  ml;  $p<0.001$ ), combined ( $158\pm 29$  ml;  $p<0.001$ ) and endurance ( $178\pm 32$  ml;  $p<0.001$ ) but not in skill ( $127\pm 30$  ml;  $p<0.001$ ) athletes vs. controls ( $111\pm 27$  ml). The STI % was shorter in athletes compared to controls ( $40\pm 5$  vs  $30\pm 4$   $p<0.001$ ); among athletes the STI % was shorter in skill ( $31\pm 4$  %;  $p<0.001$ ), strength ( $31\pm 5$  %;  $p<0.001$ ), combined ( $31\pm 4$  %;  $p<0.001$ ) and endurance ( $29\pm 4$ %;  $p<0.001$ ) athletes compared to controls ( $40\pm 5$ %. In addition, the SFR was higher in athletes compared to controls ( $212\pm 58$  ml/s vs  $310\pm 75$  ml/s,  $p<0.001$ ); among athletes higher values for SFR were identified in skill ( $256\pm 60$  ml/s;  $p<0.001$ ), strength ( $297\pm 78$  ml/s;  $p<0.001$ ), combined ( $308\pm 67$  ml/s;  $p<0.001$ ), and endurance ( $334\pm 74$  ml/s;  $p<0.001$ ) athletes as opposed to controls ( $212\pm 58$  ml/s).

**CONCLUSION** Elite athletes show a significant shortening of relative systolic time interval (STI%) in comparison to sedentary controls, in association with a significant increase in LV emptying velocity (SFR). These adaptations may contribute to enhance LV systolic function.



## Prevalence and clinical significance of negative T waves in sportsmen: a retrospective study

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**OBJECTIVE** Trained, healthy athletes frequently show 12-lead-ECG changes (sinus bradycardia, increased QRS-voltages, etc), generally regarded as physiological adaptation to athletic conditioning. Despite several studies, disagreement still exists on determinants and clinical significance of ventricular repolarization anomalies. **METHODS** Rest-ECG of the sportsmen evaluated at our Institution from 1979 to 2009 were analyzed, looking for the presence of negative T-waves >2 mm in depth in at least 3 leads (apart from III, aVR, V1). In selected cases the presence of conditions potentially responsible for these anomalies were retrospectively researched by means of clinical history and instrumental investigations (mainly echocardiography). Sportsmen with systemic diseases potentially affecting ECG (mainly hypertension), were excluded.

**RESULTS** Out of 12.387 sportsmen, only 142 (1.14%) (mean age 28.9±12.5, range 12-59 years) had negative T-waves at rest-ECG and 134 of them (94.4%) showed cardiac morpho-functional anomalies at echocardiogram or other tests, diagnostic or highly suspected for: hypertrophic cardiomyopathy (HCM, 67.9%), isolated papillary muscles hypertrophy (6.0%), myocarditis (8.9%), arrhythmogenic right ventricular cardiomyopathy (ARVC, 8.2%), valvular diseases (2.2%), ischemic cardiomyopathy (1.5%), abnormal coronary artery origin (0.7%), myocardial bridge (0.7%), dilated cardiomyopathy (0.7%), long-QT syndrome (0.7%). Forty-three of these 142 sportsmen (30.3%) had giant (>10 mm) negative T-waves, associated with certain or highly suspected HCM (83.7%, 58.3% with apical localization), isolated papillary muscles hypertrophy (4.6%), myocarditis (6.9%); only 1 case (2.3%, evaluated in early 80s) showed no significant heart abnormalities.

**DISCUSSION & CONCLUSION** Negative T-waves on rest-ECG of sportsmen are rare. When observed, a cardiac morpho-functional abnormality, sometimes at risk of sudden death, must be carefully ruled out.

**KEY WORDS** Athlete's ECG; ventricular repolarization; heart; sudden death

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## Heart rate profile to exercise: Effects of age and exercise training

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**OBJECTIVE** Heart rate (HR) dynamic during exercise test has shown to be a non-invasive tool to assess cardiac autonomic control of the nervous system, reflecting the interaction of sympathetic and parasympathetic activity. However, there is little information about the effects of exercise training on HR dynamic of healthy women of different age groups. Our purpose was to analyze the effect of two times-a-week exercise training program on HR dynamic, as well as to compare this effect among women of different age groups.

**METHODS** 117 healthy sedentary women, divided in four groups according to their age (G1 – n=30, 30.3±6.2 years; G2 – n=37; 44.1±2.5 years; G3 – n=27; 53.7±3.5 years; G4 – n=20; 66.4±6.9 years), were submitted to a two times-a-week exercise training program with aerobic (20 minutes at 60-75% of reserve heart rate), whole-body resistance (2-3 sets of 8-12 repetitions at 60-80% of 1- RM), and stretching exercise, performed for 12 month. Maximal graded exercise test (GXT) was performed at baseline and after twelve months of follow-up.

**RESULTS** Exercise training improved cardiorespiratory fitness in 10.3±5.1% with no significant difference among the four age groups. Resting and recovery HR were reduced in G1 and G2 (p<0.05), but not in G3 and G4, after the twelve month of exercise training. Peak HR did not change significantly in any group after the follow-up.

**DISCUSSION & CONCLUSION** The results suggest that two times-a-week multi-component exercise training is enough to improve HR profile to exercise in young (age < 50 years), suggesting a better interaction of sympathetic and parasympathetic system. However, this improvement was not observed in older women.

**KEY WORDS** exercise; cardiorespiratory fitness; heart rate; autonomic nervous system; aging.

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## Changes of cerebral haemodynamics at boxers according to duplex scanning

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**OBJECTIVE** To determine the condition of cerebral haemodynamics at boxers according to duplex scanning.

**METHODS** Studied condition of cerebral haemodynamics by duplex scanning extracranial brachiocephalic vessels and transcranial duplex scanning of 32 amateur boxers aged 18 to 26 years. Surveyed the boxers were in the preparatory period. Control group consisted of 30 men aged 18 to 25 years who did not have a history of deferred traumatic brain injury. The survey was conducted in the unit LOGIO 400 PRO series General Electric Company on the standard methodology used in the sensors 11, 8 and 2 MHz in a pulse mode and a color mapping. For the study of intracranial arteries using three standard access: transtemporal, transoccipital, transorbital.

**RESULTS** The increased the velocity of blood flow in the artery cerebri media met in 11 cases. Angiospasm phenomena occurred in 4 cases, the trend toward hypertonus was observed in 6 cases. Violations of venous outflow showed overload transverse sinuses - 6 observations, cavernous sinuses - 2, basal veins - 1. In 13 cases out of 32 haemodynamic pattern in the studied group of patients characterized by signs angiodystonia. In the control group from 2 people signs of angiodystonia occurred.

**DISCUSSION & CONCLUSION** Haemodynamic disorders among boxers have been characterized signs of angiodystonia (40,6%), increased the velocity of blood flow to arteria cerebri media (34,4%), acceleration of venous outflow (28,1%), which is required in some cases the appointment of drugs improving cerebral circulation.

**KEY WORDS** cerebral haemodynamics, traumatic brain injury, boxing, duplex scanning.

## Functional adaptation of articular cartilage to different physical exercises

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**OBJECTIVE** The objective of the present study was to investigate deformational behavior and functional adaptation of articular cartilage by the changes of serum level of Cartilage Oligomeric Matrix Protein (COMP) during a 30-min exercise after 12-weeks of regular high impact, impact or non-impact exercise.

**METHODS** Blood samples were drawn from 44 healthy sedentary males immediately before and after and 0.5 h after a 30-min walking exercise on a motor-driven treadmill at 5 km/h speed. Serum COMP concentrations were determined using a commercial enzyme-linked immunosorbent assay (AnaMar Medical, Goteborg, Sweden). After first measurements participants were randomly and equally assigned to high impact (running, n=11), impact (cycling, n=11), non-impact (swimming, n=11) and control groups (n=11). All exercise groups participated in sessions of 40 minutes per day, 3 days per week for 12 weeks. Exercise sessions were determined according to the ACSMs' guidelines. Participants in running and cycling groups partake sessions in the human performance laboratory one by one, while swimming group perform exercise sessions in indoor swimming pool. Throughout the 12-week period, the control group was told not to participate in any organized or structured exercise and continue their daily life activities. At the end of the 12-weeks intervention period, post tests were applied. The data were analyzed with separate 4x2 (groups and time) mixed repeated-measures ANOVA design for each phase of blood sampling. Bonferroni-adjusted paired-samples t-tests were employed for post-hoc analyses. The level of statistical significance was accepted as p<0.05.

**RESULTS** Mean values of serum COMP levels at pre-test measurements for recovery, fatigue and regeneration phases were 10.06±2.05, 11.45±2.58 and 10.24±1.83 U/I respectively. Serum COMP levels at post test measurements were 9.60±1.95, 11.21±2.36, 10.16±1.93 U/I for each phases. Multivariate tests indicate a significant fatigue or resting effect on serum COMP concentration in all experimental and control groups at pre and post tests. Therefore, pair wise comparisons were conducted in order to assess which means differ from each other. Results indicated significant differences in post test measurements among phases of cycling, swimming and control groups except running group.

**DISCUSSION & CONCLUSION** 30 minutes moderate walking activity has little influence on the increase serum COMP concentrations of young sedentary men. However, 12 weeks regular weight-bearing high impact physical exercise (running) decrease the deformational effect of walking activity by functional adaptation of articular cartilage to specific environmental requirements.

**KEY WORDS** COMP, fitness, knee joint, deformation

## Effects of anaerobic training on blood nitric oxide and haematological parameters

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**OBJECTIVE** Nitric oxide (NO) is a vasodilator and an antioxidant gas. Although the synthesis of NO has been attributed exclusively to the vascular endothelium, it has been demonstrated that red blood cells (RBCs) express the endothelial nitric oxide synthase enzyme isoform (eNOS). In addition, RBCs have been assumed to metabolize large quantities of NO due to hemoglobin (Hb). The aim of our study is to investigate the effects of anaerobic (judo) training on serum NO levels and hematological parameters.

**METHODS** 18 Turkish national female judoists (aged 17.9 ± 0.8 yr) participated in our study. In the 19 week period prior to the competitive season, once at the start and once at the end, main haematological parameters (haemogram, serum ferritin, iron, etc), NO and some biochemical parameters were analyzed in fasting blood.

**RESULTS** After training, no significant changes occurred in serum NO levels (which decreased % 10.6), significant decreases were determined in blood RBC, Hematocrit (Hct), trombosit, serum iron, creatinine and globuline levels (P<0.05), significant increases were established in blood Hb, ferritin, transaminases (aspartate amino transaminase and alanine amino transaminase activities). However, after the training, significant negative relationships were established between NO and urea levels and transaminases used as predictors of overtraining. Insignificant negative relationships were found between NO and difference values between two measurements of RBC, Hct and Hb before and after the training.

**DISCUSSION & CONCLUSION** The reason of negative effects established on blood NO levels and main haematological parameters may be in part the anaerobic nature of intensive judo training.

**KEY WORDS** Nitric oxide, Hematological parameters, Judo training.

## The effect of aquatic aerobic training on the quality of life on Multiple Sclerosis(MS) patients

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**OBJECTIVE** MS is a central nervous system disease with various physical and mental symptoms, such as physical disability, movement depauperation, walking disorders, and decrease in quality of life(QOL). Studies on MS patients began in 1868 by Sharcot. In a research which was done on 112 M.S patients by Koudouni and Orologaes (2004) the finding showed a relative improvement in (QOL) of M.S patients after 8 week of aerobic training. Purpose study the effect of an aquatic exercise for 8 weeks, on the improvement QOL of female MS patients.

**METHODS** From 100 MS patients, 25 people on the basis of illness degree and age range were selected randomly. with EDSS 1-4 with average illness time of (4 1) and age rang of (20-50) years. They were divided in two groups. Experimental group 15 people and controlled group 10 people. The experimental group participated in the exercise for 8 weeks, each week three sessions with intensity of 40-50 percent of the maximum heart-beat rate. The QOL was measured by FAMS. Version 2 questionnaire in experimental and controlled groups before and after exercise. The gathering data were analyzed by using descriptive statistic and dependent sample t- test.

**RESULTS** The research has shown that after 8 weeks, in the experimental group the QOL was meaning fully improved(P<0/01).

**DISCUSSION & CONCLUSION** Considering the results of this research, which has caused in an improvement in the QOL MS patients with low EDSS, so it seems necessary to apply an aquatic exercise for such patients. Therefore, it is recommended these exercises to be used by specialists as a supplementary remedy beside medical treatments for MS patients

**KEYWORDS** Multiple sclerosis- - aquatic exercise - quality of life

## Baseline simple and complex reaction times in female compared to male boxers

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**OBJECTIVE** Cognitive performance can be easily evaluated, nowadays, by means of computerized neuropsychological (NP) tests, but no research used this tool to investigate female boxers. Aim of the study is to compare baseline cognitive performance in female to male amateur boxers.

**METHODS** Study population was composed of a group of 28 female amateur boxers, with no history of head concussions (except boxing). A group of 56 male boxers, matched for age, employment and competitive level to female athletes formed the control group. Each boxer was requested to: a) fulfill a questionnaire collecting demographic data, level of education, occupational status, boxing record and number of head concussions during boxing; b) undergo a baseline computerized NP test (CogSport) measuring simple and complex reaction times (RT).

**RESULTS** Female were significantly ( $p < 0.0001$ ) lighter than male boxers ( $56.0 \pm 7.0$  vs  $73.1 \pm 9.8$  kg). No significant differences at NP testing scores were observed between groups. Male boxers showed a significantly longer simple-RT at the end than the beginning of the NP test ( $0.247 \pm 0.007$  vs  $0.243 \pm 0.007$  s,  $p = 0.02$ ), however with a significant lower rate of mistakes ( $0.7 \pm 1.6$  vs  $2.0 \pm 3.1\%$ ,  $p = 0.005$ ), observed also in the female group ( $0.5 \pm 1.1$  vs  $2.2 \pm 3.0\%$ ,  $p = 0.005$ ). No boxing activity parameter (fighting record, number of knock-outs, etc.) correlated with NP scores.

**DISCUSSION & CONCLUSION** Women's Olympic style boxers show no or minimal differences in baseline cognitive performance in respect to male amateur boxers. This study confirms that women's boxing seems to be as safe as male boxing in respect to cognitive performance.

**KEY WORDS** concussion; mild traumatic brain injury; contact sports; trauma; head

## Gait analysis and functional deficiencies in elite soccer players with chronic ankle instability

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**OBJECTIVE** Among all sports-related injuries, ankle injuries have a high risk for both recurrence and sequela. Instability being the most frequent and serious sequela is developed in approximately 30-40% of the patients, can be resistant to conservative managements and became permanent. It was conceived that; if the differences associated with chronic ankle instabilities can be demonstrated, pathophysiological basics of the condition will be comprehensible.

**METHODS** 157 soccer players, aged between 13-18 years, were recruited for the study. Among these players, chronic ankle instability was diagnosed in 22 players (14%), fifteen of these being eligible for the study. Eighteen healthy soccer players randomized for control group. The groups were evaluated by 3D computerized walking analysis for temporo-spatial, kinematic and kinetic assessments in both sagittal and transverse plane. For functional deficiencies; "Functional Ankle Disability Index" were performed (FADI and FADI-S). Statistical analysis was performed for assesment of the data.

**RESULTS** All cases were classified into two groups; group1 for instability cases and group2 for control group. The groups were similar in respect to average age, height and weight. There were a statistical significant difference between the groups in FADI and FADI-S results for both extremities ( $< 0.05$ ). Although temporo-spatial parameters and physical findings were similar in two groups, gait analysis demonstrated arthrokinetic changes in cases with chronic ankle instabilities.

**DISCUSSION & CONCLUSION** The studies on chronic ankle instability are generally either not discriminated the two major factors (functional and mechanical ankle instability) which are appreciated as two different entities for instability, or evaluated separately as a single factor. In the following report, functional disability diagnosed with FADI and FADI-S was considerably more severe in unstable cases. More over, unstable cases had hazardous changes for recurrence in movement pattern during walking analysis.

**KEY WORDS** soccer, chronic ankle instability, gait analysis, FADI



## The effect of aerobic and anaerobic functional fatigue protocols on ground reaction force components during jump landing movement

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**OBJECTIVE** In most tasks, most of the loss of force occurs because of the changes within the muscle or central nervous system and or both of them. There appears to be a relationship between altered neuromuscular control and muscle fatigue. The purpose of this study was to examine the effect of aerobic and anaerobic functional fatigue protocols (AAFFP) on dynamic postural stability in nonelite young soccer players.

**METHODS** Twelve male young soccer players who were playing in league one (Tehran) (age:  $17.42 \pm 0.51$  y, weight:  $67.65 \pm 6.58$  kg, height:  $173.33 \pm 3.09$  cm) that all of them was health participated in this study. Before beginning the fatigue protocol, dynamic posture stability index (DPSI) evaluated following single leg jump-landing movement (athletic task that resulting injury) with sampling frequency of 200-HZ in 3 second recording. Stability indices analyzed in mediolateral (MLSI), anterior-posterior (APSI) and vertical (VSI) direction. Immediately following fatigue, post testing was performed. The data was analyzed with analyses of variance (ANOVA) with repeated measures ( $p < 0.05$ ).

**RESULTS** ANOVA revealed significant differences when comparing anaerobic fatigue pre test and post test values for MLSI, APSI, VSI, DPSI and RPE. Likewise aerobic fatigue revealed significant differences pre test and post test values for VSI and DPSI whereas no significant differences were revealed when comparing the aerobic fatigue protocols for pre test and post test of MLSI and APSI.

**DISCUSSION & CONCLUSION** In attention to this fatigue protocols probably eccentric contraction of hamstring muscles during the late swing phase to control forward motion of the thigh and leg segments, is case of altering in hamstring quadriceps muscle strength rate and decrease lower extremity stability. Also it seems that, subjects because of deceleration the body, s downward velocity for decrease the impact force, altered mechanical mechanism of landing skill. The results of this investigation suggest that aerobic and anaerobic functional fatigue protocols, specially aerobic fatigue have effect in dynamic postural stability. This matter can be used one of the main factors in determining of injury mechanism (in jumplanding movement).

**Key words** fatigue, dynamic postural stability, soccer players, jumplanding movement

## Electromiography in front crawl technique-case of study

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**OBJECTIVE** The need to develop systems electromiographic (EMG) in quatic environment, has led several researchers to refine these instruments to ensure the credibility of the data provided by EMG. The aim of this study is to characterize the behavior of two muscle muscles involved in the crawl technique (biceps brachii and triceps brachii) over a test of 200m crawl.

**METHODS** A male swimmer trained was subjected to a test consisting of a maximum voluntary contraction (CVM) of the Biceps Brachii (BB) and Triceps Brachii (TB) for standardization. A protocol of 4 x 50m with an interval of 15 seconds at a swimming speed of pre-established, making each part to 95% of transit time for 200m crawl. The EMG were used with a Wireless signal of the BB and TB muscles of the right arm was removed throughout the test and then synchronized with the video image, and selected 5 cycles of swimming on all identical pathways.

**RESULTS** There is a gradual decrease of its average muscle activity. The BB was about 43% and TB was 26%. The largest variation on it, in the case of BB, between the third and fourth route (21%), and in the case of TB, between the second and third route (14%).

**DISCUSSION & CONCLUSION** The muscles studied demonstrated changes in the duration of swim cycles, indicating that, there is a decrease in muscle activity, this supposed to be due to limitations in production capacity under swimmer and the characteristics of the art of swimming which are changing as increasing fatigue.

**KEY WORDS** electromiography, kinematics analysis, crawl, swimming

## Methodology for investigating the use of the arms in fall recovery

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**OBJECTIVE** Despite extensive preventive efforts, falls continue to be a major source of morbidity and mortality. Most studies of falling mechanics have focused on response time, lower limb muscle strength, and leg muscle activation. Less attention has been given to rotational arm movements that express angular momentum that would otherwise be associated with destabilization of the trunk. The purpose of this ongoing study was to determine how arm rotation is modulated during a fall recovery in response to varied balance perturbations.

**METHODS** Twelve volunteer participants were initially held in a static forward-inclined position using a horizontal tether attached to a waist belt. The subjects were then unexpectedly released from initial lean angles of 5.5° and 6.5°. They were instructed avoid taking a step during the fall recovery. Six Eagle motion analysis cameras were used to track 54 markers placed on the subjects' bodies and a Kistler force platform was used to record ground reaction force. Full-body kinematics and kinetics were computed from marker and force data using Visual3D software. Custom written MATLAB code was used to compute the three dimensional angular momentum of the arms. At this writing, however, we have completed analysis of only one subject's fall recoveries.

**RESULTS** The results for a single subject showed similar angular momentum patterns for all trials. First, the arms were rapidly raised away from the body in the frontal plane. This movement was followed by a rapid rotation of both arms in the clockwise direction (viewed from the right). The angular momentum of the arms during this phase appeared to be graded in response to the magnitude of the perturbation. Peak angular momentum in sagittal plane was found to be approximately 50% greater for an initial body lean of 6.5° than for 5.5°.

**DISCUSSION & CONCLUSION** We have developed a methodology for applying a balance perturbation and measuring the use of the arms during fall recovery. Analysis of one subject's recoveries showed that the subject seemed to generate more angular momentum with the arms when a greater perturbation was applied. Processing all trials would permit statistical tests to confirm if this apparent modulation of the response of the arms is consistent across the subject population. Such findings would suggest that arm rotations are calibrated rather than being a maximal response. This same methodology may be used to study the maintenance of balance during sporting activities such as the volleyball spike.

**KEY WORDS** fall, recovery, arm rotation, tether release, angular momentum

## Characterization of temporal patterns of behavior of the crawl technique

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**OBJECTIVE** With this work we want to check the standards of the crawl technique from an observational methodology appropriated. The instrument of observation (Nilton, 2008) was developed Ad Hoc, using the references of biomechanical models, based on a mixed system of categories and formats of fields, with particular reference to four criteria that add in the form of alpha-numeric codes. The results of the quality of the instrument revealed indices of reliability and high precision.

**METHODS** We use a sample of six swimmers from Portuguese and international level as part of the Portuguese national team in swimming. Each element was subject to the overall swimming crawl technique at a distance of 25m to achieve maximum speed without a breath. The units of observation are natural (events and behaviors) and analytical (of behavior). The detection of temporal patterns by binomial analysis (Magnusson, 2000) was made by the software 5.0 Theme created by Magnusson (1996, 2000). The instrument is intended to identify patterns which are within the critical intervals, allowing examination of the inter-relationship of temporal events (movement), using the record of occurrences in the collection of patterns found in data.

**RESULTS** The patterns found in each swimmer is different and each pattern is adjusted to the particular individual techniques.

**DISCUSSION & CONCLUSION** The same swimmer can present similar structures for implementation, representing a behavior pattern. In all the swimmers were identified more than one standard. However, it is noteworthy that no swimmer of the sample made the same overall behavior at any stage observed in the five cycles analyzed.

**KEY WORDS** Temporal Patterns, Behaviour, Crawl Technique

## Characterization of anthropometric features and nutritional habits of elite Italian athletes, selected for participation in the 2008 Beijing Olympic Games

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**OBJECTIVE** aim of our study was to characterize a population of elite athletes, participating at the highest level of competition including the Olympic Games, with regard to their nutritional habits and body composition.

**METHODS** 555 elite Italian athletes (340 male and 215 female), selected for participation in the 2008 Olympic Games were included in this analysis. Athletes aged 14 to 45 years, and were engaged in 25 different sport disciplines. Anthropometric characteristics, nutritional habits and dietary intakes were assessed; specifically, height, weight, body mass index (BMI), fat mass and fat-free mass (by skin folds) were measured. Moreover, a nutritional survey was performed by expert dieticians to evaluate daily energy intake (DEI), total proteins and proteins per kilogram of body-weight, lipids, carbohydrates, C-vitamin and iron.

**RESULTS** mean values  $\pm$  standard deviations for male and female athletes were respectively: age  $27\pm 6$  and  $25\pm 6$  years, weight  $80\pm 12.8$  and  $62\pm 12.9$  kg, height  $181\pm 10.5$  and  $168\pm 8.7$  cm, BMI  $24.3\pm 2.9$  and  $21.8\pm 2.8$  kg/m<sup>2</sup>, fat mass  $13\pm 4.8\%$  and  $20.5\pm 5.6\%$ . The nutritional survey showed, in male and female athletes, respectively, DEI  $3066\pm 630$  and  $2373\pm 449$  kcal/day; proteins  $18.6\pm 3.4\%$  and  $18.6\pm 3.2\%$ ; proteins for kg of body weight  $1.8\pm 0.4$  and  $1.8\pm 0.3$  g/kg; carbohydrates  $49\pm 6.4\%$  and  $49.3\pm 6.7\%$ ; lipids  $32.3\pm 5\%$   $32.4\pm 5.7\%$ ; C-vitamins  $133\pm 78.9$  and  $136\pm 75.0$ ; iron  $16.3\pm 4.3$  and  $13.4\pm 3.6$  mg.

**DISCUSSION & CONCLUSION** Italian elite athletes appear to be in the upper range for height respect to the mean of Italian population; their fat mass is very low and, consequently, their fat-free mass is increased, as an expression of enhanced muscular structure. Indeed, nutritional habits are considered appropriate to their caloric expenditure, following the pattern of the "Mediterranean Diet" as recommended by the World Health Organization.

**KEY WORDS** athletes, anthropometric characteristics, nutritional habits

## The comparison of some bone and calcium metabolism indices in active and non active menopause women

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**OBJECTIVE** The purpose of this study was to compare some bone and Calcium metabolism in active and non active Menopause women (MW). Calcium and Phosphorus of Urinary and serum, special bone Alkaline Phosphatase as a bone construction index and Resisting Acid Phosphatase to Tartarate as a bone absorption Index and Parathyroid hormone (PaH) and Calcitonine hormone (CH) for comparison of Calcium and bone metabolism were all considered in two groups.

**METHODS** Twenty eight MW (14 active and 14 nonactive) with the some traits from those who were clients to a sport club in Sabzevar were used to from the two treatment groups. Measures: Height, weight, PWC,  $\dot{V}O_2$ Max, WHR, BMI, BP and RHR of the subjects were determined. Subjects had similar nutritional program and didn't use any drugs. Prior to breakfast morning urine test up to 80 cc and blood sample from brachialis vein up to 10 ml were gathered from the subjects. Comparison of two groups and pearson's correlation test was used to determine the relationship between the indices.

**RESULTS** 1- Serum calcium rate, serum PaH and bone AP in active MW were significantly lower than non active women, and CH rate in active MW was significantly higher than non active one ( $p < 0.05$ ). 2- Between urine calcium, serum and urine Phosphorus, between Resisting Acid Phosphatase to serum Tartarate and between Calcium ration to urine creatinin in active MW with non active women no significant difference was observed.

**DISCUSSION & CONCLUSION** It seems that prolonged regular physical activity can affect calcium and bone metabolism indices in MW and prevent degeneration of bone tissue by decreased bone regeneration and also obviate bone tissue from calcium and mineral empaiging through decreased PaH and increased CH.

**KEY WORDS** Calcium and bone metabolism. serum and Urinary Phosphorus. Alkaline Phosphatase. Acid Phosphatase. Parathyroid and Calcitonine hormones. active and non active Menopause women.

## Isokinetic strength balances of the ankle and regional bone mineral density of tibia in medial tibial stress syndrome patients

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**OBJECTIVE** Medial tibial stress syndrome (MTSS) is one of the most common causes of exercise related leg pain. Our knowledge about the pathophysiologic mechanism and the specific pathologic lesion of MTSS is limited. The primary purpose of this study was to evaluate possible disbalances of muscle forces acting on the ankle, which might play a role in pathophysiology of MTSS. Also this study aimed to evaluate possible changes in tibial regional bone mineral density (BMD) at acute phase, which was shown to decrease after 5 months of duration of MTSS.

**METHODS** Fifteen MTSS patients (mean duration of MTSS was 8 (3-24) weeks ) were compared with 13 control subjects. Mean age and body mass index of patients were  $21 \pm 2.8$  years and  $22.2 \pm 2.8$  kg/m<sup>2</sup>. Mean age and body mass index of controls were  $23.2 \pm 3.1$  years and  $21.7 \pm 2.9$  kg/m<sup>2</sup>. All subjects filled in a questionnaire about nutrition and exercise habits. Ankle plantarflexion, dorsiflexion, eversion and inversion concentric forces were evaluated using an isokinetic dynamometer. Standard tibia and femur BMD measurements were taken. The BMD of three regions from both tibias' was measured, too.

**RESULTS** Mean and peak eversion torques of MTSS group at 30°/sec velocity were significantly higher than controls (mean:  $21.9 \pm 6.4$ ;  $18.3 \pm 6.1$  Nm ( $p < 0.05$ ), peak:  $23.4 \pm 6.4$ ;  $19.3 \pm 5.0$  Nm ( $p < 0.05$ )). Mean inversion torque/mean eversion torque ratio of MTSS group at 30°/sec velocity was significantly lower than controls ( $0.97 \pm 0.22$ ;  $1.23 \pm 0.46$ ,  $p < 0.05$ ). Mean eversion torque of MTSS group at 120°/sec velocity were significantly higher than controls ( $14.0 \pm 3.6$ ;  $11.7 \pm 3.8$  Nm,  $p < 0.05$ ). Tibial regional bone mineral density showed no significant difference between groups. Tibia T-score was significantly higher in control group ( $p < 0.05$ ).

**DISCUSSION & CONCLUSION** Decreased Inversion/eversion ratio because of increased eversion torque might be a predisposing factor of MTSS. BMD of the tibia at the pain side doesn't seem to be affected.

**KEY WORDS** medial tibial stress syndrome, isokinetic strength, bone mineral density, eversion, inversion

## The evaluation of interventions based on transtheoretical model in adoption and maintenance of physical activity

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**OBJECTIVE** This study evaluates the effect of informing and counseling interventions carried out by researchers to improve the exercise behavior in adults, based on transtheoretical model.

**METHODS** The study design is a quasi-experimental interventional study, which was conducted in a single group with pre-test and post-test follow-up design. The data on individual socio-demographics, the stages of change in the context of Transtheoretical Model, process of change, self-efficacy, decisional balance, was collected by questionnaires before interventions (pre-test). Thereafter, the individual counseling was given to the participants. The follow-up evaluation continued at the first, third, and sixth months.

**RESULTS** The mean age of the participants was  $38.17 \pm 8.22$ . The difference between the stages of change determined at four different time points was highly statistically significant ( $p < 0.0001$ ). There is a significant difference in mean of the general scores of stages of change scale between pre-intervention and last intervention time ( $p < 0.0001$ ). There was a statistically significant in the self-efficacy difference between pre-intervention and last intervention time ( $p < 0.0001$ ). The mean scores of decisional balance was increased in the pros dimension and decreased in cons dimension after information and counseling interventions ( $p < 0.0001$ ). The analyses of the relation between the mean scores of the stages of change, process of change, decisional balance and self-efficacy was correlated statistically significantly ( $p < 0.0001$ ).

**DISCUSSION & CONCLUSION** As a result the group in general progressed in the stages of change. As a result, in the 64% of the participants progressed in the stages of change whereas there was no change in the 25% and 11% regressed in the stages of change. In conclusion, the evaluation of Transtheoretical Model based interventions for physical exercise behavioral improvement demonstrated that the nursing interventions is effective and beneficial to adapt positive behaviors in regular exercise behavior.

**KEY WORDS** Transtheoretical Model, Stage of Change, Process of Change, Self-Efficacy, Decisional Balance, Individualized Counseling, Intervention, Exercise.



## **General target consideration sport influence on the selector of bloody factors among male fast students.**

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**OBJECTIVE** In random; 2007 a research design with general target consideration sport influence on the selector of bloody factors (Triglyceride; Cholesterol; LDL & HDL Lipoproteins) was performed among male fast students in Islamic Azad University; Tabriz; with special targets.

**METHODS** To survey sport effect on the amount of blood Triglyceride; Blood Cholesterol; HDL Lipoproteins and LDL Lipoproteins among male fast students in Islamic Azad University; Tabriz. One hundred ten male fast students of Azad University selected by random which have been stood in two groups of fifty five people by chance. From all selectmen were cupped amount of 5 cc blood in every process before and after Ramadan. During lent month (Ramadan) for experimental groups were given sport activities such as Cooper Testing three times a week. The variations of bloody factors in the first or second test were compared in statistic method (T test) and these are following results.

**RESULTS** The meaningful variations in balance of Triglyceride and LDL & HDL Lipoproteins between experimental groups weren't observed. The meaningful relation between sport exercises and reduction of measure of Blood Cholesterol in experimental groups were observed.

**DISCUSSION & CONCLUSION** fast people can continue their sport activities without any worried. This work not only makes negative variations from blood fast but also it will reduce the measure of their blood Cholesterol; to; and keeps it in normal limit. And consequently this work prevents from illnesses such as: Intensification Blood fats; Atherosclerosis; and some infraction.

**KEY WORDS** Triglyceride, cholesterol, lipoproteins ldl & hdl, sport, fast.

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## **Acute vitamin C supplementation, exercise-induced lipid peroxidation and inflammation**

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**OBJECTIVE** The purpose of this study was to evaluate the effect of acute supplementation with vitamin C on exercise induced lipid peroxidation, muscle damage and inflammation.

**METHODS** Sixteen healthy untrained male participated in a 30 min exercise at 75% VO<sub>2</sub>max. Subjects were randomly assigned to one of the two groups: placebo (P) and vitamin C (VC: 500 mg vitamin C). Blood samples were obtained prior to supplementation (baseline), 2hrs after the supplementation (immediately pre-exercise), immediately, 2hrs and 24hrs post-exercise. Plasma levels of vitamin C, total antioxidant capacity (TAC), creatine kinase (CK), malondialdehyde (MDA), total leukocytes, neutrophils, lymphocytes, interleukin-6 (IL-6), CRP and cortisol were measured.

**RESULTS** With supplementation, plasma vitamin C concentration increased significantly only in the VC (P<0.05). TAC decreased significantly in P group, 2hrs and 24hrs after exercise (P<0.05). Although MDA levels were similar between groups at the baseline, it increased significantly after exercise only in the P group (P<0.05). CK increased immediately and 2hrs after exercise in both groups and 24hrs after exercise only in placebo group compared with pre-exercise (P<0.05). Markers of inflammation (total leukocytes, neutrophils and IL-6) and muscle damage (CK) were increased significantly in response to the exercise in both groups (P<0.05).

**DISCUSSION & CONCLUSION** VC supplementation prevented exercise-induced lipid peroxidation and muscle damage but had no effect on inflammatory markers.

**KEY WORDS** supplementation, exercise, vitamin C, inflammation

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## **S100B profiles and cognitive function at high altitude**

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**OBJECTIVE** Exposure to high-altitude can lead to Acute Mountain Sickness (AMS) and High-Altitude Cerebral Edema (HACE). In this study we investigated the effect of high-altitude on neurocognitive function and S100B-release. Increased S100B-release has been hypothesized to be a sign of loss of integrity in the Blood-Brain-Barrier (BBB).

**METHODS** Seven healthy volunteers trekked to Capanna Regina Margherita (4554 meters above sea level) in the Monte Rosa Massif. During ascent and descent, five test events were undertaken, where participants performed neurocognitive testing, Lake Louise-scoring (LLS) and blood was drawn for measurements of S100B

**RESULTS** The S100B levels increased 42-122% from baseline, and mean LLS increased from 0.57 to 2.57. A significant correlation was observed between both S100B levels and LLS, and between S100B and some neurocognitive scores.

**DISCUSSION & CONCLUSION** The study indicates that S100B can be released by a mild hypoxia in the setting of AMS. Moreover, an observed correlation between S100B and a lower score on neurocognitive tests suggests that the pathogenetic mechanisms may be associated. The study demonstrates that cognitive function can be adversely affected by symptoms of AMS.

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## **Rating of perceived exertion in cycle ergometer: Effect of maximal capacity differences**

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**OBJECTIVE** Perceived exertion is described as “the subjective intensity of effort, strain, discomfort, and/or fatigue” that is experienced during the physical exercise. Rating of perceived exertion (RPE) is a widely accepted tool in the estimation of exercise intensity and in prescription of exercise. It has been previously shown that RPE have positive associations with physiological variables, such as heart rate and oxygen utilization. The aim of our study was to evaluate the physiological responses to exercise intensities determined by heart rate reserve (HRR) method and to detect whether perceived exercise intensity can be affected by individuals fitness level.

**METHODS** Twenty sedentary participants of both sexes aged 20 to 41 (mean 26.9) participated. Rating of perceived exertion (RPE) scores were collected at different percentages of subjects’ HRRs during graded exercise test on a cycle ergometer. Following the test, subjects were divided into two groups according to their maximal O<sub>2</sub> uptakes (VO<sub>2</sub>max) as high (MET≥10; n=9), and low MET groups (MET<10; n=11). After 48 hours, participants performed the steady state exercise test at a perceived exertion level of 13-14. For regression analysis the mean values for intercepts, slopes, and Pearson r correlations were determined.

**RESULTS** In all HRR levels low MET group had significantly lower MET values (p<0.01-0.001). Perceived exertion was significantly higher in low MET group compared to high MET group during graded exercise test. In steady state cycling test, low MET group exercised at higher relative VO<sub>2</sub> values compared to high MET group (p<0.05-0.001). The groups cycled at similar HRR percentages to a given RPE score.

**DISCUSSION & CONCLUSION** Our results demonstrate that exercise intensity can be prescribed in individuals with different VO<sub>2</sub>max levels by HRR percentages or by RPE scale methods considering the fact that individual oxygen consumptions may differ. In conclusion, the guidance of perceptual indices for prescription of exercise intensity has positive associations with physiological variables, and can be used in the estimation of exercise intensity and in the prescription of exercise. Our results suggest that when exercise prescription is organized according to HRR method in sedentary individuals with different fitness levels, exercise intensity may be perceived similar despite different oxygen consumptions. High and low MET groups cycled at similar HRR percentages to a given RPE score. Moreover, exercise intensity of the groups having different maximal oxygen consumption levels could be prescribed either by HRR percentages or by RPE scale methods considering the fact that individual oxygen consumptions during exertion may differ.

**KEY WORDS** rating of perceived exertion (RPE), Borg scale, cycle ergometer, steady state exercise, VO<sub>2</sub>max differences, heart rate reserve (HRR).

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## The association between physical fitness and ventilatory efficiency in major depressive disorder: A potential adjunct for risk stratification?

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**OBJECTIVE** Cardiopulmonary exercise testing (CPET) provides eligible information regarding ventilatory abnormality in chronic heart failure (CHF) but in major depressive disorder (MDD) such data remain unavailable. Ventilatory efficiency measurements offer insights into ventilatory and metabolic dysfunction and is commonly used to stratify cardiac risk. Thus, the current study was conducted to estimate and classify ventilatory inefficiency and its relationship to physical fitness in MDD. Secondary, we evaluated ventilatory and metabolic demands at the ventilatory anaerobic threshold (AT).

**METHODS** A single exhaustive incremental exercise test was completed by 15 female pair matched major depressive patients. AT was assessed as submaximal ventilatory threshold according to Beaver and colleagues. VE/VCO<sub>2</sub> slope was fitted via linear regression to the relationship of ventilation and carbon dioxide production until peak exercise. Furthermore, peak exercise data were also assessed in order to quantify ventilatory demands and objective exhaustion levels.

**RESULTS** In depressive disorder AT appeared at high significant lower relative work rates ( $0,48 \pm 0,14$  vs.  $0,67 \pm 0,21$  W•kg<sup>-1</sup>,  $p < 0,01$ ) than in healthy controls. We found a conspicuous ventilatory abnormality with augmented VE/VCO<sub>2</sub> slopes in depressive disorder. Three out of 15 achieved critical ventilatory class (VC)-III (36,0-44,9) and 8 out of 15 achieved VC-II (30,0-35,9; figure 2). We interestingly revealed a strong correlation between physical fitness and ventilatory inefficiency ( $r = 0,84$ ).

**DISCUSSION & CONCLUSION** CPET measures are beneficial to estimate ventilatory efficiency and maximal and submaximal physical fitness in MDD. But further investigations are needed to verify if the ventilatory classification system is also appropriate to stratify risk levels in depressive disorder.

**KEY WORDS** exercise testing, ventilatory inefficiency, VE/VCO<sub>2</sub> slopes, ventilatory threshold, individual anaerobic threshold, exercise treatment, cardiac risk

## Determination of body composition and hydration status in cadet super league wrestlers (14- 17 years)

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**OBJECTIVE** In sports based on weight categories such as wrestling, many athletes are exposed to rapid weight loss applications to compete in the categories they want. However, acute weight loss is thought to affect performance and health negatively. This study aims to determine the cadet super league wrestlers' body composition and hydration levels and to investigate how this affects performance.

**METHODS** Measurements were accomplished on the first day of work, which is the seventeenth day before competition, third day before weigh in, before weigh in and immediately before the competition. During these study periods, body weight, skinfold and urine specific gravity (Usg) were measured and, scoring was done according to competition results.

**RESULTS** Body weight and hydration levels didn't change significantly until the third day of event weight ( $P > 0,05$ ). A significant level weight loss ( $\% 3,9 \pm 2,7$ ) and an increase in Usg level ( $1,024 - 1,028$  g/cm<sup>3</sup>) were determined in the last three days before weigh in. However, no significant change in Usg values ( $P > 0,05$ ) was observed after weigh in until the match, although a significant weight gain ( $P < 0,05$ ) was observed. Furthermore, no significant level correlation has been found ( $P > 0,01$ ) between the positive points obtained at the end of the competition and changes in body weight and hydration levels.

**DISCUSSION & CONCLUSION** Consequently, it can be said that there are a rapid weight loss and dehydration in cadet wrestlers just before the weigh in and there is a rapid weight gain after weigh in until the competition; however, it doesn't improve the hydration status, so the wrestlers compete dehydrated; however, this doesn't lead to a meaningful change on the wrestlers' match result.

**KEY WORDS** cadet wrestlers, hydration, urine specific gravity, body weight

## **Low back pain in elite track and field male and female athletes**

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**Objective** Low back pain is a common complaint in general adult population with disc herniation being the underlying reason most of the times. The aim of this study is to investigate and compare the cause of low back pain (LBP) in elite track and field (T&F) male and female athletes.

**METHODS** Retrospective cohort study of SEGAS clinic LBP reports compiled by certified physicians between 1998 and 2008. The participants were 18 to 26 year-old male and female elite T&F athletes with LBP. The main outcome measure was an analysis of MRI findings, classified by anatomic location and event category (throwers, jumpers, sprinters, runners and decathlon athletes).

**RESULTS** One hundred fifty six athletes (65 female, 91 male) were included in the study, all presenting with LBP. MRI reports revealed abnormal findings in 122 athletes (48 female, 74 male) and were normal in 34 athletes (17 male, 17 female). When evaluating all events concurrently disc herniation was the most common cause in both males and females, followed in decreasing order by disc degeneration, disc bulging, spondylolysis, grade I facet degeneration and muscle strain. Significant gender difference in MRI findings ( $p < 0.05$ ) was seen for three event categories. Disc herniation was more common in female throwers but in males it was more often reported in jumpers and sprinters. Degenerated disc was most commonly seen in male sprinters and in female throwers and jumpers. Facet degeneration was encountered mostly in female sprinters and male jumpers. Finally spondylolysis was mainly seen in female sprinters but evenly spread among male sprinters, jumpers and throwers.

**DISCUSSION & CONCLUSION** When evaluating all event categories concurrently our data suggest very little difference in MRI findings between elite T&F men and women. However, when assessing each category separately significant gender difference exists.

**KEY WORDS** low back pain, track and field, male, female

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## **Arthroscopic lateral release for clinical and radiographic tilt of the patella**

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**OBJECTIVE** The purpose of the present study was to evaluate the results of lateral retinacular release, in the treatment of patients suffering from pain, due to chondromalacia of the patella.

**METHODS** 107 athletes, 62 women and 45 men, who suffered, in the last 6 years (2003-2008), from patellofemoral pain syndrome, were included in the study. The criteria for inclusion were the presence of complaints of patellofemoral pain, with no predominant instability, clinical signs pointing to lateral retinacular tightness and radiological evidence of lateral patellar tilt. In 21 athletes the symptoms were bilaterally. All patients had a positive Clark test, while 32/107 (32,1%) knees had joint swelling. We performed a radiological examination in all patients. At operation all patients were subjected to a comprehensive arthroscopic examination of the knee joint. In 95/107 (88,8%) knees we cut arthroscopically the lateral patellar retinaculum. Any cartilaginous lesions of the patella were classified according to Ficat. Patellar debridement was performed in all cases except from 12/107 (11,21%) knees with 1st degree lesions. The patients began isometric exercises of the quadriceps muscle from the 1st day postoperatively. They followed a program for strengthening of the vastus medialis muscle.

**RESULTS** All patients were relieved from the pain. The 105/107 (98,13%) patients continued sports, while the 2/107 (1,87%) patients who gave up sports, had taken their decision preoperatively. In 2/107 (1,872%) patients there was a postoperative hematoma in the lateral surface of the knee and in 1 case (0,93%) there was an infection required re operation.

**DISCUSSION & CONCLUSION** The data indicated that significantly better results can be achieved in patients who have positive clinical signs pointing to patella tightness, well localized parapatellar tenderness and positive medial patellar glide test. Poorer results are to be expected in cases with severe chondral lesions.

**KEY WORDS** Patellofemoral pain, lateral patellar tilt, arthroscopic lateral release

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## **Clinical outcome of an ACL reconstruction using biodegradable interference screws and a sophisticated graft tension system**

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**OBJECTIVE** The purpose of this study is to report the preliminary postoperative clinical results after arthroscopic ACL reconstruction with quadrupled hamstring autograft, fixed with biodegradable interference screws, endopearl in the femoral tunnel and using a new tensioner for graft tensioning.

**METHODS** Between May 2003 and May 2007, we performed an endoscopic ACL reconstruction with a quadrupled hamstring autograft in 121 patients. The graft was fixed with a biodegradable interference screw and endopearl in order to enhance the mechanical stability in the femoral tunnel. The tibial side of the graft was fixed by a conical biodegradable interference screw and a washer screw as back-up fixation after tensioning each tendon by different tension. Postoperatively the patients were permitted an accelerated rehabilitation program, without a motion limiting brace. At least 2 years postoperatively (24 – 48months) x-rays, Lachmann's Test, Pivot shift and mean anterior translation of the tibial head, measured by the Rolimeter (side – to – side difference) was evaluated. The average follow-up was 35 months.

**RESULTS** Radiological findings showed an average of 22% increase in the tibial tunnel diameter. Postoperative complications were four excessive haematomas and three infections, both treated by antibiotics.

**DISCUSSION & CONCLUSION** Arthroscopic ACL reconstruction with quadrupled hamstring autograft, fixed with biodegradable interference screws and tensioning the two grafts separately, provides excellent ligament stability and permits an early accelerated rehabilitation. There was an increase in the tibial tunnel diameter but there were no effects on the clinical results.

**KEY WORDS** ACL reconstruction, hamstring's autograft, medial portal placement, graft tension

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## **The study of static lower extremity alignment in female athletes with ACL injury**

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**OBJECTIVE** Rupture of the ACL is a serious, common and costly sport injury in world. Each year an estimated more than 250000 ACL injury occur in USA. Females are 2 to 8 times more likely to sustain ACL rupture than their male counterparts. It appears several intrinsic and extrinsic risk factors associated with ACL injury. The study of three important malalignment risk factor as pronation, tibial torsion and Q angle in tear of ACL in professional female athletes.

**METHODS** Twenty ACL – injured female (age  $24.90 \pm 5.75$  yr, height  $167.05 \pm 6.58$  cm, mass  $60.88 \pm 5.58$  and athletic experience  $7.70 \pm 4.41$  yr) and 20 non-injured female (age  $24.80 \pm 5.59$  yr, height  $166.15 \pm 6.39$  cm, mass  $60.20 \pm 6.08$  and athletic experience  $7.00 \pm 3.69$  yr) were matched by age, sport and limb participated in this study. Navicular drop, tibial torsion and Q angle was measured in both limbs. Mechanism of injury was noncontact in about 90% cases.

**RESULTS** In 17 cases (85%) a medial meniscus injury was reported. The finding showed significant difference between pronation and tibial torsion in groups ( $p < .05$ ). There is no significant difference in Q angle between groups ( $p < .05$ ). Also there are no significant difference in lower extremity alignment between injured and non-injured limb of ACL injured group.

**DISCUSSION & CONCLUSION** Therefore identifying of the biomechanical risk factors and screening athletes with hyperpronation and internal tibial torsion that may predispose them the ACL to excessive injury is important also apply corrective and prevention program from coaches is needed.

**KEY WORDS** malalignment, female athletes, ACL injury, pronation, internal tibial torsion

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## **The association between tibial slope, isokinetic knee strength and anterior cruciate ligament injury risk in soccer players**

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**OBJECTIVE** The purpose of this study was to examine the influence of tibial slope and isokinetic strength of knee

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extensor and flexor muscle groups on anterior cruciate ligament (ACL) injury risk.

**METHODS** A total of 64 elite soccer players and 45 sedentary controls were enrolled in this study. Radiographic and isokinetic measures were taken before the start of season. The angle between mid-diaphysis line of the tibia and between the anterior and posterior edges of the medial tibial plateau is measured as tibial slope via lateral graphies. Isokinetic strength of knee extensor and flexor muscle groups was measured at 60 and 300°/sec through a Cybex 6000 NORM dynamometer. Individual player exposure and injuries prospectively recorded during the two and a half year period.

**RESULTS** In total, 11 non-contact ACL injuries (10 dominant and 1 non-dominant leg, incidence= 0.2/1000 playing hour) had been registered during the study period. Tibial slope of the injured players in both dominant and non-dominant legs was higher compared with the uninjured players. The difference reached significant level only for the dominant leg ( $p < 0.001$ ). The tibial slopes of the dominant legs of the injured players were higher than that of the non-dominant legs ( $p = 0.042$ ). Players with a tibial slope over the mean group value had 5.62 times "Odds Ratio" increased ACL injury risk. Injured players had higher eccentric quadriceps strength ( $p = 0.007$ ) and lower eccentric flexor/extensor ratio ( $p = 0.031$ ) at 60°/sec in both dominant and non-dominant legs than uninjured players.

**DISCUSSION & CONCLUSION** The findings of the study revealed that higher tibial slope seems to be related to increased ACL injury risk. In addition, higher eccentric quadriceps strength and lower eccentric flexor/extensor ratio should also be taken into consideration as contributing factors.

**KEYWORDS** tibial slope, knee, isokinetic strength, ACL injury

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## Aerobic training responses in young swimmers of different level

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**OBJECTIVE** Some authors (e.g. Maclaren and Coulson, 1999; Dekerle, 2006) reported that aerobic training has a positive effect on critical velocity in swimming. However, it raises the question whereas this effect is similar among swimmers of different performance level. Therefore, the purpose of this study was to determine the training responses in aerobic parameters (critical velocity and critical stroke rate) in young swimmers of different level during an in-season period of training.

**METHODS** 3 groups of 6 young swimmers of both gender belonging to the same swimming club participated in this study. All participants have been trained by the same coach and for the same club for the previous two years. Swimmers were divided according to the value of critical velocity value determined using 50 m and 400 m front crawl tests. Group 1 comprised of 6 swimmers with the best performance in the test (high level), group 3 comprised of 6 swimmers with the lower performance (poor level) and group 2 was the intermediate group. The evaluations took place in two different moments: beginning of the in-season and after 12 weeks of training. For each swimmer, critical velocity and critical stroke rate were determined in both moments.

**RESULTS** In groups 1 and 2 critical velocity increased between the first and the second moment (1.15 vs. 1.18 m.s<sup>-1</sup>; 1.04 vs. 1.07 m.s<sup>-1</sup>;  $p < 0.05$ ) whereas in group 3 the increase in critical velocity was not significant ( $p > 0.05$ ). Although critical stroke rate decreased in the same period for all groups, this decrease was not significant in none of them.

**DISCUSSION & CONCLUSION** As expected, critical velocity enhanced during the training period, suggesting that 12 weeks of swimming training cause the improvement in the aerobic capacity. The swimmers were able to perform the same intensity without increasing their stroke rate to swim at a higher velocity. The combination of stroke rate with critical velocity could be useful physiological and technical criteria for coaches for monitoring endurance training in swimmers; despite more research is needed to understand the effects of training in different level groups.

**KEY WORDS** Physiological, aerobic, technique, training, swimming.

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## Estimation of biological age in females aged 18-65 based on physical fitness factor

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**OBJECTIVE** Biological age depends on functional capacity of cells, organs, and the body as a whole. Chronological age is not always an appropriate marker of biological age, simply because the growth and aging rate is not the same for different people. This study was designed to study the rate of biological aging in females according to the level of their sporting activities. It also provided a good opportunity to produce an equation to estimate biological age of Iranian women.

**METHODS** 107 females aged 18 to 65 were recruited for the study. They belonged to age categories of 18-20, 21-25, 26-30, 31-35, 36-40, 41-45, 46-50, 51-55, 56-60, and 61-65. Each category consisted of at least 10 volunteers out of 15 females who were requested to participate in the study. Physical fitness tests included: vertical jump, modified pull-ups, sit and reach, Illinois agility test, 30 meter run, 20 meter Shuttle run, sit-ups, and medicine ball throw. Sporting activity level was determined using a standard scale. The data was statistically analyzed by Discriminant and Multiple Regression analyses.

**RESULTS** Data analysis revealed that chronological age had a reverse relationship with all physical fitness factors. However, the rate of declination of physical fitness of subjects depended on their sporting activity level, indicating the higher the sporting activity the lower the rate of declination ( $p \leq 0.05$ ). A multiple regression formula was developed for estimation of biological age in women.

**DISCUSSION & CONCLUSION** The positive effect of sport on biological age explored in this study is similar to findings of other researchers in developed countries. However, our subjects had lower physical fitness compared to them. This finding is alarming, especially when considering aerobic fitness. This study could be more reliable, if the same data are collected from other provinces of the country.

**KEY WORDS** aging, physical fitness, females, biological age

## Exercise training restores hemodynamic, hormonal and metabolic profile in normotensive young women at high familial risk of hypertension

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**OBJECTIVE** Offspring of essential hypertensive parents are at high risk of future hypertension and subsequent cardiovascular diseases. However, the underlying pathophysiology of family cluster hypertension in women is incompletely understood. Moreover, there is little information about the effects of exercise training (ET) in this population.

**METHODS** We studied healthy sedentary young women with two hypertensive parents (FH++: n=17; 25.1±4.8 years), one hypertensive parent (FH+: n=18; 24.9±4.1 years), or none hypertensive parent (FH-: n=15; 25.3±3.8 years), to analyze their ambulatorial blood pressure (ABP), carotid-femoral pulse wave velocity (PWV), and biochemistry (total cholesterol and fractions, triglycerides, glucose, insulin and insulin sensitivity). BP, nor-epinephrine (NE), endothelin-1 (ET-1) and nitrite/nitrate (NOx) were also analyzed during a graded exercise test (GXT). Then, the FH++ and FH+ women were randomly assigned to a three times-a-week ET program (FH<sub>ex</sub>) or control group (FH<sub>con</sub>), and had their ABPM, PWV, biochemistry, NE, ET-1 and NOx levels analyzed after 16 weeks of follow-up.

**RESULTS** ABP were not different between groups, but PWV was 7.5% and 12.6% higher in FH++ than FH+ and FH-, respectively, and 4.8% higher in FH+ than FH- ( $p < 0.01$ ). Insulin and insulin sensitivity were increased in FH++ and FH+ ( $p < 0.05$ ), and LDL-cholesterol tended to be higher only in FH++ ( $p = 0.07$ ). FH++ showed higher exercise diastolic BP than FH- ( $p < 0.01$ ), and increased resting, exercise and recovery NE and ET-1 levels than FH-. FH+ showed only greater rest, exercise and recovery NE, exercise EPI, and rest ET-1 ( $p < 0.05$ ). Rest, exercise and recovery NOx were lower in FH++ and FH+ than FH- ( $p < 0.01$ ). On the other hand, ET reduced PWV ( $p < 0.01$ ), insulin ( $p = 0.001$ ), insulin sensitivity ( $p < 0.01$ ), and LDL-cholesterol ( $p < 0.05$ ), to levels similar to those of FH-. ET also reduced exercise diastolic BP ( $p < 0.05$ ), rest and exercise NE ( $p < 0.05$ ), and rest ET-1 ( $p < 0.05$ ). Exercise and recovery NOx was also improved after ET ( $p < 0.05$ ). There were no significant differences in any parameter for the FH<sub>con</sub> or FH- after the follow-up.

**DISCUSSION & CONCLUSION** Hemodynamic, metabolic and hormonal abnormalities typical of hypertension were

presented in nonhypertensive young women offspring of hypertensive parents before any increase in BP, where the greater abnormalities were observed in women with a strong family history of hypertension (FH++). On the other hand, exercise training restores these abnormalities to levels similar to those of young women without history of hypertension. These results suggest that exercise training may have a potential role in the management of an inherited hypertensive disorder.

**KEY WORDS** hypertension; endothelial function; insulin; sympathetic activity; exercise; prevention

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## Prevalence of haemoglobinopathies in Qatar sportsmen

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**OBJECTIVE** Haemoglobinopathies are prevalent in many regions of the world, with the impact on both health and athletic performance varying depending on the nature of the abnormality. Extreme exercise may be hazardous in athletes even with haemoglobinopathy trait. This study wished to evaluate the prevalence of hemoglobinopathy (homozygous or heterozygous) in sportsmen in Qatar.

**Methods** 704 male athletes who underwent medical screening over a 12 month period were included in the study, with all athletes having a low Mean Cell Volume (MCV) or Mean Cell Haemoglobin (MCH) investigated with a thalassaemia screen and DNA analysis as indicated. Age ranged from 14 to 36 years old (mean 22.5).

**RESULTS** Of 104 (14.7%) athletes meeting the criteria for further investigation, 81 (77.8%) underwent further testing. The prevalence of thalassaemia trait in this group was found to be 19.7%. Haemoglobinopathies observed included 8  $\alpha$ -Thalassaemia minor, 8  $\beta$ -thalassaemia minor, 4 sickle cell trait and one Haemoglobin D Los Angeles variation. Of those found to be positive for thalassaemia, 13 were Qatari (61.9%), with the remainder being from other Gulf, Asian and African countries.

**DISCUSSION & CONCLUSION** We conclude that there is a high prevalence of hemoglobinopathy trait in athletes in this region with low MCV and MCH, and given the potential implications for health, screening and counseling to this population is recommended.

**KEY WORDS** sport, athlete, thalassaemia, hemoglobinopathy, blood rheology

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## Efficacy of COX-2 inhibitor drug on exercise-induced inflammation and lipid peroxidation

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**OBJECTIVE** The purpose of this study was to examine the effect of acute Celecoxib administration on exercise-induced inflammation, muscle damage and lipid peroxidation markers.

**METHODS** Twenty healthy untrained male (age; 25.5 $\pm$ 4.5 yrs, weight; 72.7 $\pm$ 7.9 kg, height; 177.3 $\pm$ 7.2 cm) were randomly assigned to treatment (T) and placebo (P) groups. Blood samples were taken before, immediately, 3 and 24h after exercise. Subjects ran for 30-min at 75% VO<sub>2</sub>max on treadmill. T and P groups consumed 100 mg Celecoxib and placebo immediately and 12h after the second blood sampling, respectively. Total leukocyte counts and creatin kinases (CK) activity by Aautoanalyzer, C-reactive protein (CRP) by Nephelometry and malondealdehyde (MDA) by HPLC were measured. Data were analyzed using repeated measures analysis of variance (ANOVA) with Bonferroni correction.

**RESULTS** Markers of inflammation (total leukocyte and neutrophil counts) were significantly increased 3h and decreased 24h after exercise in both groups (P<0.05). Lymphocyte counts significantly decreased 3h after exercise (P<0.05), then increased 24h after exercise only in P group. CRP and CK levels were significantly increased immediately, 3 and 24h after exercise in two groups (P<0.05), but no difference between groups. Peak of CK activity was found 24h after exercise only in T group. MDA levels were significantly increased immediately after exercise in both groups (P<0.05). There was no difference between two groups, though MDA levels were higher 24h after exercise in T group.

**DISCUSSION & CONCLUSION** According to this study, it seems acute Celecoxib administration has been able to attenuate some markers of inflammation but not lipid peroxidation.

**KEY WORDS** Celecoxib- Lipid peroxidation- inflammation- muscle damage

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## A 6-week protocol based on exercise and antioxidant supplementation improved oxidative stress in athletes with mental retardation

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**OBJECTIVE** Recent studies have reported a high prevalence of obesity and overweight in handicapped athletes. However, little information is available in the literature regarding oxidative stress in high-performance athletes with mental retardation. Mainly if we take into account high performance, overweight and mental retardation have been associated to increased oxidative damage that has been finally proposed as a pathogenic mechanism of atherosclerosis, cell aging, neurodegeneration, etc. in this population. Further oxidative damage may impair their physical performance as well as increasing the risk of sports-related injuries. Accordingly the present study was undertaken to ascertain the influence of a mixed protocol in plasmatic total peroxide concentration in athletes with mental retardation.

**METHODS** Fifty-five high-performance, overweight athletes with mental retardation volunteered for this study. Fourty were randomly included in experimental group to perform a 6-week protocol including exercise (low-moderate intensity aerobic exercise before breakfast 3 times/week, 45-50 minutes) and supplementation (1g ascorbic acid + 400 UI  $\alpha$ -tocopherol 6 times/week). Control group included 15 age-sex-trained and BMI-matched athletes with mental retardation that did not perform our protocol. Further our protocol was approved by an institutional ethic committee. Total peroxide concentrations of plasma sample were determined by using the FOX2 method with minor modifications 72-hours before starting the protocol (pre-test) and after its ending (post-test).

**RESULTS** When compared to baseline plasmatic total peroxide concentration was decreased significantly after our 6-week protocol ( $14.6 \pm 1.7$  vs  $11.3 \pm 1.2$  micromol H<sub>2</sub>O<sub>2</sub>/L;  $p < 0.05$ ). No changes were reported in controls.

**DISCUSSION & CONCLUSION** It was concluded a 6-week mixed protocol based on fasting exercise and antioxidant supplementation decreased significantly total peroxide concentration in athletes with mental retardation. Further studies on this topic are required to improve both their physical performance and health status.

**KEY WORDS** Oxidative stress; mental retardation; exercise

## The effects of heat stress on eccentric exercise induced muscle damage

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**OBJECTIVE** Heat stress has been shown to increase tissue levels of heat shock protein 70 (HSP70), which protects cells from further stresses. The purpose of this study was to determine if heat stress is effective to prevent or reduce the degree of muscle damage following eccentric exercise.

**METHODS** 22 volunteer males were randomly assigned to either sauna (SAU, n= 10, age:  $24.90 \pm 1.91$  year) or control (CON, n=12, age:  $23.00 \pm 2.21$  year) groups. SAU group was exposed to sauna for 2X20min with 10min break at a temperature of 85 °C and 50% humidity, 24h before eccentric exercise. Participants in both groups performed 8X10 maximal eccentric knee flexion (from a 180 degree full extension to 90 degree flexion) at 60 rad degrees/s. Plasma HSP70 levels were evaluated before and 24h after sauna exposure. To evaluate biochemical muscle damage markers; plasma CK, LDH, AST and ALT enzymes were determined just before and 1, 2, 3, 4, and 7 days after eccentric exercise. Isometric knee flexion and extension strengths were measured on the same time frame at a joint angle of 90 degree. In addition, neutrophil chemiluminescence, ADP and collagen induced thrombocyte aggregations were measured.

**RESULTS** There were no significant differences in resting plasma HSP70 levels between SAU and CON groups ( $p > 0.05$ ). Sauna exposure resulted in 94% increase in plasma HSP70 levels ( $p < 0.05$ ). Although CK activity significantly increased in both groups following exercise ( $p < 0.01$ ), there were no differences between SA and CON groups ( $p > 0.05$ ). LDH, ALT or AST enzyme levels did not change following exercise in either group ( $p > 0.05$ ). While eccentric exercise resulted in decreases in isometric extension strength in both groups ( $p < 0.01$ ), flexion strength was protected in sauna group, and it was higher than that of CON group ( $p < 0.01$ ). Neutrophil chemiluminescence values decreased after exercise in SAU ( $p < 0.01$ ) group, and it was lower than that of CON ( $p < 0.01$ ) group. ADP induced thrombocyte aggregation increased 24 hours after exercise ( $p < 0.05$ ), however, there were no significant group differences ( $p > 0.05$ ). On the other hand, no significant change was observed in collagen induced thrombocyte aggregation after exercise ( $p > 0.05$ ) in both groups.

**DISCUSSION & CONCLUSION** This study has shown that heat stress induced by sauna results in increased levels of

plasma HSP70 and decreased neutrophil functions. Although heat stress did not effect on biochemical damage markers following eccentric exercise, it resulted in mild degree of protection of muscle strength which could be an important for exercise performance.

**KEY WORDS** Heat stress, muscle damage, eccentric exercise

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## **Does age and physical fitness affects resistance exercise intensity progression in men?**

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**Objective** It has been recommended that older people must increase resistance exercise (RE) training intensity more slowly than young people, independtly of health or physical fitness status. However, there is no scientific evidence supporting this recommendation. Our purpose was to compare the RE intensity progression between older (sedentaries or activies) and young men.

**Methods** Healthy men, divided in young sedentaries (YS; n = 8; age = 25.9±3.7 years, BMI = 23.5±5.1 kg/m<sup>2</sup>), older sedentaries (OS; n = 7; age = 67.4±5.2 years; BMI = 26.5±4.5 kg/m<sup>2</sup>), and older runners (OR; age = 71.3±3.0 years; BMI = 22.7±0.5 kg/m<sup>2</sup>), were submitted to a 13-week RE program. RE was performed 2 times a week, and consisted of 2 sets of 8 to 12 repetitions in 9 exercises; initial intensity = 60% of 1 repetition maximum (1-RM). Exercise intensity was increased in 5% to 10% each time 2 sets of 12 repetitions were performed in a determined exercise. 1-RM test was used before and after follow-up to measure muscle strength.

**RESULTS** Muscle strength increased 35.4% after 6 month of training, followed by lower but significant increases of 8.4%, 4.2% and 5.1% at post-12, post-24 and post-36 month of follow-up, respectively (p<0.01). Cardiorespirespiratory fitness was continuously increased by 5.4%, 6.1% and 2.3% at post-12, post-24 and post-36 month of follow-up (p<0.05). Resting HR was reduced 6.1 beats per minute at post-12, did not changed at post-24, and reduced 5.3 beats per minute at post-36 month of follow-up (p<0.05). Peak HR did not changed significantly during the follow-up, and recovery HR reduced 6.15, 5.0 and 7.9 beats per minute at post-12, post-24 and post-36 month of follow-up (p<0.05).

**DISCUSSION & CONCLUSION** The results suggest that two times-a-week multi-component exercise training is enough to improve physical fitness and HR profile to exercise of middle-aged and older women, and that the improvements continue even after a three-year follow-up, although in a lower intensity.

**KEY WORDS** Aging; exercise; exercise progress; muscle strength; older.

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### 3. POSTER PRESENTATIONS

#### Roles of skeletal muscles impairment and brain oxygenation in limiting oxidative metabolism during exercise after bed rest

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“Central” and “peripheral” limitations to oxidative metabolism during exercise were evaluated on 10 young males following a 35-day horizontal bed rest (BR). Incremental (IE), moderate- and heavy-intensity constant-load exercises (CLE) were carried out on a cycloergometer before and after (1-2 days after subjects rose from bed) BR. Pulmonary gas exchange, heart rate (HR) and cardiac output (Q) (by impedance cardiography), skeletal muscle (*vastus lateralis*) and brain (frontal cortex) oxygenation (by near-infrared spectroscopy) were determined. After BR, “peak” (values at exhaustion during IE) workload (W<sub>peak</sub>), peak O<sub>2</sub> uptake (VO<sub>2peak</sub>), peak stroke volume, Q<sub>peak</sub> and peak skeletal muscle O<sub>2</sub> extraction were decreased (-18%, -18%, -22%, -19%, -33%, respectively), whereas HR<sub>peak</sub> was unaffected. The gas exchange threshold was ~60% of VO<sub>2peak</sub> both before and after BR. The efficiency of cycling (ratio between external mechanical power output and oxidative energy output) was unaffected by BR. At the highest workloads brain oxygenation data suggest an increased O<sub>2</sub> extraction, unaffected by BR. VO<sub>2</sub> kinetics during CLE (same % of W<sub>peak</sub> before and after BR) were slower (time constant of the “fundamental” component 31.1±2.0 s before vs. 40.0±2.2 s after BR). The amplitude of the “slow component” was unaffected (at the same % of W<sub>peak</sub>) by BR, thus it would be greater after BR at the same absolute W. Skeletal muscles contribute to the impairment of oxidative metabolism during exercise after BR. The reduced capacity of peak cardiovascular O<sub>2</sub> delivery did not determine a “competition” for the available O<sub>2</sub> between skeletal muscles and brain.

#### Effect of a selected endurance training program on blood CD4, CD8, and IgA active females

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**OBJECTIVE** This study examined the effect of exercise on the percent blood lymphocytes T (T helper and suppressor) and immunoglobulin A. Studies have demonstrated that strenuous physical exercise in humans is accompanied by changing in circulating levels of lymphocytes. The purpose of this study was to examine the effect of eight weeks endurance training program on blood CD8, CD4 and IgA active females.

**METHODS** Method twenty recreational active women participated in the study. Subjects were assigned in one of two experimental group (n=10) (age: 21.6±1.71years, height: 161.45±2.71cm, weight: 57.25±6.99 kg, and VO<sub>2max</sub> 34.18±2.ml.kg<sup>-1</sup>.min<sup>-1</sup>) and control group (n=10), (age: 24.25±4.30years, height: 159.81±4.86cm, weight: 54.69±3.82kg, and VO<sub>2max</sub>: 36.1±3.79 ml.kg<sup>-1</sup>.min<sup>-1</sup>) groups. Blood sampling were obtained before and after an exhaustive bout of exercise sessions. Lymphocyte subsets were determined by flow cytometry using monoclonal antibodies for T-helper (CD4+), and T-suppressor (CD8+) lymphocytes. Training group participated in an 8-week incremental endurance training program. After training, blood sample were obtained before and after an exhaustive bout of exercise. Data was analyzed using ANOVA test.

**RESULTS** There were increased in the percentage T-helper lymphocytes levels in 2 groups, decreased T - suppressor levels and increased IgA in 2 groups. There were no significant changes in IgA concentration but CD4 and CD4 / CD8 increased and CD8 decreased significantly (P<0.05).

**DISCUSSION & CONCLUSION** It was concluded that endurance training may induces changes in lymphocyte subsets but not in suppression of immune function after exercise. Elevated levels of immunoglobulins, especially IgA can be measured in the plasma of athletes after exhaustive long term exercise. We conclude that endurance training may result in significant alteration in IgA and T lymphocyte number, but their actual significant for immunity is seen controversially.

**KEY WORDS** immune system, exercise, active female

## The effect of 8 weeks endurance exercise on cytokines

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**OBJECTIVE** Several studies have demonstrated that strenuous physical exercise in humans is accompanied by an increase in circulating levels of inflammatory cytokines. Exercise is the strongest stress to which the body is ever exposed he body response to this stress through a set of physiological changes in its metabolic hormonal and immunological systems. In this study responses of the immune system to endurance exercise have been investigated.

**METHODS** 18 healthy active females, university students participated in this study. Subjects were divided in 2 groups, experimental group (age: 21.60 ± 0.54 years, weight: 57.25 ± 2.21 kg, height: 161.45 ± 0.86 cm, body mass: 21.99 ± 0.8 kg) and control group (age: 24.25 ± 1.52 years, weight: 54.69 ± 1.34 kg, height: 156.87 ± 1.71 cm, body mass: 21.40 ± 0.4 kg). After physical examinations of the 2 groups, heart rates and VO<sub>2</sub>max with the use of Bruce test were determined. The first group was subjected to endurance exercise at a heart rate 60- 75, for 8 weeks, 3 days a week, 30 min. a day. The second group did not have exercise. Pre –exercise and post 8 weeks exercise, venous blood samples were taken from each group. Plasma levels of several cytokines namely interleukins (IL) IL1 and IL 6 and TNF $\alpha$  were determined by ELISA. Statistical analyses, t-test and ANOVA used for measurement IL1, IL6 and TNF $\alpha$  response.

**RESULTS** Means showed the level of IL1 not changed in experimental group but decreased in control group, the level of IL6 not changed in experimental and control groups, the level of TNF $\alpha$  decreased in 2 groups. T test and ANOVA showed the IL1, IL6 and TNF $\alpha$  response were not significantly. The percentage of lymphocytes expressing intracellular IL1, IL6 and TNF $\alpha$  were not higher in the experimental group than in control group, and it was similar to the value estimated in the 2 groups.

**DISCUSSION & CONCLUSION** In conclusion the response of the cytokines (IL1 and IL 6 and TNF $\alpha$ ) to exercise depends on exercise intensity and duration. Recent studies show that several cytokines can be detected in plasma during and after strenuous exercise but in this study cytokines did not change, because the selected endurance training was not very strenuous and did not affect on increasing or suppressing of interleukins and TNF $\alpha$  function or proliferation.

**KEY WORDS** exercise, IL1, IL6, TNF $\alpha$

## Human growth hormon effects on the immune system: an in vitro study

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**OBJECTIVE** Several evidences underline the increased abuse of recombinant human growth hormone (rhGH) among athletes meanly because of its anabolic properties. RhGH exerts a pleiotrophic activity at cellular level which stimulates the proliferation of different cell types through the direct or in direct IGF-1 action. Previous studies demonstrated that, on lymphocytes, rhGH binding to its receptor induces an over-expression of proteins involved in cell proliferation (e.g. Cyclin E, c-myc) and the inhibition of the expression of genes involved in the apoptotic processes (e.g. Bcl-2, Bcl-XL). The aim of the present study was to evaluate the effect of rhGH, alone or in combination with corticosteroid, on cultured lymphocytes in order to analyse the efficiency of the immune system (activation, apoptosis, alloreactivity) following rhGH exposure.

**METHODS** PBMC were obtained by density gradient centrifugation of heparinized venous blood collected both from healthy and allergic donors. RhGH, was used at the following concentrations: 100 ng/ml, 200 ng/ml, 300 ng/ml, 400 ng/ml e 600 ng/ml. Apoptosis was induced with Methylprednisolone (MP) 1,5  $\mu$ M/l or incubating the cells in the presence of 1% fetal calf serum (FCS). Mixed lymphocyte cultures were carried out in order to analyze the alloreactivity. Flow cytometry was performed with the use of FACS Calibur cytometer Becton Dickinson.

**RESULTS** Following 24 hors of incubation, lymphocyte spontaneous apoptosis was significantly increased (6.39±0.24 vs 12.55±0.28). On the contrary, MP induced apoptosis was unaffected by rhGH treatment (14.95±1.87 vs 15.78±0.22). After 3 hours of incubation, rhGH treatment increased the co-expression of the activation antigens CD38/HLA-DR on CD3/CD8 positive cells only (8.41±0.57 vs 12.77±0.68). After 24 hours of incubation, rhGH treatment was able to modify the CD38/HLA-DR co-expression on CD3/CD4 positive cells too (8.80 ± 0.36 vs 19.84±2.30). RhGH treatment was unable to modify the percentage of Th2 cells on samples obtained both from healthy and allergic subjects (1.03± 0.09 vs 1.14 ± 0.14 and 1.69± 0.16 vs 1.9± 0.21 respectively). RhGH treatment was unable to modify the number and the size of cell clusters when mixed lymphocytes cultures are concerned.

**DISCUSSION & CONCLUSION** RhGH in vitro treatment exerts the following effects on lymphocytes: - increases the spontaneous apoptosis - does not modify the induced apoptosis - increases the co-expression of the activation antigens CD38/HLA-DR which lasts for at least 48 hours - does not increase the alloreactivity - does not modify the composition of the CD4+ sub-populations Th1 and Th2

**KEY WORDS** Growth hormon, lymphocyte, immune system, flow cytometry



## **A previous note regarding the influence of strength training on antioxidant defence system in stressed rats**

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**OBJECTIVE** It is widely accepted emotional stress is associated to an increased oxidative damage. Fortunately several studies have reported aerobic exercise improved oxidative stress both in experimental and human research what may be explained at least in part by increasing antioxidant defence system. However to date little information is available regarding the influence of a strength training protocol on oxidant-antioxidant balance. Accordingly the present study was designed to ascertain the effect of resistance training on plasmatic total antioxidant status in young stressed wistar rats.

**METHODS** To get this goal we used 50 male- Wistar rats, 1 month old and 125-135 g weight. Rats were adapted to the experimental condition of 12:12-h light-dark cycles. They all were emotionally stressed by immobilization for 8 weeks, 5 sessions/week, 1hour/session according to the protocol reported by Trneckova. They all were randomly divided into experimental and control groups. Animals from experimental group (n=25) were also exercised following a model performed by Tamaka in a rodent squat apparatus and performed four sets of 12 repetitions at 60-75% (increasing 5% each two weeks) of their one repetition maximum (RM) with a 120 second rest period between sets, 5 days/week for 8 weeks. Control group included age, sex and emotional stress matched rats (n=25) that did not perform any training program. Circulating levels of adrenocorticotropin (ACTH) were assessed by radioimmunoassay. Plasmatic Total antioxidant status was performed by a spectrophotometric method using commercial kits. It should be pointed out our protocol was reviewed and approved by an Institutional Ethic Committee.

**RESULTS** Immobilization stress increased plasmatic ACTH levels in experimental (250.3 +/- 8.3 vs. 757.2 +/- 12.6 pg/ml; p=0.032) and control group (248.7 +/- 8.6 vs. 986.8 +/- 14.1 pg/ml; p=0.019). At the end of the experience, plasmatic total antioxidant status in experimental rats (stressed plus exercised) was 0.72 +/- 0.03 [0.69 – 0.76] nmol/l. In control group specimens (stressed but non-exercised) plasmatic total antioxidant status was 0.57 +/- 0.06 [0.51 – 0.63] nmol/l. As was hypothesized, when mean values from both groups are compared we appreciated this difference was statistically significant (0.72 +/- 0.03 vs. 0.57 +/- 0.06; p=0.0217)

**DISCUSSION & CONCLUSION** We concluded an 8-week strength training protocol improved antioxidant defence system expressed as plasmatic total antioxidant status, in young stressed rats. Further studies are required since resistance training could be important in alleviating the pathological consequences of oxidative damage induced by emotional stress.

**KEY WORDS** Oxidative stress; emotional stress; exercise

## **The comparison of serum total antioxidant capacity, superoxide dismutase activity and lipid profile of Zourkhaneh athletes, Karateca practitioners and sedentary individuals**

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**OBJECTIVE** It is believed that prolong and intensive exercise trainings may induce tissue damages due to production of free radicals and other reactive oxygen species. Zourkhaneh (Ancient) sport is a traditional or an ancient sport in Iran and many people interested to carry out its movements or trainings in the sport location named Zourkhaneh. Despite great prevalence of Zourkhaneh and Karate sports in Iran, their effects on the oxidant-antioxidant balance of practitioners are still unclear.

**METHODS** The purpose of this study is to comparison of total antioxidant capacity (TAC), superoxide dismutase enzyme (SOD) activity, lipid profile and physical fitness characteristics of male Zourkhaneh athletes (n=14), Karateca practitioners (n=17) and sedentary individuals (n=20). For this reason, dependent variables were determined by standardized methods and precise instruments. It is applied the Kruskal-Wallis and Mann-Whitney U test for comparing groups and statistical significance was considered if p<0.05.

**RESULTS** Results showed that TAC and legs anaerobic peak power of Zourkhaneh athletes and SOD activity of Karateca athletes is significantly higher than to sedentary individuals (p < 0.05). Besides, there were no significantly differences between lipid profiles of groups. On the other hand, it is established that VO<sub>2</sub>max, legs anaerobic peak power and fatigue index of Karateca athletes are significantly higher and its body mass index(BMI) and body fat percent are significantly lower than to other groups(p<0.05).

**DISCUSSION & CONCLUSION** Generally, special trainings of karate caused karateca practitioners obtain beneficial

antioxidant system, VO<sub>2</sub> max and body composition, but it seems that the Zourkhaneh athletes should some extent modify their training methods to achieve more usefulness.

**KEY WORDS** Antioxidant systems, anti-risk factors, exercise trainings.

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## Identificación de funcional and biochemical biomarkers to detect early overtraining

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**OBJECTIVE** During exercise, metabolic, mechanical, and psychological loading result in a wide range of alterations in different organs. The level of fatigue is also important, since extreme fatigue could cause significant alterations, even irreversible ones, and overtraining could occur. An adequate strategy to detect early overtraining (overreaching) could be to consider different markers and their monitoring in standard situations when compared to processes of intensified training. The objective of this study was the identification of functional and biochemical markers, useful for the diagnosis of overreaching.

**METHODS** Nine young active male carried out a progressive and intensive aerobic intervention training of 12 weeks with 4 data collection: basal (T1), loading (T2), maximal load (T3), and recovery (T4). Ergometric test (treadmill), functional parameters (maximal heart rate, maximal oxygen uptake, blood lactate, and Borg Scale), track field test (3000 m), biochemical analyses (tumor necrosis factor-alpha, interleukine-6, myeloperoxidase, aspartate aminotransferase, alanine aminotransferase, and lactate dehydrogenase), and leukocyte subpopulations count were measured during the training. ANOVA repeated measures and Bonferroni test for post hoc comparisons were used.

**RESULTS** Subjects showed lower blood lactate levels on the maximal load period (T3) when compared to baseline ( $p < 0.05$ ), and higher perceived exertion when compared to recovery (T4) values ( $p < 0.05$ ). There were no significant differences in other biochemical parameters and leukocytes subpopulation count during the training.

**DISCUSSION & CONCLUSION** It is concluded that blood lactate and perceived exertion are reliable markers to detect overreaching and should be taken into account to avoid further overtraining. The biochemical markers studied and leukocytes subpopulations count did not predict overreaching. Granted by "Acción estratégica sobre el deporte", Spain.

**KEY WORDS** exercise training - fatigue - overreaching - functional markers - biomarkers

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## N-terminal pro b-type natriuretic peptide and homocysteine concentrations in athletes

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**OBJECTIVE** Physical activity is generally perceived as a key element for both primary and secondary prevention of cardiovascular diseases. On the contrary, several evidences suggest that intense exercise may increase the athlete's thrombotic tendency. To date, available data on exercise-related increased thrombotic tendency are still conflicting and the clinical significance of those metabolic alteration, found in apparently healthy and asymptomatic athletes, are still obscure.

**METHODS** The aim of the present study was to correlate sport activity to both NT-proBNP and homocysteine concentrations in order to clarify if hyperhomocysteinemia may be considered as a cardiovascular risk factor in athletes and NT-proBNP levels are affected by homocysteine concentrations during physical activities. The study population was composed by 78 competitive, non-professional athletes (57 M and 21 F, aged 27.5±3.8 years, mean ± SD) practising different sports disciplines and 70 healthy age matched subjects (40M, 30F), recruited from blood donors served as controls. Besides the general clinical and analytical determinations, the assessed variables included homocysteine, folate, vitamin B12, total and HDL cholesterol, LDH, CPK, NT-proBNP and IL-6.

**RESULTS** The percentages of athletes with normal and elevated homocysteine levels resulted 46% and 54%, respectively. Mean NT-proBNP levels were significantly higher in athletes than in controls (1176,66 ± 442,15 pg/mL versus 450,34 ± 180,39 pg/mL,  $p = 0.000$ ). No correlation was found between homocysteine and NT-proBNP values.

**DISCUSSION & CONCLUSION** In conclusion, both Hcy and NT-proBNP "sport-related increases" are unlikely to represent cardiovascular risk factors and/or indicators of adverse cardiac changes in athletes. In this view, hyperhomocysteinemia and high NT-proBNP levels in healthy young athletes could be interpreted as a marker of metabolic and morphologic adaptation to training rather than a pure risk factor for cardio-vascular diseases.

**KEY WORDS** Natriuretic peptide, Homocysteine, Athletes, Risk factor

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## The effect of competition on salivary steroids and mood in elite female handball players

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**OBJECTIVE** Many researches have done about the responses of hormones and behavior in sport competition (McCaul, Gladue & Joppa, 1992; Trainor, Bird & Catherine, 2003; Bernhardt, Dabbs & Fielden, 1998). Salivary steroids and mood changes following competition are controversial; some investigation did not mention any change in the level of these hormones and mood following competition (Aubets, Seggura, 1995; Calvo et. al., 1997; Droditch & Droditch, 1992; Edwards, Wetzel & Wyner, 2006). Therefore, the present study aims to investigate the effects of a real life stress situation as an official competition on salivary DHEA-S, cortisol and mood in elite female handball players.

**Methods** This research is applied from the point of practical view and is based on casual-comparative designs. The statistical population consists of elite female handball players in Homa Club in Tehran. Fifteen female handball players (age: M=23.2, SD= 4.72; height: M=168.13 cm, SD=5.67 and BMI: M=59.6, SD=8.77) was selected as a sample. None of the subjects had any history of endocrine disorders and none was on medication or hormone therapy. The study took place over a competitive period in November, during which matches were played each week. Match consist of two halves, each of 40 minutes, separated by a 10 minute recovery period, and are contested by two teams of 15 players. Mood Status Profile (POMS) –consisting of 58 items and measuring six subscales including tension, depression, anger, vigor, fatigue and confusion (McNair, Lorr & Droppleman, 1971)- was utilized for measuring the subject's mood. For Saliva sampling, five ml unstimulated whole saliva was collected from each subject in half hour and five minutes before match, during half time break, immediately, half hour and one hour after end of the match. Matches were played from 4 p.m. to 6.30 p.m. Participants were permitted to consume water during the match. None had trained the day before the saliva collections. Saliva was collected after washing the mouth and drinking 100 ml water. All samples transported on ice to the Biochemistry Laboratory for hormone determination and kept frozen at -20°C until use. The DHEA-S and cortisol value of subjects were tested in duplicate with the aid of Enzyme Linked Immune Sorbant Assay (ELISA) kit from DRG Diagnostics (Sensitivity: 25 pg/ml, Standard range: 0.2 - 12 ng/ml pg/ml and, Sensitivity:1.14 ng/ml Standard range: 2 – 80 ng/ml respectively). The concentrations of and were measured by Elisa method.

**RESULTS** Repeated measure ANOVA was utilized to compare the changes in hormones concentration. Based on repeated measure ANOVA, DHEA-S levels of these athletes indicated not a significant difference and did not vary throughout the competition ( $p>0.05$ ). But concentration of cortisol significantly changed following competition ( $F_{6,14}=6.02, p\leq 0.000$ ). According to Scheffe's post-hoc comparison tests, concentration of salivary cortisol significantly increased in half time, immediately and half hour after end of match in comparison half hour and five min before match. Neither DHEA-S nor cortisol levels were significantly different before the match (Anticipatory response). After match negative mood factors such as tension, anger and TMD ( $P\leq 0.05$  for all).

**DISCUSSION & CONCLUSION** This experiment provides evidence to suggest that stress related to competition induced high salivary cortisol concentrations than androgen. The evaluation of salivary cortisol appears as a simple, stress free, noninvasive method and sensitive biomarker of competition related stress.

**KEY WORDS** Saliva, Official competition, DHEA-S, Cortisol

## Serum and plasma concentrations of brain derived neurotrophic factor in response to maximal exercise.

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**OBJECTIVE** Serum concentrations of Brain Derived Neurotrophic Factor (BDNF) increase transiently following exercise in humans. This provides support for the hypothesis that exercise-induced increases in blood BDNF are an important component of the neuroprotective nature of physical activity. Blood BDNF is collected, stored and released by platelets and regulation of blood BDNF concentration by these cells is poorly understood. We wished to investigate the effect of maximal exercise upon serum and plasma concentrations of BDNF to gain insight into its physiological regulation.

**METHODS** Four men (mean +/- SD: age: 30.2 +/- 5.5 years; body mass: 69.5 +/- 2.4 kg; height: 1.76 +/- 0.09 m; resting heart rate: 56.2 +/- 12.4 b/min) participated and habitual physical activity level was assessed using the Baecke questionnaire, all were physically active. The participants completed a cycle ergometer based maximal exercise test ( $VO_2$  max: 4.22 +/- 0.17 L/min). Blood samples were taken at baseline, immediately following the test and at 30, 60 and

90 minutes post-test, with BDNF concentrations determined by ELISA (Chemicon).

**RESULTS** Serum levels of BDNF increased following the test and gradually fell post-test (Baseline: 6.97 +/- 4.02 ng/mL; 0 min post test: 15.7 +/- 3.5; 30 min: 13.5 +/- 3.3; 60 min: 12.0 +/- 4.22; 90 min: 11.5 +/- 5.5). Plasma levels of BDNF demonstrated an increase post-test but were considerably lower than serum levels (Baseline: 0.012 +/- 0.008 ng/mL; 0 min post test: 0.038 +/- 0.014; 30 min: 0.030 +/- 0.002; 60 min: 0.039 +/- 0.019; 90 min: 0.025 +/- 0.014).

**DISCUSSION & CONCLUSION** The results demonstrate that although serum BDNF rises above baseline levels in response to maximal exercise, this increase appears to principally reflect BDNF in platelet granule compartments and not BDNF free in the plasma. Studies reporting increases in blood BDNF post-exercise which rely on serum BDNF measures alone, cannot be assumed to indicate BDNF which is immediately free to cross the blood-brain-barrier. Instead, BDNF released into the bloodstream during exercise is collected by platelets, perhaps to buffer deleterious physiological actions. The fate of BDNF beyond this stage, presumably either degradation within the platelet or regulated uptake by other tissues via slow release from the platelet, remains to be elucidated. This work indicates that plasma concentrations of BDNF in humans are highly regulated following maximal exercise.

**KEY WORDS** Maximal exercise; Brain Derived Neurotrophic Factor; Serum; Plasma

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## Endurance exercise increases plasma anandamide levels

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Physical exercise effects on the immune system are controversial. Endocannabinoid anandamide (ANA) serum levels were higher at moderate exercise in humans and animals compared to their sedentary controls. Specific cannabinoid receptors, CB1 and CB2, are located at the central and peripheral organs i.e. immune system. The main scope of this research was to measure serum ANA levels at endurance exercise and to evaluate the immune system response. 24 male rats were categorized randomly into 3 groups labelled as; (a) Control, (b) Exercise and (c) CB1 and CB2 Receptor Antagonist+Exercise groups. All groups except the control group were exercised at 35 m/min for 60 min/day for 5 days per week for 7 weeks after 2 weeks of adaptation. Blood samples were collected immediately after the last bout of exercise. Anandamide serum levels were determined with Affinity Chromatography and HPLC; whereas alterations in immune cells (T cells and subtypes, B cells, NK cells) and T cell activation levels in blood were determined quantitatively by Flow Cytometry. Kruskal-Wallis and Mann-Whitney U tests were conducted to evaluate the hypothesis that endurance type of exercise would increase plasma ANA levels, immune effector cells and their activation. There was a statistically significant difference between the control and exercising groups in terms of ANA and immune effector cells. The ANA serum levels of exercising groups were statistically higher than the control group ( $p < .001$ ). Moreover, results showed higher T lymphocytes but lower B lymphocytes ( $p = .004$ ) and Natural Killer Cells ( $p = .002$ ) in exercising groups compared to control group. There was also a difference in terms of T cell activation between exercising and control groups. It can be concluded that endurance exercise increases ANA and thereby alters immune system response.

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## Response of athlete's red blood cell, hematocrit and haemoglobin to a short-duration submaximal activity in the morning and evening

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**OBJECTIVE** Survey the response of athlete's red blood cell, hematocrit and haemoglobin to a short-duration submaximal activity in the morning and evening.

**METHODS** 13 subjects (age: 23.7±2.3 yr; weight: 69±2.4 kg; height: 176.5±3.2 cm) selected from physical education students at Urmia University. Subjects had did regular physical activity and sport participation (at least 3 yr). Initially, in the morning of 1st day (7:00), after blood sampling (pre-test), subjects performed submaximal Astrand ergometer test –as a short-duration submaximal activity- and blood samples (morning post-test) taken immediately after the test. Then, in the evening of the 2nd day (17:00), the test practiced again by the subjects, and final blood samples (evening post-test) taken. Finally, the blood samples analyzed to determine the values of red blood cell parameters (red blood cell, hematocrit and haemoglobin).

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**RESULTS** Statistical analysis of data detected that submaximal Astrand ergometer test has no significant effect on red blood cell parameters and there is no significant difference between morning and evening results (red blood cell: rest  $5.34 \pm 0.371$   $106/\mu\text{l}$ , morning  $5.24 \pm 0.445$   $106/\mu\text{l}$ , evening  $5.11 \pm 0.645$   $106/\mu\text{l}$ ; hematocrit: rest  $46.4 \pm 1.53$  %, morning  $45.9 \pm 2.11$  %, evening  $44.7 \pm 1.97$  %; haemoglobin: rest  $15.4 \pm 1.57$  g/dl, morning  $15.1 \pm 1.32$  g/dl, evening  $14.9 \pm 1.27$  g/dl;  $P < 0.05$ ).

**DISCUSSION & CONCLUSION** We concluded that 1) submaximal Astrand ergometer test –as a short-duration submaximal activity- can not change values of athlete's red blood cell parameters and, 2) time of day (morning or evening) has no effect on responses of red blood cell parameters to this test.

**KEY WORDS** blood parameters - submaximal Astrand ergometer test - circadian rhythm - time of day

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## The effect of altitude on some physiological parameters of sprinters

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**OBJECTIVE** Altitude training, also known as hypoxic training, involves exercising in, living in or otherwise breathing oxygen reduced air for the purpose of improved athletic performance, pre-acclimatization to altitude and/or physical wellness. The aim of this study was to see the effect of altitude training on sprinters.

**METHODS** Six elite 400m sprinters from National Track&Field Team participated to this study. Age of subjects was  $23.0 \pm 1.6$  year. The metabolic effect of altitude training was investigated in sprinters. Subjects were tested before and after altitude training as pre-post tests. Ventilation functions (FVC, FEV1FVC and VC) and  $\text{VO}_2\text{max}$  were tested. Blood parameters (erythrocyte, hemoglobin, hemotocrite, MCH, and MCHC) and some physical characteristics (body weight, resting heart rate, and maximal heart rate) were measured and also the effect of altitude training was investigated on performance. Zagreb protocol was utilized on treadmill for  $\text{VO}_2\text{max}$  test. Ocean Winspiro spirometer for ventilation functions and Bayer Andrio 2120 analyzer for blood parameters were used. SPSS 16 statistical program was utilized for analyzing the data. Paired sample test was used for within the group difference. Percentiles were used for analyzing of individual differences.

**RESULTS** There were no differences between pre and post camp tests for  $\text{VO}_2\text{max}$ , ventilation functions (FVC, FEV1FVC, and VC), blood parameters (erythrocyte, hemoglobin, and hemotocrite) and maximal heart rate. There were significant differences ( $p < 0.05$ ) between pre and post camp tests for body weight, resting heart rate and blood parameters (MCH and MCHC).

**DISCUSSION & CONCLUSION** It was concluded that there were no effect on  $\text{VO}_2\text{max}$  and ventilation functions and also there were no significant differences resting heart rate, body weight, and blood parameters (MCH and MCHC) related to 3 week altitude training in sprinters.

**KEYWORDS** Altitude,  $\text{VO}_2\text{max}$ , blood parameters, ventilation functions

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## The effect of induced alkalosis on lactic acid, ammonia and exercise performance in male runner 400 meter

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In order to comprise the effects of metabolic alkalosis on anaerobic performance and some plasma metabolites, 16 young male athletes (age  $20/58$ , BMI  $21/57 \pm$ ) participated in two 400 m running sessions one hour following bicarbonate or placebo supplementation with counterbalanced order. There were three blood sampling phases (resting condition, 30min after supplementation and 2 min after 400 m running) in both of the sessions and the blood pH, ammonia, lactate and  $\text{Hco}_3^-$  levels were measured. The results showed the better performance in alkalosis session and blood  $\text{Hco}_3^-$  levels increased with respect to the resting values, however; it decreased to pre exercise level after running ( $P < 0.05$ ). The  $\text{Hco}_3^-$  levels also decreased under the resting values after running in placebo session ( $P < 0.05$ ). Significant increases was observed in blood lactate levels in both of the sessions and there was a pH decrease only in placebo session ( $P < 0.05$ ). It can be concluded that alkalosis can be considered as an ergogenic method and can increase blood  $\text{Hco}_3^-$  content and therefore the training intensity.

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## An evaluator-independent substitute for anaerobic threshold(AT)

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**OBJECTIVE** AT is often employed as a measure of exercise tolerance. It, however, is visually determined on the graph and evaluator-dependent. The point where the v-slope ( $\text{VO}_2$  vs  $\text{VCO}_2$  relation) intersects the line of respiratory exchange ratio (R) of 1 is evaluator-independent. Yet this point may be greatly influenced by tissue  $\text{CO}_2$  storage effect(CS) in a non-steady state exercise such as the ramp protocol. We hypothesized that by employing a steady state (SS) exercise protocol and using only SS values R1P will be determined free of CS.

**METHODS** Eleven healthy subjects, 6 males and 5 females(mean age, 34(SD±6.8) each underwent two symptom-limited maximal exercise, one using 25 watt/min ramp (R-Ex) and the other 3-minute step protocol(S-Ex). The five 3-minute stages were chosen based on R-Ex. The average of the last 1 minute values of  $\text{VO}_2$  and  $\text{VCO}_2$  at each stage were obtained. CS was mostly over by 2 minute and SS then ensued. These points were plotted @as the v-slope. The line crossing the R=1 was mathematically calculated and termed the R1 point (R1P). AT was determined using R-Ex values. The peak  $\text{VO}_2$ , AT and R1P were all expressed in ml/min/kg.

**RESULTS** The peak  $\text{VO}_2$ , AT(R-Ex), and R1P(S-Ex) were 34.8, 17.8 and 21.8, respectively. AT was 44.6% and R1P, 21.8% of the peak  $\text{VO}_2$ . The HR(b/min) at peak Ex, AT and R1P were 173, 118 and 128, respectively. R1P correlated well with AT ( $r=0.88$ ).

**DISCUSSION & CONCLUSION** The point where the v-slope intersects the line of respiratory exchange ratio of 1 is entirely determined mathematically, evaluator-independent, and may be substituted for AT.

**KEY WORDS** anaerobic threshold(AT), R1P( $\text{VO}_2$  at respiratory exchange ratio of 1)

## Assessment of heart rate in infants from 6 to 36 months old during aquatic activities

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**OBJECTIVE** In the last few years the aquatic activities for babies have been growing. The advantages for the baby can not be only established in the relational level, considering that the baby is able to learn and to carry out several aquatic motor skills. The aim of this study was to analyze cardiologic aspects, characterizing the heart rate behaviour in babies from six to thirty-six months old participating in aquatic activities.

**METHODS** The sample was fourteen babies of both genders, accompanied by their parents. The babies used a heart rate monitor Polar®, model S610i (non invasive method) and a receptor clock was put in the parents' wrist, which was synchronized with the filming during the aquatic activities session. The results are presented in heart rate average and standard deviation for each task defined: immersions, jumps, ventral displacements, dorsal displacements, displacements with support material, autonomous displacements.

**RESULTS** The results pointed out that the heart rate values were very similar during all the tasks performed by the babies and they were much closed to the value of the heart rate of the beginning of the session.

**DISCUSSION & CONCLUSION** The obtained results revealed acceptable and sustained standard deviation values to consider this method viable for a heart rate assessment in babies participating in aquatic activities. This method can be useful in several cardiac studies, by observing the heart rate behaviour in a baby and controlling the load that they are submitted to. With this approach, we expect to contribute to the evolution and development of the aquatic activities for babies.

**KEY WORDS** Heart rate, Aquatic activities, Infants

## Effect of circadian rhythm on athlete's ECG (ST segment) response to PWC195 test

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**OBJECTIVE** Survey on the effect of circadian rhythm on athlete's ECG (ST segment) response to PWC195 test.

**METHODS** 13 subjects (age: 23.7±2.3 yr; weight: 69±4.2 kg; height: 176.5±2.3 cm) selected from students of physical education. Initially, in the morning (8:00), resting ECGs of the subjects (rest ECG) were recorded. Then, subjects performed PWC195 test and immediately after it. Finally, in the evening of the same day (17:00) subjects performed the test (PWC195) and immediately ECGs (evening ECG) were recorded.

**RESULTS** In comparison to resting ECGs, the response of the ST segment to PWC195 test in the morning and evening were statistically significant, but there was no significant difference between morning and evening responses (rest: 0.053±0.017; morning: 0.023±0.011; evening: 0.000±0.004 mv; P<0.05).

**DISCUSSION & CONCLUSION** We concluded that 1) PWC195 test reduces the voltage of the ST segment but this reduction is not pathologically significant (<1mv) and, 2) time of day (morning or evening) has no effect on response of ST segment to it.

**KEYWORDS** Circadian rhythm – PWC195 – Electrocardiogram – ST Segment

## Effect of circadian rhythm on response of some of athlete's serum electrolytes to the submaximal PWC195 test

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**OBJECTIVE** Time of day affects many physiological characteristics such as aerobic power, and physical practice may influence the serum electrolytes. Accordingly, the purpose of this study was to survey the effect of circadian rhythm on response of some of athlete's serum electrolytes to the submaximal PWC195 test.

**METHODS** For this purpose, 13 subjects (age: 24.7±2.3 yr; weight: 69±3.7 kg; height: 176.5±2.6 cm) were selected from physical education students at Urmia University. Subjects did regular physical activity and participated to sport (at least 3 yr). Initially, in the morning of 1st day (7:00), after blood sampling (pre-test), subjects performed submaximal PWC195 test - as a short-duration submaximal activity - and blood samples (morning post-test) were taken immediately after the test. Then, in the evening of 2nd day (17:00), the test practised again by the subjects, and final blood samples (evening post-test) were taken. Finally, the blood samples analyzed to determine the concentrations of serum electrolytes (Ca<sup>++</sup>, K<sup>+</sup>, Na<sup>+</sup> and Mg<sup>++</sup>).

**RESULTS** Statistical analysis of data revealed that morning and evening submaximal PWC195 tests had no significant effects on serum electrolytes (P<0.05), and there were no significant differences between mean values of morning and evening post-tests (P<0.05).

**DISCUSSION & CONCLUSION** We concluded that, 1) short-duration submaximal activity did not change concentrations of athlete's serum electrolytes, and 2) time of day (morning or evening) has no effect on responses of serum electrolytes to this type of activity.

**KEY WORDS** Circadian rhythm, Submaximal Physical Activity, Calcium, Sodium, Potassium

## ECG holter monitoring during under-ice dynamic apnea record

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**OBJECTIVE** Heart rate (HR) reduction, cardiac output lowering and peripheral vasoconstriction are commonly observed in breath-hold diving. These changes are more pronounced in cold and deep waters and in prolonged apneas. The occurrence of extreme bradycardia and arrhythmias is not exceptional. This study reports the ECG changes observed during an under-ice dynamic apnea record.

**METHODS** An experienced breath-hold diver (male, aged 43) attempted the world record (43 m) of under-ice dynamic apnea. Immersion took place in mid-February into the iced Lake Serrai (Italy). The diver wore a wetsuit with no

flipper. Most of his face but periocular region was uncovered. At 2 m-depth a cable was set to guide the diver to several holes opened into the ice to allow ascent. ECG was recorded continuously by mean of Medilog-AR12 recorder inserted in a water-proof box and HR variability (HRV) analysis was conducted.

**RESULTS** The diver covered 83.2 m in 1'48'', with no symptoms when resurfaced. During the immersion, a progressive HR reduction occurred, with the upcoming of a junctional escaping rhythm followed by a progressive QRS widening till to a ventricular rhythm and immediate sinus tachycardia at resurfacing (130 bpm). Only one supraventricular ectopy was observed. HRV spectral analysis showed unchanged low-frequency (LF) and marked increase of high-frequency (HF) components with a LF/HF ratio drop.

**DISCUSSION & CONCLUSION** This report confirms that dynamic apnea in cold, although superficial waters induces ECG changes consisting in progressive HR reduction and occurrence of escaping rhythms. These changes, moreover, are associated to a relative vagal hyperactivity.

**KEY WORDS** breath-hold; hypoxia; arrhythmias; cold; depth

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## **Effects of bone mineral density on muscle strength gain: Bone myoregulation reflex**

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**OBJECTIVE** A bi-directional interaction between muscle and bone functions may be assumed. However effects of muscle activity on bone structure and function have been investigated till today. Aim of this study was to determine whether bone mineral density (BMD) affected muscle strength gain.

**METHODS** Twenty three young-adult healthy males were included in this double-blind prospective study. These volunteers were randomized into two groups. In electrical muscle stimulation (EMS) group, EMS of the right wrist flexor muscles was applied for six weeks; in healthy controls, transcutaneous electrical nerve stimulation was applied for six weeks. Before trial, BMD of the right distal radius were measured in all participants.

**RESULTS** Isokinetic muscle torque measurements was revealed that increase in the wrist extensors strength was 67.2% in EMS group, and was 18.1% in controls ( $p=0.001$ ). Strong correlation between baseline ultradistal radius BMD and muscle strength gain of the wrist extensors were found in EMS group. Regression analysis revealed that ultradistal radius BMD may be an important determinant of the muscle strength gain of the wrist extensors.

**DISCUSSION & CONCLUSION** Current study suggests that bone can regulate muscle activity, based on its BMD. This result implies that there may exist a mechanism that bone sensing mechanical stimuli can send the signals to central nervous system and neuronally regulate muscle activity (Bone Myoregulation Reflex). It is well known that bone subjected to loading neuronally regulates bone formation. Taken together, bone reflex may also be defined that bone subjected to loading can neuronally regulate bone formation and muscle activity.

**KEY WORDS** muscle strength, exercise, electrical muscle stimulation, bone mineral density

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## **Does taping affect the upper and lower trapezius electromyographic activity amongst patients with suspected subacromial impingement? A pilot study**

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**OBJECTIVE** One of the most predominant clinical signs in shoulder patients is the loss of muscular control around scapula with trapezius being one of the most commonly affected muscles. Shoulder taping is suggested to improve muscular control; however its effects require further investigation. Thus, the aim of this study was to explore the electromyographic (EMG) activity of the upper and lower trapezius following the application of tape in patients with suspected subacromial impingement.

**METHODS** 10 subjects (9 females, 1 male, mean age: 33.3 years) with suspected subacromial impingement, and 10 healthy subjects (7 females, 3 males, mean age: 21.3 years) who served as controls, volunteered to participate in this pilot study. Subjects were requested to perform abduction in the scapular plane with and without the application of tape. Furthermore, abduction was performed without a weight and with a 1,5kgs weight on the affected hand. Two taping techniques were utilised, 'relocation of head of humerus' and 'inhibition of upper trapezius muscle'. Bipolar surface electrodes (Ag/AgCl, 4-cm diameter, 25-mm interelectrode distance) were applied over each muscle. Changes in



frequency (F) and root mean square (RMS) of the power spectrum were calculated using the Viking Quest equipment (Nicolet Inc.). Total time of the effort was also analyzed. 5 measurements were provided for each test. Changes within groups were examined by utilising paired t tests for parametric and Wilcoxon signed rank tests for nonparametric data.

**RESULTS** For the patient group, upper trapezius yielded highly statistically significant results ( $p < 0.001$ ) following the application of the tape in both free abduction and abduction with weight. Lower RMS values were found with the tape (free abduction:  $115.3 \pm 35.3$ , abduction with weight:  $177.5 \pm 35.3$ ) than without (free abduction:  $212.7 \pm 30.4$ , abduction with weight:  $297.3 \pm 37.4$ ), indicating a decrease in upper trapezius EMG activity with the taping application. For the lower trapezius, no statistically significant differences were found following the tape in both free ( $p = 0.33$ ) and with weight ( $p = 0.1$ ) abduction. In the control group, no statistically significant differences ( $p > 0.05$ ) were found following the tape in any of the muscles and under any of the testing conditions (abduction  $\pm$  weight).

**DISCUSSION & CONCLUSION** These preliminary findings suggest that taping decreases a potentially overactive upper trapezius muscle in patients with suspected subacromial impingement, however it does not seem to alter lower trapezius muscular activity. Also, taping did not alter upper or lower trapezius EMG activity in our control group. The clinical significance of these findings will be further discussed.

**KEY WORDS** subacromial impingement, taping, electromyographic evaluation

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## The computerized analysis of muscle fatigue, using surface electromyography and synthetic indices in athletes

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**OBJECTIVE** The aim of this study was to evaluate the local muscle fatigue, using surface electromyography (EMGS), a useful simple method, especially because the EMGS unit cannot make a difference between motor units potentials during maximal muscle contraction.

**METHODS** An experimental, randomized, study was designed with 60 male subjects (average age  $24 \pm 2.7$  years), right-handers, athletes from different sports. The subjects were distributed in two groups: group A ( $n = 31$ , predominantly aerobes), and group B ( $n = 29$ , predominantly anaerobes). We have chosen the usage of EMGS correlated with the simultaneous recording of the developed muscle force, by myomechanography (MMG), with the purpose of finding a synthetically relation between the muscle force and the EMGS parameters. In this purpose we have used modern methods of computerized processing of the EMGS recordings, methods which are used frequently only by the high rank researches, and ours new methods (developed in our department, resulting original parameters and indices for better analysis of muscle contraction).

**RESULTS** From the analysis of obtained results, we selected a number of 46 electrophysiological, mechanographic, cardiovascular parameters and 7 synthetic indices derived from primary parameters, which can be used to develop an algorithm for muscle fatigue investigation.

**DISCUSSION & CONCLUSION** Comparing various sportive branches, there were significant differences for the majority of parameters and especially for the synthetic indices as exhaustion percent threshold, effort resistance, index mechanical energy - dependence and the parallelism between aerobic and anaerobic athletes. We also showed that muscular fatigue install at higher values of physical effort when the durations of repetitive contraction are shorter (in every cycle of repetitive activity the contraction was 40% and the resting time was 60%).

**KEY WORDS** athletes, muscle fatigue, surface electromyography

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## Related factors to climber's success for ascend mount Damavand (5639m)

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**OBJECTIVE** The aim of this study was to assess factors related to ability of climbers to ascent Mount Damavand (5639m). For this purpose 218 healthy volunteer Iranian climbers (8.3% female) whose aim was to ascent to the summit of Damavand were assessed on the way to the summit at 4200m.

**METHODS** Questionnaires were obtained and resting arterial oxygen saturation (SPO<sub>2</sub>%) were measured between 1 to 2 hours after arriving of participants at 4200m. On return to 4200m trekkers were interviewed regarding their worst acute mountain sickness (AMS) symptoms while above 4200m and their summiting success. AMS was assessed using Lake Louise Scoring System. Climbers who had taken medications for prophylaxis or treatment of AMS were excluded from the study.

**RESULTS** Successful summiting was significantly correlated to the AMS scores at 4200m before summiting ( $r=-0.34$ ,  $p<0.001$ ), resting SPO<sub>2</sub>% at 4200m ( $r=0.29$ ,  $p<0.001$ ), number of nights above 3000m per year ( $r=0.19$ ,  $p<0.01$ ), experience of climbing over 5000m ( $r=0.18$ ,  $p<0.01$ ), pre-exposure as having spent a night above 3000m during the 2 months before the climb to Damavand ( $r=0.14$ ,  $p<0.05$ ). Age, gender, body mass index, smoking, and having spent at an altitude of above 2000m on the night before ascending from 3000 to 4200m had no significant correlation with the summiting.

**DISCUSSION & CONCLUSION** In conclusion, having a higher resting SPO<sub>2</sub>% measured about 1 to 2 hours after arriving at high altitude, having no AMS, good acclimatization before summiting, and a good high altitude climbing experience are the factors which confer advantages to climbers who wish to ascent a 5600m peak.

**KEY WORDS** Acute Mountain Sickness; High Altitude; Lake Louise Questionnaire; Mountaineering

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## Related factors to incidence of acute mountain sickness during ascend of mount Damavand

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**OBJECTIVE** Acute mountain sickness (AMS) is characterized by nonspecific symptoms like headache, loss of appetite or nausea, dizziness, fatigue, insomnia, and peripheral edema that usually occurred within hours after rapid exposure of non-acclimatized individuals to altitudes above 2500m. The aim of this study was to assess factors related to the incidence of AMS among Iranian trekkers during ascent of mount Damavand.

**METHODS** For this purpose 218 healthy volunteer Iranian trekkers (8.3% female) whose aim was ascent to the summit of Damavand (5639m) were assessed at 4200m. Between 1 to 2 hours after arriving of participants at 4200m, questionnaires were obtained and resting arterial oxygen saturation (SPO<sub>2</sub>%) was measured. On return to 4200m trekkers were interviewed, via an investigator blinded to trekker's SPO<sub>2</sub>%, regarding their worst AMS symptoms while above 4200m; AMS was assessed using Lake Louise scoring system (self assessment). Trekkers who had taken medications for prophylaxis or treatment of AMS were excluded from the study.

**RESULTS** The most important finding was the significant correlation between the SPO<sub>2</sub>% and the further AMS scores ( $r=-0.59$ ,  $p<0.001$ ). Other significant correlations were found between the AMS scores and average number of nights above 3000m per year ( $r=-0.20$ ,  $p<0.01$ ), experience of climbing over 5000m ( $r=-0.20$ ,  $p<0.01$ ), pre-exposure as having spent a night above 3000m during the 2 months before the climb to Damavand ( $r=-0.23$ ,  $p<0.01$ ), and having spent at an altitude of above 2000m on the night before ascending from 3000 to 4200m ( $r=-0.15$ ,  $p<0.05$ ). Age, gender, body mass index, smoking, and ascent rate from 3000 to 4200m had no significant correlation with the further AMS score.

**DISCUSSION & CONCLUSION** In conclusion, a higher SPO<sub>2</sub>% on arrival at altitude, pre-acclimatization and good experience at high altitude are the factors that could be negatively related to Lake Louise AMS score. The resting SPO<sub>2</sub>% measured about 1 to 2 hours after arriving at high altitude is the strongest of the examined related factors to Lake Louise AMS score.

**KEY WORDS** Acclimatization, Arterial oxygen saturation; High altitude ; Lake Louise Questionnaire

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## Survey of drug abuse in Japan: Analysis of consultations on the bulletin board of an internet sports website

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**OBJECTIVE** Drug abuse, most notably anabolic-androgenic steroid (AAS) use, in athletes is widespread. There have been publicly accessible websites managed by drug abusers that provide athletes information about ASS and other

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drugs. We surveyed the state of drug abuse in resistance training enthusiasts in Japan by analyzing consultations on a bulletin board of one such website.

**METHODS** We accessed a Japanese-language website on it that was presumably managed by drug abusers. Specifically, we accessed a bulletin board that drug abusers were using to communicate with each other. We analyzed the contents of all consultations on the bulletin board from 2004 to 2006.

**RESULTS** Although there were 105 consultations in 2004, the number of consultations increased to 205 in 2005 and to 196 in 2006. In 2006, the method of doping was discussed in 61 consultations, the efficacy of drugs in 40, the side effects of drugs in 53, the selection of drugs in 30, and the cost of drugs in 20. Among those who posted items, 70 individuals were thinking to use drugs, 77 were using drugs at the time, and 49 had previously abused drugs.

**DISCUSSION & CONCLUSION** Drug abusers exchanged information about doping over the Internet in Japan. They especially wanted knowledge on methods of doping.

**KEY WORDS** Drug abuse, Androgenic anabolic steroid, Internet

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## **A comparison study of university students' knowledge levels about doping who are interested in individual and group sport**

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**OBJECTIVE** This study was planned to compare university students' knowledge levels about doping who are interested in individual and group sport. The study was carried out at Karamanoğlu Mehmet Bey University during fall term in 2008-2009 education-training year. 103 university students voluntarily participated and all were actively engaged in sport.

**METHODS** Data obtained by survey method. Socio-demographic features and a knowledge about doping were asked.

**RESULTS** % 35.9 of the students were girls and %64.1 were boys. Students age average was 22.42±1.74. It has been found that % 18.4 of the students has done sport for 1-3 years, % 36.9 of them for 4-7 years, %27.2 of them for 7-11 years and % 17.5 of them for 12-15 years. It was found that the dispersion of students' branches are %62.1 of team sport and %37.9 of individual sport. They have indicated that students tend to do sport %65 with their own will, %14,6 intervention of family and friends, %8,7 media and %11,7 physical education teacher and trainer.

**DISCUSSION & CONCLUSION** It has been found that the knowledge levels about doping of sportmen, who are interested in individual sports, is different from the knowledge level of sportmen who are interested in team sport and it is statistically meaningful ( $p < 0.05$ ).

**KEY WORDS** Individual sports, Team sports, doping awareness level.

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## **The effect of dark chocolate supplementation on c-reactive protein, immunoglobulins, leucocytes and platelets in response to submaximal exercise in male swimmers.**

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**OBJECTIVES** The objective of the study was to estimate the changes in C-reactive protein, immunoglobulins, leucocytes and platelets in male swimmers subjected to submaximal exercise after dark chocolate supplementation.

**METHODS** Highly trained competitive swimmers ( $n=11$ ) aged 18-21 years were recruited from athletic club Academic, Sofia, Bulgaria. The swimmers participated in randomized experimental protocol including a washout period with no chocolate intake and a supplementation period with daily ingestion of 50 grams dark chocolate, of 10 days length each. Two submaximal tests on bicycle ergometer of 15 min each (10 min at 60%  $VO_{2max}$  and 5 min at 90%  $VO_{2max}$ ) were conducted to induce oxidative stress. Blood samples were obtained for baseline measurements and at the end of each period after performing the submaximal testing.

**RESULTS** Significant increase was found after the pre-supplementation submaximal test carried out at the end of washout period in leukocytes and lymphocytes by 24.6%, monocytes by 16.7%, neutrophils by 27.5% and platelets by

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15.8%. C-reactive protein was elevated 2.3 times up to 3.44 mg/L. The submaximal testing performed after the chocolate supplementation period did not precipitate an increased response in these parameters and they were found to return to their baseline values. No changes were recorded in the IgA and IgM immunoglobulins.

**DISCUSSION & CONCLUSION** In conclusion short-term dark chocolate supplementation may have an attenuating effect on the immune system by favourably improving C-reactive protein, leucocytes, neutrophils and platelets responses to oxidative stress induced by submaximal exercise.

**KEY WORDS** c-reactive protein, leucocytes, lymphocytes, neutrophils, platelets, submaximal exercise, oxidative stress, swimmers

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## **Employees lifestyle contrastive analyse with focus of (Sport and Preventing of Drug Habitation) on 2008 Year.**

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**OBJECTIVE** The aim of this study was to consider lifestyle and compare this between athletics employees and non athletics employees on 2008 year.

**METHODS** 60 subjects from the employees were cross-sectional randomized.

**RESULTS** The result of this study entirely shows that 48.8% of their lifestyle is undesirable. Undesirable lifestyle of athletic and non athletics employees in arrangement is 68.5 and 31.5 percentage. If their parents have high educational degree, their lifestyle is more undesirable. Between genus and nourishment was seen significant relationship but in Tarigat's studying it wasn't seen. There were significant relationship between activity and preventing of drug habitation and also, between preventing of drug habitation, age average, parents' education, financially and different kind of sports. Between lifestyle's variables such as nourishment and preventing of drug habitation, activity and preventing of drug habitation were seen significant relationship. Whatever, if nourishment and activity develops more preventing of drug habitation is more desirable, and vice versa.

**DISCUSSION & CONCLUSION** We can also see significant relation between lifestyle of athletics and non athletics employees, that exactly is like the studying in Michigan State but in the research of Mohammadzade, it wasn't seen. Therefore, significant changes were seen in educationally of their parents. The researches of the Taft and Who universities show such a relationship in component of lifestyle. So, for helping people, to change their lifestyle and preventing of drug habitation and approach desirable, we should encourage them to exercise, eat healthy food and pass over the stress, avoid smoking and drug, alcohol and dangerous things.

**KEY WORDS** nourishment, physical activity, lifestyle, stress, drug habitation

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## **Increasing capacity for performance in junior rowers by taking nutritional supplements**

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**OBJECTIVE** In a world of sport in which the administering of nutrient supplements has become a basic component for seniors' rowers training, we considered it is important to experiment in this work the effects, the limits and the advantages of using some nutrient supplements, administered to a group of young rowers, which could become the performers of tomorrow. The nutrient supplements can improve the sportive performance by modifying the corporal composition and the capacity to effort of junior rowers.

**Methods** The present research was developed on a number of 50 subjects, girls (25) and boys (25), who were practicing rowing; they were administered nutrient supplements between the two medical visits.

**RESULTS** During the experiment's developing period we performed tests for observing the active body mass, the adipose tissue and the  $VO_{2max}$ .

**DISCUSSION & CONCLUSION** In what concerns the active body mass we observe that along the administering of nutrient supplements, corroborated with a specific training brought about increases from 70% initially to 86% in the final testing, fact that proves the efficiency of the program. With a rigorous training and a controlled administering of nutrient supplements, the level of the adipose tissue decreased from 23% to 12%. In what concerns the aerobic capacity to effort, the degree of the oxygen use increased from the average value of 72.22% in the initial testing to 73.16% in the

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final one. The essential amino acids with the ramification chain are of a special importance in preserving the muscular mass of the athletes who train hard, and also for the fact that they could be catabolised into muscles, thus protecting the muscular tissues from degrading when submitted to special effort.

**KEY WORDS** nutrient supplements, junior rowers

## **The effect of voluntary fluid intake of a carbohydrate-electrolyte solution or flavored water on fluid balance and soccer skill performance of preadolescent boys**

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**OBJECTIVE** The purpose of the study was to examine the effect of voluntary fluid intake (FI) of a carbohydrate-electrolyte solution (CHO-E) or flavored water (FW) on fluid balance and soccer skill performance (SSP) of preadolescent boys exercised for 60 min in warm (29 0C) and dry (humidity: 37%) conditions.

**METHODS** Sixteen boys (Tanner stage 2) aged 10-11 years performed two 60-min soccer training sessions while drinking voluntarily every 15 min either a CHO-E or FW in a random order. After completion of training the boys were tested in 5 SSP tests (Malina et al., Journal of Sports Science, 23: 515-522, 2005).

**RESULTS** FI was higher in CHO-E compared to FW (CHO-E: 665 ± 47 ml vs. FW: 481 ± 55 ml; mean + SE;  $p < 0.05$ ). However, 10 min after SSP tests percentage body weight loss (%BWL) was not different between trials (CHO-E:  $-0.06 \pm 0.2\%$  vs. FW:  $-0.2 \pm 0.2\%$ ) neither was %BWL corrected for FI (CHO-E:  $-2.0 \pm 0.1\%$  vs. FW:  $-1.7 \pm 0.1\%$ ). Body mass was not significantly reduced after exercise in both conditions. No difference was observed in heart rate (CHO-E:  $163 \pm 3$  beats.min<sup>-1</sup> vs. FW:  $160 \pm 2$  beats.min<sup>-1</sup>), rate of perceived exertion and subjective feeling of thirst or abdominal discomfort between trials. With the exception of shooting (CHO-E:  $8.9 \pm 0.7$  points vs. FW:  $6.9 \pm 0.7$  points;  $p < 0.05$ ) no difference was recorded in SSP tests between trials. Also, SSP after training in both conditions was not reduced compared to the SSP obtained after boys had undergone only a warm-up.

**DISCUSSION & CONCLUSION** For the recorded time period, ad libitum fluid intake of CHO-E or FW proved equally effective in maintaining SSP and fluid balance in boys exercised for 60 min at 29 0C.

**KEY WORDS** Sports drink, soccer skill performance, preadolescence

## **Clinical efficacy of a hyperproteic low-carb diet in obese patients with medical co-morbidities**

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**OBJECTIVE** Classic obesity management has usually low efficacy, especially in long standing cases with serious obesity co-morbidities. Recently it has been showed that hyperproteic (HP) low-carb diet has confirmed efficacy for short term weight loss. Safety and long term effectiveness remain to be proved. Therefore, the aim of this study was to access the efficacy and adverse effects of a 4 month hyperproteic (HP) low-carb diet approach in obese patients with clinical obesity co-morbidities.

**METHODS** The subjects were 32 obese patients (16 males vs 16 females,  $52.8 \pm 7.1$  vs  $53.7 \pm 10.7$  years,  $108.4 \pm 18.0$  kg vs  $94.9 \pm 12.6$  kg) with diabetes, sleep apnea syndrome or hypertension. They were engaged in a 4 month intervention program, consisting of weekly group sessions and a nutritional schedule. All patients received polivitamin and mineral supplements, and had to drink at least a litter of a potassium and oligo-element enriched beverage, divided in 5 to 7 meals. Patients on insulin, thyroid treatment or with renal or hepatic failure were excluded. Seven patients left the study: 1 because of pregnancy and 6 for no adhesion. The 4 months were divided as follows: 1st month 1000 ( $\pm 100$ ) kcal daily: CH  $30 \pm 5$ g, protein  $100 \pm 15$ g and fat  $35 \pm 5$ g and began a light walking program, 30 to 45 min; 2nd month: lunch became a 150 to 200g lean meat or fish meal, with legumes, and in the 3rd month the same with dinner. Patients should be slow walking 45 to 60 min now; 4th month breakfast, lunch and dinner were normal food, but limiting CH to 50g. Midmorning and afternoon snacks were still protein bars. Laboratory evaluation was performed monthly, whereas weight, fat mass (bioelectric impedance Tanita BC-418 Segmental Analyzer), glycaemia, blood arterial pressure and K<sup>+</sup> were assessed weekly.

**RESULTS** Significant weight and waist loss have been obtained in both genders ( $p < 0.05$ ). No hunger or significant clinical adverse effects were reported. The only significant ( $p < 0.05$ ) laboratory changes (mg/100ml) were: iron, ferritin,

glycaemia, total cholesterol, HDL, LDL, triglycerides and insulin.

**DISCUSSION & CONCLUSION** Results suggested that a HP low-carb diet is effective and safe for significant weight and waist loss. This dietary approach, in short term, promotes improvement of cardiovascular risk. Long term follow-up is being carried out, including variables driven by economical and behavioural factors.

**KEY WORDS** Obesity, diet, nutrition

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## The effect of intensive short-term exercises on protein catabolism in fasting and unfasting conditions among the elite wrestlers

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**OBJECTIVE** Metabolic responses to the physical activities in subjects with normal diet are identified to a great extent, but, in few researches, the athletes' functions are studied in fasting conditions of the holy month of Ramadan. The objective of the present paper is to study the effect of one session of intense short-term exercise (with a maximum heart rate of 85% to 95%) on protein catabolism (urea, uric acid, and keratin in blood and urine) in fasting and unfasting conditions among the elite wrestlers.

**METHODS** 16 elite wrestlers with a weight range of 60-84 kg from Khorassan Razavi province participated in this research voluntarily. Before exercising, blood and urine samples were taken from the subjects. The specialized exercise program included three periods of five minutes each during which the wrestlers changed their techniques rapidly. Immediately after exercising, the blood and urine samples were taken from the subjects. F Test was used to analyze the data and to examine the changes of urea, uric acid and keratin in subjects' blood and urine in Alfa level of 5%.

**RESULTS** The data analysis indicted that there was a significant difference between the rates of uric acid and keratin in the subjects blood in fasting and unfasting conditions. Additionally, there is no significant difference in rates of blood urea, urine urea, uric acid and keratin in subjects urine in fasting and non-fasting conditions.

**DISCUSSION & CONCLUSION** According to the results obtained from the research, there was no significant difference in protein catabolism between fasting and unfasting conditions. So, we can claim that in spite of exercising in short period of time with a maximum rate heart rate of 85-95%, the subjects probably will not face with insufficiency of carbohydrate resources; therefore, the share of protein catabolism in providing energy is insignificant and there is no worry in this regard.

**KEY WORDS** Intense short-term exercise, protein catabolism, fasting and unfasting conditions.

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## The influence of aerobic exercise and caloric restricted diet association at young patients with metabolic syndrome

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**OBJECTIVE** Metabolic syndrome is characterized by the presence of obesity, hypertension, insulin resistance, glucose intolerance and dyslipidemia. Lack of physical exercise and excess caloric intake leads to an imbalance between free fatty acid uptake, lipid storage, and fatty acid oxidation. This results in a progressive intramuscular accumulation of both lipids and fatty acid metabolites, which could cause abnormal insulin signaling, leading to skeletal muscle insulin resistance. This excess lipid deposits are prone to enhanced lipid peroxidation, which could also lead to the development and/or progression of skeletal muscle insulin resistance by increasing tumor necrosis factor - and/or by inducing mitochondrial damage. The aim of this study was to evaluate the effect of caloric restricted diet and aerobic exercise on blood pressure, heart rate, LDL-cholesterol, and waist circumference at young subjects with metabolic syndrome versus caloric restricted diet only.

**METHODS** An experimental, randomized, study was designed with twenty male subjects (average age 24±2.7 years) with metabolic syndrome. The subjects were distributed in two groups: group A (n=20) who has undertaken during 3 months a program of individualized physical exercises, 3-5 sessions/week, 40 minutes of aerobic training, at moderate intensity (70-75% from the maximum heart rate); group B (n=15) has not undertaken any physical exercise program during 3 months. The subjects in both groups were undertaken a moderate caloric restricted diet, low fat (15% of total calories), moderate protein (20% of calories), unrefined carbohydrates (65% of calories) and fiber (more than 40 grams).

**RESULTS** After 3 months, we noticed following results at group A: Systolic Blood Pressure (SBP) decreased with

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9.2±3.5 mmHg; Diastolic Blood Pressure (DBP) decreased with 5.1±2.5 mmHg; mean blood pressure (MBP) decreased with 5.1±3.2 mmHg; heart rate (HR) decreased with 9.3±2.1 beats/min; total cholesterol (TC) diminished with 55.5±5.6 mg/dl; LDL cholesterol decreased with 42.1±3.9 mg/dl; waist circumference (WaC) decreased with 5.8±1.5 cm. At group B: SBP decreased with 3.5±1.5 mmHg; DBP decreased with 2.1±1.9 mmHg; MBP decreased with 3.9±3.8 mmHg; HR decreased with 5.1±1.8 beats/min; TC diminished with 21.2±5.7 mg/dl; LDL cholesterol decreased with 11.5±3.5 mg/dl; WaC decreased with 3.5±1.5 cm.

**DISCUSSION & CONCLUSION** Our results show that, in the treatment of the metabolic syndrome, using of association between moderate caloric restricted diet and aerobic exercise has better results comparative with the caloric restricted diet only. The aerobic exercise played a major role in the reductions in serum LDL cholesterol, abdominal adiposity and blood pressure. Our results suggest that the aerobic exercise is a central key for management of metabolic syndrome and the prevention of cardiovascular diseases.

**KEYWORDS** diet, aerobic exercise, metabolic syndrome

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## Herbal-derived supplements and risks for athletes health

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**OBJECTIVE** Herbs are generally believed to be 'natural', and hence safe. There is much interest in "alternative natural approaches" in sport. It is appealing for athletes to use 'natural' substances with similar activity to 'pharmacological' ones in term of increasing performances. Indeed, many herbal dietary supplements marketed on internet are presented as legal alternative to illicit drugs.

**METHODS** The aim of the present study was to investigate the use and the potential side effects of herbs-derived supplements containing ecdysteroids and phytoestrogens among non professional athletes. Among the 1000 subjects recruited, 317 declared the use of supplements of "natural" origin. All participants were requested to fill an anonymous questionnaire containing questions regarding the use of supplements, drugs, illicit substances, other substances aimed to raise sport performances, the modality of prescription and the source mainly used for obtaining information on the assumed compounds. Only 7 athletes accepted to undergo the venipuncture in order to perform the laboratory evaluation. Testosterone, DHEA, Oestradiol, Progesteron, LH, FSH, TSH, FT3, FT4 and Cortisol were evaluated immunometrically (Axym Abbott Diagnostics Laboratories, Abbott Park, Illinois, USA), aspartate aminotransferase, alanine aminotransferase, lactate dehydrogenase, gamma glutamyl transpeptidase, total and partial bilirubin were measured spectrophotometrically (Integra 800, Roche).

**RESULTS** The use of herbs-derived supplements was declared by less than 40% of the recruited athletes with only a few subjects knowing or using ecdysteroids and phytoestrogens containing products. All of the 7 athletes who accepted to undergo venipuncture used a product containing Guggulsteron and Naringin. Four of them (1 female and 4 males) showed remarkably elevated oestradiol levels (1220 to 1605 pg/ml, reference range 40-500 pg/ml depending on the ovarian phase). The remaining tests were within the reference ranges indicating that no organ-specific toxicity was present.

**DISCUSSION & CONCLUSION** The use and the knowledge of herbs derived supplements containing ecdysteroids and phytoestrogens is still limited in Italy. The use of herbs-derived products with the aim of improving performances is considered as potentially illicit by athletes. The use of the product containing Guggulsteron and Naringin was associated with remarkably incremented oestradiol levels. This result gains even more strength when considering that this observation was performed on male subjects. No signs of acute organ-specific toxicity were observed. Longitudinal follow up is needed in order to exclude the possibility of long term side effects. This preliminary observation strongly suggests to extend the study in order to identify the effects of those kind of herbs-derived compounds.

**KEY WORDS** Herbal supplements, Athletes, Hormons, Risk Factor

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## Development of novel antioxidant-rich beverages for athletes from aqueous extracts of Mediterranean plants: Preliminary results pertaining to bioavailability, biosafety and bioactivity

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**OBJECTIVE** Performance of most forms of sport requires enhanced oxygenation of muscle cells, that typically generates extra reactive oxygen species in the body. One way to alleviate this problem is via inclusion of antioxidants in the athlete's diet. On the other hand, several Mediterranean plants possess a great potential for inclusion as nutritional supplements in beverages designed thereto, owing to their intrinsic richness in antioxidants. This research effort assessed the bioavailability, biosafety and bioactivity of water infusions of savory (*Satureja montana*) and raspberry (*Rubus idaeus*), in terms of antioxidant power.

**METHODS** In vitro studies were performed that simulate the human digestive process, using simulated gastrointestinal tract and experimental mice.

**RESULTS** A few antioxidant compounds were found not to be affected by the (simulated) digestive process, whereas other lose activity throughout it – and a few actually see their antioxidant capacity hampered under stomach-like conditions. Rutin (an important flavonoid present in many plant extracts) could be transported across the Caco-2 cell barrier, which simulates intestinal absorption: by 60 min, and using an initial 400 mM solution, 1% was found in cells and 0.1% already crossed the cell monolayer. Replacement of water by plant aqueous infusions in the diet of experimental mice did not affect their body weight and food consumption, up to 14 days. After sub-acute exposure, profiles of lipids and proteins, as well as damage of DNA were assessed as cell oxidation biomarkers, plus the levels of glutathione in liver cells (in both reduced and oxidized forms) and the activity of enzymes involved in its metabolism – glutathione reductase, glutathione S-transferase and glutathione peroxidase, besides the activity of catalase and superoxide dismutase (SOD). Ingestion of both infusions protected significantly against lipid oxidation. However, damage of DNA molecules was prevented only by raspberry, whereas protein oxidation levels were not significantly different from the control (water) for both plant extracts. The levels of liver glutathione were not significantly different, except in the case of savory – which underwent a significant decrease in reduced glutathione, but without major changes in activity of the enzymes involved in metabolism thereof. Concerning catalase and SOD – which are essential in antioxidant defence, their activity was significantly decreased by savory, and exhibited a decreasing trend in the case of raspberry extracts. Finally, the Ames test pointed at some degree of mutagenicity of raspberry – despite its being the most active extract against B(a)P, a dietary carcinogen.

**DISCUSSION & CONCLUSION** Our study has clearly unfolded the presence and activity of a number of antioxidant compounds in aqueous infusions of savory and raspberry, that can reach the end of the gastrointestinal tract, can be absorbed in the intestine and are able to alter the oxidative status in the liver; however, care must be exercised in terms of maximum dose ingested of those infusions.

**KEY WORDS** antioxidants, enriched beverages for athletes, natural plants, in vivo preliminary tests, bioavailability, biosafety, bioactivity

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## Effects of ribose supplementation on interval sprint performance

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**OBJECTIVE** We hypothesized that ribose supplementation may decrease blood concentrations of fatiguing substances like inorganic phosphate, ammonia, pH and lactate by increasing ATP regeneration and decreasing the rate of glycolysis. Thus, we aimed to study the effects of ribose supplementation on interval sprint performance and the fatiguing substance concentrations.

**METHODS** Study cohort (n=15) was consisted in physically active, young (age range: 20 to 30 years) male volunteers. With a double-blind cross over study design, each participant completed two exercise sessions with one week apart, by supplementing maltodextrine or ribose (150 mgs/kg) before exercise tests in a manner that each of them fed once with maltodextrine and once with ribose. Exercise tests were conducted on an elliptical runner (Precor EFx 576i, Precor Inc., Woodinville, WA, USA) against 1.0 watt/kg electromagnetic resistance. Two repetitions of 30 seconds maximal performances with 4 minutes interval were completed. Blood lactate (Biosen C-Line, EKF, GmbH, Barleben, Germany) inorganic phosphate, ammonia (Shimadzu UV 1700S, Shimadzu Co.Ltd., Kyoto, Japan) and pH (Sartorius PB11, Sartorius Co., Edgewood, NY, USA) were analyzed from blood samples taken at rest and five minutes after the second sprint repetition. Shapiro Wilk, Levene and t-tests were used to analyze results. Level of significance was accepted as p<0.05.

**RESULTS** Biochemical parameters did not affected by maltodextrine or ribose supplementation. However, when participants supplemented with ribose, mean power out-put of two succeeding sprints were higher (p<0.05).

**DISCUSSION & CONCLUSION** Ribose supplementation may increase repeated anaerobic performance, but biochemical parameters did not support this performance improvement. Further studies should be done with larger study cohorts.

**KEY WORDS** ribose, anaerobic performance, inorganic phosphate, ammonia, pH, lactate

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## Use of drugs and dietary supplements in croatian athletes selected for doping control in 2008.

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**OBJECTIVE** The objective of the present study was to describe the prevalence of drugs and dietary supplements use in athletes participated in the doping control during 2008. in Croatia.

**METHODS** One issue considering the doping control and used of substances in the days that preceded the doping control was statistically analyzed. The authors analyzed data collected from 239 athletes of 19 sports. There was 201 male and 28 female athletes.

**RESULTS** According to the questionnaire conducted in the doping control, about 70% athletes used some substances to ten days before the doping control. The substances were classified into dietary supplements (68,6%), non-steroidal anti-inflammatory (NSAI) (20.5%), antialergics, antibiotics, and other medicines. More than 10% female athletes used contraceptives. Moreover, 68,6% of athletes reported the use of dietetic supplements, being this group divided into vitamins (36.8%), minerals (30.9%), amino acids (23.8%) and other substances.

**DISCUSSION & CONCLUSION** We concluded that there was an overuse of anti-inflammatory and analgesic medication in many sports, which raises a concern in terms of control of symptoms. Besides that, there was an widen use of dietary supplements. This fact may cause an eventual adverse analytical finding in the doping control.

**KEYWORDS** Croatian athletes; Use of drugs; Dietary supplements; Doping control

## The effects of short-term dehydroepiandrosterone supplementation on body composition in young athletes

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**OBJECTIVE** Dehydroepiandrosterone (DHEA) is a weak steroid and precursor to testosterone, produced by the adrenal gland. It can be also found in some plants or chemically synthesized and was one of the first prohormones to enter the dietary supplement market after the 1994 US Dietary Supplement Health and Education Act, which had a significant impact on the sports supplement industry. Although DHEA is considered to be an anabolic steroid, and is banned by many sports governing bodies, including the International Olympic Committee (IOC), DHEA is a legal substance available from many retail outlets, including health food stores and supermarkets. The overall prevalence of DHEA use is not known, although several reports indicated that DHEA is one of the most popular dietary supplements especially in adolescent athletes (7).

**METHODS** Twenty young (19 to 22 years) male soccer players were allocated to two randomly assigned trials in double-blind design - ingesting 100-mg daily oral DHEA or placebo (PLA) for 28 days.

**RESULTS** There was no baseline differences in age, height, body mass, maximal oxygen uptake or body fat between groups (Table 1). Body mass was not affected by 4 weeks of DHEA supplementation ( $P > 0.05$ ) (Table 2). No significant changes in BMI, WHR, body fat or total muscle mass for the two groups were detected at the end of the trial. There was no within- or between-group difference in AFI and cAMA. Treatment with DHEA resulted in significant increase of total testosterone, estradiol and DHEA-S levels in treated athletes versus the placebo group ( $P < 0.05$ ) (Table 3). The increase in total testosterone, estradiol and DHEA-S over time was significant in the DHEA group only ( $P < 0.05$ ). Serum free testosterone values were not significantly changed during DHEA and PLA administration. No athletes reported any vexatious side-effects of supplementation.

**DISCUSSION & CONCLUSION** Results of this study suggest no beneficial effect of DHEA supplementation on body composition in young competitive athletes. Treatment with a 100 mg oral daily dose of DHEA for 28 days had no significant effect on body mass, body fat and muscle mass in soccer players, while the levels of androgens and estradiol significantly increased after supplementation in DHEA as compared to placebo. DHEA and DHEA-S are the most abundant adrenal steroid hormones in men with physiological roles yet to be determined. DHEA has been proposed as a treatment for a wide variety of conditions including obesity, aging, cardiovascular and autoimmune disease, cancer and depression (25, 30). In the field of sports and exercise nutrition, DHEA is promoted as muscle-building and fat-burning agent which could increase immune function and enhance recovery after exercise (13). However, clear evidence supporting the use of DHEA in athletic environment remains less clear. It is well known that age-related decreases in DHEA are associated with increases in obesity and a decline in lean body mass (15) yet the potential usefulness of DHEA as a slimming agent is mostly indicated by previous research in animals, particularly lower mammals.

**KEY WORDS** Testosterone, Body Fat, Muscle Mass, Estradiol

## **Relation against passive recovery and active in the 48 hours after a 4-km race**

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**OBJECTIVE** Coaching and athletes do not clearly understand what type and duration of recovery works best after a hard run to restore the body to peak racing condition. This study compared 48 hr of active recovery after a 4-km running performance with 48 hr of passive recovery.

**METHODS** A sample of 4-km runners of above-average ability completed 3 trials within 6 days. Each 4-km trial was followed by 48 hr of passive recovery (PAS) or 48 hr of active recovery (ACT), a counterbalanced protocol. The 2 initial 4-km trials constituted separate PAS and ACT baselines.

**RESULTS** Mean finishing times did not differ significantly between ACT (17.25±1.5 min) and baseline (17.11±1.7 min); nor was there significant difference between PAS (17.10±1.5 min) and baseline (16.34±1.6 min). Average heart rate for PAS (175.9±6.3 beat/min) was significantly higher than baseline (168.4±6.5 beat/min), but ACT average heart rate (175.9±6.6 beat/min) was significantly lower than baseline (168.9±6.4 beat/min). For PAS, perceived rate of exertion at ending (17.25±0.6) was significantly greater than baseline (17.11±0.9), yet for ACT, perceived rate of exertion at ending (17.10±0.8) did not differ significantly from baseline (16.34±0.7). During PAS trials, 3 individuals ran a mean 12.0±2.8 seconds slower, 2 individuals ran a mean 33.0±21.0 seconds faster, and 5 individuals ran within 5.1±2.5 seconds of their first run.

**DISCUSSION & CONCLUSION** During the ACT trials, 1 participant ran 13.0 seconds slower, 3 participants ran a mean of 34.7±13.5 seconds faster, and 8 nonresponders ran within 5.5±2.7 seconds of baseline. Results indicate that 48 hr of passive and active recovery result in similar mean 4-km performance.

## **The reliability and the objectivity of ankle volume measurement with the volumetric and the figure of eight method.**

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**OBJECTIVE** The evaluation of ankle edema is useful after trauma. The measurement of ankle volume with the volumetric and with the figure of eight method can be used for indirect ankle measurement. The aim of this study was to find the reliability and the objectivity of volumetric measurement of the ankle with volumetric method or with the figure of eight method.

**METHODS** Forty-two healthy athletes, 32 men and 10 women, 18 to 29 years old, participated in this study. The measurement of the ankle volume with the volumetric method was performed using a tank and with the figure of eight method was performed using with a tape measure, two times by two different testers.

**RESULTS** We found high reliability between the first and the second water volume measurement with the volumetric method ( $r = 0.99$ ) and with the figure of eight method ( $r = 0.98$ ). Also there was high objectivity between the two testers measurements with the volumetric method ( $r = 0.99$ ) and with the figure of eight method ( $r = 0.97$ ) for all the measurements.

**DISCUSSION & CONCLUSION** Both methods are reliable and objective for the measurement of ankle volume. The figure of eight method is easier to be used.

**KEY WORDS** Ankle volume, volumetric method, figure of eight method

## **Effect of vibration training on body composition and flexibility in healthy and sedentary women**

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**OBJECTIVE** The objective of this study is to investigate effects of 8 weeks whole body vibration training on body

composition and flexibility.

**METHODS** This study involved 60 voluntary participants. The whole body vibration group included 30 women with mean age of  $36.83 \pm 03.38$ , mean height of  $164.33 \pm 11.23$  cm and mean weight of  $67.28 \pm 05.21$ . They performed unloaded static and dynamic exercise on vibration platform (35-40 Hz, 2.5-4.0 mm., Power Plate) 3 times a week for 8 weeks accompanied by a trainer. The control group (n=30) was selected randomly and didn't participate in any training. The tests were done on both groups before and after 8 weeks. Body composition was determined (BIA - InsBody 230 Model). Standard anthropometric methods were used for measurements. Data were gathered from the right side of the body based on Anthropometric Standardization Reference Manual procedures. Posterior body flexibility was determined by sit-and-reach test.

**RESULTS** After 8 weeks, no significant change occurred in waist/hip ratio ( $p > 0.05$ ). Significant differences were observed in muscle weight ( $p = 0.001$ ), fat mass ( $p = 0.001$ ), total body water ( $p < 0.001$ ), fat free mass ( $p < 0.001$ ), body fat ratio ( $p < 0.001$ ), basal metabolic rate ( $p < 0.001$ ), and flexibility ( $p < 0.001$ ). No significant changes were found for all the outcome measures of the control group.

**DISCUSSION & CONCLUSION** Regular exercise causes changes in body composition; while there is reduction in fat mass, there is increase in fat free mass. This study showed that, whole body vibration exercise performed 3 times a week during 8 weeks causes changes on body composition and flexibility.

**KEY WORDS** body composition, vibration training, flexibility, women, exercise

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## Relationship of handgrip strength with anthropometric and body composition variables in young gymnasts

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**OBJECTIVE** Handgrip strength is an important test to evaluate physical fitness and nutritional status. The purpose of this study was to examine the relationship of handgrip strength with basic anthropometric variables in young gymnast population.

**METHODS** The study included 93 children aged 5-10 years from Catanzaro (Italy). Descriptive statistics, chi(2) tests, analysis of variance, Student's T test, Pearson Correlation and logistic regression analysis were performed. Continuous variables are presented as mean $\pm$ standard deviation. A P value  $< 0.05$  was considered statistically significant. SPSS for Window was used. Height, body mass, body mass index (BMI kg/m<sup>2</sup>) was calculated. Biceps and triceps skinfolds, arm relaxed, arm flexed, forearm and wrist girths, acromiale-radiale, radiale-styilion-radiale and midstyilion-dactylion length and humerus breadth were measured. Bioelectrical impedance analysis was performed. Maximal handgrip (HG) strength of the right hand was measured with the hand dynamometer.

**RESULTS** Handgrip strength increases with age. The correlation between HG (the dominant arm) and the variables anthropometric and bioimpedenziometric examined was significant with sex ( $r = 0.391$ ;  $P = 0.000$ ), body weight ( $r = 0.412$ ;  $P = 0.000$ ), body surface area ( $r = 0.774$ ;  $P = 0.000$ ), BMI ( $r = 0.447$ ;  $P = 0.000$ ); circumference muscle arm ( $r = 0.519$ ;  $P = 0.000$ ), fat free mass ( $r = 0.447$ ;  $P = 0.000$ ) and reactance ( $r = 0.390$ ;  $P = 0.000$ ). Stepwise multiple regression analysis indicated that the most important predictive value from the basic anthropometric variables was Fat free mass ( $r = 0.204$ ;  $P = 0.000$ ).

**DISCUSSION & CONCLUSION** Sex, body weight, body surface area, BMI, circumference muscle arm and reactance, were associated with hand strength. Fat free mass was an additional independent predictor of hand static force. It was concluded that in young gymnast, fat free mass contribute more to the prediction of handgrip strength than others anthropometric parameters.

**KEY WORDS** handgrip strength, body composition

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## Relationship of body mass index with blood pressure in young gymnasts

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**OBJECTIVE** The study aims are investigating the effect of body fat and fat localization on both systolic and diastolic hypertension in a group of young gymnasts.

**METHODS** The study included 93 children (21 M, 72 F) aged 5-10 ( $8.44 \pm 2.68$ ) years old, from Catanzaro (Italy). Descriptive statistics, chi(2) tests, analysis of variance, Student's T test, Pearson Correlation and logistic regression

analysis were performed. Continuous variables are presented as mean±standard deviation. A P value < 0.05 was considered statistically significant. SPSS for Window was used. Anthropometric measures, systolic and diastolic blood pressure were measured. We also collected the information about other confounding social variables (family history of obesity and mother's education) and behavioural variables (preferred diet and physical activity). Bioelectrical impedance analysis was performed.

**RESULTS** There was significant relation between BMI and systolic (P < 0.000) and diastolic (P < 0.000) blood pressure. Applying the multiple linear regression analysis to fix the confounding effect of age, sex, social and behavioural factors, anthropometric variables; the fatness index, BMI, was significantly related to systolic (P < 0.012) and diastolic (P < 0.022); while waist-to-hip circumference ratio (WHR) was not significant (P = 0.778 in systolic and P = 0.675 in diastolic blood pressure respectively).

**DISCUSSION & CONCLUSION** Systolic and diastolic blood pressure showed a positive relationship with the fatness index BMI, but not with WHR, in both boys and girls. This is an evidence that WHR may not be a reliable indicator of body fat distribution in children.

**KEY WORDS** Body mass index Blood pressure

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## **Study concerning the connection between the body composition and aerobic capacity of judo athletes**

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**OBJECTIVE** The purpose of this study was to establish the connection between the body composition and aerobic performance in junior judo athletes.

**METHODS** For our study we used a transverse correlational design on a group of judo players selected within the Sports Club of Pitesti (CSM Pitesti). This group was represented by six girls and six boys (the average age was of 13, 6 years). In order to establish the body composition we used the bioelectrical impedance method, determining body fat mass (FM, kg) and the percentage of adipose tissue (AT, %), as well as body mass index (BMI). Maximal Oxygen Consumption (VO<sub>2</sub> max) was measured through the Astrand method (6 minutes of pedaling on a static bike with a charge of 110-125 W).

**RESULTS** The BMI values registered in girls were higher than those of the boys (with the average of 24, 7 respectively 22, 6) for similar weight categories. The same tendency was noticed also regarding the body fat mass, being lower on boys than on girls, on a significant threshold (p<0, 01). Also, our findings showed a reverse relation between VO<sub>2</sub>max and body fat mass both in girls and boys.

**DISCUSSION & CONCLUSION** At juniors, the dynamic of the evolution of the adipose tissue is much more obvious in girls than in boys. Maintaining an optimal body weight and body composition are significant factors for determining the sports performance of judo athletes. A proper aerobic capacity helps to recover the energetic reserves that the body needs between matches.

**KEY WORDS** body composition, aerobic capacity, judo, athletes

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## **The validity of anthropometric and bioelectrical impedance analysis regression equations in predicting body composition for adolescent male athletes between the ages of 15-17 years.**

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**OBJECTIVE** This study was designed to assess the validity of previously-developed anthropometric and Bioelectrical Impedance Analysis(BIA) RE for male adolescent athletes.

**Methods** 155 male adolescent athletes (training for at least 1 year, 2 hours/3 days/week.) participated voluntarily. BD, BF%, and LBM were determined by using Hydrostatic Weighting (HW). Oxygen dilution method was used to determine residual volume (RV). Body weight (BW) in kg, height (Ht) in cm, skinfold thicknesses in mm, and circumferences in cm were measured. Resistance (R)(Ω) was measured by using BIA. Resistance Index (RI) (cm<sup>2</sup>/ Ω) was determined, Pearson Product Moment (rp) and intraclass correlation coefficient (ri) values were calculated between the reference values by HW and RE parameters. Bland-Altman plots of BD, BF% and LBM calculated corresponding RE compared with reference HW parameters to determine validity of the previously developed RE. Correlation coefficient values between reference and predicted parameters were given in parenthesis with significance level of 0.05.



**Results** To estimate BD by using Sloan (rp=0,64, ri=0,68) and Behnke&Wilmore (rp=0,74, ri=0,81) were found valid, however, Lohman (rp=0,53, ri=-0,41) and Durnin&Womersley (rp=0,63, ri=-21,33) were not. Similarly BF% RE by Katch and McArdle (rp=0,60, ri=0,36), Acikada (rp=0,63, ri=0,03), Dogu (rp=0,77, ri=0,79), Yuhazs (rp=0,74, ri=0,80), Slaughter (rp=0,59, ri=0,72) were found valid. To predict LBM by using Chumlea (rp=0,88, ri=0,93), Houtkooper (rp=0,94, ri=0,94), Segal (13) (rp=0,95, ri=0,96), Segal, fatness specific (rp=0,96, ri=0,97), Kushner and Schoeller (rp=0,93, ri=0,94), Lukaski (rp=0,88, ri=0,93), Oppliger (rp=0,96, ri=0,96) were found valid, Deurenberg (rp=0,94, ri=-2,55) wasn't.

**DISCUSSION & CONCLUSION** Although, BIA and anthropometric RE were significantly related to reference values, results approved that RE were population specific. Population specific RE is necessary to be developed for the male adolescent athletes.

**KEY WORDS** Body composition, regression equation, validity, male adolescent athletes, bioelectrical impedance analysis.

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## The effect of a fitness period for 8 weeks on cardio-respiratory fitness and body composition in national team boxers

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**OBJECTIVE** The aim of this study is to assess the effects of 8-week training program on cardio-respiratory parameters, body composition and Basal Metabolic Rate (BMR) in elite athletes and correlation among cardiorespiratory, body composition, and BMR.

**METHODS** 7 male boxers of national team (height 176.2 ±22.3, weight 74.91 ±18.51) were selected. They were evaluated by gas analyzer and body composition analyzer before and after finishing of the program. Cardiorespiratory variables (including: lactate threshold oxygen consumption [VO<sub>2</sub>-LT], maximal oxygen consumption [VO<sub>2</sub>max], rest ventilation [VE-R], lactate threshold ventilation [VE-LT], ventilation in VO<sub>2</sub>max conditions [VE-VO<sub>2</sub>max], lactate threshold heart rate [HR-LT], and lactate threshold in maximal heart rate [HR-LT], BMR, and body composition variables (such as : weight, fat mass (FM), Body Fat Percent (%BF), Body Mass Index (BMI), Lean Body Mass (LBM), Muscle Mass (MM), and Total Body Fluid (TBF) were measured. Subjects participated in exercise protocol for 6 days (2 times a day). Training program included General box training (performed each day PM), Resistance exercise (weight training consisting 10 muscles, performed for 3days, AM), and Aerobic exercise (running 30-40 min, 3 times a week, with 70-80%VO<sub>2</sub>peak, AM).

**RESULTS** Results of paired T-test showed that our training program didn't have any effect on body composition, but, cardiorespiratory variables (VO<sub>2</sub>peak, p=0.048). Results of Pearson Correlation test indicated that some cardiorespiratory variables (such as VE) was associated with body composition. Also, this correlation exists between BMR and body composition parameters.

**DISCUSSION & CONCLUSION** Our study shows that this program can improve cardiorespiratory indexes, especially when it is extended.

**KEY WORDS** Special Exercise Program, Cardiorespiratory Fitness, Body Composition, Elite Athletes

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## Investigation the effects of water resistance training on maximal strength and anaerobic power of adolescent basketball players

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**OBJECTIVE** Water resistance exercises are rehabilitation methods for injured athletes but its potential effects on healthy adolescent needs investigation. Thus the aim of this study was to investigate the effects of water resistance training on maximal leg press strength and anaerobic power of the adolescent basketball players.

**METHODS** 20 adolescent (10 male, 10 female) basketball players (Xage: 16,3±0,6 years, Xsport age: 2,3±1 years, XBMI: 21,2±3,3 kg/m<sup>2</sup>) were attended the study voluntarily. Water plyometrics were performed twice a week for eight weeks in a swimming pool. One repetition maximum (1RM) leg press strength and vertical jump (VC) performance was recorded before and after the training sessions. Anaerobic power was calculated by using VC performance. SPSS 11,5 Statistical program used to analyze data. T-Test was used to evaluate differences between pretest and the post test. "Repeated measures for ANOVA" was used to evaluate differences between pretest and post test of groups.

Significance was set at  $p < 0.05$

**RESULTS** There were significant differences between pretest and post test on 1RM leg press strength (T:-16,244, P:0,01) and the anaerobic power (T:-11,179, P:0,01). Conversely, there were no significant differences between male and female players according to 1RM leg press strength (F:1,927, P:0,182) and the anaerobic power (F:0,130, P:0,723).

**DISCUSSION & CONCLUSION** It is possible to say that 8 weeks water resistance training can be effective method for improve maximal leg strength and anaerobic power of adolescent basketball players.

**KEY WORDS** Basketball, sport, adolescent, water resistance training.

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## Anterior tibial translation in elite handball and basketball players

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**OBJECTIVE** The aim of this study was to assess the differences in anterior tibial translation (ATT) among leg dominance, sports and sex in elite handball and basketball players with no previous anterior cruciate ligament (ACL) injury.

**METHODS** We evaluated 18 handball players (10 males, 8 females; age:  $21.67 \pm 2.82$  years) and 14 male basketball players (age:  $22.71 \pm 4.49$  years). A KT1000 arthrometer was used to measure ATT for both dominant (the leg used in a single-leg landing jump) and contralateral leg. Passive displacement tests (at flexion and 15lb, 20lb and 30lb of force), manual maximum displacement test buradaki simgenin neye karşılık geldiğini anlamadım<sup>o</sup>30 (MMT) and quadriceps active test (QAT) were performed.

**RESULTS** Significant higher ATT was found for the dominant leg compared with the contralateral one, for all the performed tests ( $p < 0.006$ ). Basketball players had significant higher ATT values in their dominant leg when compared to the handball players at 15lb, 20lb and 30lb of force ( $p = 0.01$ ,  $p = 0.02$  and  $p = 0.01$ , respectively), but not in MMT and QAT. For the contralateral leg, significant higher differences were found between basketball and handball players at 20lb and 30lb of force and QAT ( $p = 0.04$ ,  $p = 0.02$  and  $p = 0.04$ , respectively). No significant differences were found between males and females players.

**DISCUSSION & CONCLUSION** Our results revealed higher ATT in the landing leg of elite handball and basketball players with no history of ACL injury. Differences in ATT among sports were found in both legs, with higher ATT in basketball players. No sex differences were found.

**KEY WORDS** knee, anterior tibial displacement, sports

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## Differences in ball shooting between futsal and soccer balls

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**OBJECTIVE** In a soccer and futsal game, the shot presents itself as a decisive action in the game. However, despite being a technical action common to both games it is used in different circumstances each time, due to various differences between the two games. One, basic, but not least is related to the characteristics of the ball. The purpose of this study is to analyze the differences in ball velocity of shot with both limbs, using the soccer and futsal ball.

**METHODS** 33 students of Sport and Physical Education performed 3 maximal velocity instep kicks with the preferred leg and 3 shots with non-preferred leg on a stationary placed standard soccer and futsal ball. The balls were of standard size, weight and inflation (soccer ball: circumference, 70 cm; weight, 430g and pressure equal to 0,6 atmosphere (600g/cm<sup>2</sup>); futsal ball: circumference 63 cm; weight, 430g and pressure equal to 0,4 atmosphere (400g/cm<sup>2</sup>) - FIFA, standard) and kicked towards a goal on 15m distance. The ball velocity was measured using a radar gun (Sports Radar 3300, Sports Electronics Inc, with  $\pm 0.03$  m/s accuracy within a field of 10 degrees from the gun). Only the best attempts with each ball were used for further analysis.

**RESULTS** The ball velocity was significant higher with the soccer balls (22.3m/s) compared to the futsal balls (20.1 m/s). The same was found when kicking with the non-preferred leg (19 vs. 17.1m/s). Furthermore a positive significant correlation ( $r = 0.84$ ) between ball velocity with the soccer ball and the futsal ball was found indicating that subjects that shot with higher velocity with the soccer ball, also shot higher with the futsal ball.

**DISCUSSION & CONCLUSION** Although the shot is a similar action in soccer and futsal, it can present different characteristics, just change the type of ball used. Simple causes such as the size of the ball may require different requirements in the coordinative control (biomechanical profile of execution) in shot with the different balls.

**KEY WORDS** Ball velocity; shooting, soccer

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## The relationship among anaerobic performance, sprint ability and hufa agility test in soccer players

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**OBJECTIVE** Soccer is gaining popularity throughout the world and is a game that is dominated by anaerobic power-capacity, endurance and strength. Also running is the predominant activity, yet explosive type effort such as sprints, jumps, duels and kicking are important factors for successful soccer performance. This critical factors relative to anaerobic performance, agility and strength (Cometti et al., 2001). The purpose of the present study was to investigate the relationship among anaerobic performance, sprint ability and HUFA test in soccer players.

**METHODS** 40 soccer players participated in this study voluntarily (10 defender, 18 midfielder, 6 forward, 6 goalkeeper subjects joined this study) (age:  $17.03 \pm 0.45$  yrs). Wingate Anaerobic Power Test (WAnT), squat (SJ) and counter movement jump (CMJ) was used for the determination of anaerobic performance, sprint-ability of the soccer players was determined by 10-20-30 meter single-sprint and Hacettepe University of Football Research (HUFA) without ball were used for the determination of agility.

**RESULTS** Anaerobic performance, sprint ability and HUFA agility test of soccer players are given in Table 1. Table 1. Anaerobic performance, sprint ability and HUFA agility test of soccer players Variables Means SD Variables Means SD Peak Power (W) 738.9 101.6 Single-Sprint time(s) Relative Peak Power(W.kgBW-1) 11.0 1.1 0-10m 1.7 0.07 Mean Power (W) 557.9 66.5 0-20m 3.06 0.12 Relative Mean Power (W.kgBW-1) 8.3 0.6 0-30m 4.21 0.12 SJ (cm) 46.3 5.2 Agility CMJ (cm) 45.5 6.2 HUFA (s) 10.46 0.37 Results of Pearson Product Moment correlation analysis indicated significant correlation between HUFA and peak ( $r=0.420$ ;  $p<0.01$ ), mean ( $r=0.358$ ;  $p<0.05$ ) powers and SJ ( $r=-0.353$ ;  $p<0.05$ ). Similarly 10 meter sprint times was significantly correlated with 20 meter sprint times ( $r=0.619$ ;  $p<0.01$ ), 30 meter sprint times ( $r=0.737$ ;  $p<0.01$ ) and relative peak ( $r=-0.351$ ;  $p<0.05$ ) powers. In addition, 20 meter sprint times was found to be significantly correlated with 30 meter sprint times ( $r=0.793$ ;  $p<0.01$ ) while peak power was found to be correlated with relative peak ( $r=0.564$ ;  $p<0.01$ ), mean ( $r=0.867$ ;  $p<0.01$ ) and relative mean ( $r=0.334$ ;  $p<0.05$ ) powers. Similarly mean power was significantly correlated with relative mean ( $r=0.436$ ;  $p<0.01$ ) power, SJ ( $r=-0.354$ ;  $p<0.05$ ) and CMJ ( $r=-0.374$ ;  $p<0.05$ ). Also SJ was found to be correlated with CMJ ( $r=0.774$ ;  $p<0.01$ ).

**DISCUSSION & CONCLUSION** Although aerobic metabolism dominates the energy delivery during a soccer game, the most decisive actions are covered by means of anaerobic metabolism. To perform short sprints, jumps, tackles and duel play anaerobic energy release is determinant with regard to who is sprinting fastest or jumping highest. This is often crucial for the match outcome. In most of studies in the literature anaerobic power and capacity are highly correlated with sprint ability, SJ, CMJ, cross-sectional area of thigh, isokinetic knee extension and flexion strength and muscle size (Stolen, et al., 200). As a conclusion, the findings of the present study indicated significant correlation among HUFA and anaerobic power-capacity and single-sprint performance in soccer players.

**KEY WORDS** Anaerobic Performance, Sprint Ability, HUFA Agility Test, Soccer Players

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## Factors influencing the performance in the YO-YO intermittent endurance test – level 2 in youth football players

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**OBJECTIVE** The Yo-Yo Intermittent Endurance Test – Level 2 (YYIEL2) evaluates the ability to perform intense exercise repeatedly. However, despite its common use in football training at different competitive levels, little information exists regarding the responses of youth football players to the YYIEL2 and the physical factors associated with performance in this test. The purpose of this study was to examine whether the ability to accelerate, decelerate and turn may contribute to performance during the YYIEL2 in youth football players.

**METHODS** A sample of 239 youth male football players from three age groups (U15: n=102; U17: n=59; U19: n=74) was evaluated in sprint performance (5m and 30m) and agility (T-test shuttle run) using photoelectric cells. The YYIEL2 was performed as a measure of intermittent exercise performance. Self-reported stage of pubic hair indicated

maturity status. Analysis of variance and Bonferroni's post hoc test determined differences by age group. Multiple regression models weighted for maturational status estimated whether the sprint and agility performances were associated with the distance covered during the YYIEL2. Statistical significance was set at 0.05.

**RESULTS** As expected, the older the players the higher was the performance in all functional tests conducted. However, significant differences in performance were only found between the U15 and both the other two groups in all the tests considered ( $p < 0.001$ ). The YYIEL2 was significantly correlated with 5m sprint, 30m sprint and agility tests results (respectively:  $r = 0.36$ ;  $r = 0.50$ ;  $r = 0.56$ ;  $p < 0.001$ ), when controlling the performance by maturity status. The explained variance on the distance covered in the YYIEL2 was estimated in 31% ( $r^2 = 0.31$ ;  $p < 0.001$ ), although excluding the variables 5 and 30m sprint. The shuttle run test was the single factor that could predict the YYIEL2 performance ( $b = 0.56$ ;  $p < 0.001$ ).

**DISCUSSION & CONCLUSION** We found moderate correlations between the distance covered during the YYIEL2 and the performance in sprint and agility tests. Previous studies found similar correlations between  $VO_{2max}$  in a treadmill protocol and the YYIEL2, pointing out that the performance in the YYIEL2 seems to be a weak indicator of maximal aerobic power in football players. Thus, despite the usefulness of the YYIEL2 as an aerobic fitness-related field test to be used in football, other factors than  $VO_{2max}$ , such as peripheral limitations and the ability to accelerate, decelerate and turn, may influence the performance during the test.

**KEY WORDS** Soccer, Endurance, Fitness, Training

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## Jump analysis in the futsala top players

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**OBJECTIVE** Until now, jump analysis has mainly been used to indirectly measure the explosive strength of the knee extensors and to obtain valuable information about the strength training process in both individual and team sports (Noyes et al., 2005). For most open skill sports, asymmetry is observed in the neuromuscular behaviour of the athlete and in the distinct uses of the lower limbs in order to achieve the specific movements required for that sport (Sannicandro, 2008). This study is established to individualize differences in the phase of overstretching (eccentric phase) of the jump among two lower extremity in futsala top player.

**METHODS** 20 futsala top players ( $175.7 \pm 3.2$ cm,  $72.6 \pm 4.7$  kg,  $28.9 \pm 2.2$  yrs) have been valued with a Counter Movement Jump (CMJ) to measure time of the eccentric phase and produced peak eccentric strength. Athletes that had reported a lower-limb injury during the previous 18 months of competitive activity were excluded from the study. To evaluate the load that the single limbs are placed under, a CMJ was analyzed by means of two unilateral strength platforms (Twin Plates, Glubus Italia, 1000 Hz). The individual platforms gave separate readings for the different limb. Prior to the evaluation, every soccer player declared which was his dominant kicking leg (non-jumping leg) and which was his dominant leg for performing a single-leg-jump (jumping leg) as has already been observed in literature (van der Harst et al., 2007; Myer et al., 2006). Statistical analysis was performed using the Wilcoxon test and its statistical significance was set at  $p < 0.05$ .

**RESULTS** The results are summaries in table 1. Parameters jumping leg non-jumping leg CMJ (cm)  $32,6 \pm 2,5$   $32,6 \pm 2,5$  Duration of overstretching (sec)  $0,13 \pm 0,01^*$   $0,15 \pm 0,02$  Peak Eccentric Force (N)  $-6203,6 \pm 1784,2^*$   $-5323,9 \pm 2332,9$

**DISCUSSION & CONCLUSION** Comparison of the jumping and non-jumping leg reveals differences in the neuromuscular behaviours of the limbs during the eccentric phase of the CMJ. The futsala player shows a functional asymmetry of the lower extremity as also individualized in other open skill sports: this could constitute a potential increased risk of muscle injury for 5-a-side football players. They are had to individualize strategies able to reduce such functional asymmetry for the prevention of the injuries. References Myer et al., J Strength & Cond Res, 2:345-349. 2006 Noyes et al., Am J Sports Med, 33: 197-207. 2005 Sannicandro, Br J Sports Med, 42 (6): 541. 2008 van der Harst et al., Clin Biomech, 22 : 674-680. 2007

**KEY WORDS** prevention of injuries - functional asymmetry - jump

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## The use of full squat power test as predictor of sprint running ability in soccer players

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**OBJECTIVE** To the best of our knowledge, we have not found any study prior to ours that studied the relationships between muscular power using light loads in the Full Squat (FS) exercise and sprint ability. Therefore, the aim of this study was examine the associations between power out with light loads in the FS and sprints in under-21 soccer players.

**METHODS** Twelve soccer players under-21 were asked to perform FS. All performed trials of FS with 20, 30, 40, 50, and 60kg in a Smith Machine. Each subject executed three reps of each load in order to determine maximum concentric Average Power (AP). Bar displacement, average velocity (m.s-1), and average and Peak Power (PP) (w) were recorded by attaching a rotary encoder to the end of the bar. Sprint testing was performed with photocell gates, placed at 0, 10, 20, and 30m. Only the best sprint was considered for 10(T10), 20(T20), 30(T30), 10-20(T10-20) and 20-30m (T20-30). Correlations were determined using Pearsons r. Statistical significance was accepted at  $p < 0.05$  for analysis.

**RESULTS** Significant correlations ( $r = -0.62/-0.81$ ;  $p < 0.05/p < 0.01$ ) were observed between AP (30, 40, 50, and 60kg) and T10, T20, T30, T20-30. T20, and T30, also correlated significantly with PP ( $r = -0.63/-0.65$ ;  $p < 0.05$ ).

**DISCUSSION & CONCLUSION** As predictor, AP and PP produced during the FS must be maintained with high values to explain short sprint performance in soccer players. These findings suggest that resistance training with light loads can be an alternative for heavy load training programs in soccer players under-21.

**KEYWORDS** Full squat, sprint, soccer

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## Relationship between weighted countermovement jumps and sprint performance in soccer players under-21

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**OBJECTIVE** The countermovement jump (CMJ) is related with sprint performance in soccer players. Despite the increasing research, no study examined the relationship between power in weighted CMJ and sprint in soccer players. The aim of this research was to verify the relationships between CMJ power out put with light weights and short sprints in soccer players.

**METHODS** Twelve soccer players under-21 were asked to perform CMJL. All performed two reps of CMJL with 20, 30, and 40kg in a Smith Machine. The highest peak concentric velocity repetition was taken for analysis. Bar displacement, peak velocity (m.s-1), and Average (Ap) and Peak power (Pp) (W) were recorded by attaching a rotary encoder to the end of the bar. Sprint testing was performed with photocell gates, placed at 0, 10, 20, and 30m. The best sprint was considered for 10(T10), 20(T20), 30(T30), 10-20(T10-20) and 20-30m (T20-30). Correlations were determined using Pearsons r. Statistical significance was accepted at  $p < 0.05$  for all analysis.

**RESULTS** Significant correlations ( $r = -0.65/-0.82$ ;  $p < 0.05/p < 0.01$ ) were observed between Ap in CMJ with 20, 30, and 40kg and T30, and T20-30. In addition, we also observed significant correlations ( $r = -0.64/-0.79$ ;  $p < 0.05/p < 0.01$ ) between Pp and T10-20, T30, and T20-30.

**DISCUSSION & CONCLUSION** This research indicated that Ap and Pp produced during weighted CMJ can be an important parameters to explain short sprint performance in soccer players. These findings suggest that CMJ training with light loads can be added to sprint training programs in soccer players under-21.

**KEYWORDS** Countermovement, peak power, sprint

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## Determination of the anaerobic power and capacity after long high intensity loading in professional soccer players

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**OBJECTIVE** Analyses of energy systems have very important role of to determination sport performance, planning and processing training process. Obtained results give us information, answers organism about alactate and lactate anaerobic capacity the soccer player during the anaerobic training season, up to measurement blood lactate obtained information how to load soccer players, across to detection fatigue index date how much will be do recovery time after two long high intensity loading. The purpose of this study its the determine anaerobic power capacity and fatigue index after three long high intensity loading in professional soccer players. In this way we determine the anaerobic power at professional soccer players and the index of fatigue between three high intensive loadings, with purpose to

get informations which will be used in designing trainings to enlarge the anaerobic power at soccer players.

**METHODS** Anaerobic power and capacity fatigue index was determined with modified Wingate test. (3x30sec.). Blood lactate was taken with portable lactate analyser after 1 test 1 sample, after 2 test 2 sample, after 3 test 3 sample and 4 sample 5 minute after loading.

**RESULTS** Obtained results soccer players was product highest values (peak power/kg, lactate mmol/L) after first and second test. In the 3 test soccer players was manifested more down values results. This situation we explain like the fact the soccer players its not been enough conditioning in the phase we are done measurement. During the prepare measurement protocol we detecting 4 th test soccer players its not been finished and they cannot more energy the 4 th maximal loading.

**DISCUSSION & CONCLUSION** We found there statistical values of fatigue index W1YI 40.06%±7.29 ; W2 YI 51.07%±6.85 ; W3 Yi 54.11%±13.78. With which we conclude that the index of fatigue increases after every interval, in case to develop a stimuli (maximum power/kg) we want, the periods of relaxation in the first two intervals should be increased gradually. There were statistical significant relationship between Peak power/kg and Minimal power/kg during 3 measurement ( $p < 0.001$ ). The differences in manifesting maximum and minimum power in three tests remained considerable at same proportion. There was significant relationships between blood lactate 2 values and fatigue index W2 YI 51.07%±6.85 ( $p < 0.05$ ). With increasing of the level of lactates also increases the index of fatigue. There were significant differences between lactate values ( $p < 0.001$ ). Which gives us the information of varying of the development in inserting (including) of anaerobic lactating energetic system during high intensive loading.

**KEY WORDS** Soccer, anaerobic power and capacity, fatigue index

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## Following the training process with heart rate and blood lactate monitoring of professional soccer players

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**OBJECTIVE** High intensity interval intermittent training is very important for increasing the functional ability of soccer players. There are a lot of methods and parameters that could help to monitor and evaluate the effects of this kind of training. The aim of this study is to evaluate the effects of high intensity interval intermittent training using continuous monitoring the heart rates and blood lactates on the field.

**METHODS** 30 male soccer players at the age of 17 to 35, all from the professional soccer football team "Rabotnicki – Kometal" – Skopje, were examined during the researching period. The researching process was realized in 3 periods: Pre-preparation (first research), Pre-competition (second research), Post-competition (third research). All periods mentioned were tested in laboratory and field conditions. Testing was repeated 3 times by using the high insensitive interval intermittent training that included 6 series multiplied by 4 min with a 2 min. rest between intervals. Also, during the breaks blood tests were taken to view the levels of lactates 8 times (after every interval), and 12 min. slow (easy) running – jogging. During the all 3 period of measurement soccer players was monitored with heart rate monitor polar S610i.

**RESULTS** In soccer players with bigger  $VO_{2max}$  before starting the 1-th interval less levels of blood lactate ( $p > 0.05$ ) were found. In soccer players with more muscle mass higher levels of blood lactate ( $p > 0.05$ ) were found. In soccer players with high level of body fat percentage, higher levels of blood lactate ( $p > 0.05$ ) after the 5-th and 6-th interval were found. During the recovery period in soccer players with high levels of  $VO_{2max}$  higher values of blood lactate were found because this athletes have high lactate tolerance. We did not find the significant differences in heart rate between the intervals, ( $p > 0.05$ ).

**DISCUSSION & CONCLUSION** We found that the rest time after 4-th and especially 5-th series it's not enough for recovery soccer players. Recovery running (12 min. jogging) after specific high intensity interval intermittent soccer drills its not enough period for recovery soccer players.

**KEY WORDS** Soccer players, lactate, heart rate, interval intermittent, recovery.

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## The effects of detraining on lower force and maximum aerobic power in pre-pubescent football athletes

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**OBJECTIVE** Detraining results in the loss of cardiovascular and metabolic characteristics and consequently results in the reduction of  $VO_{2max}$  and muscular strength (Coyle, 1994, Evangelista & Brum, 1999). For most researchers the  $VO_{2max}$  is an indicator of greater fidelity in the characterization of aerobic power of an individual, as well as their level of fitness (1,2,3,4,5,6). Because detraining in young athletes has received little attention, is important to discuss this area. In adults, training-induced increases in muscle strength and  $VO_{2max}$  appear to decline during detraining about and in the same rate as they increase during training. To date, only one study (Blimkie et al., 1989) looked at the effects of 8 weeks of detraining in prepubertal boys following 20 weeks of resistance training. The training-induced strength gains regressed towards the growth-adjusted control level during the detraining period, suggesting that alike with adults, training adaptations are reversible (Blimkie et al., 1989). The aim of this study was to know the effect of detraining in a period of 34 days on the Maximum Aerobic Power (MAP) and Lower Force (LF), in pre-pubescent children football players.

**METHODS** Eight pre-pubescent male football players (age  $12.75 \pm 0.71$  years; weight  $41.46 \pm 6.66$  kg; height  $1.51 \pm 0.06$  cm; BMI  $19.30 \pm 3.59$ ) were assessed before and after 5 weeks of a detraining period. A Modified Balke maximal protocol using ergo-spirometry procedures (Cosmed® K4b2) was selected to determine  $VO_{2max}$  and the Ventilatory Anaerobic Threshold (VAT) as estimates for the aerobic capacity. To access the LF a Countermovement Jump (CMJ) was made in the Ergojump®. Data comparisons were set to determine the relationships between the parameters resulting from testing.

**RESULTS** The MAP ( $VO_{2max}/kg$ ) show a significant difference from the pre vs post detraining period ( $69.27 \pm 5.41$  ml.kg.min<sup>-1</sup> vs  $63.22 \pm 4.95$  ml.kg.min<sup>-1</sup>,  $p=0.002$ ) however the LF doesn't report significant changes.

**DISCUSSION & CONCLUSION** The results suggest that 5 weeks of detraining decrease the MAP ( $VO_{2max}/kg$ ) of pre-pubescent football players although not significant changes were report on the LS parameter.

**Keywords** Detraining; prepubescent children; football; maximum aerobic power, lower strength

## Relationship between kicking ball velocity and explosive strength in physical students of both genders

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**OBJECTIVE** Soccer kicking, due to its relevance in the soccer game, continually raises the curiosity of researchers and can be seen from different perspectives. The purpose of this study was to evaluate explosive strength of lower limbs and its relationship with ball velocity in kicking performance in male and female sport students

**METHODS** 32 (16 men and women) students of Sport and Physical Education participated in the study. A radar gun (Sports Radar 3300, Sports Electronics Inc., with  $\pm 0.03$  m/s accuracy within a field of 10 degrees from the gun) was used to assess ball speed during soccer kicking performance. The height of a countermovement jump with arm (CMAJ) and without arm (CMJ) was measured in order to calculate the explosive strength of lower limbs. The vertical height was measured using a trigonometric carpet (Ergo jump Digitime 1000, Digest Finland).

**RESULTS** In all tests the men always showed better results than the women (ball velocity: 26.6 vs. 18 m/s; CMJ: 0.36m vs. 0.27m; CMAJ: 0.42m vs. 0.29m). However, no significant correlation was found between ball velocity and explosive strength for neither gender ( $r < .30$ ).

**DISCUSSION & CONCLUSION** This study indicates that explosive strength of the lower limb, measured by countermovement jumps, is not of major importance for the ball kicking performance. This shows that there may be other factors, possibly in the coordinative control (technique of kicking), acting in complementarily, in a similar kicking to the tested with positive or negative influence at the final outcome. Furthermore, although there are studies that relate the CMJ with the force produced by the lower limbs, may be necessary in this case, the use of more specific tests.

**KEY WORDS** Soccer, explosive strength, ball speed, kicking

## Effect of physical activity in young gymnasts

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Body composition is influenced by many factors. Especially during the adolescence period, an important role is played by the practice of physical activity, with large variations due to the type, intensity and frequency of the activity. There, the idea aroused to check the influence of a specific preparation program for the gymnasts drafted by the Federal Technical Board on body composition, in a population of young athletes. The programs consisted of 6 hours in 4 training sessions in the first group and 3 hours in 3 training sessions in the second group, for 8 months. The objective was to evaluate the effect of these programs on anthropometric parameters. All the athletes, after the anamnesis, have been subjected to medical examination, and measurement of anthropometric and functional parameters. The verification of body composition has been carried out with bioelectrical impedance analysis (BIA). Our population consisted of 93 athletes (21 M, 72 F),  $8.44 \pm 2.68$  years old. The results of the study yielded statistically significant correlation between weekly training hours and body weight ( $r=0.359$ ;  $P=0.000$ ), body surface area ( $r=0.436$ ;  $P=0.000$ ) and lean body mass ( $r=0.320$ ;  $P=0.002$ ). After the creation of multiple linear regression models to highlight the effect, training hours ( $\beta=0.204$ ;  $P=0.000$ ) and years of sports practice ( $\beta=0.158$ ;  $P=0.000$ ) remained as principal predictors of lean mass. The results of the study confirm that estimation of fat tissue with BIA and detection of the studied parameters, are highly related in our population ( $r=0.846$ ;  $P=0.000$ ). The percentage of lean mass increases significantly in direct proportion to the intensity and frequency of physical activity carried out. Based on our data, we aim to provide important information regarding the influence of such an intervention on these measures in young gymnasts and to allow improving physical activity in children.

**Keywords** Physical activity, bioelectrical impedance analysis

## The effect of plyometric training associated with the practise of handball on the evolution of explosive force of young male handball players

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**OBJECTIVE** The main of our research is to compare the effects induced by a program of plyometric training associated with the practice of handball on the evolution of explosive force of young male handball players.

**METHODS** Twenty (20) players (age:  $17 \pm 0.56$  years old; height:  $179.75 \pm 7.91$  cm; weight:  $74.8 \pm 13.15$  kg; BMI:  $23.08 \pm 3.34$  kg/m<sup>2</sup>) participated voluntarily to this study. They were spread into two groups: Experimental group G.E. (n=10) and group of control G.C. (n=10). The GE followed a program of plyometric training inspired from that elaborated by Robert W. Spurrs and al in 2002, integrated with the practise of handball while the G.C followed another training system (handball). All the players have been tested and rested before and after six-week training. The test carried out are squat jump test, free-arm counter movement jump, five jump test standing long jump and the shuttle test 10\*5 m.

**RESULTS** The results obtained have shown at the high jumping level in squat jump the values achieved allow to distinguish significant ameliorations at the experimental group level with  $p < 0.001$ . As for the counter movement jump, the two group have achieved significant ameliorations with  $p < 0.001$  for the G.E. and  $p < 0.005$  for the G.C. Concerning muscular elasticity and the distance covered in five jump test, the ameliorations are not significant. We also noticed a significant amelioration for both standing jump and shuttle test 10\*5 m, respectively with  $p < 0.001$  and  $p < 0.032$ .

**DISCUSSION & CONCLUSION** This research showed the effect of plyometric training associated with the practise of handball on the evolution of velocity and explosive force of young handball players.

**KEY WORDS** Plyometric training, explosive force, young male handball players, velocity, explosive force



## **A comparative survey of the offensive efficiency of the high-level handball players of the front and the rear lines**

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**OBJECTIVE** Team Handball is an Olympic sport now played professionally in Europe. However, despite increasing professionalization, there is a paucity of research data concerning performance. Here, the analysis of performance is correlated with a certain number of factors. Therefore, the aim of this study was to investigate and identify patterns of efficiency in the offensive actions composed by the front and rear lines in high-level Team Handball players.

**METHODS** 74 professional male Team Handball players participated in this study (age:  $28.24 \pm 3.72$  years; height:  $190.03 \pm 9.6$  m; weight:  $91.03 \pm 12.90$  kg; lean body mass:  $25.03 \pm 2.80$  kg/m<sup>2</sup>). The following parameters were measured: the circulation of the ball; shooting (a. successfully, b. shooting defended by the goalkeeper, c. missing shooting); the length of the attack; and the shooting velocity

**RESULTS** The players of the central axis were more offensive effective than the players of the two side axis. Further, the shooting velocity determined significantly ( $p < 0.001$ ) the success of the attacks. The duration of the attacks concluded with goal was more important than the duration of the attacks defended by the goalkeeper and with missing shootings ( $p < 0.001$ ).

**DISCUSSION & CONCLUSION** The rate of goal success of the players of the central axis was significantly higher than the success goal rate of the players of the front and rear lines.

**KEY WORDS** Team Handball, shootings, "front" line, "back" line, length of the attacks, shooting velocity

## **Effect of plyometric training on vertical jump performance and neuromuscular adaptation in volleyball players**

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**OBJECTIVE** Successful sporting performance at elite competition levels often depends heavily on explosive leg power of the athletes involved. Volleyball players rely heavily upon anaerobic energy systems to supply energy demands. Successful participation in volleyball requires athletes be able to propel themselves into the air during both offensive and defensive maneuvers. Although, in relation to enhancing VJ performance, plyometric training has been helpful, the effects of such training on neuromuscular responses have yet received less attention. Because there is no specific research on the efficacy of plyometric training on neuromuscular responses, the purpose of this study was to examine the effects of plyometric training on vertical jump performance and neuromuscular adaptation in volleyball players.

**METHODS** A semi experimental research was conducted. Statistical methods were t tests and two way ANOVA. Thirty male volleyball players (Age:  $17.53 \pm 0.74$  yrs; Height:  $177.7 \pm 3.1$  cm; Weight:  $61.31 \pm 5.32$  kg), who had a minimum of two-years volleyball training volunteered to participate in a 12-week plyometric training program. The subjects were divided into plyometric training (PT) ( $n=15$ ) and control (C) ( $n=15$ ) groups, based on vertical jump heights.

**RESULTS** The results showed that there were no pre-test significant differences between the two groups. Two way ANOVA showed significant differences between pre- and post-test in the PT group in M wave parameters: latency (ms), nerve conduction velocity (m/s) and vertical jump height, but there were no significant differences in IEMG (mV/ms) and amplitude (mv), also there were no significant differences between pre- and post-test in the control group in IEMG, latency, amplitude and nerve conduction velocity. But after the training period, more significant differences in latency, NCV and VJ height were observed in the PT group than in the C group, there were also no significant differences in amplitude and IEMG ( $P=0.789, 2.57\%$ ) between the two observed groups ( $P > 0.05$ ).

**DISCUSSION & CONCLUSION** It is possible to conclude from this study that coaches and trainers consider PT as a strategy for increasing volleyball players' explosive performance. This may have taken place in neuromuscular responses including: optimizing motor units (MU) pattern (intra-muscular activation), optimizing MUs recruitment, augmentation in nerve conduction velocity (NCV), decrement in reflex excitability of the motor pool.

**KEY WORDS** Plyometric training, EMG, M-wave amplitude, vertical jump, nerve conduction velocity

## Asymmetry of force fluctuation during low-intensity isometric knee extension

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**OBJECTIVE** Although there are few reports on the asymmetry of force fluctuation (FF) in the muscles of the upper limbs, the asymmetry of FF in the leg muscles during <30% MVC remains unclear. The purpose of this study was to investigate the asymmetry of FF in the leg muscles during isometric knee extension at 10% MVC.

**METHODS** 20 healthy males (21±2 years) performed unilateral isometric knee extension that was measured by a strain gauge force transducer. After obtaining the maximal voluntary contraction (MVC), the subjects performed force matching tasks; sustained isometric knee extension for 15s at levels corresponding to 10%, 20%, and 30% MVC with the visual feedback. During the force matching tasks, the mechanomyogram (MMG) signal was detected by an accelerometer arrangement placed on the vastus lateralis, midway between the greater trochanter and the lateral condyle of the femur.

**RESULTS** (1) a greater FF and MMG-amplitude were found in the 30% MVC task than in the 10% or 20% MVC tasks; (2) a lower mean power frequency (MPF) of MMG was found in the 10% MVC task than in the 20% or 30% MVC tasks; (3) a greater FF and MMG-amplitude were found in the stronger limb in MVC than in the weaker limb in MVC at 30% MVC task; (4) no differences were found in FF and MMG-amplitude between the stronger and weaker limbs at 10% and 20% MVC tasks; (5) no difference was found in MPF-MMG between the stronger and weaker limbs at all tasks; and (6) significant positive correlations were found between the target force values and the FF at each contraction intensity.

**DISCUSSION & CONCLUSION** These results suggest that (1) FF asymmetry at intensities of MVC below 20% is not due to differences between the contraction intensities and discharge rate properties; (2) FF asymmetry at intensities of 30% MVC is found by the difference of discharge rate properties; and (3) FF increases with absolute load (i.e. target force value) by increased discharge rate variability, in same relative loads (i.e. % MVC).

**KEY WORDS** Force fluctuation, mechanomyogram (MMG), asymmetry, isometric contraction

## Path-flow analysis model for anthropometric, hydrodynamic and biomechanical variables in age-group swimmers

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**OBJECTIVE** The aim of this research was to develop a path-flow analysis model for age-group swimmer's speed based on anthropometric, hydrodynamic and biomechanical determinants. The theoretical model was developed according to main review papers about these determinants (e.g. Lavoie and Montpetit, 1986).

**METHODS** Thirty eight male swimmers (12.97±1.05 years-old) with several competitive levels were evaluated. It was assessed: (i) anthropometrical variables such as body mass (SECA, 884, Hamburg, Germany), height (SECA, 242, Hamburg, Germany), fat mass (Tanita, BC-545, Middlesex, UK), body surface area (Haycock et al., 1978); (ii) hydrodynamic variables including vertical buoyancy (Costa et al., 2009), prone gliding after wall push-off (Costa et al., 2009) and; (iii) the biomechanical variables stroke length, stroke frequency and velocity after a maximal 25-m swim with an underwater start being data recorded in the middle 15-m (Craig and Pendergast, 1979). Path-flow analysis was performed with the estimation of linear regression standardized coefficients between the exogenous and endogenous variables. When appropriate, according to the theoretical model, simple or multiple linear regression models were computed. The standardized regression coefficients ( $\hat{\alpha}$ ) were considered and significance of each  $\hat{\alpha}$  was assessed with the t-Student test ( $p < 0.05$ ). The effect size of the disturbance term for a given endogenous variable, which reflects unmeasured variables, was 1-R<sup>2</sup>. To verify the quality of the model, root mean square residuals (RMSR) was computed.

**RESULTS** Confirmatory path-flow model can be considered as being close to the RMSR milestone, but even so not suitable of the theory (RMSR = 0.11).

**DISCUSSION & CONCLUSION** The confirmatory model excluded the vertical buoyancy and the relationship between height and fat mass.

**KEY WORDS** Swimming, children, performance, relationships

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## Longitudinal assessment of elite swimmers performance leading to 2008 Beijing Olympic Games

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**OBJECTIVE** The aim of this research was to track and analyze the stability of 400-m freestyle performance throughout elite swimmers preparation to the 2008 Beijing Olympic Games.

**METHODS** One hundred and six male swimmers were analyzed for five consecutive seasons (2003 to 2008). All swimmers were in the top 150 of 400-m Freestyle 07-08 FINA World Ranking. Swimming performance was collected using best personal time in 400-m Freestyle event, on official competitions in each season, on a short course pool. An exploratory data analysis was performed (Shapiro-Wilk). Longitudinal assessment was made by: (i) mean stability; (ii) normative stability. For mean stability quartiles, means plus standard deviations were computed for each season. Data variation was analyzed with ANOVA repeated measures followed by a post-hoc test (Bonferroni). Normative stability was analyzed with self-correlation (Pearson) between the performances throughout the five seasons. Cohen's Kappa (K) was computed in Longitudinal Data Analysis software (v. 3.2, Dallas, USA) with a 95% confidence interval.

**RESULTS** There was a trend for a performance improvement throughout the swimmer's preparation. Significant variations in the mean swimming performance were verified [ $F(1,11) = 171305.9$ ;  $p < 0.01$ ]. Post-hoc test revealed significant variations between all swimming seasons analyzed ( $p < 0.01$ ) except for the pair wise comparison between third and fourth seasons. Self-correlation values ranged between moderate and high throughout the swimmer's preparation. Stability becomes high in the fourth season ( $r = 0.723$ ). The K value, was low ( $K = 0.331 \pm 0.043$ ).

**DISCUSSION & CONCLUSION** The prediction of final swimmer's performance, based on initial season's performance is moderate. The change from third to fourth season can be a milestone were the ability to predict the swimmer's final performance level increases strongly.

**KEYWORDS** Swimming, Performance, Prediction

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## Hormonal and metabolic evaluation of 12 weeks swimming training in females

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**OBJECTIVE** The biological safety margin in people regularly practising physical exercises is greater, which in the context of health may be of particular importance. Therefore, the aim of our study was to evaluate the selected metabolic and hormonal indices in female participants of swimming training involving aerobic components.

**METHODS** Two groups were examined: the experimental group ( $n=19$ ,  $21.0 \pm 1.3$  years, BMI  $22 \pm 2$ ) and the control group ( $n=19$ ,  $20.0 \pm 1.1$  years, BMI  $22 \pm 2$ ). The swimming training covered a period of 12 weeks, 3 times per week for 60 minutes. Blood samples were collected before the training (cycle I), following 6 weeks (cycle II) and 12 weeks of training (cycle III), before and after each swimming session, in order to determine the level of lactic acid, glucose, free fatty acids, growth hormone, leptin, insulin, cortisol and testosterone. Body mass, fat and fat free mass were measured in resting conditions using bioelectrical impedance. Heart rate was recorded during an hour-long training. Endurance level was evaluated using the Cooper test in water.

**RESULTS** In each testing cycle physical exercise caused significant ( $P < 0.05$ ) increase in lactic acid and free fatty acid levels and decrease in glucose levels. Similar significant ( $P < 0.05$ ) training-induced increases in growth hormone level and decreases in insulin and leptin levels were observed. In the case of cortisol and testosterone the changes were insignificant. The mass of adipose tissue (25-26%) remained at a similar level throughout the experiment. In the

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successively conducted testing cycles, the distance covered during the Cooper test was longer with each cycle. Lower post-training lactic acid level was determined in cycle III as compared with cycles I and II. Similar results were observed in the case of free fatty acids, glucose and growth hormone levels. Decreases in leptin levels were significant in cycles II and III.

**DISCUSSION & CONCLUSION** Training induced decrease in the biological cost of 60 minutes' physical effort, and improvement in the endurance level in the tested female swimmers. Lack of adverse hormonal response, continuous anabolic-catabolic balance, stable energy profile and maintenance of similar body mass are indicative of beneficial health-promoting effects of the training.

**KEY WORDS** Swimming training, anabolic-catabolic balance, leptin

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## Qualitative versus quantitative analysis of the behavior patterns of the elite butterflyers

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**OBJECTIVE** The purpose of this study was to find patterns in the swimming technique of butterfly based on Behavioral Observation System of Technical and compare the data obtained from the kinematic analysis (quantitative).

**METHODS** In the analysis of temporal patterns (T-pattern) and a sequence of five cycles gestures executed at maximum speed at 25 meters, studied the behavior of three technical elite swimmers of Portuguese participants in the Olympics, with a record 259 and a full alphanumeric codes 120 configurations. The instrument based on a mixed system of categories and field formats, with technical features observed during the execution of hand cycles. The validity was assured by the index of intra-observer reliability (95%) and inter-observer accuracy (96%). To detect patterns exist, each swimmer, using the Theme 5.0 software, which allowed to identify the stable structures of technical performance within a critical interval of time ( $P < 0.05$ ) - t-patterns. To compare the data we performed a kinematic analysis. The calculation of kinematic variables was performed by software Ariel Performance Analysis System (APAS).

**RESULTS** The patterns were different, adjusting to the characteristics of technical implementation of the swimmers. Each swimmer may display settings with different levels of complexity of structure, depending on the implementation of changes within the hand cycle. By comparing the codes with the kinematical values found that complement and show the same information.

**DISCUSSION & CONCLUSION** The potential quality of this instrument is evident by the patterns obtained from a temporal sequence and that when faced with mathematical models describe the same information.

**KEY WORDS** Technical Analysis, Patterns; Butterfly; Chronology; Kinematics

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## Observation of the stability of a technical implementation of evidence in 200m butterfly

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**OBJECTIVE** The aim of this study was find patterns in the swimming butterfly technique at a distance of 200 meters using the system Behavioural Observation System of the Technical Butterfly, qualitative analysis allows the observation and study of the stability of the technical implementation.

**METHODS** Instrument for ad-hoc, with the structure of the instrument based on a mixed system Categories and Field Formats which we can record specific techniques observed during the gestural cycles. We performed the analysis of temporal patterns (T-pattern), a sequence of five gestural cycles of the butterfly style in each part of 50 meters. To study the sequence of codes and their interaction representative of the technician in two swimmers at the national level. Swimmers performed the tasks with speed competition, with the same control by the GBK PACER. To detect the



temporal patterns of each swimmer, using the Theme 5.0 software, which allows to identify the structures of the technical standard within a range of critical time ( $p < 0.05$ ) - T-patterns

**RESULTS** In the results the patterns found settings are different and different levels of complexity depending on the adjustments made by the swimmers in gestual cycles. Variations of codes in each time producing different settings, to determine the differences between cycles of the swimmer.

**DISCUSSION & CONCLUSION** Comparing patterns found distinct differences between swimmers, the records demonstrated a clear behavioral similarity when compared the result with the biomechanical model of the general butterfly technique. Technique is objective for the purpose it was created and is a valuable instrument for qualitative analysis.

**KEY WORDS** Technical Analysis, Stability, T-Patterns, Butterfly, Temporal

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## Training control in young female swimmers: a case study

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**OBJECTIVE** The need to improve competition times encourages coaches to use different methods to control the training process. However, not always, the available processes are easy to be applied in a large group of female competitive swimmers. Furthermore, the use of some tests in young swimmers is questionable. Hence, the aim of this study was to apply a simple protocol to assess the process of training in a group of female swimmers.

**METHODS** Eleven female swimmers participated in this study (11.45 (0.52) years old, 1.50 (0.08) m, and 39.81 (7.84) kg). All the swimmers belonged to the same swimming club. After 3 weeks of general training tasks, the swimmers were engaged in a 9 week training period in order to prepare the participation in the Regional Championship. During this period the swimmers performed 6 units of training per week (week 1: 19.0 km, week 2: 22.0 km, week 3: 22.0 km, week 4: 24.0 km, week 5: 26.0 km, week 6: 23.0 km, week 7: 25.0 km, week 8: 26.0 km, week 9: 21.6 km). Every Thursdays, after a 30 min warm up each swimmer performed two trials of a 50 m front crawl all out test, with a 15 min rest. Only the best performance was used to control the training process. A repeated-measures analysis of variance with Bonferroni adjustment was used to analyze the differences between the mean values of each week performance. The significance level was set at  $p < 0.05$ .

**RESULTS** 50 m performance did not change during the first three weeks of training ( $p > 0.05$ ). In the week four the performance significantly decreased (week 1: 39.09 (4.51) s, week 4: 39.86 (5.12) s;  $p < 0.05$ ). The present study also showed no significant differences in performance between week 1 and weeks: 5, 6, 7 and 8. Nevertheless, at the last week of preparation there was a performance enhancement (week 9: 38.72 (4.38) s,  $p < 0.05$ ).

**DISCUSSION & CONCLUSION** With a simple and easy test it was possible to monitor swimming training. We believe that these data could be used by coaches to control training in young competitive swimmers and simultaneously promote some adjustments during the preparation. Here, we were able to notice a performance improvement in the 50 m front crawl trial during the last week of training, before the competition, which corresponded to a decrease in the overall training volume. It seems that in short distances events the reduction of training volume could enhance young competitive swimmers performance.

**KEYWORDS** Performance, training volume, monitoring, short distance events.

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## Training evaluation in male age-group swimmers

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**OBJECTIVE** Monitoring the training process represents an important task during sports preparation. However, not always the applied protocols help to address the coaches' concerns, namely regarding its complexity and difficulty to be used in large samples. Therefore, the aim of this study was to apply a simple protocol to control the training process in a group of male age-group swimmers.

**METHODS** Thirteen age-group male swimmers were involved in this study (12.46 (0.52) years old, 1.53 (0.10) m, and

42.81 (5.93) kg). All the swimmers belonged to the same swimming club. After 3 weeks of general training tasks, the swimmers were engaged in a 9 week training period in order to prepare the participation in the Regional Championship. This period comprised the months of October, November and December and corresponded to the first training macro cycle. During this period the swimmers performed 54 units of training (6 units per week) (week 1: 3.17 km/unit, week 2: 3.67 km/unit, week 3: 3.67 km/unit, week 4: 4.0 km/unit, week 5: 4.33 km/unit, week 6: 3.83 km/unit, week 7: 4.17 km/unit, week 8: 4.33 km/unit, week 9: 3.6 km/unit). Every week, each swimmer performed two trials of a 50 m front crawl all out test, with 15 min of rest between them. Only the best performance was used to monitor the training process. A repeated-measures analysis of variance with Bonferroni adjustment was used to analyze the differences between the mean values of each week performance. The significance level was set at  $p < 0.05$ .

**RESULTS** 50 m performance did not change during the first eight weeks of training ( $p > 0.05$ ) (week 1: 33.58 (2.44) s). Nevertheless, at the last week of preparation there was a significant performance enhancement (week 9: 33.12 (1.89) s,  $p < 0.05$ ).

**DISCUSSION & CONCLUSION** In the last week of training it was possible to verify a performance increasing in the 50 m front crawl test. This week corresponded to a decrease in training volume attempting to achieve a better competitive performance. The 50 m test trials seemed to be a very simple test that can be used by swimmers' coaches to control and monitor the training process in swimming, especially in age-group swimmers.

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## The energetics of surface events in finswimming, analysis by the concept of critical velocity method

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**OBJECTIVE** This study aimed to investigate the energetics of surface events (SF) by the analysis of the concepts of critical velocity (CV) and anaerobic swimming capacity (ASC), in finswimming.

**METHODS** The subjects were 9 finswimmers (5 males and 4 females, 24±5 years) who were members of the Japanese national team. Subjects performed five different swimming distances (100m, 200m, 400m, 800m and 1500m SF) at maximal effort in a 50m long course swimming pool. On the basis of the previous study (Oshita et al. Int J Sports Med, 2009), CV was calculated using 400m and 800m swim times. Velocity (V) multiplied by swimming time (T) implies that swimming distance (D);  $D = V * T$ . The equation of regression line can be expressed as follows:  $D = a * T + b$ , thus  $V = a + b/T$ . Theoretically, if we could set the swimming velocity at a level where one can perform indefinitely,  $b/T$  will approach zero and V will approach a. Therefore, CV can be expressed as the slope of the regression line;  $CV = a$ . Further, ASC was employed as the linear coefficient (y-intercept) of each individual regression.

**RESULTS** The findings of this study were: (1) V of all distance SF (100m to 1500m) showed significant positive correlation with the CV ( $r = 0.73$  to  $0.94$ ); (2) V-100m, V-200m and V-400m revealed significant positive correlation with the ASC ( $r = 0.69$  to  $0.81$ ); (3) V-800m and V-1500m did not show significant correlation with the ASC ( $r = 0.59$  to  $0.64$ ); and (4) ASC was significantly correlated with the residual error, calculated from the regression analysis for the relationship between CV and the V-800 ( $r = 0.94$ ) and V-1500 ( $r = 0.95$ ).

**DISCUSSION & CONCLUSION** These results suggest that: (1) the anaerobic performance (expressed as ASC) contributes to SF performance below 400m; (2) the aerobic performance (expressed as CV) contributes to SF performance from 100m to 1500m; and (3) the performance of 800m or 1500m SF could be considerably explained by the aerobic performance; however, unexplained residual error could be explained by the anaerobic performance.

**KEY WORDS** Finswimming, surface event, critical velocity, anaerobic swimming capacity

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## Study of the drag coefficient during the first and second gliding positions of the breaststroke underwater stroke using computational fluid dynamics

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**OBJECTIVE** The underwater phases of swimming, after starts and turns, are an important component of the total event time in swimming, being essential to minimize the hydrodynamic drag during the gliding. Additionally, the underwater passive drag ( $D_p$ ) of swimmers in a streamlined position has been measured experimentally. These studies revealed the difficulties involved in conducting such experimental research. An alternative approach is to apply the numerical technique of computational fluid dynamics to determine a swimmer's passive drag. Computational fluid dynamics (CFD) analysis is a tool to examine the water flow around a submerged swimmer's body. The purpose of this study is to determine and compare the passive drag and the drag coefficient (CD) in the first and second gliding positions of the underwater breaststroke using the CFD.

**METHODS** A swimmer's model was created using AutoCAD. Gambit allows to built the fluid mesh and improve the swimmer's model. This model, then the turbulent model was used on the commercial code. The k- $\epsilon$  processed by Fluent and applied to the fluid flow on a tridimensional model of an adult male swimmer. Two gliding positions were studied: a ventral position with arms extended at the front and a ventral position with arms along side the trunk, corresponding to the first and second glide positions of the breaststroke underwater stroke. Five velocities ( $v=1.0, 1.39, 2.0, 2.5$  and  $3.0$  m/s) were used in the simulations. Non-parametric Mann-Whitney test was used to compare the differences between the variables. The significance level was  $\alpha=0.05$ .

**RESULTS**  $46.89$  N for the first glide position,  $66.97$   $90.85$  N for the second glide position. For both positions the  $D_p$  and  $128.18$  increase, while the CD decrease, with increasing velocity. For the second glide  $0.308$  are significantly higher ( $p=0.008$ ) than position the CD values ( $0.775$   $0.022$ ) for the first glide position ( $0.407$   $0.022$ ).

**DISCUSSION & CONCLUSION** The position with the arms extended at the front yielded a smaller CD, suggesting that swimmers' shall adopt this position. Additionally, we propose that it should be given more emphasis to the first glide position in the underwater breaststroke, after starts and turns, rather than the second glide. The use of CFD allows the assessment of fluids characteristics and the drag forces in swimming.

**KEY WORDS** Biomechanics, swimming, hydrodynamic position, underwater breaststroke, computational fluid dynamics, passive drag, drag coefficient

## Analysis of selected physiological and kinematic performance parameters during incremental test in elite young swimmers

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**OBJECTIVE** The purposes of this study were to investigate and evaluate the relationships between stroke kinematics (i.e stroke rate and stroke frequency) and physiological (i.e heart rate and blood lactate concentration) parameters during incremental exercise in young elite swimmers and moreover to examine the extent which changes in these parameters are associated with swimming performance as indicated by average velocity.

**METHODS** 15 male (age,  $15.93 \pm 1.7$  years; height,  $172.8 \pm 6.31$  cm; weight,  $65.86 \pm 6.11$  kg) and 18 female (age,  $15.62 \pm 1.2$  years; height,  $165.5 \pm 3.2$  cm; weight,  $57.43 \pm 3.09$  kg) swimmers participated in this study. Subjects performed an incremental  $7 \times 200$  m test in their specialized stroke. Stroke rate (SR), stroke frequency (SF), velocity (V), heart rate (HR), rating of perceived exertion (RPE) and blood lactate concentration (BLa) were measured for each 200 m. Pearson product moment correlation was used to determine the relationships between variables for all strokes and for both genders. Significance was accepted at the  $p < 0.01$  level.

**RESULTS** Statistically significant correlations were found between SR and V ( $p < 0.01$ ;  $r = 0.63$  to  $0.99$ ), SF and V ( $p < 0.01$ ;  $r = 0.64$  to  $0.99$ ), BLa and V (except for men's and women's freestyle) ( $p < 0.01$ ;  $r = 0.63$  to  $0.94$ ).

**DISCUSSION & CONCLUSION** According to results V increased by increasing SR and SF. Different combinations of SR and SF produced similar velocities with different fatigue levels as indicated by BLa levels, while the best combination for reaching a given V varied both between and within swimmers. The fastest times reached in the test were generally slower than expected. It is possible that the swimming speeds were not maximal in the final 200 m swim because of cumulative fatigue, which is a major limitation for assessing race pace. An additional test that produces velocities similar to those used in competitions would be more useful for the purpose of providing optimal kinematic information specific to racing speeds, which would facilitate performance improvement through regular monitoring in training.

**KEY WORDS** swimming, stroke rate, stroke frequency, lactate, incremental exercise test.

## Fatigue electromyographic analysis during the 200m front crawl

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**OBJECTIVE** Surface electromyography (EMG) is a non-invasive method for assessing athletes' neuromuscular function. EMG amplitude - mean or root mean square - and spectral EMG parameters - mean and median frequency of the power spectrum - are traditionally used to evaluate the motor unit activity pattern during exercise, as well as skeletal muscle fatigue. The purpose of this study was to examine the changes in the EMG spectral parameters during a 200m front crawl maximal effort.

**METHODS** It was conducted a case study with a male swimmer (2008 Olympic Games participant, 21 years old, 71kg, 180cm, 182cm of arm span and 8.8% of body fat mass). The EMG activity of the relevant muscles for the front crawl technique (flexor carpi radialis, biceps brachii, triceps brachii, pectoralis major, upper trapezius, rectus femoris, biceps femoris and tibialis anterior) was assessed during 200m front crawl test performed at maximum intensity. Bipolar active differential electrodes were positioned over the skin on the surface projection of the muscle after shaving and cleaning. The electrodes were fixed and isolated by plastic films and strapping tape, being used a complete swimsuit. The data was assessed by surface EMG, recorded by a water protected 8-channel system, with a sample frequency of 1000 Hz. All information was processed by the Acknowledge 3.9.1 software, being the data filtered with a pass-band (5-500 Hz). Afterwards, for its analysis, it was determined the mean frequency of stimulation of the muscular fibres during the time window corresponding to a stroke cycle for each 25m lap. The mean frequency was computed for every muscle in each stroke cycle analyzed (using the Fast Fourier transform spectral analysis algorithm). The relationship between mean frequency and the studied laps was assessed using linear regression analysis and Pearson correlation coefficient ( $p \leq 0.05$  was accepted).

**RESULTS** It was found high inverse correlation values between mean frequency and the laps for the flexor carpi radialis ( $r=-0.71$ ,  $p=0.049$ ), biceps brachii ( $r=-0.80$ ,  $p=0.018$ ), triceps brachii ( $r=-0.96$ ,  $p<0.001$ ), pectoralis major ( $r=-0.70$ ,  $p=0.05$ ), upper trapezius ( $r=-0.89$ ,  $p=0.003$ ), rectus femoris ( $r=-0.87$ ,  $p=0.005$ ), biceps femoris ( $r=-0.76$ ,  $p=0.031$ ) and tibialis anterior ( $r=-0.80$ ,  $p=0.017$ ) muscles.

**DISCUSSION & CONCLUSION** These facts evidence a significant involvement of the studied muscles in this specific swimming technique, as well as a progressive installation of internal fatigue during the 200m front crawl distance. These fatigue electromyographic analysis could be useful to assess the swimmer's individual neuromuscular limitations along swimming exercise.

**KEY WORDS** Fatigue, EMG, Swimming

## Relationship between intracyclic velocity variation and arm coordination in 200m front crawl

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**OBJECTIVE** Intracyclic velocity variation (IVV) is an up-to-date biomechanical parameter used to characterize swimming technique. From this point of view, front crawl is the most efficient technique since its actions allow more continuous propulsion: the arms move rhythmically in an anti-phase inter-limb relationship, reflecting an intrinsic coordination mode. Indeed, movement coordination emerge as a consequence of the constraints imposed on each action, reflecting a propensity towards self-organizing optimality in biological systems. The purpose of this study was to establish the relationship between the IVV and arm coordination (using the Index of Coordination parameter - IdC) throughout a 200m front crawl maximal effort.

**METHODS** Six male swimmers of national level (20.2±1.94 years old, 70.5±5.86 kg, 176.4±6.46 cm, 183.6±6.30 cm of arm span, and 10.1±2.34% of fat mass) performed a 200m front crawl test at maximal intensity. Tests were conducted in an indoor 25m swimming pool, being the swimmers monitored when passing through a specific pre-calibrated space six stationary video cameras (two surface and four underwater, Sony® DCR-HC42E). One complete arm stroke cycle, without breathing, was analysed in each 50m length, being assumed a six-beat kick synchronization. An anthropometric model of 21 points was adopted and digitized with APASystem (Ariel Dynamics, USA) at a frequency of 50 Hz, manually and frame by frame. Image coordinates were transformed to 3D object-space coordinates using the DLT algorithm. Afterwards, data was smoothed by a low pass digital filter of 6Hz. IVV was determined through the coefficient of variation of the velocity of the centre of mass in x, y and z axes. After the data normality was verified, a



one way repeated measures ANOVA was used to compare IVV and IdC along the test. Regression equations, as well as its coefficients of determination and Pearson correlation coefficients, were computed to assess the relationships between IVV (x, y, z) and IdC. The level of statistical significance was set at  $p < 0.05$ .

**DISCUSSION & CONCLUSION** The analysis of IVV throughout the 200m front crawl effort revealed a non-significant difference between laps in the three axes of motion and significant differences for the IdC between each 50m length. These results are in accordance with previous (unpublished) data from our group. The main finding of this study was non-correlation between IVV and IdC for the three axes, suggesting that the stability of the IVV was ensured by changes in the arm coordination. The high inter-variability of IdC suggests future studies with larger samples.

**KEY WORDS** Intracyclic velocity variation, arm coordination, swimming

## **Tethered swimming in crawl: Arm stroke propulsive force at different 5 swim rates**

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**OBJECTIVE** A swimmer's performance results from the interaction of propulsive and resistive forces, which can only increase by reducing the resistive forces, or increase the propulsive forces (Toussaint, 2006). Researchers have developed many methods for this type of evaluation, tethered swim (Dopsaj et al., 2003, Taylor et al., 2001) and Mad-System (Toussaint, 2006).

**METHODS** Six males swimmers of the portuguese national team (21.8±9yrs, 73.64±6.9 bm, 182.26±6.1bh) performed only the arm crawl swimming task, on an ergometer without breathing, with tied and supported legs, and with the head placed in a helmet containing a sensor of force, connected to a computer. The frequency increment was set at 5 cycle/min(C/M) from 35C/M to 55C/M. Four underwater cameras were used to kinematical analysis with APAS. Descriptive statistics were used, and Pearson correlation to identify the correlation between the increase of the propulsive force and swim rate, with a level of significance of  $p < 0.05$ .

**RESULTS** The swimmers reaches a high value of propulsive force in the entry of the arm due to join the insweep and upsweep action of the other arm. The 45 C\M is the rate that reach a higher propulsive force, while the insweep action on the 55 C\M rate is where the swimmers reach the maximum propulsive force. The correlation between the increase in strength and the swim rate was significant ( $r = 0.754$ ,  $p < 0.05$ ).

**DISCUSSION & CONCLUSION** The most effective swim rate is the 45C\M which the swimmer can develop greater propulsive force (128.01 N) whether or not the fastest swim rate analyzed, and the insweep action is the most propulsive on all stroke phases.

**KEY WORDS** Tethered Swim; Propulsive Force; Crawl; Swimming Biomechanics

## **Handgrip is associated with swimming performance in female elite swimmers but not in male**

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**OBJECTIVE** Several authors have been trying to isolate, from a wide range of variables, those which determine mostly the success in competition. The hand grip isometric strength, long used as a measure of total body strength was, recently, associated with swimming performance in young and elite master swimmers. In this context, the aim of this study was to associate the hand grip isometric strength with swimming performance in male and female elite swimmers.

**METHODS** 35 elite Portuguese swimmers from both genders were selected (19 males and 16 females,  $18.8 \pm 3.2$  years). For each subject the grip strength in both hands was measure using an adjustable mechanical hand dynamometer. The best performance in 100, 200 and 400 meters front crawl were used as dependent variables.

**RESULTS** Our results show, in females, a relationship between right grip strength and swimming performance in 100 meters front crawl ( $r = -0.562$ ,  $p = 0.029$ ). There was no relationship between swimming performance in longer distance competitive events (200 or 400 meters) or among males ( $p > 0.05$ ).

**DISCUSSION & CONCLUSION** Despite the general type of this strength assessment, grip strength seems to be a good and stable estimator of swimming performance in short distance events, namely in elite female swimmers.

**KEY WORDS** Swimming, handgrip, genders

## Comparison of body mass index between swimmers and non-trained individuals with down syndrome

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**OBJECTIVE** Overweight and obesity are predisposing factors for the development of several debilitating diseases. A standardized estimate of an individual's relative body fat assessed from his height and weight - the Body Mass Index (BMI) - has become a useful and simple measure to estimate overweight and obesity. Moreover, studies report that obesity is prevalent in individuals with Down Syndrome. The purpose of the present study was to compare the BMI between Down Syndrome competitive swimmers and non-trained Down Syndrome individuals.

**METHODS** Six swimmers (19.8 ± 4.5 years old, 2.5 ± 2.0 years of training background, 5.2 ± 1.2 training units per week - being each unit composed of 1.4 ± 0.2 h of water training and 0.9 ± 0.4 h of dry land training, namely flexibility and/or weight lifting), from the Down Syndrome Portuguese swimming team and 10 Down Syndrome non-trained individuals (19.6 ± 2.9 years old) were evaluated. The assessed anthropometric characteristics were height and weight, from which BMI was calculated [BMI = (weight (kg) / height (m)<sup>2</sup>]. A non-parametric Mann-Whitney test was used to compare the anthropometric differences between the swimmers and the non-trained individuals (a significance level of  $p \leq 0.05$  was accepted).

**RESULTS** Mean and SD values of weight, height and respective BMI were: (i) 58.4 ± 14.1 kg, 154.3 ± 12.1 cm and 24.3 ± 4.1 BMI for the swimmers' group and (ii) 74.3 ± 8.1 kg, 143.4 ± 9.5 cm and 36.8 ± 5.3 BMI for the non-trained group. As expected, differences between the two groups were observed in weight ( $p = 0.016$ ) and BMI ( $p < 0.001$ ).

**DISCUSSION & CONCLUSION** In fact, the higher BMI in non-trained group seems to indicate that a sedentary way of life contributes to obesity. Indeed, subjects with Down Syndrome that are physically active (involved in regular swimming practice) had a BMI in normal weight score for the general population, being, nonetheless, higher when compared with swimmers without disability. Therefore, regular competitive swimming training seems to be significant to achieve a fit weight among Down Syndrome population, being advised their increasing participation namely for health purposes.

**KEY WORDS** Down syndrome, adapted swimming, obesity, BMI

## Stability of patterns of behavior in the butterfly swimmers

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**OBJECTIVE** The purpose of this study was to find patterns in the swimming technique of butterfly, with an adaptation of the Behavioral Observation System Tech. This, as a instrument for ad-hoc qualitative analysis enables the study of the stability of the technical implementation, an applicant in optimization sport. When used in the training of swimmers, can turn, reduce the variability in behavioral tuning technique of swimming. Through the analysis of temporal patterns (T-pattern) and a sequence of five cycles run at maximum speed hand, studied the behavior of four technical elite swimmers in Portuguese, with a record 259 alphanumeric codes and a total 160 configurations. The structure of the original instrument based on a mixed system of categories and formats Field, which can record technical features observed during the execution of hand cycles. The validity was ensured through the index of intra-observer reliability (95%) and inter-observer accuracy (96%). To detect patterns exist, each swimmer, using the Theme 5.0 software, which allowed to identify the stable structures of technical performance within a critical interval of time ( $P < 0.05$ ) - t-patterns.

**METHODS** Through the analysis of temporal patterns (T-pattern) and a sequence of five cycles run at maximum speed hand, studied the behavior of four technical elite swimmers in Portuguese, with a record 259 alphanumeric codes and a total 160 configurations. The structure of the original instrument based on a mixed system of categories and formats Field, which can record technical features observed during the execution of hand cycles. The validity was ensured through the index of intra-observer reliability (95%) and inter-observer accuracy (96%). To detect patterns exist, each swimmer, using the Theme 5.0 software, which allowed to identify the stable structures of technical performance within a critical interval of time ( $P < 0.05$ ) - t-patterns.

**RESULTS** The patterns were different, adjusting to the characteristics of technical implementation of the swimmers. Found that the swimmer can make settings with different levels of complexity of structure, depending on the implementation of changes within the hand cycle. Variations of codes in each configuration obtained using the SOCTM,

determine the differences between swimmers.

**DISCUSSION & CONCLUSION** However, the records show a clear behavioral similarity compared the result with a general pattern of the butterfly technique. Conclusion: As we can see that the potential quality of this instrument is evident by the patterns obtained from a temporal sequence.

**KEY WORDS** Technical Analysis, Patterns, Butterfly, Chronology

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## Kinematical constrictions during breaststroke swimming with a portable gas analyzer snorkel

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**OBJECTIVE** To determine the kinematical constrictions in maximal breaststroke swimming bouts with the AquaTrainer® snorkel (Cosmed, Rome, Italy).

**METHODS** Seven national level breaststrokers performed two maximal bouts of 100-m swims (separated by 48 hours): (i) one bout connected to the AquaTrainer® snorkel (constricted swim); (ii) one bout without the snorkel (free swim). The swims were videotaped in sagittal plane with a pair of cameras providing a dual projection from both above and underwater. The study comprised kinematical analysis of stroke cycles using APAS and a VCR (f = 50 Hz). To create a single dual projection image, the independent digitalization from both cameras was reconstructed with the help of a calibration volume and a 0.01). The±2D-DLT algorithm. Digitalization reliability was high (ICC=0.97 following measures were assessed: (i) swimming performance (T100); (ii) stroke parameters (stroke cycle period, stroke rate, stroke length and mean swimming velocity); (iii) estimated swimming efficiency by the swimming index; (iv) speed fluctuation (dv) and the mathematical characterization of dv. Mean dv curves normalized to time were computed with MATLAB. The polynomial regression (7th power) between dv and normalized duration of the full stroke cycle was calculated. Wilcoxon tests were performed to compare significant differences in the dependent variables (performance, stroke mechanics and efficiency variables) according to the independent variable (free versus constricted swim) (P<0.05).

**RESULTS** T100 was significantly higher for constricted swimming than in free condition (6.26%; Z=-2.366; P=0.02). The remaining variables showed no significant differences between the two swimming conditions. In both exercise conditions, dv was characterized by a bi-modal profile. The determination coefficients for the dv mathematical model were significant (P<0.01) and 0.47.

**DISCUSSION & CONCLUSION** None of the stroke mechanics and efficiency variables evaluated presented significant differences between both swimming conditions. The AquaTrainer® constrictions might be related mainly to the start and turn phases. (Supported by FCT grant: POCI/DES/58362/2004)

**KEYWORDS** Kinematical constrictions, swimming performance, stroke parameters, AquaTrainer snorkel, breaststroke

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## Relation between energy expenditure and time spent in physical activity and fitness in middle age adults

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**OBJECTIVE** Physical fitness is often considered as a good measure of individual physical activity. The aim of the study was to assess the relations between energy expenditure and time spent in physical activity of different intensities and aerobic fitness indicators in adults.

**METHODS** In the sample consisted of employed urban living adults (31 men and 20 women aged 40±3.7 years). Relation between energy expenditure and time spent in physical activity (PA) and fitness were analyzed. Energy expenditure (EE)-total relative EE (TEErel) and relative EE during PA (AEErel), and the time spent sedentary and in low (1.5-3MET) moderate (3-6MET) and high (> 6MET) intensity PA was measured by combined system Sense Wear Armband™ (Body Media, Pittsburgh, PA) during seven consecutive days. Aerobic fitness indicators – maximal oxygen uptake (VO<sub>2</sub>maxrel), aerobic threshold (VO<sub>2</sub>AT) and anaerobic threshold (VO<sub>2</sub>AnT) were determined during direct treadmill spiroergometric testing using K4 Cosmed equipment.

**RESULTS** To reveal the relations between EE and aerobic fitness indicators Pearson's partial correlations controlled for gender were calculated. The results showed significant positive correlations between the EE indicators (total and EE

during activity) aerobic fitness indicators. The time spent in sedentary activities was significantly negatively correlated with  $\text{VO}_2\text{maxrel}$  and  $\text{VO}_2\text{AT}$ . The time spent in low intensity activities didn't show significant correlations with aerobic fitness indicators. Moderate activity was partially correlated with  $\text{VO}_2\text{maxrel}$  ( $r=0.36$ ) and  $\text{VO}_2\text{AT}$  ( $r=0.43$ ). Only time spent in vigorous activity was significantly correlated with  $\text{VO}_2\text{AnT}$ .

**DISCUSSION & CONCLUSION** Activities of at least moderate intensity were positively connected with aerobic fitness indicators. Only vigorous activity was related to anaerobic threshold.

**KEYWORDS** Energy expenditure, physical activity, physical fitness

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## Ventilatory responses to incremental exercise during menstrual cycle of active and inactive females

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**OBJECTIVE** The effects of menstrual cycle hormones on exercise performance have been studied previously. However, the results remain controversial. Particularly, the respiratory responses to progressive intensity exercise have shown inconsistent results. It is thought that the higher levels of circulating estrogen and progesterone are the stimuli for altered ventilatory responses during the luteal phase of the cycle. Our purpose is to compare the ventilatory equivalents in the early follicular and luteal phases of active and inactive females' during incremental exercise.

**METHODS** Twenty healthy active and inactive Females volunteered to participate in the study. Recruitment will be limited to young (19-25yrs) with no known history of cardiopulmonary, metabolic or musculoskeletal disease. Furthermore, The luteal phase was determined by the level of Progesterone, Prolactin, FSH and LH hormones in blood samples. The pulmonary gas analyzer (K4B2) was applied to measure the, minute ventilation (VE), ventilatory equivalents ( $\text{VE}/\text{VO}_2$ ,  $\text{VE}/\text{VCO}_2$ ) in two phases. An incremental graded exercise test was conducted on a cycle ergometer in menstrual phases.

**RESULTS** T-test was performed to detect baseline differences across menstrual phases. The results indicated no significant differences ( $p>0.05$ ) in minute ventilation and ventilatory equivalents across the menstrual cycle of active and inactive females.

**DISCUSSION & CONCLUSION** There were no significant differences in gas exchange variables during incremental exercise test between the early follicular and luteal phases of active and inactive females. These results provide additional data suggesting that the timing of the menstrual cycle phase may not be as critical as once thought when designing future exercise ventilation studies. This may have important implications for individuals whose work, athletic competition, or recreation schedules.

**KEY WORDS** Menstrual cycle, incremental exercise, females

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## The relationships between squat jump and short sprint performance in trained track and field athletes

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**OBJECTIVE** In many team sports and track and field (T&F) events, sprints most frequently occur over short distances from both standing and rolling starts. Although squat jump (SJ) has been extensively used in training, data concerning kinematics factors across a sample of T&F is scarce. The goal of this study was to examine the relationship between short sprint performance and kinematics of SJ exercise in a sample of trained T&F athletes.

**METHODS** 13 T&F athletes (range 20-28 years) were asked to perform 3 maximal SJ weighted jumps (17kg) while ground reaction forces were sampled using a portable force platform. During a testing session, T&F performed three trials with 3 minutes of rest between each jump. Only the best attempt was taken to analysis. Jumping height, peak force, peak power, average power, and impulse were analyzed during the concentric phase. In addition, sprint testing was required to perform 3 maximum effort sprints (30 and 40m). Here, only the best sprint was considered for each distance. Correlations were determined using Pearson product-moment correlation coefficient. Statistical significance was accepted at  $p<0.05$  for all analysis.

**RESULTS** Significant correlations ( $r= -0.60$  and  $r=-0.78$ ;  $p<0.05$ ) were observed between SJ performance and 30 and 40m sprints, except for impulse and peak power ( $p>0.05$ ).



**DISCUSSION & CONCLUSION** As predictors, is important that the peak force, peak power, and velocity produced during the SJ must be maintained with high values to explain sprint performance in short distances. However, more noticeable was the non significant predictive value of the peak power out put for 30m.

**KEY WORDS** Squat jump, sprint, track and field

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## The relationships between sprint run and countermovement jump kinematics in elite track and field athletes

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**OBJECTIVE** During the past 50 years countermovement vertical jump (CMJ) has been extensively used in training and testing. However, there is a paucity of research examining the relationships between sprinting and jumping performances. In addition, data concerning kinematics factors across trained subjects is scarce. The aim of this research was examine the relationship between sprint run and kinematics measures on CMJ performance in a sample of trained track and field (T&F) athletes.

**METHODS** 10 elite T&F athletes (range 22-27 years) were asked to perform 3 maximal CMJ weighted jumps (17kg) while ground reaction forces were sampled using a portable force platform. During a testing session, T&F performed three trials with 3 minutes of rest between each jump. The best two jumps were taken to analysis. Jumping height, peak force, peak power out put, average power out, and impulse were analyzed during the concentric phase. In addition, sprint testing was required to perform three maximum effort sprints of 30 and 40m. Only the best sprint was considered for each distance. Correlations were determined using Pearson product-moment correlation coefficient. Statistical significance was accepted at  $p < 0.05$  for all analysis.

**RESULTS** Significant correlations ( $r = -0.688$  and  $r = -0.91$ ;  $p < 0.05$  and  $p < 0.01$ ) were observed between 30 and 40m sprints and CMJ performance, except for impulse ( $p > 0.05$ ).

**DISCUSSION & CONCLUSION** As predictors, is important that the force and power produced during the concentric phase must be maintained with high values to explain sprint performance in short distances. Nevertheless, more noticeable was the non significant predictive value of impulse. These readings suggest that the positive impulse is not a major variable in predicting CMJ performance.

**KEYWORDS** Countermovement jump, sprint, track and field

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## Study regarding the morpho-functional changes occurring after sport retirement in Romanian elite athletes

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**OBJECTIVE** Sport performance represents a temporary activity during lifespan, due to inevitable constraints such as loosing of eligibility, injuries or aging per se. Taking into account the medium and long time physiological evolution of the retired athletes represents an important objective for sport professionals, offering the basis of a prophylactic approach of these individuals, who show sometimes fragility in the passing process to a new life style.

**METHODS** We evaluated the morpho-functional changes occurring after sport retirement using a semi-structured interview, anthropometrical measurement (weight, body mass index, thoracic perimeters, range of motion for major joints) and functional tests (electrocardiography-EKG, spirometry, posturography and hand dynamometry) on 50 Romanian elite athletes. The experimental group (sex ratio 1/1, average age 37,8 years) consists of athletes from different sport branches such as soccer, handball and volleyball, in the first 10 years after sport retirement. We compared the tested parameters with old recorded data (when the athletes were active), using the chi square test.

**RESULTS** We ascertained significant changes ( $p < 0.05$ ) regarding the athletes' morpho-functional status: weight gain (35% of the athletes), EKG borderline abnormalities (30%), reduced spirometric parameters (20%), rising area of the statokinesigram (20%) and self-image deterioration (25%).

**DISCUSSION & CONCLUSION** The deconditioning of the retired athletes is potentially dangerous because it determines a level of physiological deterioration of the athletes, in absence of the habitual stressing factor represented

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by the physical training. Athletes' deconditioning syndrome is a reality with large implications, associating cumulative risk factors for the sport retirement pathology.

**KEY WORDS** sport, retirement, deconditioning, athletes

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## Flexibility asymmetries of the lower extremities in professional soccer players

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**OBJECTIVE** Almost every soccer player possesses some degree of functional footedness, which leads to consistent asymmetrical loads and significant anatomic and functional adaptations in the musculoskeletal structures of the lower extremities. Gradually, these adaptations induce a potential impact to the mechanisms of injury, also by means of flexibility asymmetries. The purpose of this study was to investigate selected flexibility asymmetries in the lower extremities of professional soccer players.

**METHODS** Ninety (90) professional soccer players of the 3rd Greek National Division (age 23.4 +/- 4.8 years; height 1.78 +/- 6.7 cm; body mass 74.2 +/- 7.6 kgs) participated in this study. Flexibility measurements were taken using a universal goniometry for hip, knee and ankle joint

**RESULTS** Significant flexibility asymmetries were found between the dominant and the non-dominant side. The dominant leg was more flexible only in hip internal and external rotation, while the non-dominant leg was more flexible in all other joint measurements with a significant difference in hip flexion (87.3 deg. vs 89.37 deg, p<0.05) and hip abduction (50.76 deg. vs. 57.72 deg, p<0.01).

**DISCUSSION & CONCLUSION** Professional soccer players tend to demonstrate significant muscle flexibility asymmetries. During soccer practise power movements are accumulated with higher shifts of mechanical impact not only to the preferred side but also to the non-preferred one. Interestingly, this laterality process produces significant flexibility adaptations on the femoral muscles "in favour" of the non-dominant side. The findings are discussed with regards to their potential implication for injury prediction in soccer players.

**KEY WORDS** Soccer, Flexibility, asymmetries

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## Knee and ankle isokinetic strength asymmetries in professional soccer players with right footedness

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**OBJECTIVE** Nearly every soccer player possesses some degree of functional footedness, which leads to consistent asymmetrical workloads and significant adaptations in various aspects of functional muscle capacity in the lower extremities. The purpose of this study was to investigate selected strength asymmetries in the lower extremities of professional right-footed soccer players.

**METHODS** Seventy-nine (79) Greek professional soccer players comprised the right-footed subgroup selected via a footedness-specific questionnaire out of a larger sample of 104 athletes totally studied. Maximum voluntary extension and flexion concentric torque of the knee (60, 180 & 300 deg / sec) and ankle (60 deg / sec) was assessed bilaterally

**RESULTS** Significant isokinetic muscle strength asymmetries were found between the dominant and the non-dominant side for knee extension at 60 deg/s ((244.8 +/- 37.6 Nm vs. 238.3 +/- 35.3 Nm, p<0.05) and knee flexion at 60 deg / sec (142.2 +/- 28.4 Nm vs. 137 +/- 27.9 Nm; p<0.05) and at 180 deg / sec (107.7 +/- 18.2 Nm vs. 103.5 +/- 18.7 Nm; p<0.05). In all cases the knee extensors and flexors of the dominant leg were stronger than those of the non-dominant leg. No significant asymmetries were found for the rest of the variables regarding the ankle measurements.

**DISCUSSION & CONCLUSION** Our study confirmed the presence of muscle strength specific asymmetry in the lower extremities of right-footed soccer players. Soccer players with a definite right-footed dominance tend to demonstrate significant muscle strength asymmetry in favour of the dominant side under low angular velocity concentric contractions.

**KEY WORDS** Soccer, lateralities, strength asymmetries

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## The effect of aerobic training on improvement of the balance in Multiple Sclerosis patients

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**OBJECTIVE** MS is a disease of central nerve system which involves brain and spinal cord. The cause of this disease is still unknown. This cause makes disorder in conducting nerve and electrical current by destroying myelin and consequently. Studies on MS patients began in 1868 by Charcot. In a research which was done on 112 M.S patients by Rosava (2004) the finding showed a relative improvement in balance of M.S patients after 8 week of aerobic training. Purpose of this study was to examine the effect of an aquatic exercise for 8 weeks, on the improvement of balance of female MS patients.

**METHODS** It is an applied research with semi-experimental method. From 100 MS patients, 25 people on the basis of illness degree and age range were selected randomly with EDSS 1-4 with average illness time of (41) and age range of (20-50) years. They were divided into two groups. Experimental group consists of 15 people and controlled group consists of 10 people. The experimental group participated in the exercise for 8 weeks, three sessions per week with intensity of 40-50 percent of the maximum heart-beat rate. Stabilometer device was used to measure the balance in experimental and controlled groups before and after exercise. The gathered data were analyzed by using descriptive statistics and dependent sample t-test. **RESULTS** The research has shown that after 8 weeks, in the experimental group the balance was meaningfully improved ( $P < 0.01$ ).

**DISCUSSION & CONCLUSION** Considering the results of this research, which has caused an improvement in the balance of MS patients with low EDSS. So it seems necessary to apply an aquatic exercise for such patients. Therefore, it is recommended that these exercises be used by specialists as a supplementary remedy beside medical treatments for MS patients.

**KEYWORDS** Multiple sclerosis, aquatic exercise, balance

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## Acute effects of static and ballistic stretching on strength-power and sport specific performance parameters in elite female fencers

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**OBJECTIVE** Stretching as a part of a pre-exercise warm-up routine has become traditional practice in many sports. Recent studies have shown that stretching actually creates acute decreases in strength and jumping performance. Only a few studies have investigated performance-related parameters. The purpose of this study was to examine the effects of different modes of stretching on strength-power and fencing-specific performance-related parameters in 10 elite female fencers.

**METHODS** The subjects were tested for squat jump (SJ), countermovement jump (CMJ), drop jump (DJ), time of lunge, power of lunge and time of shuttle fencing test, after different warm-up protocols consisting of static or ballistic stretching. Subjects underwent 3 repetitions of 3 static or ballistic stretching exercises for quadriceps, hamstring and the gastrocnemius muscles lasting for 20 s with a 20 s rest period each. Data were analyzed using a 2 (pre-post) x 2 (static-ballistic stretching) analysis of variance and post-hoc t-test with Bonferroni corrections. Significance was set at  $\alpha = 0.05$  probability level.

**RESULTS** There were no pre-post significant differences in flexibility, drop jump and contact time of the drop jump, elasticity (CMJ-SJ), time and power of lunge, shuttle-specific fencing test after static stretching protocol. On the other hand, significant pre-post differences were observed in SJ ( $24.7 \pm 3.1$  vs.  $23.6 \pm 3.1$ ,  $p < 0.05$ ) and CMJ ( $29.71 \pm 4.9$  vs.  $28.02 \pm 4.4$ ,  $p < 0.05$ ) after static stretching while ballistic stretching did not affect strength-power parameters and fencing performance.

**DISCUSSION & CONCLUSION** Given these data, it is advisable that fencers avoid any static stretching in the later stages of a general warm-up, while ballistic stretching seems to be not beneficial in improving fencing performance.

**KEY WORDS** Fencing, warm-up

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## Effect of different rest intervals during resistance training on Insulin-like Growth Factor-1, Cortisol, Creatine Kinase and Blood Lactate

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**OBJECTIVE** It has been well known that the stress of heavy-resistance exercise has a potent effect for both strength development and muscle fiber hypertrophy. This may be due, at least in part, to exercise induced acute increase in serum anabolic hormone. Therefore, the purpose of this study was to compare the effects of three different rest intervals on IGF-1, cortisol (CO), Creatine Kinase (CK), and blood lactate concentrations.

**METHODS** Hence, ten recreationally strength-trained men (age=20.37 ± 2.44 years, body mass= 65.6 ± 26.70 kg) volunteered as subjects that in 4 separate sessions with 48 h from each other performed 4 different resistance trainings (RT). In the first session, one repetition maximum (1RM) was determined. From second to fourth session, subjects performed 4 sets of squat and bench press with 85% of 1RM until exhausted and one of the rest intervals (60, 90 and/or 120 second) was used in a random order between sets.

**RESULTS** It wasn't observed a significant difference among the three programs in IGF-1 concentration. However, it was observed a significant increment of 3.6 and 23 percent in IGF-1 concentration immediately and 30 min after exercise during RT with 60 s rest between sets. CO concentration in protocols with 60 and 90 s rest increased significantly more than 120 s protocol. CK and blood lactate concentration changes weren't differing between protocols but post exercise CK concentration significantly increased in each protocol.

**DISCUSSION & CONCLUSION** Growth factors, including IGF-I are known to be mediators of satellite cell activation, increased protein synthesis, decreased protein degradation, hyperplasia, and myofibril hypertrophy during muscle growth and development (Jennische, 1987). The response of IGF-I to acute RT is less clear. In the present study, although postexercise values of IGF-1 during three protocols increased but IGF-1 concentration changes immediately after protocols were significant only in RT program with 60 s rest between sets, which was consistent with the results of Boroujerdi & Rahimi (2008). Based on the findings could be said that heavy RT (4 sets × 85% of 1RM) with short rest between sets was resulted higher increases in IGF-1, CO concentration and muscle fiber injury. Because of acute hormonal responses to RT augmented training-induced adaptations, these results shows that rest interval between sets may be resulted in long-term increases in muscle size and strength. Also, because of these two hormones stimulate muscle protein synthesis, so this type of training was recommended to athletes who train in order to gain muscle hypertrophy.

**KEYWORDS** Insulin-like Growth Factor-1, Cortisol, Creatine Kinase, Rest Intervals between sets

### References

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## A case report: Effects of Intermittent hypoxic exposure on anaerobic performance of two orienteering athletes

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**OBJECTIVE** Introduction Intermittent normobaric hypoxic exposure has been used for increasing anaerobic sportive performance of athletes. The results from previous studies have been conflicted. The purpose of this study was to evaluate the effectiveness of intermittent normobaric hypoxic exposure on anaerobic performance of two orienteering athletes.

**METHODS** Methods Two orienteering athletes participated in this study aged 21 and 23 years. Participants underwent clinical and instrumental diagnosis excluding any cardio-respiratory problems. The participants breathed the hypoxic gas mixture in 5-min intervals interspersed with 5-min recovery periods of normal room air for a total of 60 minutes at each session 3 days per week for a 3-week period. The percent of the oxygen in the hypoxic gas concentration was at %13 during the intervention. We evaluated anaerobic performance by using peak power (PP), mean power (MP) before and after the study. Hemoglobin (Hgb) and hematocrit (Htc) were also measured.

**RESULTS** Results PP and MP of the first athlete increased %8.6 (5.18 -5.62) and %6.7 (9.65-10.29) respectively. The other's values showed the following increases %9.1 (4.50-4.94) and %7.8 (8.64-9.61) respectively. Hgb and Htc also improved (the first athletes' %5.2 and %6.7; the others %7.3 and %8.3)



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**DISCUSSION & CONCLUSION** Conclusion The effect of 3 weeks intermittent hypoxic exposure used in this study seems to improve anaerobic performance and hematological parameters. It is necessary to confirm these results by using with control group studies.

**KEY WORDS** intermittent hypoxic exposure, anaerobic performance

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## Evaluation of postural status and general health of students

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**OBJECTIVE** It is shown that incorrect motor habits, weaknesses of abdominal or back muscles usually result in postural abnormalities, and these may affect social communications. It is believed that modification of these abnormalities can improve general health.

**METHODS** Aim of this research was to investigate postural status of students, therefore 44 girls and 43 boys were randomly selected and was evaluated by using posture screen, Conformator apparatus, flexible ruler, and NewYork test. We measured the general health of participants by GHQ-28 questionnaire of Goldber & Hilier. It is applied Chi Square test and Spearman correlation coefficient for extraction of results

**RESULTS** We observed that degree of scoliosis ( $P<0.04$ ) and lumbar pain ( $P<0.01$ ) of girls is higher than boys, but there are no differences between their kyphosis and lordosis. There was a significant negative correlation between degree of kyphosis and general health ( $r=-0.26$ ,  $P<0.01$ ) and a significant negative correlation between degree of lordosis and physical signs ( $r=-0.33$ ,  $P<0.004$ ). In addition, there was a significant negative correlation between degree of lordosis and housework ( $r=-0.30$ ,  $P<0.05$ ), degree of kyphosis and upstairs ( $r=-0.22$ ,  $P<0.04$ ), degree of scoliosis and daily physical activity ( $r=-0.30$ ,  $P<0.004$ ).

**DISCUSSION & CONCLUSION** This study revealed the relative distribution of posture abnormalities in the students and it is, therefore, recommended that they must learn relevant motor patterns, apply principles of proper daily movements, and try to carry out regular exercise in order to remove weaknesses of the abdominal and back muscles.

**KEYWORDS** Body Status, General Health, Physical Activity.

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## Effects of aerobic-step trainings on the body composition, physiological and psychological characteristics of middle-aged healthy women

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**OBJECTIVE** Aerobic-Step trainings are cardiovascular programmes that provide a high energy cardio workout to music, and features high intensity intervals followed by muscle conditioning tracks designed to shape and tone the entire body while pushing fat-burning systems into high gear. The purpose of this research is to study of aerobic-step trainings on the body composition, physiological and psychological characteristics of middle-aged healthy women.

**METHODS** 15 regularly active women in the aerobic-step trainings and 15 sedentary women participated in the study. We applied Mann-Whitney U test for comparing groups and statistical significance was accepted if  $P<0.05$ .

**RESULTS** Results show that aerobic-step trainings significantly decreased waist to hip ratio ( $p<0.03$ ) and waist circumference ( $p<0.01$ ), and also significantly increased flexibility ( $p<0.004$ ), strength of back muscles ( $p<0.002$ ), endurance of shoulder muscles ( $p<0.003$ ) and maximal oxygen uptake ( $p=0.000$ ). Furthermore, it is revealed that aerobic-step trainings significantly improved ( $p<0.05$ ) mood states in the context of depression, tension, fatigue, confusion and vigor.

**DISCUSSION & CONCLUSION** In conclusion, participation in the aerobic-step trainings for 3 months, 3 session per week and each session minimally 45 minutes will be associated to beneficial improvements in the most physical, physiological and psychological characteristics of middle-aged women. However, more improvement needs increasing of training frequency and focuses on the strength enhancement of the upper body.

**KEYWORDS** Aerobic-Step Trainings, Psychological Adaptations, Physiological Adaptations.

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## Determinaion of the best pre-jump height for two-legged vertical jump

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**OBJECTIVE** High jumping ability is a very crucial advantage in many sporting activities. The purpose of this study was to examine the effect of different pre-jump heights on two-legged vertical jump and to determine the best pre-jump height(s).

**METHODS** Subjects included 35 females and 45 males. By matched randomized sampling, subjects were assigned in 4 groups, namely: control, 10 cm pre-jump, 20 cm pre-jump, and 30 cm pre-jump. Every group participated in their own specific training program for 6 weeks. Statistical analyses were based on analysis of variance. Mean ( $\pm$  SD) of weight and height for males vs. females were 67.3 ( $\pm$  1.22) vs. 55.8( $\pm$  0.96) Kg and 177 ( $\pm$  0.93) vs. 163( $\pm$  0.71) cm, respectively.

**RESULTS** The results showed that both groups of males and females had a significant increase in their post tests compared to pre-tests ( $p < 0.05$ ). It was shown that jumps with pre-jump were generally better than jumps with no pre-jump, anyway no significant difference was found among pre-jumps of 10, 20, and 30 cm heights. Therefore, we concluded that since 10 cm pre-jump consumes less energy, it is more advantageous. Especially in the competition, where players need hundreds of consecutive jumps, 10 cm pre-jumps will make them less tired.

**DISCUSSION & CONCLUSION** In present study, for both sexes, the rate of spike improvement was much better in experimental groups than control groups. It was independent from the rate of progress in jump which was relatively less. It is likely that rather than increasing jump height, training enables the players to use more of their jump potential during the game.

**KEYWORDS** two-legged vertical jump, pre-jump height

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## Determination of proper hieght of jump for plyometric training

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**OBJECTIVE** Jumping in different directions is very important in many sports. Also jumping plays an important role in most ball games and some non-ball games. Plyometrics is known as the best training method for development of explosive power. One of the problems here is how to determine the intensity of training to increase the efficiency of training and to reduce the chance of injury at the same time. The purpose of this study was to determine the proper height of jump for ten repetitive jumps over hurdles.

**METHODS** 78 male (36) and female (42) university students (height:  $1.70 \pm 0.08$ , weight:  $62.09 \pm 8.93$ ) voluntarily participated in the study. The subjects performed two different height jumps, namely 1 repetition maximum (1RM) and 10 repetitions maximum (10RM) height jumps. Tests were administrated in two different sessions with 48 hours rest between them.

**RESULTS** Considering the rate of drop in height of 10RM compared to 1RM jump, statistical analysis showed there were 3 groups of individuals, namely under 15 cm, 20-25 cm, and more than 30 cm drops. Correlation matrix of anthropometric and other measures of the study showed that the best correlation was found between 1RM and 10RM jumps height. It meant that we could estimate 10RM height jump by only knowing the 1RM jump height. This finding was also verified by discriminant analysis. It showed that for 59% of cases, 1RM jump could correctly determine the 10RM grouping.

**DISCUSSION & CONCLUSION** The rate of drop in height of repetitive jump compared to 1RM jump is varied (from 10 to 35 cm) in different individuals. The best predictor of the rate of drop is 1RM performance; simply the more the 1RM, the more the rate of drop. Anyway, some other unknown variables also play roles here. This study showed it had nothing to do with anthropometric measures. We suggest it is likely that the technique of jump which determines the energy cost of every jump should make a very important role in this regard.

**KEY WORDS** jump, jump height, plyometric training.

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## **Effect of 12-Wk low intensity exercise with slow movement and tonic force generation: Is it possible to improve the motor functions in older men?**

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**OBJECTIVE** Age-related sarcopenia results in functional weakness. Recently, low intensity resistance training with slow movement (LST) performed by older adults has proven effective for increasing muscle size and strength compared with a typical program (LN). Our goal was to determine whether motor functions in related activities of daily living are altered with periodized LST machine exercise in old men.

**METHODS** In this randomized control trial (RCT), 19 physically active old men aged 60-73 years were assigned into 2 groups and performed knee extension and flexion at low intensity (50% of one-repetition maximum) following two regimens proposed by Tanimoto et al. (2006): with slow movement (LST group); with normal movement (LN group). Muscle power gain and functional ability were measured before and after 12-wk intervention. Intention-to-treat analysis was performed ( $P < 0.05$ ). **RESULTS** No pre-intervention differences were seen in all outcomes. Both LST and LN program improved 12% and 11% in leg press power, respectively. LST improved 4% in hand grip strength, while LN did not. LN improved 12% in stand and reach test, while LST did not. No significant changes were seen in 5 times sit-to-stand test, 1-leg balance time, and walking speed. We could not find any significant between-group differences.

**DISCUSSION & CONCLUSION** We conclude that 12-wk LST can improve muscle power and strength, but is not effective for optimizing functional abilities in active older men.

**KEY WORDS** slow movement, community-dwelling older men, motor function, RCT, PRT

## **Relationship between isokinetic knee strength and vertical jump performance in 12-13 years old male football players**

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**OBJECTIVE** The purpose of the study was to evaluate the relationship between isokinetic knee strength and vertical jump performance in 12-13 years old football players.

**METHODS** A total of 30 healthy football players (age= 12,73±0,44 years, height= 150,53±7,56 cm, body weight= 43,03±6,89 kg, percentage of body fat= 10,54±1,06 %) participated in this study. Isokinetic knee extension and flexion torques were determined at 60°.s<sup>-1</sup> and 180°.s<sup>-1</sup> (Cybex Norm 6000, USA). Beside this, the subjects was asked to do two different jumping types which composed of squad jumping (SJ) and counter movement jumping (CJ) by the use of Bosco test protocol (Bosco Contact Mat; New Test 1000).

**RESULTS** Results indicated a significant correlation between 60°.s<sup>-1</sup> dominant quadriceps peak torque and CJ ( $r=0.36$ ) ( $p < 0.05$ ). Additionally, 60°.s<sup>-1</sup> non-dominant quadriceps peak torque was correlated with SJ,  $r= .43$  ( $p < 0.05$ ) and CJ,  $r= .51$  ( $p < 0.01$ ). But no significant correlation were found for 180°.s<sup>-1</sup> dominant and non-dominant quadriceps peak torque and vertical jump performance.

**DISCUSSION & CONCLUSION** The present study may be useful as comparison basis for future studies aiming evaluate the isokinetic muscle function in young football players. This finding provides new evidence in elucidating the relationship between strength and vertical jump performance, but it should be noted that while cybex test performed with one leg, the vertical jump test performed with two legs.

**KEY WORDS** Isokinetic strength, jump, young football players

## **Assesment of the effects of short training period by incremental intermittent maximal test in track athletes**

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**OBJECTIVE** The study was aimed at assessing the outcome of short-term training period on oxygen uptake ( $\text{VO}_2$ ), heart rate (HR) and lactate by using newly designed incremental intermittent maximal test.

**METHODS** Ten competitive middle and long distance runners aged 16-34 years were tested twice at the beginning (test1) and the end (test 2) of 14 days training period. The participants performed on a treadmill a series of increasing bouts of 2 min each with initial velocity of 4.8  $\text{km}\cdot\text{h}^{-1}$  separated by 40 sec pause to collect lactate samples, at work increments by 1.2  $\text{km}\cdot\text{h}^{-1}$  until exhaustion.

**Results** No significant differences in  $\text{VO}_2$  and HR during exercise were observed in both tests. The highest  $\text{VO}_2$  ( $p<0.05$ ) was attained at exhaustion in test 2 ( $3.76\pm 0.30 \text{ l}\cdot\text{min}^{-1}$  vs  $3.45\pm 0.53 \text{ l}\cdot\text{min}^{-1}$ ). The maximal velocity ( $\text{Vel}_{\text{max}}$ ) in both tests was 19.2  $\text{km}\cdot\text{h}^{-1}$ . Lactate threshold (LT) defined as 2.5  $\text{mM/l}$  and anaerobic threshold or the onset of blood lactate accumulation (OBLA) at 4.0  $\text{mM/l}$  were found to be improved ( $p<0.001$ ) from 50% to 62.5%  $\text{Vel}_{\text{max}}$  and from 62.5% to 81.2%  $\text{Vel}_{\text{max}}$  respectively, reflecting better training outcome.

**DISCUSSION & CONCLUSION** It appears that LT and OBLA are more informative estimates contributing to the assessment of the effects of short-term training period.

**KEY WORDS** Oxygen uptake, heart rate, anaerobic threshold, maximal treadmill test, middle and long distance runners

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## Body composition of visually impaired students

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**OBJECTIVE** Increased body fat in childhood is associated with significant preventable health risks. The purpose of this study was to estimate the body composition of students with visual disabilities as well the impact of the degree of visual impairment and the level of physical activity on it.

**METHODS** 190 visually impaired students (106 boys and 84 girls), 9-19 y aged, underwent anthropometrical measurements for determination of body composition. BF% was predicted by skinfold equations of Slaughter M. et al. (1988). The subjects were divided into 2 groups according to the severity of visual impairment (totally blind and with residual vision) and into 2 groups on the basis of whether participate in extracurricular sports or not. Statistical significance between means was tested by independent samples t-test.

**RESULTS** The results showed that 42% of the boys and 40,8% of the girls with visual impairment had BF% above the proposed by Slaughter M. et al. optimal range. BF% was higher in the subjects with total blindness than in these with residual vision in all age groups. BF% was optimal in pupils involved in sports activities, but had increased values in pupils, who do not practice sport. However, the degree of visual impairment and the physical activity level did not influence the lean body mass (LBM) of the assessed subjects.

**DISCUSSION & CONCLUSION** Almost a half of investigated children and adolescents with impaired vision have increased BF%. Residual vision and increased physical activity have impact mainly on the amount of BF, but have low influence on LBM.

**KEY WORDS** Body composition, visually impaired students, skinfold method

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## Effect a period of selective program training on body composition and physical fitness factors on non athlete women

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**OBJECTIVE** In this research the effect a period of selective program training (decreasing number of practice session versus increasing exercise intensity) was investigated over some factors of physical and physiological fitness (aerobic power, body fat percentage, flexibility of back muscles, endurance of abdomen muscles, endurance of shoulder girdle muscles, power of leg muscles and body mass index).

**METHODS** The among 18-22 year old non-athlete students of Ilam university 60 subjects were divided into 4 groups (3 experiment groups and one control group). The experiment groups exercised with certain intensity one, two and three sessions per week for 8 weeks. The exercise consisted of walking and running with certain speeds for each experiment group in a way that three session group exercised with low intensity, the two session group exercised with moderate intensity and the one session group did exercises with high intensity.

**RESULTS** The findings showed that in factors such as aerobic power, body fat percentage, body mass index and endurance of abdomen muscles the more the number of session and the less the intensity, it was among better results .

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But in factors such as flexibility of back muscles, power of leg muscles, the more the intensity and the less the number of the session.

**DISCUSSION & CONCLUSION** The better results were obtained and in factor endurance of shoulder girdle muscles, this with two session practice showed better results.

**KEY WORDS** Exercise intensity, frequency, non-athlete women

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## Gender effect at the reaction time in the sedentary individuals

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**OBJECTIVE** Reaction time is considered a complex task. Reaction time is defined as the amount of time an individuals takes to respond and complete a movement after a stimulus has been presented. The aim of this study is to compare the the lower extremity reaction time in sedentary and healthy young women and men.

**METHODS** 25 women and 26 men college students, ages 18 to 26 years, were included to the study voluntarily. Age, height, weight, body mass index and ankle reaction time measurements were recorded. Lower extremity reaction time was measured with the Nelson Foot Reaction Test.

**RESULTS** While there were no significant differences between women and men in age and height values, the weight and body mass index values were higher in men. There was a significant difference in the Nelson Foot Reaction Test outcomes between men and women, with better levels in men than women ( $p<0.05$ ).

**DISCUSSION & CONCLUSION** There is a direct relationship between the reaction time and the injury. The reaction time was compared in the athletes, elderly individuals, only in women, only in men, and in female and male athletes. Female athletes have ligament injury risk three times higher than men. In our study, it was found that the reaction time of the sedentary and healthy women was worse according to men. We suggest that in the evaluation of the sedentary individuals starting with any recreational sport, and at the determination of the activity type which will be recommend, it will be useful to consider the lower extremity reaction times.

**KEY WORDS** reaction time, gender, sedentary individuals

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## Muscle strength and cardiorespiratory fitness across aging: Effects of a two times-a-week exercise training program

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**OBJECTIVE** The lack of time of modern life makes difficult to reach the exercise recommendation of 2-3 and 3-6 times-a-week resistance and aerobic training, respectively. However, there is little information about the effect of lower training volumes in women. Our purpose was to analyze the effect of two times-a-week exercise training program on muscle strength and aerobic capacity, as well as to compare these effects among women of different age groups.

**METHODS** 117 healthy sedentary women, divided in four groups according to their age (G1 – n=30, 30.3±6.2 years; G2 – n=37; 44.1±2.5 years; G3 – n=27; 53.7±3.5 years; G4 – n=20; 66.4±6.9 years), were submitted to a two times-a-week exercise training program with aerobic (20 minutes at 60-75% of reserve heart rate), whole-body resistance (2-3 sets of 8-12 repetitions at 60-80% of 1-RM), and stretching exercise, performed for 12 month. 1-RM strength test were performed at baseline, and after three, six and twelve months of follow-up. Maximal graded exercise test (GXT) was performed at baseline and after twelve months of follow-up.

**RESULTS** Exercise training improved muscle strength in 24.1±8.9%, 10.7±4.5% and 7.2±4.7% after three, six and twelve weeks of follow-up, respectively ( $p<0.05$ ). Cardiorespiratory fitness was also improved by exercise training as demonstrated by the increase of 10.3±5.1% and 5.3±3.2 in the duration and METs at peak of GXT, respectively, after twelve weeks of follow-up ( $p<0.05$ ). The percentage of increase in muscle strength and cardiorespiratory fitness was not significantly different among the four age groups.

**DISCUSSION & CONCLUSION** The results suggest that two times-a-week multi-component exercise training is enough to improve muscle strength and cardiorespiratory fitness of women, independently of their age.

**KEY WORDS** Exercise; Cardiorespiratory Fitness; Muscle Strength; Aging

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## Strategies for monitoring the recovery of junior canoeists

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**OBJECTIVE** As knowledge in what concerns the phenomena and processes of a great variety within sport's practice developed more and more, it was noticed that in many cases the technology used in training is no longer responsive. The necessity for a more objective control over the athlete's evolution during training and competition emerged.

**METHODS** The present research is meant to test the efficiency of a new recovery program on junior canoeists. 24 subjects were involved, divided into two groups: one experimental (n=12) and one of control (n=12). The research's design was one of the type pre-after tests.

**RESULTS** The subjects from both groups were evaluated in the beginning and at the end of the program. There were carried out testings for VO<sub>2</sub> Max., T.T.R. - 45''; T.T.R. - 10'', the Dorgo index.

**DISCUSSION & CONCLUSION** The advantage of the adaptive process concerning the effort specific to canoe is to be found in the increase of the aerobic effort capacity (VO<sub>2</sub> Max, within 62, 21% in the 1<sup>st</sup> testing and respectively 74, 82% in the 2<sup>nd</sup> one). The anaerobic effort capacity, expressed through two metabolic parameters T.T.R./45'' and T.T.R./10'', varied between 44-83% in the initial testing and respectively 61% and 86% in the final testing. The analysis of the variations of the Dorgo index that we evaluated during the tests represents a short-time prediction regarding the neurovegetative and cardiovascular modifications of the athletes, offering the possibility of a rapid intervention in the process of training and recovery.

## Relationship between full squat performance and vertical jump in Track & Field elite athletes

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**OBJECTIVE** Although the squat exercise has been extensively used in order to increase lower body strength, few studies were conducted on a large subject sample of elite athletes. Therefore, the present study aims to determine the relationships between countermovement jump (CMJ) height and full squat (FS) performance in a large sample of Track & Field top athletes.

**METHODS** A group of 29 elite male (range 20-28 years) triple and long-jumpers volunteered to participate in this study. Subjects performed three trials with 3 minutes of rest between each CMJ. This was accomplished by measuring jump performance on a trigonometric carpet (Ergojump Digitime 1000, Digest Finland). Additionally, The FS was measured in a Smith Machine starting with resistances of 27kg (FS27); 37kg (FS37); 47kg (FS47); 57; (FS57); 67kg (FS67); 77kg (FS77); and 87kg (FS87); This data was obtained in real time through a linear transducer (T-Force, Murcia, Spain) that was connected to the Smith Machine bar through a steel cable. Four minutes of recovery between each series of repetitions were taken. The test ended for each subject when the average speed of movement was less than 0.4 m•s<sup>-1</sup>. This speed was chosen as the reference because in a pilot study, it was observed that the maximal strength value (1RM) was attained at near this speed.

**RESULTS** The FS27 was significantly (acceleration: r=0.52; p<0.01 and peak power: 0.59; p<0.01) related with jump performance. Further, the CMJ height was only significantly associated with peak power obtained with FS47 (0.46; p<0.05) and FS77 (0.64; p<0.01).

**DISCUSSION & CONCLUSION** As predictors, is important that the aeration and power produced during the concentric phase of the FS exercise must be maintained with high values to explain CMJ height. Nevertheless, heavier loads can be also important to determine vertical jump performance.

**KEY WORDS** Full squat, countermovement jump, track and field.

## Climatology's applications concerning recovery in sportsmen

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**OBJECTIVE** This present paper proposes itself to demonstrate the influence of the medium altitude in body recovery to football players, starting from the hypothesis that training in a medium altitude contributes to the counterbalance of

the vegetative nervous system.

**METHODS** The study was made on a number of 11 football players with ages within 16-18 years old, registered with the International Curtea de Arges sports club. We have noticed the influence of the subalpine climate over the football players' health status as they were on their recovery training in Nucsoara Camp on August, 2008. For evaluation, we performed measurements for cardiac frequency and blood pressure daily, in the morning and we used the parameters that they had noted on the self-control journal. For a better emphasis of the variations concerning the physiological indicators we performed the Schellong test and we used the Dorgo index of recovery.

**RESULTS** The final testing shows an improvement of the results for the Dorgo index (in the initial testing the average of the indexes was of -3, reaching in the final testing an average of -20;  $p < 0.001$ ) and also for the Schellong testing (in the initial testing the differential blood pressure in clinostatism was of 55 mmHg, and in orthostatism of 65 mmHg; in the final testing the differential blood pressure in clinostatism was of 45 mmHg, and in orthostatism of 52 mmHg;  $p < 0.001$ ).

**DISCUSSION & CONCLUSION** Combining conducted recovery programs with the influence specific to subalpine climate on the organism shows positive results, by influencing in a significant manner the variability of the physiological indexes pursued. We have to keep into account the fact that sportsman's life regime influences considerably the variability of the physiological indexes pursued. The minimum period of time after which notable physiological modifications occur is of 10 days.

**KEY WORDS** Climatology, recovery, sportsmen

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## The rightward shift of v-slope on increasing ramp in cardiopulmonary exercise testing (cpx)

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**OBJECTIVE** To evaluate the effects of increasing ramp on the v-slope ( $VO_2$  vs  $VCO_2$  relation) and anaerobic threshold (AT) detection in CPX.

**METHODS** Six college soccer club members (mean age of 20.8 (SD:1.0)) underwent 3 symptomatic maximal bicycle CPX using 3 ramp protocols (15, 25, 50 watt/min). The sequence of tests were varied randomly and each test done on separate days. On the v-slope plot the slope before and after AT was termed S1 and S2, respectively. The v-slope shifted rightwards immediately following exercise and stayed that way (to the right of  $R=1$  diagonal line, where R denotes respiratory exchange ratio) until the appearance of AT. The slope before S1, which was significantly less than a rest R value, was termed S transient (Str) and probably represented tissue  $CO_2$  storage effect. The rightward shift was quantified as the average distance between the  $R=1$  line and the v-slope, expressed in  $VO_2$  (ml/min).

**RESULTS** The exercise duration (minute) in 3 protocols was 16.4, 9.09 and 5.5, respectively. The peak  $VO_2$  (ml/min/kg) was 58.1, 54.5 and 49.8 respectively. The average rightward shift of the v-slope was 122, 188 and 170, respectively (15 vs 50 watt,  $p < 0.05$ ). Generally ramp increase resulted in the lengthening of Str, shortening of S1 with slope unchanged, and a steeper rise in S2. AT, however, remained constant.

**DISCUSSION & CONCLUSION** The ramp increase in the bicycle exercise using ramp protocol resulted in the rightward shift of the v-slope representing accentuated tissue  $CO_2$  storage effect. Although the shift did not alter AT, it made AT detection procedure more complex.

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## Continuos incremental field test to estimate velocity and maximal oxigen consumption in not-expert runners

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**OBJECTIVE** Parameters such as maximal oxygen uptake ( $VO_{2max}$ ) and velocity at which  $VO_{2max}$  occurs ( $VelVO_{2max}$ ) are often used to training control purposes to enhance runner's performance. This study had two purposes: (i) determine the relationship between  $VelVO_{2max}$  obtained in continuous incremental filed test (CIFT) and  $VelVO_{2max}$  determined on a treadmill in a laboratory; and (ii) verify if it is possible to estimate the  $VO_{2max}$  based on CIFT velocity.

**METHODS** Fourteen recreational runners (3 to 4 training sessions per week) with average body mass  $72.87 \text{ kg} \pm 7.35$ ,

174.78 cm  $\pm$  4.81 in height and 29.85 years  $\pm$  7.12 years-old of age, were tested. The subjects were evaluated in two separate sessions. One session in the field (running in a track field): each subject performed a continuous incremental test until exhaustion; first step 10 km/h, and 1 km/h increment every two minutes. The velocity of the last complete bout was registered and considered as CIFTvel. Respiratory changes were not evaluated. In the second evaluation session we applied a protocol similar to CIFT in the lab (running on a treadmill). Oxygen uptake, respiratory exchange ratio (R) and heart rate (HR) were continuously recorded and averaged for the last 30s of each bout. VO<sub>2</sub> was measured using a stationary breath-by-breath metabolic unit (Cortex, Model MetaLyzer 3B, Leipzig, Germany) which includes a heart rate transmitter (Polar Electro Oy, Kempele, Finland). It was considered the VO<sub>2</sub>max the highest value registered during test. The VelVO<sub>2</sub>max was the velocity corresponding to the bout at which the increment in the VO<sub>2</sub> to the next bout was lower to 2 ml/kg/min. When this did not occur VelVO<sub>2</sub>max was the velocity corresponding to VO<sub>2</sub>max.

**RESULTS** It was found a good relationship ( $R = 0.82$ ,  $P < 0.01$ ) between determined VO<sub>2</sub>max and estimated VO<sub>2</sub>max by the formula: VO<sub>2</sub>max (ml/kg/min) = CIFTvel (km/h)  $\times$  3.5, as proposed firstly by Leger and Mercier (1984)\*. It was found a very good correlation between determined VelVO<sub>2</sub>max in lab and CIFTvel ( $R=0.97$ ,  $P<0,01$ ). In this sample, this relationship could be expressed as: VelVO<sub>2</sub>max (km/h) = 0.99 CIFTvel (km/h) + 0.35.

**DISCUSSION & CONCLUSION** The estimated VO<sub>2</sub>max and VelVO<sub>2</sub>max based on the data obtained from CIFTvel seem to be strongly related with VO<sub>2</sub>max and VelVO<sub>2</sub>max determined in lab. Besides, that is an easy, practical and non-invasive method to estimate those parameters, namely were lab facilities were not available. \* Léger L., Mercier D.: Gross energy cost of horizontal treadmill and track running. Sports Med. 1, 270-77, 1984.

**KEY WORDS** VO<sub>2</sub>max, VelVO<sub>2</sub>max, Field Test, Running, Estimation.

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## Estimation of relative load from mean propulsive velocity in the concentric bench press exercise

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**OBJECTIVE** Several acute training variables have been identified for the purpose of designing resistance training programs (Kraemer and Ratamess 2004). Exercise intensity is generally acknowledged as the most important stimulus related to changes in strength levels (Fry, 2004) and has been commonly identified with relative load (percentage of one repetition maximum, 1RM). Movement velocity is another variable which could be of great interest for monitoring resistance exercise intensity but its role has often been overlooked in the everyday practice of strength training (Izquierdo 2006; Pereira and Gomes 2003). This study examined the possibility of using mean propulsive velocity data to estimate relative load in the bench press (BP).

**METHODS** One hundred and twenty strength-trained young males performed an isoinertial strength test with increasing loads up to the 1RM for the individual determination of the load-velocity profile in the concentric BP. Vertical instantaneous velocity was directly measured by a linear velocity transducer attached to a Smith machine and sampled at a frequency of 1,000 Hz.

**RESULTS** A very close relationship between mean propulsive velocity (MPV) and load (%1RM) was observed ( $R^2=0.98$ ,  $SEE=0.06$  m/s). Individual second-order polynomial curve fits for each test gave an  $R^2$  value of  $0.996 \pm 0.003$  (range: 0.983-0.999;  $CV=0.3\%$ ) Mean velocity attained with 1RM (V1RM) was  $0.16 \pm 0.04$  m/s and was found to influence the MPV attained with each %1RM. Stability in the load-velocity relationship was also confirmed regardless of individual relative strength, although certain tendency towards slightly lower velocity values with each %1RM was found for the strongest subjects.

**DISCUSSION & CONCLUSION** The results of this study confirm an inextricable relationship between relative load and MPV in the concentric BP; i.e. each percentage of 1RM has its own corresponding MPV value. This finding has important practical applications for monitoring resistance training, such as: 1) evaluate strength without the need to perform a 1RM test, or a test of maximum number of repetitions to failure (XRM); 2) determine the %1RM that is being used as soon as the first repetition with any given load is performed; and 3) prescribe and monitor training load according to velocity, instead of percentages of 1RM or XRM. An equation for estimating relative load from movement velocity was obtained ( $\%1RM = 8.4326 MPV^2 - 73.501 MPV + 112.33$ ;  $R^2=0.981$ ,  $SEE=3.56$  %1RM).

**KEY WORDS** Exercise testing, muscle strength, 1RM prediction, isoinertial assessment.

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## Some neurophysiologic assessments trough event related potential in performance sports

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**OBJECTIVE** Somatosensory evoked potentials (SSEPs) are an electrical response recorded from the human nervous system produced by tactile or electrical stimulation of peripheral sensory or mixed nerve. The objective of our study was to evaluate some of the somatosensory evoked potentials waves parameters (latencies and intervals) at sportsmen from different sport categories: volleyball, handball, fencing and to compare the obtained data, in order to emphasize specific cortical plastic functional modifications induced by performance training.

**METHODS** The study was made on a lot of 18 professional sportsmen, with ages between 16 and 24 years, which practice sports for at least for 5 years. SEP obtained by stimulating (electric stimuli of an intensity superior by 3-4 mA to the motor threshold, a duration of 0,2 ms and a frequency of 3 Hz) the median nerve at the radiocarpian articulation level, bilateral, successive, was recorded with a MEP 150 Nihon-Kohden device using active electrodes placed on C3' and C4' and reference electrode placed on the scalp (Fz); were measured the SEP waves (P14, N20, P22-25, N25-30, P30, N35, P40) latencies and the intervals between waves P14-N20 and waves N20-P25.

**RESULTS** By analyzing the obtained results, was revealed that the SEP waves parameters differences were not statistically significant both for the whole lot and sports categories.

**DISCUSSION & CONCLUSION** In our case, the performance training did not influence the somatosensory evoked potentials waves parameters and so, it did not determine any specific cortical functional modifications at the studied professional sportsmen for neither of the sport categories.

**KEY WORDS** Volleyball, Handball, Fencing, Somatosensory Evoked Potentials (SSEPs).

## The load that maximizes the mechanical power output in the bench press depends on the outcome parameter used

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**OBJECTIVE** When light and medium loads are lifted in typical isoinertial exercises, there exists a final phase during which deceleration is of greater magnitude than what would be expected due solely to the effect of gravity, this being the result of the athlete applying force in the opposite direction to the load's motion. Thus, the concentric portion of a lift can be further subdivided into a propulsive (positive force) and a braking (negative force) phase (Jidovseff et al. 2007). This study aimed to examine the load-power relationship in the bench press (BP) by comparing the relative load that maximizes the mechanical power output (Pmax) using three different measures: mean power over the whole concentric portion (MP), mean power of the propulsive phase (MPP) and peak power (PP).

**Methods** One hundred strength-trained males performed a concentric BP strength test for the individual determination of the full load-power relationship. An isoinertial dynamometer sampling at 1,000 Hz was attached to a Smith machine and used for all mechanical measurements.

**RESULTS** The Pmax load was found to be dependent on the parameter used. When using MP, power was maximized at a load of 54.2% 1RM, although no statistically significant differences were found between 40-65% 1RM. For MPP and PP, Pmax was found at 36.5% 1RM and 37.4% 1RM, respectively, with no differences between these loads. No significant differences in power output were found for loads between 20-55% 1RM for MPP or PP. The absolute Pmax values obtained in the BP tests were 453 ± 69 W for MP, 568 ± 84 W for MPP, and 938 ± 148 W for PP, all significantly different from each other (P < 0.001).

**DISCUSSION & CONCLUSION** These results highlight the importance of considering the contribution of the propulsive and braking phases in the assessment of isoinertial strength. Referring the mean values to only the propulsive phase appears necessary to avoid underestimating an individual's true strength capability when light and medium loads are used. The present study also provides evidence that there is not a clearly defined point in the load spectrum that maximizes power output (Cronin and Sleivert 2005), but rather there exist a relatively broad range of loads that yield similar high power values.

**KEY WORDS** Propulsive Phase, Load-Power Relationship, Muscle Strength, Isoinertial Testing.

## The effects of flexibility on the vertical jump and leg strength of sedentary and physically active persons

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**OBJECTIVE** The main purpose of this study was to determine the effects of low or high capacity of flexibility on leg strength, vertical jump and anaerobic power, and whether these effects are related with age, height, weight, gender and doing exercise or not. Moreover, the other aim of this study is to evaluate the differences in physical and physiological characteristics of active person in sports (active) and inactive person in sports (sedentary).

**METHODS** For 500 participants aged between 18-30 years, firstly; all participants of age, height, body weight, flexibility, leg strength, vertical jump and anaerobic power characteristics were determined. Height was measured by Holtain Stadiometer, body weight by Tanita Fat Analyzer, leg strength by Tanita Back and Lift Dynamometer, vertical jump by Takei Jumpmeter and flexibility was measured by Sit and Reach Table. In addition, anaerobic power was estimated by Lewis Formula:  $P = 4.9 (\text{Body weight})^{0.75}$ . Then participants were divided into groups as active-sedentary, female-male, sedentary female-male, active female-male, active-sedentary male and active-sedentary female and these groups were compared each other with t test and alpha level was set as 0.05 for statistical significance. Then, the relationships among physical and physiological characteristics of groups were determined by correlation analysis.

**RESULTS** For 500 participants of average values found respectively; in age 21,71 ± 3,02 year, in height 171,69 ± 9,38 cm, in body weight 65,37 ± 12,55 kg, in leg strength 98,85 ± 36,73 kg, in vertical jump 48,49 ± 11,83 cm, in flexibility 24,89 ± 7,95 cm and in anaerobic power 101,11 ± 27,49 kgm/sec. When the active and sedentary group compared; there were significant differences ( $p < 0,05$ ) in height, leg strength, vertical jump, flexibility and anaerobic power and there was no significant difference in body weight ( $p > 0,05$ ). When the groups compared according to gender; there were significant differences ( $p < 0,05$ ) between groups in age, height, body weight, leg strength, vertical jump and there was no significant difference in flexibility ( $p > 0,05$ ). For 500 participants investigated totally, there were significant relationship among age and body weight, height, leg strength, vertical jump, anaerobic power. There were also significant relationship among height and body weight, leg strength, vertical jump, anaerobic power. In addition, body weight related with leg strength, vertical jump and anaerobic power. Moreover, leg strength related with vertical jump, flexibility and anaerobic power and than vertical jump related with flexibility and anaerobic power.

**DISCUSSION & CONCLUSION** When the active and sedentary group compared each other, active group has higher values in height, leg strength, vertical jump, flexibility and anaerobic power than sedentary group. Only at the point of body weight there was no significant difference between both groups. For genders; male group has higher values than female group in height, body weight, leg strength, vertical jump but there was no significant difference in flexibility for both groups. So, it can claim that flexibility is more closely related to doing sports than effect of gender. According to results of correlation analysis, in 500 participants; flexibility related with vertical jump and leg strength, that is, when the flexibility increases vertical jump and leg strength also increases. In addition, when the participants investigated separately as a male and female groups; another relationship appeared in both of them: Flexibility related with anaerobic power. In this case, it can be considered that anaerobic power can develop via increasing flexibility.

**KEY WORDS** Sportsman, Sedentary, Leg Strength, Vertical Jump, Flexibility, Anaerobic Power

## The effect of recovery periods on heart rate during repeated sprints

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**OBJECTIVE** There has been an increased interest in the occurrence of fatigue and muscle responses to intermittent work especially during repeated bouts of brief and intensive exercise. However, heart rate responses to repeated exercise have attracted little interest. Therefore the purpose of the present study was to examine the effect of different recovery periods (continuous, 15s, 30s and 45s) on heart rate during repeated sprints.

**METHODS** Nineteen active male university students participated in this study voluntarily ( $M_{\text{age}} = 23.47 \pm 2.01$  yrs,  $M_{\text{height}} = 176.24 \pm 8.02$  cm,  $M_{\text{BW}} = 74.47 \pm 9.66$  kg,  $M_{\text{fat}} = 9.71 \pm 4.46$  %). Subjects performed four 12x20m running repeated sprint ability tests with different recovery periods (continuous, 15s, 30s and 45s) in random order at separate occasions. Continuous repeated sprint ability test was performed as a control condition. During the repeated sprint ability tests heart rates of the subjects were continuously recorded stroke-by-stroke with telemetric heart rate monitors and maximum heart rate and average heart rate were determined for each repeated sprint ability test that was applied with different recovery periods. For statistical analysis one way analysis of variance (ANOVA) with repeated measures was

used and Bonferroni post hoc analysis was used to determine from which group differences occurred.

**RESULTS** One way analysis of variance (ANOVA) with repeated measures showed significant differences maximal heart rate ( $F_{(3,16)}=15.968$ ;  $p=.000$ ) and average heart rate ( $F_{(3,16)}=26.120$ ;  $p=.000$ ). Bonferroni post hoc analysis indicated that 15s, 30s and 45 s of recovery periods resulted in significantly lower maximum and average heart rate values compared with continuous recovery period ( $p<0.05$ ) and also 45s of recovery period resulted in significantly lower maximum and average heart rate values than that of 15s and 30s recovery periods ( $p<0.05$ ).

**DISCUSSION & CONCLUSION** Our results indicated during running repeated sprint ability tests maximum and average heart rate is highly affected by different recovery periods. As a conclusion it can be said that 45s of recovery period had more effect on maximal and average heart rates during running repeated sprint ability tests.

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## Effects of daily physical activity recorded by metabolic armband on peak oxygen consumption, ventilatory threshold and leg extension strength in physical therapy students

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**OBJECTIVE** To investigate the influence of practical clinical applications on physical activity levels of physical therapy students and to reveal the relationships between daily physical activity levels and aerobic endurance indices as well as isokinetic strength.

**METHODS** Forty-two subjects were recruited for the study. Total energy expenditure (TEE), resting energy expenditure (REE), active energy expenditure (AEE) and the total number of steps were measured over a 3-d period with using a portable armband. In a second experiment subjects performed a maximal exercise test. Relationships between the energy expenditure levels and the respiratory indices such as peak oxygen uptake and ventilatory threshold and isokinetic strength were examined.

**RESULTS** No significant differences were found in the energy expenditure measurements, ventilatory indices and isokinetic test results between junior and intern student groups. Isokinetic strength was highly correlated both with TEE ( $r=0,61$ ;  $0,64$ ) and REE ( $r=0,80$ ;  $0,79$ ). Correlation between fat free mass (FFM) and aerobic endurance indices were poor ( $r=0,43$ ;  $0,34$ ), although there was a high level association between isokinetic strength and FFM ( $r=0,81$ ;  $0,81$ ).

**DISCUSSION & CONCLUSION** Patient-side clinical practice does not lead to an improvement in physical activity levels of students. There are significant relationships between daily physical activity, aerobic endurance indices and lower extremity isokinetic strength.

**KEY WORDS** Energy Expenditure, Ventilatory Threshold,  $VO_2$  peak, Isokinetic Strength.

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## Arterial stiffness, blood pressure, physical activity and maximal oxygen consumption in middle-aged former male athletes

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**OBJECTIVE** Epidemiological studies have demonstrated that former athletes show lower prevalence of cardiovascular diseases, hypertension, diabetes and cancer. Interestingly, studies are limited and some of them show contradictory results. Purpose of the present study was to evaluate the arterial stiffness of middle-aged former athletes and its relationships with blood pressure, physical activity and maximal oxygen consumption.

**METHODS** Measurements were performed in 29 ( $55.2\pm 5.9$  yrs;  $180.0\pm 8.0$  cm;  $89.8\pm 15.7$  kg) healthy male former athletes. The methods used included DXA for the determining body fat percentage, resting blood pressure, questionnaire for determining physical activity level and maximal oxygen consumption ( $VO_{2max}$ ) using modified Balke test on treadmill. To measure arterial stiffness, pulse wave analysis was performed.

**RESULTS** Study subjects showed relatively high mean physical activity level (2.9 times/week;  $4.1\pm 3.2$  hours/week). The mean  $VO_{2max}/kg$  of the group was  $38.4\pm 8.3$  ml/kg/min (varied from 24.0 ml/kg/min to 58.2 ml/kg/min). Hypertensive former athletes ( $n=17$ ) had significantly stiffer arteries compared to normotensive former athletes ( $n=12$ ). Correlation analysis revealed, that blood pressure values were significantly related to different arterial stiffness parameters (augmentation index, pulse wave velocity, small and large artery elasticity, etc). According to different physical activity level, the study groups did not reveal any significant differences in arterial stiffness parameters.

Correlation analysis showed that physical activity had also no significant associations between arterial stiffness variables, at the same time  $\text{VO}_2\text{max/kg}$  showed significant inverse relationship between pulse wave velocity, overweight values (body mass index, body fat percentage), systolic and diastolic blood pressure.

**DISCUSSION & CONCLUSION** In conclusion, our study results revealed that elevated blood pressure is significantly related to arterial stiffness among physically active middle-aged former athletes.

**KEYWORDS** former athletes, physical activity, endothelial function, arterial elasticity

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## **Influence of block periodization on adaptation in well-trained race walkers**

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**OBJECTIVE** Race walking is the technical and athletic expression of fast walking and it can be considered an endurance performance. Little information exists in the scientific literature relating to the most effective training intensity and periodization for the enhancement of maximal oxygen uptake ( $\text{VO}_2\text{max}$ ) in well-trained race walkers. Unlike traditional periodization, which usually tries to develop many abilities simultaneously, block periodization hypothesized that different types of specialized mesocycle-blocks are suitable to various modes of biological adaptation, i.e. homeostatic regulation or a mechanism of general adaptation. The aim of this study was to examine the influence of block periodization on  $\text{VO}_2\text{max}$  and blood lactate variables (lactate threshold-LT, onset of blood lactate accumulation-OBLA, mean velocity at lactate threshold-v at LT) in race walkers of the same performance level.

**METHODS** Six competitive race walkers (mean age:  $28.6 \pm 4.4$  yrs; height:  $176.2 \pm 5.1$  cm; weight:  $64.1 \pm 6.2$  kg;  $\text{VO}_2\text{max}$ :  $61.8 \pm 8.5$  ml.min<sup>-1</sup>.kg<sup>-1</sup>) were studied. The protocol consisted in walking with proper technique at 8, 10, 12 and 14 km.h<sup>-1</sup> for 4 minutes without rest in between. Thereafter, speed was incremented by 0.5 km.h<sup>-1</sup> every two minute until exhaustion to determine  $\text{VO}_2\text{max}$ .

**RESULTS** Mean  $\text{VO}_2\text{max}$  was  $66.9 \pm 9.5$  ml.min<sup>-1</sup>.kg<sup>-1</sup> and was reached at  $14.4 \pm 0.7$  km.h<sup>-1</sup>. After the block periodization, there were statistically significant increases in  $\text{VO}_2\text{max}$  and blood lactate variables ( $\text{VO}_2\text{max}$  at LT, v at LT,  $\text{VO}_2\text{max}$  at OBLA, v at OBLA;  $P < 0.05$ ).

**DISCUSSION & CONCLUSION** It seems that, for race walkers who are already trained, improvements in endurance performance can be achieved through block periodization. However, considering the low number of the athletes involved, further studies should be conducted before giving training recommendations to athletes and coaches.

**KEY WORDS** race walking, adaptation, training,  $\text{VO}_2\text{max}$ .

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## **Effect of three different throwing training programs with same workload on throwing performance with soccer ball in females**

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**OBJECTIVE** Several training programs based on the principles of overload, either by resistance or by velocity of the movement exercise, can be employed. The purpose of this study was to determine if different specific throwing programs based upon velocity, resistance or a combination with the same workload would enhance throwing performance with soccer balls.

**METHODS** 40 female high school students (age 16.4yr, mass 56.5 kg, height 1.62 m.) divided in three groups that were matched on performance, participated in the study. The resistance-training group (RES) trained overhead throwing with a 3kg medicine ball for 3 sets of 6 reps per session while the velocity-training group (VEL) threw 6 sets of 14 reps with a regular soccer ball. The combi-group (COM) threw 9 reps with the 3kg ball followed by 3 sets of 14 reps with a regular soccer ball. These training programs were matched on the same workload. Throwing performance with a soccer ball was tested before and after a training period of six weeks with two sessions per week.

**RESULTS** All groups significantly ( $p < 0.05$ ) increased the throwing distance with around 1.3m (RES: 0.7m, COM: 1.4m, VEL: 1.7m). The throwing velocity increased also significantly with 4.9% (RES), 6% (COM) and 7.4% (VEL) while no significant differences ( $p > 0.05$ ) between the groups were found after the training period.

**DISCUSSION & CONCLUSION** This indicates that three types of training regimen with the same workload after a

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short period of training, increases the throwing velocity in a similar way, which shows that workload is of importance in designing training programs and comparing training with each other.

**KEYWORDS** Resistance-training, velocity-training, soccer ball throwing

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## **In-season resistance training in junior volleyball players using different volume distribution**

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**OBJECTIVE** Variation in the volume of resistance exercise completed can be a potent stimulus for positive adaptations and is critical for the researcher and the practitioner to quantify and monitor. To date, however, it has not been very clear how this parameter can influence strength values in junior competitive volleyball players. The aim of this study was to determine the effect of two resistance training (RT) programs and to compare the changes that occurred in maximum strength and power values.

**METHODS** 12 volleyball players (17.1±0.5 years old, 1.81±7.7 m and 68.8±9.6 kg) were randomly divided into two groups. Apart from normal practice sessions, all players underwent 8 weeks of RT. Subjects performed sets of 3-10 reps with a load of 50-80% 4- repetition maximum leg press; sets of 3-8 reps with a load of 60-85% of 1-repetition concentric bench press; plus vertical jumps. One group executed a volume distribution of 3+3 sets (G1: n=6) while the other group (G2: n=6) completed 4+2 sets muscular during 8 consecutive RT weeks. The total volume and the intensity of training were the same in both groups. Measurements of maximum strength (1RM: bench press and leg press) and power (countermovement jump, ball throwing) were made before the beginning of the program and 8 weeks after the RT regimen.

**RESULTS** After 8 weeks of RT, both groups increased significantly ( $p = .000$ ) all strength and power parameters. The results showed that both groups presented significant improvement in maximum strength (1RM) without significant differences in either of the two methods ( $p > 0.05$ ).

**DISCUSSION & CONCLUSION** The present findings suggest that when the total volume and the intensity of training were the same, the maximum strength and power improvements were equally in both training programs.

**KEY WORDS** Young volleyball players, volume, strength, power

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## **Play and Learning: Effectiveness play-based method in teaching 1th grade elementary mathematics concepts**

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**OBJECTIVE** The aim of this study was to assess effectiveness play-based method vs. traditional style in teaching 1th grade elementary mathematics concepts.

**METHODS** Sixty two 1th grade elementary school girls selected and assigned randomly in to experimental (31 pupils) and control group (31 pupils). While teaching method in control group was traditional, in experimental group mathematic concepts thought by play-based method (e.g., one way road, ball and wall). One week after each concept teaching, learning exam and three weeks later retention exam with same contents for both groups has been taken simultaneously. Independent t test and Cohen's  $d$  (effect size) executed to assess mean scores difference.

**RESULTS** Results showed meaningful higher scores in experimental group on learning and retention mathematic concepts in left & right, less, more and equal, summation & subtraction as compared control group ( $p < 0.05$ ).

**DISCUSSION & CONCLUSION** Overcoming challenges such as anti-play opinion require effort by researcher to clarifying connections exist between play and learning. If parents, teachers and policy makers come to believe in the educational value of play, they will be less likely to put pressure to reduce or remove play from childhood curriculum. Results of present study confirm that play can and must hold its central role in early mathematic education.

**KEYWORDS** mathematic concepts, play, learning

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## Are 8 weeks of training enough to decrease active drag in front crawl swimming?

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**OBJECTIVE** Hydrodynamic drag is the force that a swimmer has to overcome in order to maintain his movement through water. Several attempts have been made to apply technology to determine this force (Toussaint et al., 2004). The velocity perturbation method (Kolmogorov and Duplishcheva, 1992) was developed to assess the drag of a person who is actively swimming. Active drag is highly dependent of swimming technique. Thus, the aim of this study was to assess the effects of 8 consecutive weeks of training on active drag in young swimmers.

**METHODS** 20 age group swimmers of both gender belonging to the same swimming club participated in this study (12.20±0.70 years old, 1.51±0.09 m and 41.28±7.17 kg). All participants have been trained by the same coach and for the same club for the previous two years. Active drag measurements were conducted in two different trials: at the beginning of the season and after 8 weeks of training. The velocity perturbation method was used to determine active drag in front crawl (Kolmogorov and Duplishcheva, 1992). Both trials were conducted in a 25 m swimming pool and in-water starts were used.

**RESULTS** After 8 weeks of training, mean active drag (drag force and drag coefficient) decreased, although no significant differences were found between the two trials (34.66±16.84 N vs. 32.81±12.60 N; 0.34±0.16 vs. 0.31±0.09; p>0.05).

**DISCUSSION & CONCLUSION** The present findings suggests that 8 weeks of swimming training (48 training units, 21.0±0.25 km per week) were not enough to allow significant improvements on swimming technique. One can recommend that specific training sets concerning technique correction and improvement in young swimmers should be a main aim during training planning. References: -- Kolmogorov, S.V., Duplisheva, A. (1992). Active drag, useful mechanical power output and hydrodynamic force coefficient in different swimming strokes at maximal velocity. *Journal of Biomechanics*, 25, 311-318. -- Toussaint HM, Roos PE, Kolmogorov S. (2004). The determination of drag in front crawl swimming. *Journal of Biomechanics*, 37, 1655-1663.

**KEY WORDS** Young swimmers, technique, drag, training effects.

## Swimming performance changes in young swimmers: A case study

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**OBJECTIVE** Critical velocity has been defined as the maximum swim velocity that can be maintained during a long period of time without exhaustion (Wakayoshi et al., 1992). This parameter is widely used by coaches to determine the intensity of swimmers' aerobic ability. Further, some authors suggested the concept of critical stroke rate associated with the aerobic performance (Pelayo et al., 2000). However, these two parameters are not always linked together during training. It is not clear to determine if an improvement on the aerobic ability is dependent on physiological and/or technique enhancement. Therefore, the purpose of this study was to determine the changes in critical velocity and critical stroke rate in young swimmers during a period of training.

**METHODS** 18 swimmers of both gender participated in this study (13.40±0.29 years old, 1.58±0.10 m, 47.50±13.50 kg). The evaluations took place in two different moments: beginning of the season and after 12 weeks of training. For each swimmer, critical velocity and critical stroke rate were determined in both moments using 50 m and 400 m maximal tests in front crawl.

**RESULTS** Critical velocity increased between the first and the second moment (1.05 vs. 1.09 m/s; p<0.05) whereas critical stroke rate decreased in the same period (1.10 vs. 1.05 cycles/s; p<0.05).

**DISCUSSION & CONCLUSION** Critical velocity increased and critical stroke rate decreased between the two evaluation moments, suggesting that technical ability was improved during the training period. The swimmers were able to swim at the same energetic intensity at higher velocities with lower stroke rate. These data could be used by coaches to control training. REFERENCES: -- Wakayoshi, K., Ikuta, K., Yoshida, T., Udo, M., Moritani, T., Mutoh, Y. and Miyashita, M. (1992). Determination and validity of critical velocity as an index of swimming performance in the competitive swimmer. *European Journal of Applied Physiology and Occupational Physiology* 64, 153-157. -- Pelayo, P., Dekerle, J., Delaporte, B., Gosse, N. and Sidney, M. (2000) Critical speed and critical stroke rate could be useful physiological and technical criteria for coaches to monitor endurance performance in competitive swimmers. In:

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**KEY WORDS** Critical velocity, critical stroke rate, training, monitoring.

## **Bilateral stress fractures of the calcaneus in a dancer**

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**OBJECTIVE** The etiology of stress fractures is multifactorial, and many risk factors have been implicated. Calcaneal stress injuries are fairly common overuse injuries in military recruits and athletes but it is a rare injury in dancers.

**METHODS** A case report

**RESULTS** A case of bilateral stress fracture of the calcaneus in a 26-year-old woman dancer is presented. She has suspended her dancing career for 5 years and then resumed dancing in a professional dance group where folk dance figures were more common including heel strikes and hopping. Dancers were practicing for selection of professional level with very intense training schedule 8 hours a day 6 week in a week. After 4 weeks of starting dance training, non-specific heel pain had been started. It was undiagnosed for a month because of normal x-ray images and treated conservatively as a non-specific heel pain. Because of continuing pain further imaging performed and then bilateral calcaneal posterior oblique stress fracture was diagnosed by MRI. As a risk factor, dancing on a hard floor with unsuitable shoes, intense and long training periods with insufficient resting periods, high motivation because of selection for dance company was detected. Her BMI was in normal range and she had no laboratory or bone mineral density abnormalities. She also didn't have any complain of hormonal diseases. As the treatment, vigorous activities were stopped for 6 weeks, soft heel pads and mild anti-inflammatory drugs were given. Her complain were stopped after 6 weeks, she gradually returned modified dance trainings. But she couldn't continue her dancing career because of not selected to the company.

**DISCUSSION & CONCLUSION** Bilateral calcaneal stress fractures are uncommon in dancers, but sometimes career ending results. In our case repetitious heel striking, breaking up dancing for a long period, and returning with intense training schedule, insufficient resting periods, dancing on a hard floor and unsuitable shoes were the etiologic factors. In such cases treatment is easy but reaching the previous level of performance is hard.

**KEYWORDS** dance, calcaneus, stress fracture

## **Long term analysis of the type, frequency, causality and treatment periods for injuries in PFC Lokomotiv Plovdiv for the 2002-2008 period**

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**OBJECTIVE** Trauma is one of the big problems of the present-day in sports. The frequency and the heaviness of trauma are increasing continuously in the recent years. In spite of the upgraded rehabilitation and prevention of traumas, the problem is getting more serious.

**METHODS** The aim of the study is to analyze the traumatism of a professional football club for the period of 6 years (2002-2008). The registered trauma data for the players of PFC "Lokomotiv" - Plovdiv official team have been subject to a strong documentation and analysis.

**RESULTS** The results were displayed in 10 tables. The results of the allocations of the traumas have been displayed and categorized according to the period they have been sustained (pre-seasonal preparation period/official season; during training/play). They have also been categorized according to the reason for the trauma (rough play, bad pitch conditions, improper equipment, fatigue/overuse), and concerning the location of the trauma (parts of the upper limb, lower limb, head, torso), as well as according to the injury type (acute: wounds, contusions, strains, sprains, fracture or chronic due to overuse: Achilles tendinitis, epicondilitis, insertionitis, chondropathias, myositis, ARS complex) and concerning injury seriousness (sports disability up to 3 days, from 4 to 10 days, from 11 to 20 days, from 21 to 30 days, over 30 days), as well as chronologically and according to the seriousness of the trauma inabilities over 30 days.

**KEY WORDS** Sports trauma, sports injuries, football, soccer

## The relationship between joint hypermobility and sports injuries in female volleyball players

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**OBJECTIVE** Joint hypermobility is defined as a benign condition in which some or all of the joints have range of motion beyond the normal limits. It is suggested that joint hypermobility increases the risk of sports injuries. The aim of this study was to investigate the relationship between sports injuries and hypermobility in female volleyball players between the ages of 16-22.

**METHODS** This study was performed on 101 volunteer athletes playing in 12 different teams at various levels of Turkish Volleyball Leagues during 2006-2007 season. Sports injury history was recorded by a questionnaire. Athletes were examined for joint hypermobility determined by Beighton Score which classified into the three categories: 0-2(non-hypermobility), 3-4 (moderately-hypermobility), 5-9(distinctly-hypermobility). In addition to descriptive analysis, chi-square test was used to compare the groups. Significance was set at  $p < .05$ .

**RESULTS** Mean age of the players' was  $18.45 \pm 2.39$  years and the mean training age was  $4.43 \pm 2.36$  years. Thirty seven of 101 athletes (36,6%) were non-hypermobility, 22 were (21,8%) moderately hypermobility and 42 were (41,6%) distinctly hypermobility in which 7(18,9%), 11(50,0%) and 20(47,6%) had previous sports injury, respectively. Statistically significant relationship was found between hypermobility and sports injuries ( $p < .01$ ).

**DISCUSSION & CONCLUSION** It was found that joint hypermobility increased the risk of sports injuries in female volleyball players between the ages of 16-22. Medical examination before the sports participation and appropriate injury prevention methods may provide better protection. Additional research is needed to clearly determine whether a relationship exists between hypermobility and sports injury in volleyball players.

**KEY WORDS** Volleyball, Sports Injury, Hypermobility.

## Investigation the injury condition of amateur football and basketball players

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**OBJECTIVE** Because of the popularity and the importance of the professional games, scientific researches about sport medicine focus on professional players. In this aspect, while it is possible to find many researches about injury condition of professional players, about the amateur player is need more investigation. Thus the aim of this study was to investigate the injury conditions of amateur players.

**METHODS** Totally ninety-nine amateur licensed players including forty-nine basketball players (28 male, 21 female) and fifty football players (31 male, 19 female) (Xage:  $23.8 \pm 4.1$  year, Xsport age:  $11.9 \pm 3.5$  year) were attended the study voluntarily. Data collected by using sport injury questionnaire form include; demographic data, injury location, injury type and the reason of the injury which was developed by researcher. SPSS 11,5 statistical program was used to analyze data. "Chi-Square Test" was used to analyze differences between groups. Findings accepted significant at  $p < .05$  level.

**RESULTS** Analysis showed that; while lower extremity was the most injured body part (40,4%), sprain was the mostly seen injury type (27,6%) and improper floor was mostly described reason of the injury (40,4%) among the basketball players, head and neck were the most injured body parts (43,1%), contusion was the most seen injury type (29,5%) and improper floor was mostly described reason of the injury (43,1%) among the football players. Analyze proved that there was no significant differences between football and basketball players according to injury type, location of the injury and the reason of the injury ( $p > .05$ )

Study showed that even location of the injury and the injury type was different for basketball and football, reasons of the injury were similar for both basketball and football players. Thus it is possible to advice that firstly, standardizing the courts then using protective equipment while playing can be effective to reduce the rate of the injury among amateur basketball and football players.

**KEY WORDS** Sport, injury, amateur player, football, basketball



## Musculoskeletal injuries during the 8th world university wrestling championship 2008

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**OBJECTIVE** The purpose of the study is to record the incidence of the athletes' injuries, sustained during the 8th World University Wrestling Championship 2008, held in Thessaloniki, Greece (9-13 July).

**METHODS** Twenty seven countries from all over the world participated in the Championship with 226 athletes. There were three wrestling styles: Free style (LL), Female wrestling (LF), Greco - Roman (GR). Twenty countries participated in Free style, with 77 athletes and 59 matches took place. In Female wrestling 17 countries participated with 65 athletes and 58 matches took place. In Greco-Roman style 20 countries participated with 84 athletes and 77 matches took place.

**RESULTS** The total of all injuries was 18 and on top of it there was one athlete who suffered from stomach ulcer penetration. In detail there were 7 injuries in Free style, 6 in Female style and 6 in Greco-Roman style. One athlete in Female style sustained 2 injuries. In free style occurred 1 ankle sprain, 1 tooth fracture, 3 knee injuries, 1 neck abrasion, 1 cervical sprain. As for the female injuries 2 ankle sprains 2 knee injuries and 1 mentum laceration were recorded. The Greco-Roman style involved 3 nose contusions, 1 eyebrow laceration and 2 shoulder dislocations.

**DISCUSSION & CONCLUSION** The incidence of injury was 8.85%. In this study we analyze the type of injury per wrestling style, sex, category, body location and side.

**KEY WORDS** Sports injuries, wrestling, epidemiology

## Effect of static stretching on delayed onset muscle soreness before eccentric contraction

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**OBJECTIVE** The main purpose of this study was to determine the effect of static stretching before eccentric contractions on DOMS (delayed onset muscle soreness). Many studies showed that DOMS, CK and LDH enzymes increased in recovery period. Eccentric contractions that use in exercise, it is possible have side effect, for example damage to member of cells, releasing macrophages, releasing enzymes and pain until 48 hours after exercise especially in down hill and weight training with over load. This exercise induced damage in muscle fibers. It is possible static stretching inhibits or increased damage of eccentric contractions.

**METHODS** 21 volunteers female university student (P.E. students) were selected. Who were normal healthy, with no positive clinical finding. After having the procedures fully explained to them written information consent was obtained. Subjects were assigned in one of two experimental group (n=10) (age:21.6±1.71 years, height:161.45±2.71 cm, weight: 57.25±6.99 kg, and  $Vo_{2max}$  34.18±2. ml.kg<sup>-1</sup>.min<sup>-1</sup>) and control group (n=11), (age:24.25±4.30 years, height:159.81±4.86 cm, weight:54.69±3.82 kg, and  $Vo_{2max}$ :36.1±3.79 ml.kg<sup>-1</sup>.min<sup>-1</sup>) groups, All subjects were right handed. As pre test venues blood sampling of all subjects were taken and after that experimental group performed static stretching on shoulder, elbow and arm for 15 minutes, then they performed eccentric contraction. Control group performed, only eccentric contraction. Blood sampling were obtained before, immediately after exercise, 24 48 hours after and, were drawn from an anticubital vein with subjects in the seated position. Sensation soreness were assessed by pain chart. Data was analyzed using ANOVA test,  $\alpha$  was set at 0/05. Data are presented as mean ± ME of the mean.

**RESULTS** There were an increasing CK and LDH enzymes levels in subjects blood. So subjects had pain and inflammatory in their hands. Changes were higher in experimental group. The results showed that eccentric contraction induced DOMS, CK and LDH enzymes levels increased in two groups (especially in experimental group), post test and continuously 24 hours after that the but the effects of static stretching of CK, LDH enzymes and DOMS are not significant.

It shows that the static stretching has a effect on CK and LDH. The results showed warm up not only did not prevent the muscular damage and did not decrease the pain of cellular damage, but also the warm up by eccentric stretching increased CK and LDH. MS (muscle sourness) are acute (Immediately after exercise) or delayed after, 24 - 48 hours after exercise. That is better static stretching use after general warm up, because muscle fibers and member cells do not damage and deplete enzymes.

**KEY WORDS** muscle soreness, CK, LDH, contraction

## An investigation of injury patterns in female futsal players

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**OBJECTIVE** In futsal, like the other sports, athletes are exposed to various sports injuries. The main purpose of this study was to investigate injury patterns, prevalence and causes in female futsal players.

**METHOD** This study was performed on 66 volunteer female athletes playing at different teams during 2008-2009 seasons. Clinical interview method was used in this study and sports injuries were detected by means of data forms. The data form was developed by investigator. Ten parameters were examined related sports injuries in futsal. Describe statistic was applied and chi-square test was used to determine whether there was a significant difference between the categorical parameters. Statistical significance level was set at  $p < .05$ . The SPSS statistical software package program was used to perform the analyses.

**RESULTS** In this study, the average age of the players was  $20.72 \pm 2.08$  and the average training age was  $6.33 \pm 2.88$ . Totally 93 sports injuries were investigated related futsal. Twenty nine (31.2%) of the all injuries occurred in preseason and 64 (68.8%) occurred in the competition season. Fifty three (57.0%) of 93 injuries occurred in lower extremities and 22 (23.7%) occurred in upper extremity. The overall injury rate of ankle injuries was 25 (26.9%), knee: 20 (21.5%), low back: 15 (16.1%), hip/thigh/leg: 11 (11.8%), shoulder: 8 (8.6%), elbow: 4 (4.3%), hand/finger: 5 (5.4%), and head/face: 5 (5.4%). The proportion of acute traumatic injuries was 73 (78.5%) and overuse was 20 (21.5%) and 24.7% of all injuries were caused by contacting to rival player. In all injuries, the overall duration of return to sports rates were with in 1-3 days: 10 (10.8%), 4-7 days: 32 (34.4%), 2-3 weeks: 24 (25.8%), 1-2 months: 17 (18.3%) and 3+ months: 10 (10.8%). Hospitalization rate due to sports injury was 63 (67.7%) and no applied to hospital for 30 (32.3%) injuries. No significant differences were found in the any frequency of injury between acute and overuse group.

**DISCUSSION & CONCLUSION** This study showed that competition season injuries were exceedingly higher than preseason injuries. Similarly, acute traumatic injuries had consistently higher proportion than overuse injuries. It results from contact to rival players powerfully under match stress. The lower extremity area showed a higher percentage of injuries than the upper extremity. The most common injury area was ankle with  $> 25\%$  rate. Because futsal is a foot sport, high rate of lower extremity injuries (ankle, knee, leg, hip and thigh) may be accepted unexceptional. Wearing protective equipment for body area at risk and efficient warm up/calm down exercises should reduce the risk of sports injuries related futsal. The limitation of our study was to be a retrospective research. Additional prospective research is needed to clearly determine injury patterns in futsal.

**KEYWORDS** Futsal, Sports Injury.

## Injury prevention through logistic regression equations

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**OBJECTIVE** The difference in the length of the lower members and the foot varus and valgus have shown that they are related to a greater incident in lower extremities injuries, as well as the articular laxity, the flexibility and biomechanics or structural parameters. Prediction of injuries by means of logistic decline. The models of decline include a series of technical math that try to measure the relation among a variable turned out and an or some variables. Shambaugh (1991) relates structural measures with the incident of injuries in the lower extremities in basketball players by means of an equation of logistic decline of three variables that predicted the probability of wound in a 91%. Salazar (2000) contributed a new mathematical injuries predictor formula by means of an analysis of logistic decline. SALAZAR' INJURIES INDEX  $1/1 + e^{0.1621 - 0.06344 \cdot \text{Shambaugh Index Medium}}$ \* Our purpose is to relate them among itself of mathematical form by means of equations of logistic decline.

**METHODS** We used the SHAMBAUGH' INJURIES INDEX:  $\text{IMBALANCE OF WEIGHT} \cdot 0,36 + \text{ANGLE-Q RIGHT DEVIATION} \cdot 0,48 + \text{ANGLE-Q LEFT DEVIATION} \cdot 0,86 - 7,04$  We have submitted to analysis the different predictor variables in athletes (150 athletes, 80 men, 70 women, 14 and the 18 years) obtaining the mathematical algorithm Fernández's Injuries Index :

**RESULTS** The analysis by logistic decline can be a valid method in the discrimination of anthropometrics parameters related to the injuries. FERNÁNDEZ' INJURIES INDEX  $1/1 + e^{-(0.757 \cdot \text{QA} - 0.647 \cdot \text{DLM2})}$  (QA: Femoral q Angle; DLM: Dismetry Lower Members) The good classification of the model obtained was of the 68.6%. The Cut point (0.5), indicates that the subjects with equal values or over 0,5 would remain fit in in the category of possible injured while a lower value would fit in them inside the category of possible unharmed.

**KEY WORDS** Fernández' Injuries Index, injuries, Imbalance of lower members.

## The analysis of injury patterns in female volleyball players

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**OBJECTIVE** Athletes are exposed to various sports injuries in volleyball like the other sports. The aim of this study was to analysis injury patterns, prevalence and causes in female volleyball players.

**METHODS** 101 volunteer female athletes (age: 18.45±2.39, experience: 4.43±2.36) playing at different teams during 2006-2007 seasons participated to study. Interview method was used in this study and sports injuries were detected by means of data forms. The data form was developed by investigator. Describe statistic was applied and chi-square test was used to determine whether there was a significant difference between the categorical parameters. Statistical significance level was set at  $p < .05$ . The SPSS statistical software package program was used to perform the analyses.

**RESULTS** In this study, totally 60 sports injuries were analyzed related volleyball. Twenty eight(46.7%) of the all injuries occurred in preseason and 32(53.3%) occurred in the competition season. Thirty six(60.0%) of 60 injuries occurred in lower extremities and 16(26.6%) occurred in upper extremity. The overall injury rate of ankle injuries was 24(40.0%), knee:10(16.7%),back-low back: 8(13.3%), hip/thigh/leg:2(3.3%), shoulder:5(8.3%) and hand/finger:11(18.3%). The proportion of acute traumatic injuries was 43(71.7%) and overuse was 17(28.3%). In all injuries, the overall duration of return to sports rates were with in 1-3 days: 5(8.3%), 4-7 days: 16(26.7%), 2-3 weeks:28(46.7%), 1-2 months: 7(11.7%) and 3+ months: 4(6.7%). Twenty for(40%) injuries occurred in block position and 10(16.7%) occurred spike position. Center and spiker players suffered from injuries with higher rate. No significant differences were found in the any frequency of injury between playing position.

**DISCUSSION & CONCLUSION** The lower extremity area had a higher percentage of injuries than the upper extremity and acute traumatic injury rate was extremely higher. It may result from repetitive jumping powerfully and net actions during the play. The most common injury area was ankle because of contact the rival players in the block and spike positions. Center and spiker players had a higher rate of injuries thus these players should be more careful especially in net actions. Wearing protective equipment for body area at risks such as ankle, rehabilitations after the previous injuries and efficient warm up/calm down exercises should reduce the risk of sports injuries related volleyball. The limitation of our study was to be a retrospective research. Additional prospective research is needed to clearly determine injury patterns in volleyball.

**KEY WORDS** Volleyball, Sports Injury.

## Football injuries in youth national teams: A three year prospective study

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**OBJECTIVE** The aims of this study were to investigate the incidence of injury and to examine the influence of age on the injury profile at youth national football level.

**METHODS** Starting from 2004, the U-17 Turkish male youth national team was followed by the same team physician for three years during their progression as U-18 and U-19. A total of 52 players were registered throughout the study, and individual player exposure and injuries sustained by the team participants were prospectively recorded.

**RESULTS** 44 injuries were documented among 24 (46.2%) players. Injury incidence was about five times higher during match play than training (48.7 vs. 10.5). The youngest group (U-17) sustained more training injuries and fewer match injuries than did the oldest group (U-19). The majority of injuries (65.9%) leded time loss and 72.4% of which resulted in absence from football of one week or less. Moderate to severe injury rates were higher in U-19 compared with U-18 and U-17 teams (28.6% vs. 20% and 12%). Traumatic injuries represented 52.3% of injures and the rest was in overuse nature. In U-18 and U-19 teams, all traumatic injuries happened during matches and mostly with contact mechanism. For U-17 team, 53.8% of traumatic injuries occurred in trainings and all were in non-contact nature leading time loss. In training injuries of U-17 level, overuse injuries were two times higher than traumatic injuries. However, for U-19 level, 57.1% of overuse injuries occurred during matches. The largest part of injuries (79.5%) was to the lower extremities and the most frequent locations being the thigh and hip/groin. Muscle injury was the leading injury type followed by contusions. For U-17 and U-18 teams, a greater proportion or all of muscle injuries were sustained during trainings. Conversely, in U-19 team, muscle injuries mostly occurred in matches. Re-injury rate was 25% and all were in overuse nature and tended to cause less absence than non-reinjures.

**DISCUSSION & CONCLUSION** Finding of increasing match and decreasing training injury incidences with age may indicate a greater risk with higher intensity of competition and advantage of developed technical capability and injury-avoidance skills in trainings. Furthermore, player age seems to have an apparent effect on the nature and severity of injuries with respect to match play or training exposure.

**KEY WORDS** Injury incidence, youth football, soccer, national team

## Sport behaviours and leisure time activities in patients with total knee arthroplasty

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**OBJECTIVE** Outcome evaluations of lower extremity joint reconstructions should include an assessment of patient activity levels. The aim of this study is to investigate the sport behaviours and leisure time activities of osteoarthritic patients after total knee arthroplasty (TKA).

**Methods** 103 patients (92 women, 11 men), with the mean age 66.9± 8.1 years, who received TKA approximately 39 months ago, were included to this study. The examination consisted of measurement of the sport behaviour and leisure time activity with the Modified Baecke Questionnaire for Older Adults, and the knee function with the Hospital for Special Surgery Knee Scale (HSS).

**RESULTS** The HSS mean score of the participants was 89.21±9.44. While there was no pain in 82.8% of patients, there was minimal pain in 17.2% of patients. According to the Modified Baecke Questionnaire for Older Adults, 27.2% of patients have participated to sport activities reported as walking, swimming and aerobic exercises. Walking was reported by all of the patients, who have participated to sport activities, apart from one patient. The most reported leisure time activity was watching television (mean 3.99±2.26 hours per day). 55 patients were watching television more than 4 hours per day.

**DISCUSSION & CONCLUSION** Although TKA surgery increased patient's functional level and decreased pain, patients with TKA have inactive lifestyle after arthroplasty. The most of patients were not participated to any sport activity and they were spent more time with watching television. A combination of physical exercise and behavior education may enhance the ability of patients with TKA to perform daily activities. These patients must be encouraged to be physically active.

**KEY WORDS** total knee arthroplasty, sport behaviours, leisure time activities

## A recurrent patellar cartilage fissur in a professional football player: A rare case and follow up

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**OBJECTIVE** Anterior knee pain is a common problem in sport. Football players may sustain such problems more frequently compare to other sport disciplines. Retropatellar cartilage is prone to injuries and problems are difficult to diagnose without proper approach. Injury mechanism and physical examination may lead to suspicion of a cartilage problem however imaging tools are necessary to put correct diagnosis for appropriate treatment. In the meantime, arthroscopy is always a choice for through management.

**METHODS** A 25 years old male football defensive player (professional for 10 years) had weakness and pain during stair climbing, kneeling and squatting. He explained an onset of pain during training a month ago but subsided with ice application and use of non-steroidal anti-inflammatory drugs. Following a fall on his knee during the last training, pain has become more severe. Physical examination showed limited effusion, retropatellar pain and sensitivity during palpation and (+) patellar aggregation. Knee hyperextension was painful. X-ray was negative. Magnetic resonans imaging (MRI) revealed a 4 mm wide fissur extending to subchondral bone. Subchondral bone was sclerotic and significant bone odema was detected.

It was decided to start conservative treatment after consultations and sportive rehabilitation was commenced. 3 weeks isometric strengthening and non-weight bearing activities were applied. 3 intra-articular hyaluronic acid injections with 10 days interval was done. Straight runs were introduced after 4th. week and terminal range isotonic activities were added. After the 6th. week, his complaints reduced by % 60-70. However, MRI did not show any betterment of cartilage fissur. By the 9th week, his complaints nearly subsided totally and training on the field was resumed. MRI taken on the 12th week showed filling of cartilage over the lesion.

The player had a second trauma (20th weeks after the first problem) on his knee by falling down again (a protest against referee) after fully returned to sport activities on the 8th. week. MRI showed the similar lesion even with greater subchondral odema. After one week absolute rest, intraarticular injections repeated three times with one week intervals. Same conservative sportive rehabilitation program was followed. He started training with the team after the 8th Week as he had no pain and limitation. MRI showed healing on the fissur after 8th week and no odema after 12th week.

**DISCUSSION & CONCLUSION** Knee problems are more common compare to other anatomical regions in football players. Ligamentous and meniscal injuries are more pronounced. However, injuries to cartilage should also be



considered carefully because these take longer time to recover and may cause recurring problems. Patellar chondromalasia, contusions, dislocations and/or fractures can be associated with cartilage problems. Clinical diagnosis of cartilage problems may pose difficulties because of no specific findings and possible concomitant injuries. A careful anamnesis, through physical examination and imaging methods may help to achieve proper diagnosis and planning treatment. Arthroscopy can be considered for complicated cases.

## Results of the anterior cruciate ligament reconstruction in athletes

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**OBJECTIVE** Rupture of the ACL is common knee injury and often it leads to sudden cessation of successful sport careers. The injury leaves permanent consequences leading to chronic anterolateral rotator knee instability and with time to osteoarthritis. Arthroscopic ACL reconstruction is the treatment of choice, especially for active athletes. The aim of our study is to follow on results of operatively treated patients – active athletes after the arthroscopic reconstruction of ACL, and their return to pre-injury sport activities.

**METHODS** The analysis included 78 athletes (66 men and 12 women, 55% active and 45% recreational). Arthroscopic ACL reconstruction was in all patient done by using STG graft, along with endobutton, retrobutton, transfix II fixation for femoral condyle and bioabsorbable interference screw for tibia. 75 patients were treated with single bundle technique and 3 with double bundle technique. We analyzed and compared parameters obtained by clinical examination and functional test, before and after the operation.

**RESULTS** The average follow up period was 19,6 (6 do 34 months). Preoperative Lysholm score was 57,33, and postoperative 92,64 (range, 43-100). Preoperative Tegner activity level was 2,43, and postoperative 6,89 (range, 1-10). Arthrometric measurements of patients before the operation were in average 8,45mm of anterior shift of tibia in relation to femur which was corrected postoperatively to 2,18mm in average. 64 patients returned to sport activities to the pre-injury extent while 14 did not (7 due to change in life style, 5 for not having physiotherapy and 2 for poor operative result).

Results of the ACL reconstruction in our patients are compatible with world results and patients were satisfied with postoperative results. These led to early return to ADL and competitive sport activities (in average, for 6,2 months).

**KEY WORDS** anterior cruciate ligament, arthroscopy, Tegner, Lysholm score

## Combination or not of knee extensors exercise with neuromuscular electrical stimulation in patients with patellofemoral pain syndrome?

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**OBJECTIVE** Patellofemoral pain syndrome (PFPS) is a common problem among adolescents and young adults, characterised by peripatellar pain when ascending or descending stairs, squatting or sitting with flexed knees. There is an increased interest in the role of exercise for the treatment of PFPS. The aim of this study is the comparison of the effect of non-weight-bearing knee extensor isometric and concentric exercise and their combination with neuromuscular electrical stimulation (NMES) of the knee extensor muscles in patients with patellofemoral pain syndrome.

**METHODS** Fifty six patients with PFPS, ten men and forty six women, between 18 and 45 years of age were randomized into two groups. The first group (A, n=28) performed at home, 20 minutes exercises program, two times daily, consisted of non-weight-bearing isometric and concentric exercises that focused on strengthening the quadriceps and hip flexors muscles for 8 weeks. The other group (B, n=28) performed 20 minutes training program, two times daily, of superimposed (electrically evoked and voluntary activation) isometric knee extensions in supine position with the knee in full extension. During stimulation, participants were informed to maximally contract their knee extensors taking into account their pain threshold. Biphasic, rectangular symmetrical pulses by an electrostimulator were used to provoke muscle activation. We evaluated the pain with the Visual Analog Scale (VAS) during ascending stairs, descending stairs and standing up from a sitting position and the Kujala patellofemoral score before and after the practice of a 8 weeks program. Additionally we evaluated the compliance of the patients with these programmes.

**RESULTS** A significant ( $p < 0.05$ ) reduction of pain and improvement of the Kujala score was observed in group B, but not in patients of group A. The patients of group B referred a much better compliance with this program. When we

isolated the group A patients, who had low compliance in program with exercises, there was found significant reduction of pain and improvement of the Kujala score in group A patients ( $p < 0,05$ ).

**DISCUSSION & CONCLUSION** The combination of non-weight-bearing knee extensor isometric and concentric exercises with neuromuscular electrical stimulation reduces the pain and improves the functionality of patients with PFPS. The patients refer better compliance with this treatment protocol.

**KEY WORDS** Patellofemoral pain syndrom, exercise, electrostimulation

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## Lumbar intervertebral disc findings in elite track and field female Greek athletes

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**OBJECTIVE** The majority of orthopaedic problems experienced by competitive track and field athletes are related to pain in the lower legs esp. thigh and ankle region. Low back pain is a less common reason of complaints. There has been no previous research into lumbar disk "degeneration" in elite track and field athletes. Our hypothesis was that excessive physical loading accelerates lumbar disk "degeneration" in elite track and field athletes.

**METHODS** Study participants were 46 (18 to 29 year-old) elite track and field female athletes and 30 age and sex matched non athletic individuals. Lumbar intervertebral discs were evaluated using T2-weighted magnetic resonance imaging in the axial and sagittal plane. Based on our MRI exams we estimated and compared the prevalence of abnormal disk findings ("degeneration") and their disk level in the study groups and we further investigated the potential relationship among their event category (throwers, jumpers, sprinters, runners and decathlon athletes) and disk findings.

**RESULTS** Thirty five out of 46 elite track and field athletes and 15 out of 30 controls had abnormal MRI findings regarding lumbar intervertebral discs at various disk levels and the prevalence was significantly greater in the elite athletes group ( $P=0.004$ ). Lumbar MRI reported the presence of: 1) disc herniation in 13 athletes and 8 controls 2) disc degeneration in 12 athletes and 6 controls 3) disc bulging in 10 athletes and 6 controls and 4) High Intensity Zone (HIZ) in three athletes. L5-S1 level was significantly more frequently degenerated in both groups. Disc herniation was the most common finding in both groups, but the prevalence was significantly greater in the elite track and field athletes. In addition disc herniation was more common in throwers, degenerated disc was most commonly seen in female jumpers and throwers and disc bulging was more often reported in jumpers.

**DISCUSSION & CONCLUSION** In conclusion, excessive physical loading accelerates lumbar intervertebral disk "degeneration", especially in the L5-S1 intervertebral segment.

**KEY WORDS** Lumbar Mri, Track And Field, Female

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## Risk of shortening in postural lateral trunk flexion muscles in shooters

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**OBJECTIVE** It is a common experience that the shooters feel discomfort and sometimes pain in their backs. The effect of static prolonged trainings is the muscle fatigue. This leads to changes in muscle length and to loss of force. THE PURPOSE OF THIS STUDY is to assess the changes in length and static endurance of m.quadratus lumborum in shooters.

**METHODS** There were assessed 15 athletes fired a sport and an air small-calibre rifle and pistol during the period March – June 2009. All of them were students (6 female and 9 male) at the National Sports Academy "Vassil Levsky", Sofia, Bulgaria at average age of 20.7 years. The tests of shortening and static – strength endurance for m.quadratus lumborum were applied.

**RESULTS** The asymmetric shortening of m.quadratus lumborum was observed at all of the examined shooters. The average difference between both sides was 1.87 cm. The rate of the differences in the static – strength endurance was 12 (80%) per 15 shooters, with almost 8 (66, 7%) showing the lower results in the shortened side. On 3 (20%) athletes the results of both sides were similar.

**DISCUSSION & CONCLUSION** The sustained static efforts in shooters lead to asymmetric changes in the length of m. quadratus lumborum and to decreasing of the static – strength endurance of the shortening muscle. The adequate physiotherapy provides the correct diagnostic of the muscle imbalance. These findings should be considered to restore the muscle balance and to improve the shooting posture. Key words: endurance, m. quadratus lumborum, shooters, shortening

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## Theory and clinical approaches to chronic back pain by synchronism and entrainment

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Vibrations and rhythms, as a result of organs and single cells, are well known in the field of clinical medicine. Also their changes until a total stop (death) have been described for decades. In cardiology and sports medicine it is well established to use time patterns (cell vibrations as a result of cell activity) for diagnostics. Using time patterns (electrical, magnetical, mechanical, gravitational) specifically for therapy is new and opens the new field of vibrational and regenerative medicine. Biophysics of today gives the idea how biological structures are the result of physico-chemical processes, that are driven by body intrinsic and / or body external rhythms. Such bio-informative fields interact the whole span of life and stabilize dynamically. In the early 90<sup>th</sup> we already showed in high resolution videomicroscopes cellular oscillations depending from the biophysical environment. More and more we recognized, that geometry can be seen as the informational link between time- and space-pattern and that by “entrainment” body-rhythms and physicochemical processes are locked into phase. Next step was to find out how far “basic evolutionary time patterns”, regarded as natural conductor-frequencies are disturbed in diseases like chronic back pain and how far such attractors can be systematically and continuously restored beginning from microscopic cellular level and brought back to a synchronous cooperation on macroscopic level. Skeletal muscle clearly shows “bifurcation like” behaviour during contraction. The muscle turns either into quivering (rescue) mode or cramping, hardening (injury) mode. This injury mode is clinically seen in low back pain patients. Following this dynamic approach the Matrix-Rhythm-Therapy, a “Rhythmic Micro-Extension-Technique”, was developed, that turns the injury mode into rescue mode by entrainment. For the first time the so far neglected time-structure (time-pattern) of the organism is directly used as order parameter for the treatment. This innovation got the PCT and US patent and is used in present day modern medicine. Clinically evaluated studies have been done in governmental rehabilitation-clinics of the RVA, FaberCastell, Rodenstock and at Daimler, Stuttgart.

## The use of tecartherapy in the treatment of hematoma. Case study

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**OBJECTIVE** Tecartherapy is a new therapeutic method. It radiates low frequency radio waves (0,485 Mhz) and transfers electric charges, by the form of ions, increasing the metabolism of the cells and allowing the rehabilitation of the tissues. Aim: The evaluation of the effectiveness of Tecartherapy, when it is used as the only form of therapy in the treatment of a hematoma in the area of the foot.

**METHODS** Female athlete of Tae Kwon Do, 27 years old, during practice stroke the basis of her second metatarsal against the elbow of her partner. A large hematoma was formed in the area of the foot and ankle. The patient reported severe pain and difficulty in walking. Method: The patient was treated exclusively with Tecartherapy once a day for four consecutive days. The detumescence was evaluated by measuring the diameter of the foot. On the first day the diameter at the exact point of the hit was 25 cm, while at the right foot it was 22 cm. No medication was received.

**RESULTS** After the period of four days the hematoma was substantially reduced. The diameter was 22 cm and there was no pain during walking. The athlete gradually returned to practice without any particular problems.

**DISCUSSION & CONCLUSION** The use of Tecartherapy can be very effective for treating a hematoma. Further research is required to show if the combination of Tecar with other forms of therapy has better results in similar situations.

**KEYWORDS** Tecartherapy, hematoma, physiotherapy

## Transdermal permeation of Hialsorb Sport®

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**OBJECTIVE** The aim of this study was to determine the transdermal permeation of HIALSORB SPORT®, which is a

fluid emulsion for joint massage that contains 0.25% of Hyaluronic Acid and 0.25% of other mucopolysaccharides.

**METHODS** The transdermal permeation of the mucopolysaccharides present in HIALSORB SPORT® was studied in vitro with human skin from the abdomen of healthy woman who underwent cosmetic surgery (0.4 mm thick). Skin samples from 6 donors were used and barrier integrity of skin samples was characterized by transepidermal water loss (Tewl) measurements. We used Franz-type vertical diffusion cells with an effective permeation area of 2.54 cm<sup>2</sup> and a receptor compartment volume of approximately 13 ml. The formulation studied (0.3 g) was placed in the donor compartment and the receptor chamber was filled with PBS (phosphate-buffered saline, pH 7.4) and kept at 37±0.5 °C. Samples of 400 µl were withdrawn from the receptor compartment during 24 hours. The determination of the glycosaminoglycans was determined by means of a spectrophotometric assay using dimethyl-methylene blue (Farndale et al, 1982).

**RESULTS** The study shows that the degree of permeation of Hyaluronic Acid and other mucopolysaccharides (expressed as total glycosaminoglycans) through the human skin of 6 different donors and from the emulsion called HIALSORB SPORT® at 24 hours was circa 17%.

**DISCUSSION & CONCLUSION** We found that the transdermal permeation of glycosaminoglycans from the emulsion was circa 17%, ensuring perfect lubrication and good joint function. The degree of absorption is shown to be 2 to 5 times higher than topical Sodium Diclofenac.

**KEY WORDS** transdermal permeation hyaluronic mucopolysaccharides lubrication joint

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## The benefices of associating set in the treatment of sport related injuries

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The objective of the study was to assess the efficiency of associating enzyme therapy to the specific, classic forms of drug treatment in injured athletes: systemic, local and physiotherapy. It was aimed to see if administration of enzyme therapy to other non-invasive treatment can improve the recovery, in time and regarding the sequela pathology. Fifty-eight high level athletes, was used and was followed-up for 7 months. They practiced different types of sport and there was an even gender distribution. The injuries were classified in following groups: contusions, fibrillar lesions, lumbalgic syndrome, enthesitis/ tendinitis, myositis, sacroileitis. Twenty nine person were treated with specific treatment, both local and systemic and physiotherapy and the other 29 person were given Phlogenzym besides this forms of treatment, in the dosage of 5 tablets two times a day, for 3 weeks. The results showed that the administration of Phlogenzym shortened the period of recovery with 3 to 5 days (considering the first day that the athlete was able to start training after injury), eased the symptomatology (pain, discomfort, functional impotence measured by a scale from 1 to 5), and there was less sequela pathology in about 70% and a good compliance and practically no side effects (patient declaration on how they felt about the medication taking two times a day, between meals and side effects – only one complain of mild digestive transit acceleration, normalised after stopping the treatment). As a conclusion, we may say associating Phlogenzym to the classical treatment of traumatic sport related injuries shortens the duration of recovery and limits the onset of potential sequela pathology.

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## Tendoactive®: A novel nutraceutical formulation for the prophylaxis and treatment of tendon injuries in athletes

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**OBJECTIVE** Tendinopathies are common tendon disorders associated with inflammation, microtears in the extracellular matrix and decreased tensile strength of the affected tendons. There is an acute need for developing new therapeutic strategies due to the current lack of effective treatments. Therefore the aim of this study was to evaluate the prophylactic effectiveness of Tendoactive® on the repair and regeneration of tendon injuries modelled using human tenocytes in vitro.

**METHODS** Primary human tenocytes in monolayer cultures were either stimulated with interleukin-1β (IL-1β), stimulated with IL-1β and Tendoactive® or pre-stimulated with Tendoactive® followed by co-treatment with Tendoactive® and IL-1β. Tendoactive® is a novel nutraceutical formulation that includes mucopolysaccharides. Cell

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adhesion, proliferation, vitality and production of extracellular matrix (ECM) were evaluated with light microscopy and transmission electron microscopy (TEM). Expression of the extracellular matrix protein type I collagen and the signal transduction and adhesion molecule  $\beta$ 1-integrin were studied with immunofluorescence. Immunoblotting was performed to evaluate expression of metalloprotease-1 (MMP-1), cyclooxygenase-2 (Cox-2) and Caspase-3.

**RESULTS** Tendoactive® had a strong stimulatory effect on human tenocyte proliferation and ECM production and was able to counteract the IL-1 $\beta$ -induced catabolic, apoptotic and inflammatory effects in human tenocytes. Furthermore, treatment with Tendoactive® reversed the adverse effects of IL-1 $\beta$  resulting in the down-regulation of IL-1 $\beta$ -induced expression of MMP-1, Cox-2 and caspase-3 and upregulated type I collagen and  $\beta$ 1-integrin synthesis.

**DISCUSSION & CONCLUSION** These results suggest that Tendoactive® may be used effectively in the prophylaxis and treatment of tendinopathies for the healing, regeneration and repair of tendons.

**KEY WORDS** tendon tendinopathies tendonitis mucopolysaccharides tenocytes

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## Early rehabilitation program for anterior cross ligament using hydrodynamic flume channel

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**OBJECTIVE** Today, ACL breaking is one of the most important professional sports injuries but also affects a big number of people. Different stabilized protocols set the recovery time between 4 to 8 months for professionals players and 8 to 12 for the rest of patients. This study presents a new Early Rehabilitation Program for ACL injuries after surgery into an early phase using some of the main working areas for a Physiotherapist today. The goals are pointed to get the early recovery of the plastia and to reduce the time to return to full activity after surgery, paying attention and respecting during the process the Natural injury Evolution and patient conditions. Since around 85% of human movements are based in accelerate and non-accelerate forces this program is trying to introduce these principles to get the general and specific

**METHODS** The patient selected to perform this study is 35 years-old man with an ACL breaking injury right knee and no other relevant clinical history details for this study. Early Rehabilitation Program designed. The surgery technique selected was a 12 cm plastia from semitendinosus muscle and internal rectus muscle from the right leg. This technic avoid the main risk factor like the inmunitary problems from the use of external plastia. To apply the Kinesitapping during the surgery, we use a passive mobilization of the knee after the doctor close the skin tissue. When the patient came to our treatment room the first day after surgery, he informed to us that no bad sensation was feeling on the skin tissue and the resistance of the tape was 100%. In the first joint examination, the right knee flexion reach 55° in sagittal plane and the extension movement was perfect from the first moment. The inflammation for quadriceps muscle is presented in a very low scale and the edema is minimum, as well. It was located at the popliteus area. We applied the second Kinesiotapping technique, using the muscle internal vastus and external vastus of the quadriceps, looking for the muscle contraction reactivation. For the first 5 days of treatment Manual Therapy was applied including Leduq Linphatic Drainage method to avoid the edema and reduce the joint pain mobilization because the influence of sympathetic system. We mainly had use the “call technique” on the leg and the “re-absorption technique” for the knee joint. Then, we used the passive movements by TGO (osteopathy general treatment) for the entire leg starting from the feet until the hip joint. The rhythm is control by the patient capacity, gently and respecting the arc move limits. This phase also includes an starting active muscle contractions and movements, using an eccentric exercises to allow us to increase the joint balance and muscle reactivation, working in a close chain contraction ( CCC ) to protect the young plastia and to reduce miofascial syndrome. In this phase, we tried to wake up the plastia receptors and fight against muscle trophy after the immobilization period. All these actions follow the rule NO PAIN, so the low intensity and rhythm are the key of this early rehabilitation. The plastia is not ready to work properly and during the first 5-6 treatments we focussed on the neurological concept to protect the plastia and stimulating the receptors. The Flume Channel technology orientated in two different ways. First, the most commonly use is to perform and improve a sports technique and develop training programs for swimming, canoeing, football and basketball, and in the other hand, we found different programs specialized in respiratory therapy, but also for some other muscleskeletal diseases. Since our main concern is to discover this fantastic tool to develop physical rehabilitation programs for we get this significant information: water speed, heart rate, lactic acid level production, amplitude and frequency of each movement.

**RESULTS** Although the short long of sessions, just 7, in this Early Rehabilitation Program of ACL, the results show to us an important and significant improve from the originals parameters. The passive flexion knee is 95° on sagittal plane and the active flexion knee is 90° without any painful reaction. The extension movement is 100% from the first day and the edema have been reduce as minimum. The walk now is correct and the patient is not using anymore a crutch after 7 sessions. The patient is not taking anti-inflammatory pills.

**DISCUSSION & CONCLUSION** We believe that this protocol could be use by all the people with the same injury and the results confirm that no previous physical conditions are need to perform this program.

We follow the Natural joint Evolution and respect the intensity of level exercise according with the water speed to get

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the normal range of movements for the normal life activity. Unfortunately, there is not bibliography about the use of Flume Channel for ACL so we understand that this is only an approach and we must keep on trying to develop a systematic and controlling protocol. The Kinesiotaping effects after surgery and the real coordination with the Doctors means one of the most interesting advances for early recover, taking care of the scar tissue and reducing the edema for the immobilization period. This 7 days treatment conclude like a perfect departure point to attempt the second phase of rehabilitation and reduce the recovery time in a significant way. We should progress to investigate this techniques combination and go further in our goals.

**KEY WORDS** Hydrodynamic Flume Channel, Kinesiotaping, Manual Therapy, Anterior Cruciate Ligament

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## A retrospective survey of therapeutic ultrasound usage in sports medicine unit

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**OBJECTIVE** Contrary to wide use of US there is remarkable little evidence for benefit in the treatment of musculoskeletal conditions. The aim of the study was to analyze the use of US in managing commonly encountered sports injuries.

**METHODS** The study is one year retrospective survey of US usage in Sports Medicine Unit. Documentation from 116 (73 male, 43 female) athletes in average 26.2 (SD 10.4) years old were analyzed by pathology, involved tissue, body region, treatment frequency and use of US alone or in combination with other modalities.

**RESULTS** Out of 1814 athletes treated in sports medicine unit 574 were referred to physical therapy and 20.2 % received US therapy. Documentation for US application was insufficient regarding precise (physiotherapeutic) diagnoses, dosage (intensity, duration, frequency, mode, treatment intervals) and effectiveness. 9.5 % of diagnosis were nonspecific. US was used for treatment of soft tissue inflammations in 39.7 %, distensions of muscles, tendons and ligaments in 29.3 %, ruptures of muscles, tendons and ligaments in 16.4%, and pain treatment in 14.7 % of cases. The most frequently treated tissues were muscles (41.4 %). Majority of the US treatments were done on lower limb (63.8 %). The number of consequent treatments in average were 11 (SD 3) ranging from 3 to 30. Only in 12.1 % of the cases the US was applied as single therapy. In combination with one additional modality US was used in 42.2 % and with two 43.1 % of cases.

**DISCUSSION & CONCLUSION** The use of US in Sports Medicine Unit in general is in concordance with literature. Referring physicians are deciding for polypragmatic approach, which may express uncertainty regarding the therapeutic effects of US.

**KEY WORDS** therapeutic ultrasound, sports injuries

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## Rotator Cuff Tear: To operate, or not, that is the question

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**OBJECTIVE** The aim of this presentation was to portray a case of a 27-year-old male Olympic waterpolo player who suffered a partial rupture of his left distal supraspinatus tendon of his non-dominant arm while he was trying to save a strong outside shot. Intense shoulder pain accompanied with a limited abduction ability was the chief complaint. MRI completed the initial assessment. The player was given a medical advice not to play the imperative game, but he decided to compete against the medical advice, risking a more serious injury. Later on he was voted the best Montenegrin national athlete in 2008. After the Olympics he decided to temporarily withdraw from waterpolo because of his injury. The crucial question was whether he should be managed surgically or through more conservative treatment which would include intensive physiotherapy and rest. Various opinions were given and there was a strong international disagreement among sport physicians what would constitute an optimal treatment. However the athlete himself opted for a conservative treatment

**METHODS** Intervention included application of low frequency magnetic field, isometric exercises and interferential current therapy.

**RESULTS** This case had the complete resolution of the pain and impairment after 3 months of conservative treatment which included intensive physiotherapy. At 6-months follow-up, the athlete remains asymptomatic and the isokinetic test provided almost complete recovery of the strength of his supraspinatus muscle.

**DISCUSSION & CONCLUSION** Conservative treatment proved effective with complete recovery of the injury.

**KEY WORDS** rotator cuff tear

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## **Distal biceps brachii tendon repair-single incision suture anchor technique**

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**OBJECTIVE** Complete rupture of the distal biceps insertion is an infrequent injury. 96% of biceps tendon injuries involve the long head, 1% the short head, and 3% the distal insertion. The injury does appear to be most commonly caused by an unintentional eccentric load to a flexed elbow with a shortened and contracted muscle forcing the joint into extension. We report three athletes with rupture of the distal biceps tendon, repaired with a single incision suture anchor technique.

**METHODS** The athletes were one gymnast, one wrestler and one rower. The gymnast and the wrestler were injured during competition, while the rower was injured during strength training. In all athletes the injury sustained in the process of resisting a heavy load with a flexed elbow.

**RESULTS** Clinical examination and MRI of the elbow confirmed the diagnosis of distal biceps brachii tendon rupture. The patient underwent surgery where a complete distal tendon tear was repaired, using two Super Anchor 2.9 mm (Mitek) through a single anterior incision. At last follow-up, there was no neurovascular deficit.

**DISCUSSION & CONCLUSION** In the present study we describe step by step the anterior approach and the suture anchor technique. We believe that operative repair of distal biceps tendon rupture, using a single anterior incision and suture anchors is a safe and effective method of treating this injury.

**KEY WORDS** Sports injuries, tendon ruptures, surgical management, biceps brachii muscle, distal insertion

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## **Manubriosternal dislocation: Review of principles of management**

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**OBJECTIVE** Manubriosternal dislocation is an unusual injury mainly occurring in young patients. It is caused by direct or indirect trauma and is classified as type I (posterior displacement of sternum) or type II (anterior displacement of sternum). Direct traumas are frequently caused by road accident and sport. But the dislocation can be caused by indirect flexion-compression injury of the thorax. Due to few cases in the literature, the correct management of this injury is not widespread.

**METHODS** We report the case of a 44 years-old patient with type I dislocation due to blunt chest trauma. He presented with pain at breathing. To avoid surgery, we tried to treat him with kind chest physiotherapy and pain killers. The dislocation spontaneously reduced when the patient coughed. The injury was afterwards treated surgically to stabilize the reduction with plate and screws because the pain at breathing was still present. We reviewed the literature to define the guidelines of management.

**RESULTS** The X-ray which gives the diagnostic and the electrocardiogram are the first step in the management. The chest tomodensitometry is mandatory to check the impact on the great vessels and the trachea. The conservative treatment including painkillers, local application of ice, rest and plaster bandage gives bad long term results, especially in the type I dislocations. Chronic pain, risk of subluxation and relapse of dislocation are the more frequent complications.

**DISCUSSION & CONCLUSION** In emergency, the manubriosternal dislocation must be treated with pain killers and soft chest physiotherapy to achieve the reduction. If the dislocation is Type I and the patient has compression symptoms on the trachea or major vessels, surgical treatment by plating with screws is the best treatment. In Type II dislocations, the conservative management consisting of closed reduction and elastoplast strapping can be attempted but close follow-up is necessary to exclude the occurrence of the suspected complications. If needed, secondarily, the conservative option must be converted in surgical treatment.

**KEY WORDS** Manubriosternal dislocation, management, chest physiotherapy

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## **The heart failure's carvedilol beta-blockade and exercise training's sympathetic blockade in healthy athletes: Who blocks what in a heart rate dynamic analysis during an exercise test?**

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Heart Institute (InCor HCFMUSP)

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**OBJECTIVE** In recent years, beta-blocker therapy has become a primary pharmacologic intervention in patients with heart failure by blocking the sympathetic activity.

**AIM:** To compare the exercise training's sympathetic blockade in healthy subjects (athletes) and the carvedilol's sympathetic blockade in sedentary heart failure patients by the evaluation of the heart rate dynamic during an exercise test.

**Methods** A total of 75 sedentary heart failure patients (26 optimized and 49 non-optimized) in a stable condition (for, at least, 3 months), 15 healthy soccer players (athletes) and 17 sedentary healthy subjects were recruited to perform a cardiopulmonary exercise test. The heart rate dynamic (rest, reserve, peak and the peak heart rate in relation to the maximum predicted for age) was analyzed and compared between the four groups.

**RESULTS** The heart rate reserve was the same between optimized (48±15) and non-optimized (49±18) heart failure patients ( $p<0.0001$ ). The athletes (188±9) showed a larger heart rate reserve compared to sedentary healthy subjects (92±10,  $p<0.0001$ ). Athletes and healthy sedentary reached the maximum heart rate predicted for their age, but none of the heart failure patients did.

**DISCUSSION & CONCLUSION** The carvedilol's sympathetic blockade occurred during the rest and during the peak effort in the same proportion, but the exercise training's sympathetic blockade in healthy subjects occurred mainly in the rest.

**KEY WORDS** Heart failure, heart rate, carvedilol, exercise.

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## Different kinds of sports: Effects on bone and cardiovascular risk factors

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**OBJECTIVE** Sports can positively influence bone mineralization and exert positive cardiac and vascular effects. Aim of the study: To evaluate the effects of different sports on bone health and mineralization, lipid profile, insulin sensitivity, endothelial function and intima-media thickness.

**METHODS** We evaluated 46 athletes practicing rugby (#6), downhill skiing (#19) and ice-hockey (#21). Mean age (years) was 13.3±0.36, 12.7±0.9 and 11.2±0.8 respectively. Bone mineralization was evaluated by DEXA and bone health [SOS (speed-of-sound)- and BTT (bone-transmission-time)-SDS] by bone ultrasound. We also evaluated the lipid profile and insulin sensitivity [HOMAr (Homeostasis- Model- Assessment- for- insulin -resistance) and QUICKI (quantitative-insulin-sensitivity-check-index)]. Endothelial function was evaluated by flow mediated dilation of the brachial artery (FMD) and the intima-media thickness (IMT) by B-mode ultrasound at the level of the common carotid artery.

**RESULTS** Rugby players are heavier than skiers and ice-hockey players [Body-Mass-Index standard-deviation-score (BMI-SDS) 0.57±0.58, -0.08±0.71 and -0.44±0.68 respectively]. Lipid profile is not very different between the three groups, only rugby players show higher triglyceride values. Skiers have increased bone mineralization and higher bone quality than ice-hockey players. We find a positive correlation between BMD-SDS and BMI-SDS, SOS-SDS, BTT-SDS and weekly exercise time. There is also a correlation between BMI-SDS, HOMAr, QUICKI and serum insulin values.

**DISCUSSION & CONCLUSION** The results are preliminary and further values need to be analyzed. Thus far we see that different kinds of sports affect bone mineralization and bone quality in different ways, skiing induces the most positive changes. There is no evidence of a different influence on the vascular risk factors.

**KEY WORDS** different sports - cardiovascular risk factors - bone health

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## A search about risk factors of coronary arter disease on elite level wrestlers

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Coronary artery disease comes among causes of sudden death in the athletes. This research was scheduled to identify coronary artery disease risk factors for elite-level wrestlers. Descriptive cross-sectional study was done at Karamanoğlu Mehmet Bey University between January and March. 10 elite level wrestlers at Physical Education and Sport Academy constituted search group. Research covered 10% of the wrestlers' has expressed that it is heart disease. Average age of

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the athletes participating in Research is  $22:43 \pm 1.67$  with %30 girl, %70 boy. Group stated that %7 still smoke, %80 don't do sport aside from training, %70 take nourishment overly on meat and meat products, %90 skip daily course, %80 eat fast-food generally. The blood pressure and blood sugar starvation values of Sportsman values; in girls; systolic  $116.28 \pm 13.74$  mmHg,  $66.32 \pm 11.64$  mmHg diastolic, average of hunger for blood glucose values as  $92.24 \pm 14.72$  mg / dl were identified, and the average blood pressure values in men; mmHg systolic  $121.34 \pm 9:32$ ,  $10:42 \pm 74.83$  mmHg diastolic, average of hunger for blood glucose values as  $92.24 \pm 14.72$  mg / dl were identified as  $88.76 \pm 16:07$ . As a result, 20% of total cholesterol, 10% systolic, 20% diastolic blood pressure, and 10% above the normal value blood sugar were found. In the search group, smoking, not doing sport, irregular nutrition levels, which are in between KAH risk factors, are high. KAH risk is seen more widely in the 30 years and over, As that group that we are studying at is average age of the young, we can talk that it will occur KAH risk factor in the future years

**KEY WORDS** Wrestlers, Coroner Arter Disease

## Gender-related autonomic cardiac modulation in young elite athletes

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**OBJECTIVE** Physical exercise induces beneficial effects on cardiac autonomic activity with higher parasympathetic tone. Studies of gender-related differences in autonomic cardiac regulation indicate higher vagal activity in young women compared to men. The purpose of this study was to evaluate gender-related autonomic cardiac modulation in young elite athletes by using heart rate variability (HRV) analysis.

**METHODS** The ECG recordings were performed supine at rest in 40 healthy young subjects divided in 24 elite athletes (12 females, mean age  $20.2 \pm 2.0$ , and 12 males, mean age  $19.9 \pm 1.7$ ), matched according to the sports disciplines and age, and 16 untrained controls (5 females, mean age  $22.1 \pm 0.6$ , and 11 males, mean age  $25.5 \pm 3.7$ ). For the HRV analysis FFT spectra were evaluated from the tachograms. Low frequency (LF: 0.04 - 0.15 Hz) and high frequency (HF: 0.15 - 0.80 Hz) spectral bands were calculated and the LF/HF ratio was derived.

**RESULTS** In the athletes, no significant differences between females and males were observed in the mean heart rate (HR) ( $54.3 \pm 11.5$  vs  $57.6 \pm 7.1$ ,  $p = ns$ ), LF and HF spectral components ( $2387.6 \pm 3214.3$  vs  $921.6 \pm 933.9$ ,  $p = ns$  and  $4312.6 \pm 5970.0$  vs  $1846 \pm 2253.0$ ,  $p = ns$ , respectively) and in LF/HF ratio ( $0.6 \pm 0.3$  vs  $0.7 \pm 0.5$ ,  $p = ns$ ). In the controls, there was no significant difference between females and males in the mean HR ( $65.8 \pm 2.3$  vs  $67.3 \pm 5.2$ ,  $p = ns$ ); the LF and HF spectral components (ms<sup>2</sup>) were significantly higher in males ( $452.0 \pm 318.2$  vs  $0.05$ , respectively),  $< 0.05$  and  $760.4 \pm 621.2$  vs  $376.4 \pm 283.8$ ,  $p < 153.9 \pm 61.6$ ,  $p$  whereas LF/HF ratio was significantly lower in females ( $0.5 \pm 0.3$  vs  $1.2 \pm 0.7$ ,  $0.05$ ). Comparing athletes to controls, male athletes presented lower mean HR  $< p$  and LF/HF ratio, while female athletes had lower mean HR but similar LF/HF ratio. Both groups of athletes had higher LF and HF spectral components (ms<sup>2</sup>).

**DISCUSSION & CONCLUSION** Despite the sex-linked differences in autonomic cardiac nervous control observed by some authors our results suggest no gender-related differences in autonomic nervous activity in athletes. In comparison to untrained subjects male athletes showed higher vagal activity.

**KEY WORDS** autonomic nervous system, athletes, gender

## ECG alterations in amateurs cyclists after stress test

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**OBJECTIVE** The electrocardiogram (ECG) of rest and the ergometry monitored they constitute two diagnostic actions of highly sensibility and specificity in the sports population to detect pathologies of incompatible risk with the sports activity. Nevertheless, the duration of the tests of effort can be very important for the apparition of ECG graphics disturbances. Therefore, the purpose of this work is to determine if the duration of the test of effort influences on the apparition of ECG alterations in amateurs cyclists.

**Methods** 17 amateurs cyclists from 21 to 56 years of age (with a 39.11-year-old average), all they practicing habitual with, at least, 3 years of training. DIMEQ 503 Electrocardiogram. ELITE Digital MAG utilizing the bicycle of personal highway of each cyclist. They were submitted to three tests of effort. The first one consisted of an incremental test beginning to 50 w and enlarging other 50 w every 2 m

inutes. The second, carried out to the 7- 10 days, they were 60' to a 60% of the maximum load reached in the first test and the third test, carried out to the 10- 15 days, of the second, and they were 20 km to the 100% of their possibilities. In the end of each test an ECG in supine position and in rest was carried out

**RESULTS** We believe it is necessary to conduct more extensive testing effort to detect electrocardiographic abnormalities that could encourage the athletes's sudden death.

**DISCUSSION & CONCLUSION** Rest incremental 1 hour 20 km. Normal 17 17 17 3 subepicardic ischemia 0 1 0 4 preexcitación s. 0 1 0 2 post ischemia 0 0 0 2 transwall ischemia 0 0 0 1 conductión alts 0 2 0 5 After a test of 20 Km of I pedal maximum alterations are presented more ECGraphics that after an incremental test or an hour of I pedal to the 60%.

**KEYWORDS** Electrocardiogram, ergometry, cycling, sudden death.

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## **Effects of physical training on the ventricular fibrillation recurrence after application of energy shocks with defibrillator and on the energy level to revert this arrhythmia. An experimental study**

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**OBJECTIVE** It has been published that physical training could protect against cardiac sudden death, which is produced in most cases by ventricular fibrillation (VF), and it has been proposed as an antiarrhythmic intervention. VF instauration and maintenance are related with the complexity of this arrhythmia and with electrophysiological heterogeneity of the myocardium. Moreover it has also been reported that physical training decreases electrophysiological heterogeneity of myocardium. We hypothesized that physical exercise could reduce the necessary energy to revert VF and decrease recurrence of this arrhythmia after the defibrillation.

**METHODS** Five NZW rabbits were submitted to a six-week endurance exercise training program, and six controls were not trained. When the exercise program was finished, rabbits were anaesthetized (ketamine, 10 mg/kg i.v.), killed and the hearts excised, isolated and perfused in a Langendorff system. A pacing electrode and a plaque with 256 recording electrodes were positioned on the left ventricle. Without interrupting the perfusion of the isolated heart, VF was induced at increasing frequencies and recordings were performed. We have used a defibrillatory technique based on a bipolar wave method. Immediately after VF triggering, the attempts to defibrillate were applied using increasing levels of energy until VF reversion; a second VF was induced again and several energy levels were also applied three minutes after VF triggering. We have determined: a) the total recurrence of VF after its cessation; and b) the energy to defibrillate after three minutes of VF start, when this second VF was produced. To compare the recurrence of VF between control and trained group a "chi-square" test was applied. To compare the energy to defibrillate between the two groups an unpaired Student t test was used. Differences were significant when  $p < 0.05$ .

**RESULTS** VF recurred in four hearts from control group whereas no heart recurrence was observed in the trained group ( $p < 0.05$ ). Mean energy to defibrillate in control group was higher than in trained group ( $0,24 \pm 0,19$ ;  $n=6$ , vs.  $0,10 \pm 0,04$ ;  $n=5$ ). Values of energy to defibrillate were given in joules.

**DISCUSSION & CONCLUSION** The results seem to be in accordance with the findings previously reported about the increase on ventricular electrical homogeneity and stability of ventricular myocardium by training (Hajnal et al., 2005, Such et al., 2008). Indeed, as the mentioned properties are maintained, VF complexity will be less and will also be easier to interrupt the arrhythmia. In conclusion, physical training decreases VF fibrillation recurrence and the energy to revert this arrhythmia.

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## **Menstrual dysfunctions, their connection with body composition and the level of physical activity burden in the sample of elite Bosnian sportswomen**

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**OBJECTIVE** Low energy availability (with or without eating disorder), amenorrhea and osteoporosis, alone or coupled as a Female Athlete Triad pose a significant health risk for sportswomen and physically active women (1). Many studies explored the connection between physical activity and menstrual dysfunctions, a condition also known as "functional hypothalamic amenorrhea". Intensive physical strain, low energy consumption, early training commencement age, low body mass index (BMI) or low percentage of body fat (% BF) are seen as possible causes. The objectives of the research were as follows: 1) determine the prevalence of menstrual disturbances in the sample of sportswomen (N=84) and the control group (N=27), 2) examine the influence of body composition (BMI, % BF) and the intensity of training on the menstrual cycle.

**METHODS** The groups of sportswomen were comprised of 34 ball game players (basketball and handball state champions), 27 athletics players (17 national team short and long race runners) and 23 dancers, aged between 14 and 25. The control group was comprised of female students of the Medical Faculty, uninvolved in any sports, and of the same age. A detailed questionnaire was used to determine the menstrual profile. The definitions of menstrual dysfunctions (primary amenorrhea, secondary amenorrhea, oligomenorrhea) were in line with the ACSM Position Stand; The Female Athlete Triad 2007 (1). The % BF was determined via the bio-impedance method and the BMI standard equation. The intensity of the training is represented by the weekly hour number of trainings and competitions.

**RESULTS** The primary amenorrhea, secondary amenorrhea and oligomenorrhea prevalence was significantly higher in the sportswomen group (12/84), (9/84), (11/84) in comparison to the control group (0/27). Statistically highest prevalence of menstrual disturbances was in the group of athletics players, the primary amenorrhea (9/27), oligomenorrhea (8/27). The value of the % BF was statistically significantly lower ( $p < 0,05$ ) in oligomenorrheic sportswomen (11,64%) in comparison to the eumenorrheic ones (16,60%). The BMI was not statistically connected to menstrual dysfunctions. The highest intensity of training was in the group of athletics sportswomen (13,98 h/week) which was found to have the most menstrual dysfunctions

**DISCUSSION & CONCLUSION** Menstrual dysfunctions were more frequent in the group of sportswomen than in the group of those who were not involved in sports. The lower % BF was related to oligomenorrhea. Weekly physical activity burden is linked to the frequency of menstrual dysfunctions.

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**KEY WORDS** Menstrual dysfunctions, sportswomen, body mass index, percentage of body fat

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## The search of psychognosis and physiological aspects of menopausal women athletes in Shahreza

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**OBJECTIVE** The Purpose of this project is the search of psychologic and physiologic aspects in menopausal women athletes and the effect of some variables in the menopausal symptom's rate such as: Current age of women, their menopausal age, single or married status, education level, occupation, menstruation's status, the rate of bloodshed in one year before menopause and finally, the mental, psychic and physical status in women one year before menopause. In this project Social statistic of research contains all women athletes in Shahreza.

**METHODS** Statistical symbol is about 80 menopausal women athletes in Shahreza whom have been chosen randomly . The tools for information collection is the questionnaire of survey in menopausal women that examined two aspects of psychognosis and physiologic of menopause. After completion, all information have been given to SPSS software and interpreted by using unilateral an analysis of Variance , Spearman Rank- Order Correlation and pearson Rank- Order Correlation.

**RESULTS** There is no meaningful relation between the age of menopause women athletes and their symptoms of menopause. The rate of menopausal symptoms athletes in terms of the women single – married status is not different.

**DISCUSSION & CONCLUSION** The rate of menopausal symptoms athletes in terms of their education level ,occupation, their menstruation status is not different. There is a meaningful relation between the rate of menopausal symptoms athletes and bloodshed in one year before menopause. There is a meaningful relation between the rate of menopausal symptoms athletes and psychic- psychological status in one year before menopause.

**KEYWORDS** menopause, athletes, women, physiologic, psychognosis

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## The effect of mode of exercise on cardiopulmonary responses during the menstrual cycle of women

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**OBJECTIVE** It has been reported that kinetics are faster in walking than in cycling. It is possible there is some feedback from the muscles to accelerate the response of the cardiovascular system. The feedback may have a central effect, and stimulate cardiovascular kinetics, but the results are inconsistent. Cycling is easier than running because of the special physical position the body has on a bicycle. The purpose of this study is to evaluate the effects of mode of exercise on the cardiopulmonary index during the early follicular and luteal phases of moderately active women.

**METHODS** Twenty healthy moderately active women who had taken part in (3-4) sessions physical activity each week. The participants were randomly classified in two equal groups and performed an incremental exercise on Treadmill and Cycle Ergometer during their early follicular and luteal phases until they were exhausted. The luteal phase was determined by the level of Progesterone and Gnadotropic hormones in blood samples. The pulmonary gas analyzer was used to measure the, oxygen pulse,  $VO_2$ max, HRmax in two phases.

**RESULTS** Paired samples T-tests were performed to detect baseline differences across two menstrual phases in two modes of exercise. The results indicated no significant difference of oxygen pulse in the luteal and early follicular phases of moderately active women in none of the two modes of exercise.

**DISCUSSION & CONCLUSION** It seems that because of the physical depression during menstrual cycle, which is due to the moderately active women, the replacement of running with cycling, with the aim of making physical activity simpler and encouraging female to continue their activity during this time, is recommendable.

**KEY WORDS** early follicular phase, luteal phase, oxygen pulse, incremental exercise

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## A survey of the impact of intensive exercises on reducing of employees low back pain

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**OBJECTIVE** This research aimed to study about impact of intensive exercises on reducing of employees low back pain in 1387. Subjects of this research is Azarbaijan rejional electrical company personnel who worked 1387 in the following departments: training, financial affairs, public relations, procurement and dispatching. Two hundred of the mentioned employees who had low back pain were selected by accessible sampling, and their specifications were collected using questionnaire. After collecting and analyzing low back pain reasons and reliminary analyzing of data, they divided to two one hundred members.

**METHODS** Two questionnaires wich had been designed by researcher, were used in order to collect data. The First questionnaire included 36 closed questions. 6 weeks later, after doing 29 intensive practices upon low back about 20 minutes every morning & afternoon, the second questionnaire including 14 closed questions were presented.

**RESULTS** The correlation coefficient test showed strong and positive relationship between intensive low back practices and low back pain decrease ( $r=79\%$ ). On the other hand, the weight loss occurred due to 6 weeks exercising. 80 members of experimental group lost 1.37 kg weight on average after 6 weeks intensive low back practices.

**DISCUSSION & CONCLUSION** low back pain has been occurred after moving heavy things and sitting for a long time on work place cheir.

**KEY WORDS** low back pain, sleep style, sitting, studying and things movement

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## Anthropometric characteristics of tennis performance players between the ages of 8 and 12 years old

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**OBJECTIVE** The purpose of this study was to investigate anthropometric characteristics of tennis performance players between the ages 8-12 years old.

**METHODS** The subjects of the study consisted of 50 female tennis players with mean age of  $10.60 \pm 0.07$  years old,

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height of 147.47±04.83 cm, weight of 41.39±06.36 kg, 43 male players with mean age of 10.70±01.44 years, height of 146.82±06.82 cm, weight of 39.99±06.82 kg and 60 children for the control group (30 females and 30 males) who were in the same of age group and have not participated regularly in any sport's activity or training exercises. The control group was selected randomly. Female players have been playing tennis for 3.91±1.40 years and their starting age of tennis is 6.72±1.05 years. Male players have been playing tennis for 4.18±1.38 years and their starting age of tennis is 6.56±0.94 years. All of the 153 subjects joined the study voluntarily. Tennis players (n=93) were players for the domestic teams that participated in the Turkiye Tennis Championship. Standard anthropometric methods were used to determine body mass, body height and all of skinfold and circumference measurements. All of the anthropometric measures were taken from right and left sides of the body based on Anthropometric Standardization Reference Manual procedures. Body composition was determined by bioelectrical impedance analysis (BIA).

**RESULTS** According to the results of comparison of anthropometric measures; there were significant differences in skinfold thickness ( $p<0.001$ ), circumference measurements of biceps, forearm and wrist ( $p<0.001$ ) between right and left sides of female players, whereas there were no significant differences in length measurements ( $p>0.05$ ) and circumference measurements of thigh, calf and ankle ( $p>0.05$ ) between right and left sides of female players. There were significant differences in skinfold thickness ( $p<0.001$ ), circumference measurements of calf, biceps, forearm and wrist ( $p<0.001$ ) between right and left sides of male players, whereas there were no significant differences in length measurements ( $p>0.05$ ) and circumference measurements of thigh and ankle ( $p>0.001$ ) between right and left sides of male players.

**DISCUSSION & CONCLUSION** Tennis causes significant changes in the measurements of left and right sides of the tennis players between the ages of 8 and 12 years old that have been playing tennis for average of 6 years.

**KEY WORDS** tennis player, body composition, anthropometry, training

## Daily physical activity related to risk factors for cardiovascular disease in children

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**OBJECTIVE** This study evaluated if accelerometer measured physical activity predicts clustering of risk factors for cardiovascular disease (CVD) in children aged 8 to 11 years.

**METHODS** Cross-sectional study of 156 (81 boys and 75 girls) children aged 8-11 years, recruited from an urban population-based cohort. Total body fat mass (TBF) and abdominal fat mass (AFM) were measured by Dual-energy x-ray absorptiometry. Body fatness was expressed as TBF percentage of total body mass (BF%). Body fat distribution was calculated as AFM/TBF. Maximal oxygen uptake ( $VO_2PEAK$ ) was assessed by indirect calorimetry during a maximal exercise test and indexed for body mass (ml/min/kg). Blood was sampled and analysed for lipoprotein (LDL, HDL and total cholesterol) and triglycerid (TG) concentrations. Resting heart rate (HR), systolic and diastolic blood pressures (SBP and DBP) were measured. Pulse pressure (PP) and Mean artery pressure (MAP) were calculated. Daily physical activity was assessed by accelerometers for four days and daily accumulation of moderate and vigorous physical activity (MVPA) were calculated (defined as above 3500 counts/min with the Actigraph accelerometer). Maturity was evaluated according to Tanner. Skewed values were normalised by natural logarithm (ln). Z-scores (Value for the individual-mean value for group)/SD were calculated. Sum of z-scores for BF%, AFM, AFM/TBF, SBP, DBP, PP, MAP, HR, LDL, -HDL, LDL/HDL quotient, total cholesterol, TG, and  $-VO_2PEAK$  were calculated in boys and girls, separately, and used as an indices of clustered risk.

**RESULTS** Boys performed significantly more minutes of MVPA per day compared to girls (46±21 vs. 35±13,  $P<0.001$ ). Pearson correlation between MVPA versus indices of clustered risk was for boys (-0.16, NS) and for girls (-0.38,  $P<0.05$ ). Boys and girls were divided according to tertiles of MVPA. One-way ANOVA analysis indicated significant differences in sum of z-scores between tertiles of MVPA in girls ( $P=0.003$ ), whereas no significance difference could be observed in boys ( $P=0.54$ , NS).

**DISCUSSION & CONCLUSION** In this population-based cohort of children aged 8 to 11 years accelerometer measured minutes of moderate and vigorous physical activity per day predicted clustering of risk factors for CVD in girls aged 8-11 years, no such pattern could be observed in boys, which could be attributed to a higher physical activity level.

**KEY WORDS** Children, Physical activity, Accelerometers, CVD risk factors

## **Associations among the physical activity regime, the attitude towards alimentation and the nutrition condition in Romanian adolescents,**

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**OBJECTIVE** Although physical activity level of adolescents is generally higher than adults, the decrement in their fitness level (in the conditions of inadequate diet) represents a reduced protection against metabolic and cardio-vascular diseases of the future adults.

**METHODS** The aim of this study was to determine the relations between the alimentation type, the nutritional status and the physical activity regime in Romanian adolescents. We realized a transversal study by using questionnaires for the physical activity regime (Physical Activity Index, PAI) and the attitude towards nutrition (Eating Attitude Test, EAT), both modified and standardized on Romania's population. We also evaluated anthropometrical data: weight, weight excess, height and body mass index (BMI) on two groups of Romanian adolescents: 50 boys (average age 16.1 years) and 50 girls (average age 16.3 years). "T test" and the effect size test (Cohen's d) for independent groups were performed to determine the differences between boys and girls.

**RESULTS** The boys' data suggests in average a good nutritional status (medium BMI 21.8; medium weight deficit 0.8 kg) and a very good physical activity regime (medium PAI 71.5) in the context of a good attitude towards alimentation (medium EAT score 5.1). The girls' data distinguishes by a slight weight excess (medium BMI 22.3; medium weight excess 1.4 kg), a more reduced physical activity regime as compared to boys' group (medium PAI 56.8), in the condition of a good attitude towards alimentation (medium EAT score 5.5).

We obtained a statistical significance of the differences between groups' means for all parameters: for BMI  $p < 0.05$ ,  $d = 0.63$ ; for weight excess  $p < 0.05$ ,  $d = 0.85$ ; for PAI  $p < 0.001$ ,  $d = 1.13$ ; for EAT  $p < 0.03$ ,  $d = 0.34$ .

**DISCUSSION & CONCLUSION** In adolescents, gender is related with the nutritional status level in the context of a certain type of physical activity regime and attitude towards alimentation. Among Romanian adolescents the differences between boys and girls refer to the physical activity regime and the nutritional status and less to the alimentation habits (type of diet). The differences in observed patterns can be explained by the physiological (hormonally induced) and psychological (behavioral) differences between the two genders. In addition, the interval of the variability of the normal morpho-functional development can be altered by the energetic unbalances between the food share and the physical activity expenses, especially in the adolescence critical age.

**KEYWORDS** physical activity, nutrition condition, adolescents

## **Relationship between cardiovascular fitness and adiposity in boys and girls aged 9-16 years**

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**OBJECTIVE** Obesity in children and adolescents is increasing rapidly worldwide and may be related with decreased health related fitness. The purpose of the present study was to examine the relationship between adiposity and aerobic fitness in a large sample of young healthy boys and girls.

**METHODS** A total of 8023 healthy and physically active individuals (5307 boys and 2716 girls) participated in this study. Body composition was measured by bioelectrical impedance using a leg-to-leg analyser at least 3 h after the last meal and cardiovascular fitness was measured using the shuttle run test to exhaustion from which maximal oxygen uptake values ( $VO_{2max}$ ) were calculated according to the level accomplished. Participants were divided into eight age groups (9,10,11,12,13,14,15,16 years) and means were compared using a two way ANOVA for independent samples. Relationships between variables were assessed using the Pearson product moment correlation coefficient (r).

**RESULTS** There was no significant difference between boys and girls in height and weight until the age of 13 years, while the percent body fat was higher in girls in every age group, with the difference increasing after the age of 11 years.  $VO_{2max}$  relative to body weight in boys remained relatively stable from 9 to 13 years and showed a small increase thereafter. However  $VO_{2max}$  relative to body weight in girls decreased significantly with age, especially after the age of 13 years. This could not be accounted for by the small increase in body fat. The correlation coefficients between  $VO_{2max}$  relative to body weight and percent body fat were significant and negative for both boys and girls (from -0.40 to -0.59  $p < 0.001$  in boys and from -0.32 to -0.47  $p < 0.001$  in girls). These correlations were always higher in boys compared to girls. Moreover, percent body fat was positively correlated with  $VO_{2max}$  expresses in absolute terms (l/min), suggesting that cardiopulmonary capacity is increased in overweight individuals, but the excess fat results in a

load that decreases performance.

**DISCUSSION & CONCLUSION** The results of this study showed that increased adiposity results in decreased aerobic fitness relative to body weight in all age groups. Since low aerobic fitness is related to inactivity during childhood and adolescence, it is suggested that maintenance of normal body composition is important for promoting an active life style.

**KEY WORDS** children, adolescents, obesity, aerobic fitness

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## **Longitudinal study of physical fitness, health and the influence of socio-economics factors, obesity and sedentary behaviours on children of primary school of Fundão**

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**OBJECTIVE** The present study intends to analyse physical fitness level of children of the Primary School of Fundão. It's a longitudinal study carried out in three years (1999/2000; 2000/2001 and 2001/2002) within three moments of observation. The main goals are: (i) to describe and interpret the evolution of anthropometric variables and body composition (obesity), as well as, the physical fitness levels regarding health of children of both sexes with ages between 7 (at the beginning of the study) and 10/11 years old (at the end of the study), belonging to classes from the primary school of Fundão; (ii) to verify the relationship between the socio-economic factors and the sedentary behaviours on the evolution of the physical fitness levels; (iii) to interpret the variability that occurs inside each one and between sexes in the three moments of observation.

**METHODS** The sample was constituted by 135 students, 71 males and 64 females with ages between 7 and 10/11 years old. In the evaluation of physical fitness, the adaptable Battery tests of AAHPERD (1988) was used. In the evaluation of body composition (obesity) the Body Mass Index was used and in the determination of socio-economic factors we turned to a questionnaire. The statistical procedures were One-Way Anova. To estimate the parents influence, the Pearson and Spearman correlations were used to the categorical variables.

**RESULTS** The main results obtained in this research were: - The medium values of height, weight and body mass index translate a significant growth as a result of the age; - The average differences showed us the distinction between boys and girls; - Boys were slightly taller, heavier and reported a higher body mass index; - The overweight and obesity values were 35.9% in females and 43.6% in males; -The obeses were older, heavier and taller; -Boys from a lower socio-economic status in terms of their parents' job showed better results in resistance trial compared to boys from a higher socio-economic status ; -Boys from a higher socio-economic status in terms of their parents' schooling present better results than those from lower socio-economic status at the following trials: resistance and strength; - In females there is no significant correlation between the socio-economic status and the physical fitness variables.

**DISCUSSION & CONCLUSION** A relationship between the socio-economic factors and the sedentary behaviours on the evolution of the physical fitness levels was found. Furthermore, variability occurs inside each one and between sexes during the evaluations.

**KEY WORDS** Physical fitness, anthropometric fitness, obesity, body mass index, socio-economics

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## **Functional body mass index in school children**

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**OBJECTIVE** A profile of the Body Mass Index of students in primary and secondary in urban and rural Andalusia was assessed.

**METHODS** 1166 subjects (539 boys and 624 girls); students of 5th and 6th grade, 1st, 2nd, 3rd and 4th year at secondary and 1st and 2nd year in high school participated. Participants were municipalities of urban were from the major capitals of Granada and Almeria whereas participants of rural were from Adelaide and Olula del Rio of Almeria, Noalejo (Jaén) and Estepona (Málaga). Body weight, height and Body Mass Index (Weigh Tanita TBF-300 and a standard height of straight branches) of participants were determined.

**RESULTS** The measures of underweight, overweight and obesity in children from rural areas are higher compared to that of urban areas. Percentile of urban to rural are: p <5 Thinness 1.56 (+/- sd 0.33) 2.59 (0.49) <0.05 5-84 Normal 76.35 (8,78) 68.06 (7.91) <0.05 85- 94 Overweight 14.67 (4.01) 16.06 (4.98) <0.05 >95 Obesity 7.43 (2.85) 13.29 (3.76) <0.05 This aspect is considered normal to have a big difference in socioeconomic level, in lifestyle and eating

habits. There is a minimal difference in measures of underweight and overweight among urban and rural areas. Obesity showed a big difference in boys and girls from rural areas with regard to urban locations.

**DISCUSSION & CONCLUSION** The results which are presented below represent the differences comparisons underweight, overweight and obesity, among different groups (urban and rural areas).

**KEYWORDS** Body Mass Index, overweight, obesity, children.

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## Body Composition and Somatotype in 10-18 year old male soccer players and their relation with athletic performance and soccer injuries

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**OBJECTIVE** Although there are some studies examining the somatotype and body composition in soccer players, their effects on athletic performance aren't clear. The aim of this study was to determine the body composition and somatotype profiles of young soccer players belonging to a Turkish soccer team participating in super league and to examine the relationship of somatotype and body composition to athletic performance and injury rates.

**METHODS** The sample consists of 122 male soccer players aged 10-18 years. The players were divided into 3 groups according to their ages: 1. 10-12 years 2. 13-15 years 3. 16-18 years. Somatotypes were estimated with the Heath-Carter anthropometric somatotype method and body compositions have been assessed using Tanita TBF 300 M. Participants performed a field running test starting with 8 km/h running speed, the speed increased by 2 km/h every 3 minutes until exhaustion and blood lactate concentrations were measured for each running speed. The running velocities corresponding to 4mmol.L<sup>-1</sup> blood lactate concentration were determined. The injuries of all players were recorded through one year. SPSS version 15.0 was used for statistical analysis.

**RESULTS** The somatotype of 122 soccer players was 2.23±0.62 – 4.14± 0.86 - 3.24± 0.86 (ectomorphic mesomorph). The somatotypes of 3 age groups were respectively : (2.13±0.82 – 4.10±0.97 – 3.42±0.98), (2.11±0.56 – 4.09±0.97 – 3.44±0.86) and (2.38±0.51 – 4.22±0.87 – 2.96±0.72). There was a statistically significant difference in ectomorphy component between 2. and 3. groups (p<0,05). The body composition characteristics were fat % 9.69±3.80, fat mass 5.12±2.24 kg and fat free mass 48.86±13.05 kg. The reduction in fat percentage was significantly correlated with increase in age between 1. and 2. groups (p<0.01) and between 1. and 3. groups (p<0.001). The mean running velocity was 11.79±1.37 km/h. There wasn't any statistically significant relation between somatotype, body composition and running velocity. The injury percentage was 21.3%. There was no significant difference in somatotype between injured and noninjured players.

**DISCUSSION & CONCLUSION** The players in our study were more mesomorphic than the Turkish young soccer players in previous studies but less mesomorphic than their international counterparts. The low values of mean running velocities can be explained by the differences in training intensity and frequency, in addition to low mesomorphy ratings as well as the differences in method. There was no negative relationship between somatotype and injury rates. Training plans directed towards improving muscularity can be suggested for young soccer players.

**KEYWORDS** Somatotype, Body composition, Athletic performance, Sports injury, Soccer.

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## The physiological effect of football in prepubescent children

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**OBJECTIVE** Football as an invasive field game is characterized by intermittent activity profiles with a very important aerobic demands. VO<sub>2</sub>max and the Ventilatory Anaerobic Threshold (VAT) have traditionally been considered as the "gold standarts" for evaluation of endurance performance. Most of the researchers in this matters says that the former is an indicator of greater fidelity in the characterization of aerobic power of an individual, as well as their level of fitness while the latter provides a better index of aerobic performance (1,2,3,4). However, when we talk about children they are very different from the adults. This study intends to know the physiological effect of a sport such as football in the prepubescent child from the same school and city.

**METHODS** Participants: 8 football players (FP - age: 11,73 ± 0,46; weight: 41,83 kg ± 9,35; BMI: 17,35 ± 2,07) and 10 non football players (NFP - age: 11,42 ± 0,46; weight: 43,20 kg ± 4,70; BMI: 19,10 ± 1,91) participated in this study. The entire sample was randomly assessed from the same city (Rio Maior, Portugal) and the same school. A maximal, progressive and incremental test using ergo-spirometry procedures (Cosmed® b2) were selected to test in laboratorial context. Heart rate was measured with the Polar S610. The comparison and descriptive data was analyzed between the



groups (SPSS, ver.15.0).

**RESULTS** Significant differences were observed for the VO<sub>2</sub>max/kg and VAT parameters between the groups. However there were no differences found in the percentage of the LAV from the VO<sub>2</sub>max/kg. We also identified some differences in the recovery phase.

**DISCUSSION & CONCLUSION** When we talk about children who attend regular practice of football, we can say that this sport promote an adaptation on physiological characteristics very slightly in children as seen in the graphic analysis. So, the results suggested that there is an aerobic adaptation due to the practice of this sport in these children.

**KEY WORDS** Football, Prepubescent Children, Cardiorespiratory Fitness

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## Effect of a short time physical activity program on the lipid profile of primary school students

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**OBJECTIVE** Lipid profile (LP) is an important predictor of morbidity and mortality, and some studies showed that it can be optimized by means of at least two months programs. The aim of this study was to analyze if LP could be optimized after performing 13 lessons of moderate-vigorous physical activity of 45 minutes twice a week in primary school students

**METHODS** Thirty subjects (14 boys and 16 girls) in 5th level of Primary School of Granada (Spain) aged 10-11 years participated in the study. The sample was divided into two groups: Intervention Group (IG) and a Control Group (CG), composed by 15 subjects each. The intervention program was carried out in 13 lessons of moderate to vigorous PA (82 ± 2% of Maximal Heart rate -HR-) in 2 weekly lessons of 45 minutes. Intensity was controlled by means of HR monitors (Polar RS800cx). Anthropometrical variables, as well as arterial pressure and blood biochemical composition were measured in all subjects.

**RESULTS** Statistical analysis (SPSS 15.0) revealed no differences for gender. The T test for related samples was used to examine possible differences between IG and CG as well as between pretest and posttest after the intervention. Results showed that IG reduced significantly (p<0.05) systolic (100.8±8.2 Vs 97±7.1) and diastolic arterial pressure (59±6.5 Vs 54.3±4.3), while CG did not. Also IG showed a significant reduction (p<0.01) in Total Cholesterol (156.1±23.4 Vs 140.5±15.8) and cLDL (93.5±21 Vs 73.3±13.4) and an increase in cHDL (49.2±9.4 Vs 54.3±7.9) which are statistically close to significance. In CG no differences were observed between pretest and posttest conditions for any of these variables. Glucaemia was reduced in both groups, although the difference was greater in IG. So, LP was improved clearly in IG comparing to CG.

**DISCUSSION & CONCLUSION** A program of 13 lessons of moderate-vigorous PA twice a week during 45 minutes each can improve LP of 10-11 years old primary school students, so cardiovascular risk related to LP can be minimized in a relatively short period of time.

**KEY WORDS** Physical activity, children, lipid profile, health

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## Aerobic capacity can be improved by means of a 13 lesson program of physical activity in primary school students

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**OBJECTIVE** Aerobic capacity is an important predictor of morbidity and mortality because of cardiovascular factors as well as other causes. Some studies showed that this condition can be optimized by means of at least two months programs. The aim of this study was to analyze if differences could be produced in Maximal Oxygen Uptake (VO<sub>2</sub>max) when performing 13 lessons of moderate to vigorous physical activity of 45 minutes twice a week in primary school students.

**Methods** Sixty six students (35 boys and 31 girls) in 5th level of Primary School of Granada (Spain) aged 10-11 years

participated in the study. The sample was divided into two groups: Intervention Group (IG) composed by 18 subjects, and a Control Group (CG) composed by 48 subjects. The intervention program was carried out in 13 lessons of moderate to vigorous PA ( $82 \pm 2\%$  of Maximal Heart rate -HR-) in 2 weekly lessons of 45 minutes. Intensity was controlled by means of HR monitors (Polar RS800cx). To evaluate maximal aerobic capacity the 20m shuttle test was carried out using the equation of Ruiz et al. (2008).

**RESULTS** Statistical analyses (SPSS 15.0) revealed no differences for gender. The T test for related samples was used to examine possible differences between IG and CG as well as between pretest and posttest after the intervention. Results showed no differences between IG and CG in the pretest ( $42.95 \pm 2.99$  Vs  $43.48 \pm 2.56$ ), as well as the CG showed no changes from pretest to posttest ( $42.95 \pm 2.99$  Vs  $43.25 \pm 3.29$ ) as this group did not perform any intervention. On the other hand, IG showed a significant improvement compared to CG ( $p < 0.05$ ) in the posttest ( $43.25 \pm 3.29$  Vs  $45.95 \pm 4.26$ ), as well as IG improved significantly ( $p < 0.01$ ) from pretest to posttest ( $43.48 \pm 2.56$  Vs  $45.95 \pm 4.26$ ).

**DISCUSSION & CONCLUSION** A program of 13 lessons of moderate to vigorous PA, twice in a week for 45 minutes can improve  $VO_{2max}$  of 10-11 years old primary school students, so cardiovascular risks related to reduced aerobic capacity can be minimized in a relatively short period of time.

**KEY WORDS** Physical activity, children, aerobic capacity, health

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## Continuous versus intermittent aerobic exercise intermittent in the treatment of obesity

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**OBJECTIVE** Our study proposes to compare the effects of continuous aerobic exercise versus intermittent aerobic exercise on subjects with obesity. This sample is part of a research project about the effects of physical exercises in the prevention and treatment of metabolic syndrome.

**METHODS** The study, has been developed during 16 weeks and included 40 male patients with obesity, with ages between 17-20 years, which have been separated into two groups: group I (n=20), who has undertaken 45 minutes of continuous aerobic exercise/day, 5 sessions/week, at submaximal intensity (70-75% of  $VO_{2max}$ ), and group II (n=20) who has undertaken same type of exercise but daily session was divided in three events of 15 minutes at minimum 3 hours interval. General indications regarding the diet were set for each patient at moderate caloric consume.

**RESULTS** The anthropometrics parameters before and after 16 weeks of physical exercises at group II comparative with group I : weight (kg) decreased  $8.9 \pm 2.5$  versus  $6.1 \pm 1.3$ ; waist circumference (cm):  $10.0 \pm 4.3$  versus  $6.0 \pm 2.5$ ; BMI:  $5.0 \pm 1.5$  versus  $3.5 \pm 1.4$ ; %Body Fat:  $6.7 \pm 1.5$  versus  $5.1 \pm 2.5$ .

**DISCUSSION & CONCLUSION** For treatment of obesity, the using of intermittent aerobic exercise has better results comparative with the continuous aerobic exercise. Additionally, we recommend the insertion of a minimum 3 hours rest between physical exercises sessions for a greater caloric expenditure after intermittent exercise.

**KEY WORDS** Obesity, continuous aerobic exercise, intermittent exercise.

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## Both the aerobic and strength training decreased serum chemerin concentrations in prediabetic middle-aged men

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**OBJECTIVE** The elevated production of various adipokines, including chemerin, interleukin 6 (IL-6), leptin, retinol binding protein-4 (RBP-4) and tumor necrosis factor alpha (TNF- $\alpha$ ) and decreased production of adiponectin are considered to have important role in development of diseases like metabolic syndrome and type 2 diabetes. Chemerin, a novel recently discovered adipokine that regulates adipocyte differentiation, has been found to associate inflammation markers and components of metabolic syndrome as BMI, HDL-C, hypertension and triglycerides [1]. In this study, the effects of 12 weeks exercise intervention on the serum adipokines of the obese pre-diabetic men were investigated.

**METHODS** Prediabetic obese men (n = 144) aged 40–65 years were studied at baseline and at 12 weeks in a randomized controlled multi-centre intervention study. Their BMI varied from 25.1 to 34.9. Volunteers were randomized to one of three groups: (1) control group (C, n = 47) that had no supervised exercise during intervention period, (2) Nordic walking group (NW, n = 48) that trained aerobically 60 minutes with Nordic walking exercises three times per week, or (3) resistance training group (RT, n = 49) that trained 60 minutes with strength and power type exercises three times per week. The intervention period did not consist of dietary counseling. Adiponectin, IL-6 and TNF- $\alpha$  were measured from the plasma samples using BioRad Bio-Plex 200 System and chemerin and RBP-4 from the serum samples using Thermo Multiskan.

**RESULTS** Both types of exercise decreased significantly serum chemerin concentrations compared to control group. In addition, plasma leptin concentration decreased statistically only in the NW group. There were no changes in the circulating adiponectin, IL-6, RBP-4 and TNF- $\alpha$  concentrations.

**DISCUSSION & CONCLUSION** Progressively structured both aerobic and strength & power training decreased significantly serum chemerin concentrations after 12 weeks intervention program in pre-diabetic middle-aged men. Six months metformin treatment, anti-diabetic drug, decreased also significantly serum chemerin concentrations in women with POCS [2]. It seems that both type of exercise have similar regulatory effects of circulating chemerin than metformin treatment.

**KEYWORDS** Chemerin, exercise intervention, leptin,

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## Study regarding muscular parameters changes at young obesese after an individualized physical training programme

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**OBJECTIVE** The purposes of our study were: testing and monitoring the physical effort at young obese subjects, reducing their body weight, increasing their muscular parameters in order to improve their physical appearance consecutive to lowering body weight.

**METHODS** The study group was formed by 35 students of our university, 27 females and 8 males. The including criteria were: age between 18 and 25 years ( $19,3 \pm 2,1$  years), body mass index over 30 ( $32,5 \pm 2,1$  kg/sqm) and absence of any pathology that prohibits the physical effort. The evaluation protocol consist in: somatometric examination, ergospirometric and nutritional analysis, quality of life evaluation (with MOS SF-12 scale); we established the particularities of an individualized physical training programme therefore the physical effort was done mostly in the corresponding area for maximum consumption of lipids; also, the subjects benefits of a nutrition counseling. The proper physical training programme (made for 3-4 times on a week for 35-40 minutes) consist in endurance effort on treadmill, stepper, elliptical bicycle, ergometric bicycle; the re-evaluation was made after 8 months. The muscular force was assessed with a Chatillon MSC dynamometer on the main muscular groups of the body.

**RESULTS** After 8 months, we obtained an increase of muscular force of the majority of monitored groups, but a significant increase just of trunk and lower limbs muscles with  $p < 0.05$ , because the accent was made mostly on these groups. We also obtained the decrease of body weight with a mean of 10,4 kg, decrease of BMI with a mean of 5,2 kg/sqm, decrease of fat mass with 11,1%, increase of life quality, for Physical Component Summary (PCS) with a mean of 10.1 points and with 19.1 points for Mental Component Summary (MCS), all with  $p < 0.05$ . The increase of muscular force was not correlated with the decrease of body weight, changes of fat or lean mass or fitness score ( $r < 0.2$ ), so we can conclude that the increase of muscular force was related directly with the participation to the training programme.

**DISCUSSION & CONCLUSION** The goal of this study – the improvement of physical appearance and muscular force, the reduction and maintenance of the selected subjects' body weight at levels closer to the optimum, the improvement of the eating and physical activity and the increase of the life quality was reached till this point of the study. Acknowledgement This paper work was supported by a CNCSIS project, Projects-Ideas, nr. 909/2009.

**KEY WORDS** individualized training programme, muscular force, obese

## **Regular exercise reduced homocysteinemia in adults with metabolic syndrome**

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**OBJECTIVE** It is widely accepted individuals with metabolic syndrome presented an increased risk of cardiovascular disease. However the precise mechanisms underlying this association are not completely understood. Hyperhomocysteinemia has been described as a significant and independent risk factor for cardiovascular disease. The present study was designed to determine the influence of regular exercise on homocysteinemia in adults with metabolic syndrome.

**METHODS** Sixty young male adults with metabolic syndrome according to the criteria reported by the National Cholesterol Education Program Adult Treatment Panel III volunteered for this study. Forty-five were randomly included in experimental group to perform a 12-week aerobic training program, 3 days/week, consisting of warm up (10 min), main part (35-50 min [increasing 5 minutes each three weeks]) at a work intensity of 60-75% of peak heart rate (increasing 5% each three weeks) and cool-down (10 min). Control group included 15 age, sex and BMI-matched adults with metabolic syndrome that did not perform any training program. Written informed consent was obtained. Further our protocol was approved by an institutional ethic committee. An enzymatic assay was used to determine plasmatic homocysteinemia (Catch Inc, Seattle). It was assessed twice: 72-hours before starting the program (pre-test) and after its ending (post-test).

**DISCUSSION & CONCLUSION** When compared to baseline, plasmatic homocysteinemia was decreased significantly after being exercised ( $11.6 \pm 0.5$  vs  $9.7 \pm 0.4$   $\mu\text{mol/l}$  homocysteine;  $p < 0.05$ ). On the contrary no changes were reported in controls. Regular exercise may reduce homocysteinemia in adults with metabolic syndrome. Further long-term follow-up studies are required to determine whether correction of homocysteinemia improves clinical outcomes of individuals with metabolic syndrome.

## **Falls in elderly: Physical fitness, balance and mobility and fear of falling in elderly practitioners and no exercise practitioners**

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**OBJECTIVE** The decline in physical fitness (PF), balance and mobility together with fear of falling increase the risk of falls in elderly people. The main goal of this study was to compare in elderly subjects with and without regular practice of physical exercise (PE) the occurrence of falls, PF, balance and mobility and the fear of falling.

**Methods** The sample was composed by 30 elderly subjects, aged between 67 and 93 years old, equally divided in two groups in function of being practitioners (P) or non-practitioners (NP) of regular PE. The occurrence of falls in the past year before the study was self-reported. To evaluate PF three tests of the Senior Battery Fitness Test (SFT), of Rikli and Jones were used. Balance and mobility were assessed by the Scale of Balance and Mobility of Tinetti and, the Falls Efficacy Scale International (FES-I) was used to evaluate the fear of falling.

**RESULTS** Subjects on group P presented higher values of PF and balance and mobility and smaller values on the fear of falling, being the differences to group NP statistically significant ( $p < 0.05$ ). The correlations between the performance in the tests of PF and the indexes of balance and mobility and the fear of falling were significant. The frequency of falls reported by P and NP were similar, however, the results of logistics regression indicated that NP group had a risk 1,5 times higher of falling relatively to group P (Odds Ratio =1,5).

**DISCUSSION & CONCLUSION** We concluded that the practice of regular exercise has a positive effect in PF, in the balance and mobility and on the fear of falling. These facts didn't led to differences in the number of falls reported, but they suggest a trend in the diminution of the risk of falls compared to elderly institutionalised NP.

**KEY WORDS** Elderly; falls; physical exercise; physical fitness; balance and mobility; fear of falling.



## Physical inactivity during leisure time. A comparative study between rural and urban young people

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**OBJECTIVE** The physical activity of young people is an important and interesting research topic. It is well documented that there is an association between lower levels of physical activity routines and health problems issues. Thus, the purpose of this study was to investigate the routines of physical activity and its association with the urban and rural context in young female people.

**METHODS** The sample consisted of 214 girls (13-16 years old) from rural and urban context. Physical fitness was measured by AAHPERD (1988) battery tests, and Pacer test, from Prudencial FITNESSGRAM (1994). Physical activity was measured by the diary of the physical activity and accelerometer CSA. Urban and Rural classification was based on INE (1996). Comparisons between rural and urban girls were conducted using independent t-tests. The significance level was set at  $p < 0.05$ .

**RESULTS** The results suggest that girls from the urban context are taller and heavier, but no significant differences were found. Sit-ups and sit-and-reach values were better in urban than in rural girls. Rural girls presented a better performance in Pacer test and mile test. Girls from rural context appeared to be more active, mainly in high categories of intensity (13-14 years old). Urban girls are more sedentary during week. On the other hand urban girls appeared to be more active on weekends (15-16 years old).

**DISCUSSION & CONCLUSION** Our results suggest that urban-rural context influences physical activity. Furthermore, weekend days appeared to increase physical activity in urban girls.

**KEY WORDS** Physical activity, urban context, rural context, urban-rural contrast.

## Sport related physical activity is related to measures of cardiorespiratory fitness, cardiac autonomic health and serum BDNF concentration in man

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**OBJECTIVE** We sought to examine relationships between the differing components of physical activity (work, sport and leisure), cardiorespiratory fitness and cardiac autonomic health in normal men ( $n=28$ ) and women ( $n=16$ ).

**METHODS** The average age was  $33.0 \pm 10.3$  years, height  $1.78 \pm 0.06$  m, body mass  $77.2 \pm 10.8$  kg for men; corresponding values for women were: age  $36.6 \pm 11.9$  years, height  $1.69 \pm 0.06$  m, body mass  $64.8 \pm 7.4$  kg. Cardiorespiratory fitness ( $\dot{V}O_2\max$  L/min) was estimated from heart rate and work rate (Åstrand-Rhyming cycle ergometer test); seated heart rate and blood pressure were measured after 5 minutes stabilization using an automated sphygmomanometer (Dinamap PRO 400 V2). Cardiac autonomic health was assessed from supine measures of heart rate variability (HRV) as the R-R interval (RRI, milliseconds), using standard telemetry techniques (Polar S810i, Kempele, Finland) and methods of analysis ( $n=21$ ). Physical activity was assessed by questionnaire (Baecke *et al.* 1982 *Am. J. Clin. Nutr.* **36**: 936-942) ( $n=43$ ) and resting serum BDNF (brain-derived neurotrophic factor) measured using an ELISA kit (enzyme-linked immunosorbant assay; Clinicom) ( $n=44$ ). **RESULTS** There was no significant difference in estimated  $\dot{V}O_2\max$  values for men ( $3.75 \pm 0.84$ ) compared with women ( $3.43 \pm 0.72$  L/min) ( $P=0.206$ ). There was no difference in seated heart rate  $63 \pm 12$  vs.  $61 \pm 10$  b/min ( $P=0.718$ ), blood pressure: systolic  $129 \pm 11$  vs.  $124 \pm 9$  ( $P=0.181$ ) and diastolic  $70 \pm 10$  vs.  $72 \pm 8$  mmHg or serum BDNF concentrations  $7.33 \pm 3.02$  vs.  $6.90 \pm 2.01$  ng/mL ( $P=0.611$ ), men versus women respectively. Similarly there was no significant difference in Baecke scores work ( $2.43 \pm 0.54$  vs.  $2.24 \pm 0.72$ ,  $P=0.336$ ), sport ( $4.67 \pm 1.69$  vs.  $4.42 \pm 1.65$ ,  $P=0.645$ ) and leisure ( $3.57 \pm 0.60$  vs.  $3.41 \pm 0.58$ ,  $P=0.372$ ) for men versus women respectively; nor indeed for total Baecke score ( $10.67 \pm 2.25$  vs.  $10.07 \pm 1.91$ ,  $P=0.376$ ).

The Baecke sport score was correlated with the supine RRI,  $r=0.539$  ( $P=0.012$ ,  $n=21$ ); seated heart rate,  $r=-0.438$  ( $P=0.003$ ,  $n=43$ ); cardiorespiratory fitness,  $r=0.536$  ( $P=0.000$ ,  $n=43$ ), and serum BDNF concentration  $r=-0.428$  ( $P=0.004$ ,  $n=43$ ).

**DISCUSSION & CONCLUSION** The results show that sport activity, rather than work or leisure physical activity is associated with conventional indices of cardiorespiratory fitness, cardiac autonomic health and serum BDNF concentration.

**KEY WORDS** Sport-related physical activity; Cardiorespiratory fitness; HRV; BDNF; Baecke

## ACE I/D genotype in Bulgarian Athletes

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**OBJECTIVE** The aim of this study was to analyze ACE I/D gene polymorphism among 70 professional athletes, divided into three groups according to a power-time model of performance (Anaerobic Power – AnaP, Anaerobic Capacity – AnaC and Anaerobic Aerobic - AnaA), and 44 controls from Bulgarian population.

**METHODS** Genotyping for the ACE I/D variant was performed by Polymerase Chain Reaction (PCR). PCR primers were forward 5'- CTGGAGACCACTCCCATCCTTTCT-3' and reverse 5'- GATGTGGCCATCACATTTCGTCAGAT – 3'. Ventilation and CO<sub>2</sub> output were continuously measured breath- by-breath during the Wingate test.

**RESULTS** ACE II genotype and I-allele frequency in our sample are one of the lowest in comparison with other studies with Caucasian populations. In AnaA group, the frequency of D-allele was significantly higher than in AnaC group (66% vs 50%, p=0,02), contrary to the prevailing data showing association of endurance with I-allele. We found that ACE ID and II genotypes significantly correlate with Peak Power Output (p=0,00004 ; p=0.01) and Relative Power Output (p=0,0002 ; p=0,03) between athletes and controls. Although DD has the highest Peak and Relative Power Output, there was no significant difference. In those athletes who had Relative Power Output above 10 Watts/kg there was a tendency of higher distribution of D-allele in comparison with those below 9 Watts/kg, although not statistically different. DD genotype athletes had higher Lean Body Mass in comparison with II genotype athletes (p=0,02). ACE ID AnaA group of athletes had significantly higher CO<sub>2</sub> exhalation, compared with ID genotype AnaP athletes (3779 vs 3110 ml, p=0,04). Similar observations was found also between ID genotype AnaC and AnaA athletes and controls (p=0,04 and p=0,0001), but not with AnaP group. **DISCUSSION & CONCLUSION** High D-allele frequency in AnaA group could be connected with the fact that the vast majority of the sports are with mixed anaerobic-aerobic character. Such sport activities require relatively high speed and strength demands. Furthermore, the presence of D-allele in ACE heterozygous persons also indicates favorable conditions for speed and strength capacities development.

**KEY WORDS** ACE gene, Athletes, Wingate test

## Skeletal muscle gene ACTN3 and physical performance: genotype-phenotype relation

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**OBJECTIVE** ACTN3 gene is responsible from the production of alpha-actinin-3 protein, which has force-generating capacity of muscle fibers, and which is restricted to fast fibers. Recent studies show that elite sprint athletes had a higher frequency of the RR genotype. The purpose of the study was to investigate ACTN3 gene variations and their probable phenotypic reflection by using physiological methods, and to show ACTN3 polymorphism in Turkish soccer players (n=44).

**Methods** After determining the genotypes by analyzing the blood samples, three groups (XX, RR, RX) were formed. The groups were existing R577X variant in both ACTN3 genes (XX, n=4), not existing R577X variant in both ACTN3 genes (RR, n=22), or existing R577X variant only one of the two ACTN3 genes (RX, n=11), respectively. To determine aerobic performance, Bruce protocol was applied on treadmill and maximal oxygen consumption (VO<sub>2</sub>max) was measured by metabolic analyzer. On a separate day, anaerobic performance was evaluated by Wingate test. Student's t-test or analysis of variance (ANOVA) was used for comparisons.

**RESULTS** Nine % of the soccer players had homozygotism for R577XX codon. The VO<sub>2</sub>max and maximal ventilation levels in XX group were increased compared to RR group (p<0.05) and RX groups (p<0.05). Oxygen utilization in ventilatory threshold in XX group was increased compared to the other groups (p<0.05-0.01). VO<sub>2</sub>/HR (pulse oxygen) levels were not different between groups. XX group performed increased values in the shuttle run tests. Peak power values, pointing out the anaerobic performance, were increased in XX and RX groups (p<0.05).

**DISCUSSION & CONCLUSION** Our findings evaluated the effect of genotypic variations on sprint and endurance performance of athletes contributing the understanding of genotype-phenotype relation. The results shows that ACTN3 gene mutations increases aerobic and anaerobic performance. This study was supported by Marmara University research foundation (BAPKO).

**KEY WORDS** ACTN-3, VO<sub>2</sub>max, peak power, soccer players

## The type V collagen gene is associated with performance of ironman triathletes

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**OBJECTIVE** Various genetic loci and markers have been related to physical performance or health-related phenotypes. Other genetic sequence variants, including a polymorphism within the gene which codes for type V collagen, the COL5A1 BstUI Restriction Fragment Length Polymorphism (RFLP), have also been associated with increased risk of chronic Achilles tendinopathy. Type V collagen is a quantitatively minor fibrillar collagen, which is believed to regulate lateral fibril growth within tendons. The primary aim of this study was therefore to determine if the COL5A1 BstUI RFLP is associated with ultra-endurance performance

**METHODS** Three hundred and thirteen Caucasian male participants of the 2006 and 2007 226km South African Ironman triathlons participated in this study. All participants were genotyped for the COL5A1 BstUI RFLP. A one-way anova co-varied for age was used to determine genotype effects on physiological characteristics and performance in either the 2006 or 2007 South African Ironman triathlons. A Tukey's post-hoc analysis was used to identify specific differences between genotype groups.

**RESULTS** Participants with a TT genotype of the COL5A1BstUI RFLP (n=114) completed the 180km cycle stage (P=0.043), the 42.2km run stage (P=0.025), as well as the overall 226km race (P=0.036) significantly faster than individuals with a CC genotype (n=57). There were no genotype effects on time to complete the 3.8km swim stage or any other physiological characteristic.

**DISCUSSION & CONCLUSION** This is the first study to identify the COL5A1 BstUI RFLP as a marker for physical performance. The exact mechanism by which this genetic variant is associated with performance is unknown.

**KEYWORDS** Endurance, Genetics, tendon,

## Effects of leisure-time physical activity on health related quality of life, body composition, and physical fitness of male faculty members

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**OBJECTIVE** In public health and medicine, the concept of health-related quality of life refers to a person or groups perceived physical and mental health over time. Physicians have often used health-related quality of life to measure the effects of chronic illness in their patients to better understand how an illness interferes with a persons day-to-day life. The purpose of this research was clarifying the effects of leisure-time physical activity on the health related quality of life (HRQOL), body composition (BC) and physical fitness of male faculty members of Birjand University, Iran..

**METHODS** 40 males were selected randomly and divided equally into physically active and non-active in leisure-time by a questionnaire. The dependent variables including HRQOL, body fat percent, flexibility, strength, and maximal oxygen uptake(VO<sub>2</sub>max) were measured by SF-36 questionnaire, caliper, flex board, dynamometer, and Monark's work bicycle(839 model) respectively. We applied MANOVA test for analysis of data and statistical significance was considered if P<0.05.

**RESULTS** Results indicate that physically active participants in leisure-time had higher HRQOL with regard to limitation of physical function, bodily pain, general health, and social function compared to non-active group(P<0.05). Although BC, strength, and flexibility were not significantly different (P>0.05) between groups, the mean VO<sub>2</sub>max of physically active participants was significantly higher (P<0.05) than that of the non-active group.

**DISCUSSION & CONCLUSION** Generally, physically active faculty members in leisure-time had better HRQOL and VO<sub>2</sub>max, and are more likely to have an improved BC, strength, and flexibility provided that they increase their weekly physical activity.

**KEY WORDS** Quality of life, Physical Fitness, Physical Activity.

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## Physical activity as a buffer for life-stress

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**OBJECTIVE** The stress buffering capacity of physical exercise is well documented. Habitually active individuals are expected to experience less stress than their inactive counterparts. However, to date in real life settings this hypothesis has received little attention. The aim of this work was to examine the hypothesis among 52 first year university students facing the novel challenge of university life.

**METHODS** Participants listed their experienced life-stress on a 26-item questionnaire. Based on the answers a low- and high-stress group was formed. Self-reports about the amount of exercise per week, average hours of sleep per day, and time spent with studying were also collected.

**RESULTS** Data were analyzed with a 2 (stress category) by 2 (gender) by 3 (amount of exercise, sleep, and study) multivariate analysis of variance (MANOVA) followed up with univariate tests. The results revealed that the high-stress group, independent of gender, has reported statistically significantly more hours of exercise per week (12.9 (6.5) versus 9.1 (4.2),  $p < .02$ ), and less hours of sleep (6.7 (1.0) versus 7.4 (0.7),  $p < .008$ ) than the low-stress group.

**DISCUSSION & CONCLUSION** These findings show that in spite of less sleep (which could be a sign of stress in itself) students who experienced more stress also performed more exercise. Such results are in contrast with the “more exercise – less stress” notion in the literature. Indeed the current findings suggest that habitually active students who experience increased stress in their lives try to cope by increasing the amount of exercise.

**KEY WORDS** Exercise, Physical activity, Sleep, Stress, Student,

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## Considering lifestyle and comparison between athletics employees and non athletics employees with focus of (sport and preventing of stress)on 2008 year

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**OBJECTIVE** The aim of this studying was, to considering lifestyle and comparison between athletics employees and non athletics employees on 2008 year.

**Methods** Cross-sectional method was used on 60 person of those employees that chosen by random chance.

**RESULTS** The result of this studying, entirely shown that %48/8 of their lifestyle is undesirable. Undesirable lifestyle of employees athletic and non athletics employees in arrangement is 68/5 and 31/5 percentage. There were significant relationship between activity and preventing of stress and also, between preventing of stress, age average, parents' education, financially and different kind of sports. Between lifestyle's variables such as nourishment and preventing of stress, activity and preventing of stress were seen significant relationship. Whatever, if nourishment and activity have more developing, preventing of stress is more desirable, and vice versa. For helping people, to change their lifestyle and preventing of stress and approach desirable, we should encourage them to exercise, eat healthy food and pass over the stress, avoid smoking and drug, alcohol and dangerous things.

**DISCUSSION & CONCLUSION** We can also see significant relation between lifestyle of athletics and non athletics employees, that exactly is like the studying in Michigan State but in the research of Mohammadzade, it wasn't seen. Therefore, significant changes were seen in educationally of their parents. That means, if their parents have high educational degree, their lifestyle is more undesirable. The researches of the Taft and Who universities show such a relationship in component of lifestyle.

**KEY WORDS** Lifestyle, stress, physical activity, nourishment, athletic.

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## Serious sport injury, motivation & burnout: Can self- determined motivation predict burnout in injury elite handball players?

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**OBJECTIVE** The purpose of this study is to predict the burn out according to the self-determined motivation of

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Iranian injury elite handball players.

**METHODS** The subjects were 28 injured elite handball players that they didn't participate in competition for 4 weeks due to injuring. Participants completed the SMS and ABQ questionnaires at the start of competitive season and injured situation.

**RESULTS** The results demonstrated that the significant negative correlation between intrinsic motivation ( $r = -0.87$ ,  $p = 0.000$ ) and extrinsic motivation ( $r = -0.70$ ,  $p = 0.000$ ) with burnout. Besides, there was a significant positive correlation between amotivation and burnout ( $r = 0.87$ ,  $P = 0.000$ ). Moreover, multiple regressions revealed that there was a linear correlation between motivation's subscales and burnout (motivation:  $r^2 = 0.81$ , intrinsic.m:  $r^2 = 0.75$ , extrinsic.m:  $r^2 = 0.49$ , amotivation:  $r^2 = 0.77$ ) ( $p < 0.05$ ).

**DISCUSSION & CONCLUSION** Results revealed that there was a relationship between subscales motivation and burnout after sport injuries and this means that it is possible to predict the athlete's burnout by the motivation subscales. Therefore, attention to the role of important of motivation in the recovery period and return to sport will be very critical and attention to the athlete's behaviors and attitudes may be useful for their rehabilitation.

**KEY WORDS** Sport injury, Motivation, Burnout, Self-determination, Elite handball players.

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## Improving football player's performance using counseling for decreasing competitive anxiety

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**OBJECTIVE** The performance of football players are influenced by a large numbers of psychological factors including: personality, emotion and cognition of the individuals. The empirical data from sport psychology research proved that high level of competitive anxiety decreased the performance of the athletes. The hypothesis of the research was that applying a cognitive behavioral programme for decreasing competitive anxiety will improve the football player's performance.

**METHODS** It was designed a quasi experimental design with control and experimental group. The subjects included in the study were 26 young football players, 15-16 years old. The competitive anxiety was measured using Martens CSAI2 (Competitive State Anxiety Inventory). The performance of football players was identified using behavioral data observed during competitions, such us numbers of errors and correct interventions. The counseling programme was formed by 18 weekly sessions intended to reduce the three components of anxiety: arousal, cognitive and self-esteem.

**RESULTS** Using a one-way analysis of variance (ANOVA) it was found that reducing anxiety by counseling positively influenced the quality of the football players game ( $F = 2.569$   $p < 0.05$ ) and decreased the number of player game errors ( $F = 2.231$   $p < 0.05$ ).

**DISCUSSION & CONCLUSION** The claim of our research that reducing anxiety will increase athlete performance is sustained by a large number of empirical data from sport and cognitive psychology. The novelty of our approach was the mixture of techniques from clinical psychology and the sport and coaching field which was used to improve player's performance.

**KEY WORDS** sport psychology, football players performance, competitive anxiety

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## Study of Relationship Between Perfectionism in Sport with Cognitive and Somatic Anxiety in Team and Individual athletes

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**OBJECTIVE** The purpose of this study was investigation of relationship between perfectionism in sport with cognitive and somatic anxiety in team and individual athletes.

**METHODS** 400 team and individual athletes that were selected voluntary and completed the Sport Multidimensional Perfectionism( Dunn et al, 2005) and competitive anxiety (Martens et al, 1990) (items of two sub-scales of this scale: cognitive and somatic state anxiety) scales.

**RESULTS** Results of Pierson correlation was indicated a positive correlation between personal standards, concern over mistakes, perceived coach pressure and perfectionism with cognitive and somatic anxiety in team and individual athletes. But there was not any correlation between perceived parental pressure with cognitive and somatic anxiety in

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team and individual athletes.

**DISCUSSION & CONCLUSION** It can be concluded that, dimensions of perfectionism was increasing the competitive anxiety in team and individual athletes.

**KEY WORDS** perfectionism, competitive anxiety, team athletes, team athletes

## **Dissociation of performance parameters at the individual anaerobic threshold require specific exercise recommendations for depressed patients**

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**OBJECTIVE** Aerobic exercise training is considered an adequate complementary treatment strategy for major depressive disorder (MDD). However, there is a need for comparative methodological investigations to determine the appropriate exercise intensity for these patients.

**METHODS** The study compared submaximal exercise intensity determination with those derived from maximal parameters such as percentages of heart rate reserve (HRR), maximal heart rate (HRmax) and peak oxygen uptake (VO<sub>2</sub>peak) of patients and controls. An exhaustive incremental bicycle exercise test was completed by 15 female MDD patients and matched controls. The individual anaerobic lactate threshold (IAT) as a gold standard to determine individual aerobic exercise intensity was assessed according to Stegmann and coworkers. Exercise intensities at 70 and 85% of HRmax, 70 and 85% of HRR and 50 to 80% of VO<sub>2</sub>peak were compared to the IAT.

**RESULTS** Patients suffering from MDD switched earlier to anaerobic metabolism than matched healthy controls (F=6.31; p<0.01). But interestingly, the level of self-rated perceived exertion, concentration of lactate, respiratory exchange ratio and heart rate at the IAT level revealed no significant difference between both groups. Additionally, MDD patients achieve higher %IAT values from 50 to 80% of VO<sub>2</sub> peak (F=42.35; p<0.001) and at 70% and 85% of HRR (F=3.77; p<0.01) as well as HRmax (F=3.84; p<0.01).

**DISCUSSION & CONCLUSION** Due to a growing number of clinical aerobic exercise treatments in depressive disorders exercise intensities >70% of (a) HRmax, (b) HRR, (c) VO<sub>2</sub>peak should be amended by IAT and Borg-scale measurements to avoid over challenging anaerobic demands.

**KEYWORDS** aerobic exercise training, peak oxygen consumption, heart rate reserve, maximal heart rate, individual anaerobic threshold, exercise treatment, exercise testing, exercise intensity determination,

## **The relationship between aerobic performance, muscular strength and body mass index with mood status profile of female students**

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**OBJECTIVE** This study aims to find the relations between aerobic performance, muscular strength and body mass index with mood status profile in female students.

**METHODS** This research is applied from the point of practical view and is based on correlational designs. The statistical population consists of single non-athletic female young students (19-26 years old) of Azad University (Roudehen) summing up to 161 on the basis of stratified random sampling regarded as a sample. The aerobics functioning of students was tested with the aid of 12-minute Cooper Field test. Their superior muscular strength was tested with maximal shoulder muscle strength test, and inferior muscular strength tested with the Squat test. BMI was calculated from weight and height scaling. To create the mood status profile, the researchers have used the POMS test consisting of 65 items (McNair, Lorr, & Droppleman, 1992).

**RESULTS** Considering the fact that POMS is consisted of 6 subscales, we have used multivariate repeated measure ANOVA for data analysis. The results showed that aerobic performance had a significant relationship with the subscales of POMS. Meanwhile the relationships between superior and inferior muscular strength possessed no significant relationship with mood status profile. In addition to the fact that POMS concludes a total score, the analysis of multiple regression results indicated that there exists an overall significant relationships between the mentioned variables with mood status. Among the predictors, the superior muscular strength and the BMI possessed the highest significant slopes in the regression equation and have the greatest effect on the subjects' mood status.

**KEY WORDS** Aerobic Performance, Muscular Performance, BMI, Mood Status Profile

## Mental imagery in sport – EMG pattern analysis

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**OBJECTIVE** The present study is a contribute to the knowledge of the mechanisms underlying mental imagery. The aim of the present study is to gain more insight into the mechanisms underlying mental imagery. While there is ample evidence that motor performance and mental imagery share common central neural mechanisms, the question whether MI is accompanied by subliminal electromyographic (EMG) activity remained unsolved, as well as the qualitative pattern of this activity.

**METHODS** In this study, thirty height (38) right-handed subjects were randomly divided into two (2) groups, experimental and control. Experimental group was submitted to a mental training program with three months duration. Bouth groups were evaluated before and after the mental training period. Subjects from experimental group and control group were asked to throw and to imagine throwing a dart in to a concentric target. Performance and EMG activity from 2 muscles of the dominant arm (agonist and antagonist) was monitored. For EMG signals acquisition, we used bipolar electrodes, with a gain of 350 (at 1000Hz). The electromyographic signals were captured on a analog-digital 16-bit plate (MP100 - Biopac System) with a sampling rate of 2000Hz per channel.

**DISCUSSION & CONCLUSION** A significant increased pattern of EMG activity was recorded in all muscles during mental practice, when compared to the rest condition, while there is no visible movement. Although being subliminal, the magnitude of this activation was found to be correlated to the effort required to really throw a dart. This correlation and performance results, increase significantly after a period of 4 weeks (14 sessions) of mental practice in experimental group. Control group had no changes. Results seem to indicate that it is more plausible to explain the learning effects of mental practice in terms of a top-down mechanism based on the activation of a central representation of the movement than in terms of a peripheral bottomup mechanism. However a facilitating action seems to be present based on muscles activation.

**KEY WORDS** Imagery. EMG

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## Biofeedback as a psychological training tool

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**OBJECTIVE** This study aimed to examine the impact of implementing a psychological training program, composed by relaxation techniques, mental imagery and biofeedback (based on electromyography signals) on the recovery of the mobility of the upper limb of a subject (athlete) after stroke. We defined as specific aims of the study the decrease of muscular tension caused by musculo-skeletal spasticity; examine the efficacy of mental training in enhancing the functionality of the hand motor; promote mental health and personal well being by examining the state of your mood.

**METHODS** Subject was submitted to a mental training program with a three months duration and was evaluated by Profile of Mood States (POMS - McNair, Lorr e Droppleman, 1971), Imagery Capacity Questioner (Bump, 1989) and the Reaching Performance Scale (RPS- Levin, Desrosiers, Beauchemin, Bergeron & Rochette, 2004). The program was divided into four phases, each with specific OBJECTIVES. Phase 1 – start the relaxation program, Phase 2 – relaxation and mental imagery; Phase 3 - Introduction to the work with electromyography (EMG), Phase 4 - Integration of all techniques. For EMG signals acquisition, we used bipolar electrodes, with a gain of 350 (at 1000Hz). The electromyographic signals were captured on a plate analog-digital 16-bit (MP100 - Biopac System) with a sampling rate of 1000Hz per channel.

**DISCUSSION & CONCLUSION** Results showed that there was a significant reduction in the spastic effect that increased the level of EMG signals on Common Flexor of Fingers. The Common Extender fingers showed a greater capacity for work and individual control that is reflected in the ability to control the movement of individual fingers. Globally, after intervention, EMG pattern show a much coordinated System than before the intervention. For the state of humor in the final phase of the program, the subject showed a pattern similar to profile iceberg. Previous studies in this field showed that subjects with hemi paresis underwent mental training improved the ability to reach objects as well as isolated movements of the hand and fingers (Dijkeman, Wood & Hewer, 2005) also in our study subject obtained improvements at both, motor and psychological level. Malouin et al. (2004) claim that mental practice has become an additional technique for neurological rehabilitation, as improvements were found in functional recovery of upper limb after stroke in patients who undergo in this type of rehabilitation.

**KEY WORDS** Biofeedback, EMG, Imagery

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## Cognitive disorders among boxers which moved mild traumatic brain injury

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**OBJECTIVE** Identify the nature and degree of cognitive disorders among boxers which moved mild traumatic brain injury.

**METHODS** We examined 32 amateur boxers, duration ranged from 5 to 14 years (champions and winners of championships of Ukraine among adults). The age range varied from 18 to 26 years. Surveyed the boxers were in the preparatory period. The number of boxing matches ranged from 51 to 176, the total number of traumatic brain injury in the form of knock-down which moved during the sports career ranged from 2 to 15. Control group consisted of 30 men aged 18 to 25 years who did not have a history of deferred traumatic brain injury. To assess cognitive function using standard clinical scale: Mini-mental State Examination (MMSE), Frontal Assessment Battery (FAB), clock drawing test.

**DISCUSSION & CONCLUSION** Mild cognitive disorders occurred in 14 boxers that had a history of one or more mild traumatic brain injuries. Most often, this group of patients complained about the deterioration of memory and bad sleep. Mild cognitive disorders showed a decrease of concentration, short-term memory disorders. There have been increased fatigue, and slow pace of work as it completes the tests. In the control group cognitive disorders had not been detected. Conclusions. Mild cognitive disorders that may cause concern about the patient and decrease the quality of life found in amateur boxers middle-level skills in 43,8% of cases. Their objective will require the use of new sensitive neuropsychological techniques.

**KEY WORDS** cognitive disorders, boxing, mild traumatic brain injury

## Does overweight lead to different perceptions of basic psychological needs satisfaction?

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**OBJECTIVE** The systematic alterations of lifestyles lead to a reduction of physical activity levels and to increased weight. This issue can be linked with the people motivation to exercise, and according to Self-Determination Theory (SDT) people motivation is a function of three “*fundamental nutriments*”: the basic psychological needs of autonomy, competence, and relatedness. The purpose was to study the relation between body mass index (BMI) and basic psychological needs (BPN), and look at the differences between groups with normal weight and overweight.

**METHODS** 371 exercisers from private fitness centers (252 females, 119 males) with 32.4±11.7 years of age and different levels of exercise experience participated in this study. The Portuguese version of the Basic Psychological Needs in Exercise Scale (BPNES) and Body Mass Index (BMI) as an international classification (mild thinness and normal weight: 17-24.99; pre-obese and obese class I: 25-34.99) was used.

**DISCUSSION & CONCLUSION** Results showed low correlation between BMI-Competence ( $r=-0.039$ ;  $p=0.451$ ), BMI-Autonomy ( $r=-0.054$ ;  $p=0.297$ ) and BMI-Relatedness ( $r=-0.035$ ;  $p=0.496$ ). Results also indicated no significant difference between Group 1 (mild thinness and normal weight) and Group 2 (pre-obese and obese class I) in perceptions of: Competence ( $t=0.887$ ;  $p=0.376$ ), Autonomy ( $t=1.087$ ;  $p=0.278$ ), Relatedness ( $t=1.282$ ;  $p=0.201$ ). Apparently, these findings revealed that people with normal weight and overweight have the same perception about the satisfaction of their basic psychological needs. Both groups revealed high levels of competence (Group 1:  $M=3.94\pm0.46$ ; Group 2:  $M=3.89\pm0.47$ ), autonomy (Group 1:  $M=4.03\pm0.56$ ; Group 2:  $M=3.98\pm0.56$ ) and relatedness (Group 1:  $M=4.01\pm0.55$ ; Group 2:  $M=3.93\pm0.57$ ).

**KEY WORDS** Exercise Psychology, Self-Determination Theory, Basic Psychological Needs, Body Mass Index

## Body mass index and behavioral regulation- an overweight person is or is not less self-determinate than normal weight person

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**OBJECTIVE** According to Self-Determination Theory (SDT) more internalized regulated types of behaviour lead to feelings of self-determination, and consequently more maintenance on the chosen activity. In others words, most people engage in exercise for extrinsic reasons, but if they do not enjoy the activity or discover inherent satisfactions they are



unlikely to persist at it. Therefore, the purpose of this work was to study the relation between body mass index (BMI) and relative autonomy index (RAI), and look at the differences between groups with normal weight and overweight.

**METHODS** 115 exercisers in private fitness centers (75 females, 40 males), with  $30.4 \pm 9.8$  years of mean age and different levels of exercise experience participated in this study. To assess exercisers motivation Behavioural Regulation in Exercise Questionnaire-2 (BREQ-2) was used. Also the Portuguese version (BPNEsp) and relative autonomy index (RAI) and Body Mass Index (BMI) as an international classification (normal weight: 18.5-24.99; pre-obese: 25-29.99) was used. Exercisers were randomly approached by researchers before exercise session.

**RESULTS** Results showed that there was no significant correlation between BMI and RAI ( $r = -0.109$ ;  $p = 0.245$ ). Results also showed that there was no significant difference between Group 1 (normal weight:  $M = 14.37 \pm 2.5$ ) and Group 2 (pre-obese:  $M = 13.88 \pm 3.5$ ) in self regulation behavior ( $t = 0.817$ ;  $p = 0.415$ ).

**DISCUSSION & CONCLUSION** Apparently, these findings revealed that both groups regulate their behavior to autonomous forms (intrinsic motivation), and experience more feelings of self-determination. These results are not consistent with previous study which revealed that exercisers with higher IMC were more external regulated than the lower IMC exercisers.

**KEY WORDS** Exercise Psychology, Self-Determination Theory, Behavioral Regulation, Body Mass Index

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## Mental training in a psychomotor task performance

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**OBJECTIVE** Imagery is considered to be one of the most popular performance enhancement techniques or psychological skills because of its versatility in effecting several different outcomes. Aim of the present study was to investigate whether individualized imagery interventions had an effect on motor task performance. Output measures were velocity (time) and mistake frequency in a computer car race game.

**METHODS** Forty-four undergraduate students ( $M\text{-age} = 21.7 \pm 2.69$  yrs) volunteered for the present study. Participants were randomly assigned to one of three groups: Experimental Group 1 (Exp1) was submitted to a motor training process (completed 10 sessions of 5 game trials); Experimental Group 2 (Exp2) to a motor and mental practice program (after 5 imagery sessions, they practiced 5 sessions of 5 game with mental imagery training after the completion of each trial followed by a 3 min interval) and Control Group did not have any activity between initial and final evaluation. An imagery script was created for imagery practice. This included the following images: image the movements and feelings during race preparation, mental race practice and arriving at the end of the race.

**RESULTS** We found significant differences in time between Pre and Post Test in both Experimental Groups, ( $p = 0.00$ ) with smaller times in post test. Control Group had no significant differences ( $p = 0.06$ ). We also found significant differences between pre and post test in Group Exp2 - Mistake I -(bumping one time) evaluation ( $p < 0.05$ ). We didn't found significant differences between group Exp1 and Exp2 ( $p > 0.05$ ).

**DISCUSSION & CONCLUSION** Considering that Group Exp2 had half of motor practice time, this supports the hypothesis that imagery facilitated performance in this particular task. This study provides evidence for practitioners who wish to use imagery interventions to enhance performance.

**KEY WORDS** Imagery, Performance, Training

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## Effects of maternal walking, voluntary running and forced swimming during pregnancy on anxiety reaction in rat offspring

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**OBJECTIVE** The beneficial effects of physical activity and exercise on brain functions and psychological behavior such as control of depression and anxiety are well documented. In this study the effects of maternal walking, voluntary running (WVR) and forced swimming (FS) during pregnancy on anxiety reaction in offspring was evaluated.

**METHODS** The pregnant female Wistar rats ( $n = 30$ , 10 for each group) were randomly assigned into three groups: the sedentary control group, WVE group and the FS group. Each of the WVR rat was given access to a running wheel which was freely rotated against a resistance of 100g, for during pregnancy. Also the swimming pool was filled with water at 32°C and the rats in the swimming group were forced to swim for 10 min once a day for 5 days. After delivery of mothers and pups reach to 2 month age, Elevated plus Maze (EPM) test was used to study the anxiety reaction by measure of time spent and number of entrances to open arms.

**RESULTS** Analysis of data indicated that WVR of mother during pregnancy decreased anxiety like behavior in offspring and also FS during pregnancy increased anxiety reaction in offspring significantly ( $p < 0.05$ ).

**DISCUSSION & CONCLUSION** Finding above showed that WVR and FS during pregnancy have modulated anxiety behavior in offspring that for clear of mechanisms need to further researches.

**KEY WORDS** Voluntary exercise, Anxiety, Swimming, Pregnancy, Rat

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## **Effects of peripheral and central beta-adrenergic receptors blockade on exercise induced enhancement of learning and memory in rat**

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**OBJECTIVE** The beneficial effects of physical activity and exercise on brain functions such as improvement in learning and memory are well documented. The aim of this study was to examine the role of peripheral and central beta-adrenergic receptors in voluntary-exercise induced enhancement of learning and memory in rat.

**METHODS** In order to block the peripheral and central beta-adrenergic receptors, the animals were given the beta-antagonist propranolol (10 mg/kg), or the peripherally acting beta-antagonist nadolol (20 mg/kg) before each night of five consecutive nights of exercise, respectively. Then their learning and memory were tested on the Morris water maze (MWM) task using a two-trial-per-day for five consecutive days. A probe trial was performed two days after the last training day.

**RESULTS** Our results showed that propranolol, but not nadolol reversed the exercise-induced improvement in learning and memory in rat ( $p < 0.05$ ).

**DISCUSSION & CONCLUSION** These findings indicate that central, but not peripheral beta-adrenergic receptors may mediate the effects of exercise on learning and memory.

**KEYWORDS** Exercise, Beta-adrenergic receptor, Learning, Memory

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## **Evaluation the effects of walking, voluntary running and forced swimming on acquisition and retrieval of spatial memory in Rat**

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**OBJECTIVE** The beneficial effects of physical activity and exercise on brain functions such as improvement in learning and memory are well documented. In this study the effects of walking, voluntary running (WVR) and forced swimming (FS) on acquisition and retention of spatial memory has been evaluated.

**METHODS** Male Wistar rats ( $n=30$ , 10 for each group) were randomly assigned into three groups: the sedentary control group, WVE group and the FS group. Each of the WVR rat was given access to a running wheel which was freely rotated against a resistance of 100g, for 5 days. Also the swimming pool was filled with water at 32°C and the rats in the swimming group were forced to swim for 10 min once a day for 5 days. Morris water maze (MWM) test was used to study the learning and memory.

**RESULTS** Analysis of data indicated that a stringent two-trial-per-day, 5-day MWM training protocol and a probe trial two days after the last MWM training day revealed that performing of swimming or WVR significantly increased both acquisition and retention phases of spatial memory ( $p < 0.05$ ).

**DISCUSSION & CONCLUSION** Findings above showed that voluntary exercise and swimming have beneficial effects on learning and memory.

**KEY WORDS** Voluntary exercise, Swimming, Learning and memory, Rat

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## Effects of short-term and long-term of 3 types of exercise training on lactate dehydrogenase, creatine kinase, and malondialdehyde in rats

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**OBJECTIVE** The purpose of this study was to determine the effect of short-term (1 session) and long-term (36 sessions) of various exercise training (endurance, sprint and combined) on serum indexes of muscle's damages (Lactate Dehydrogenase, Creatine Kinase, and Malondialdehyde).

**METHODS** For this reason, 40 young rats (3 month old) randomly divided in to 4 groups including Control (n=10), Endurance (n=10), Sprint (n=10) and Combined group (n=10) (combining endurance and sprint training). The training protocols were designed based on oxygen cost, so that the intensity of the endurance training program was set at 70-80% VO<sub>2</sub>max, while the intensity for the sprint training group was set to 100% VO<sub>2</sub>max. Following 1<sup>st</sup> and 36<sup>th</sup> sessions of exercise training, blood samples were taken.

**RESULTS** Analyze of data using Two Way Repeated ANOVA showed: 24hr Following 1 session of exercise training, there were significant increase in activity of CK and LDH enzymes (p<0.05) (but not MDA, p>0.05) in training groups vs. control group. This situation was followed more severely after 36 sessions of training.

**DISCUSSION & CONCLUSION** In all, results of this investigation indicated that both short – term and long – terms exercise training lead to muscle's damages, and this injury are more intensive in combined group in comparison with others. Also, considering that MDA index didn't change among groups in more of evaluation phase, although indexes of muscle's damages existed, it can be said that probable mechanism of initiating muscle injury is not lipid peroxidation.

**KEY WORDS** Endurance, Sprint, and Combined exercise training; creatine kinase, lactate dehydrogenase, malondialdehyde

## Lumbar intervertebral disc findings in elite track and field male Greek athletes

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**OBJECTIVE** The majority of orthopaedic problems experienced by competitive track and field athletes are related to pain in the lower legs esp. thigh and ankle region. Low back pain is a less common reason of complaints. There has been no previous research into lumbar disk "degeneration" in elite track and field athletes. Our hypothesis was that excessive physical loading accelerates lumbar disk "degeneration" in elite track and field athletes.

**METHODS** Study participants were 45 (18 to 28 year-old) elite track and field male athletes and 30 age and sex matched non athletic individuals. Lumbar intervertebral discs were evaluated using T2-weighted magnetic resonance imaging in the axial and sagittal plane. Based on our MRI exams we estimated and compared the prevalence of abnormal disk findings ("degeneration") and their disk level in the study groups and we further investigated the potential relationship among their event category (throwers, jumpers, sprinters, runners and decathlon athletes) and disk findings.

**RESULTS** 36 out of 45 elite track and field athletes and 14 out of 30 controls had abnormal MRI findings regarding lumbar intervertebral discs at various disk levels and the prevalence was significantly greater in the elite athletes group (P=0.001). Lumbar MRI reported the presence of: 1) disc herniation in 12 athletes and 7 controls 2) disc degeneration in 12 athletes and 5 controls 3) disc bulging in 9 athletes and 4 controls and 4) High Intensity Zone (HIZ) in eight athletes. L5-S1 level was significantly more frequently degenerated in the athletes group (P =0 .04). Disc herniation and degeneration were the most common findings in both groups but the prevalence was significantly greater in the elite track and field athletes. In addition disc herniation was more common in jumpers and sprinters, degenerated disc was most commonly seen in male sprinters and disc bulging was more often reported in jumpers.

**DISCUSSION & CONCLUSION** In conclusion, excessive physical loading accelerates lumbar intervertebral disk "degeneration", especially in the L5-S1 intervertebral segment.

**KEY WORDS** Lumbar mri, track and field, male

## Effects of menstrual phase on metabolic capacity in healthy active and inactive women

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**OBJECTIVE** Despite the evidence for an effect of the female sex steroids on exercise substrate metabolism, data on the effects of the normal menstrual cycle on glucose kinetics and carbohydrate oxidation are conflicting. Some studies report that glucose rates of appearance and disappearance are significantly decreased in the luteal vs. follicular phase of the menstrual cycle coincident with a decrease in whole body carbohydrate oxidation. Our purpose was to compare the metabolic capacity during the early follicular and luteal phases in healthy active and inactive women.

**METHODS** Twenty healthy active and inactive women, 19-25 yr of age, with no known history of cardiopulmonary, metabolic or musculoskeletal disease participated in this study. The participants performed an incremental exercise test on cycle ergometer during their early follicular and luteal phases until they were exhausted. The luteal phase was determined by the level of Progesterone, Prolactin, FSH and LH hormones in blood samples. The pulmonary gas analyzer (K4B2) was applied to measure the respiratory exchange ratio (RER),  $\text{VO}_2$ ,  $\text{VCO}_2$  in two phases. Paired samples T-tests were performed to detect baseline differences across two phases ( $p < 0.05$ ).

**RESULTS** The results indicated no significant difference of RER,  $\text{VO}_2$ ,  $\text{VCO}_2$  in the luteal and early follicular phases of active and inactive women ( $p > 0.05$ ).

**DISCUSSION & CONCLUSION** Findings may have important implications for metabolic research and in interpreting results of studies examining relative substrate utilization in response to various stimuli and suggested that timing of the menstrual phase may not be very critical when designing future exercise ventilation studies.

## Effect of a selected endurance training program on plasma interleukins and immune cells in active females after one bout of exhaustive exercise

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**OBJECTIVE** Exercise is the strongest stress to which the body is ever exposed. The body response to this stress through a set of physiological changes in its metabolic, hormonal and immunological systems. The purpose of the study was to examine the effect of eight weeks endurance training program on plasma IL1, IL6,  $\text{TNF}\alpha$ , CD4 and CD8, in active females after one bout of exhaustive exercise.

**METHODS** Twenty recreationally active women participated in the study. Subjects were assigned in one of the two groups: training ( $n=10$ ; age  $21.6 \pm 1.71$  years, height  $161.45 \pm 2.71$ cm, weight  $57.25 \pm 6.99$ kg,  $\text{VO}_2\text{max}$   $34.18 \pm 2$   $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ) and non-training ( $n=10$ ; age  $24.25 \pm 4.30$ years, height  $159.81 \pm 4.86$ cm, weight  $54.69 \pm 3.82$ kg,  $\text{VO}_2\text{max}$   $36.1 \pm 3.79$   $\text{ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$ ). Blood sampling were obtained before and after an exhaustive bout of exercise (Bruce protocol). Training group participated in an 8-week incremental endurance training program. After 8 week, subjects repeated the protocol and, blood samples were obtained before and after the exercise. Data was analyzed using ANOVA test.

**RESULTS** There were no significant change in IL1, IL6,  $\text{TNF}\alpha$  concentrations but, CD4 and CD4/CD8 decreased and CD8 increased significantly ( $P \leq 0.05$ ).

**DISCUSSION & CONCLUSION** Endurance training may induce changes in lymphocyte subsets but not in suppression of immune function after an exhaustive bout of exercise. Recent studies show that, several cytokines can be detected in plasma during and after strenuous exercise. However, in this study, cytokines did not change because the selected endurance training was not very strenuous and did not affect increasing or suppressing of interleukin function or proliferation. Endurance training induced adaptation in immune cells and decreasing CD4 was lower and increasing CD8 was higher in experimental group.

**KEY WORDS**  $\text{TNF}\alpha$ , CD8, CD4, interleukin

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## The effect of exhaustive exercise on IgA and TNF $\alpha$

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**OBJECTIVE** In vivo depletion of lymphocyte subsets allows investigation of the role of specific subsets in protective immunity. Immune cells are potent intracellular that regulate inflammation and immune response. The others have shown that exercise causes changes in specific types of immune components. These changes depend on duration and intensity of exercise. This study examined the effect of exhausting exercise on the IgA and TNF $\alpha$ .

**METHODS** 20 recreationally active healthy women with no positive clinical finding volunteered for this study. They were measured in height ( $162.81 \pm 3.982$  cm), weight ( $56.11 \pm 5.79$  kg), BMI ( $21.74 \pm 1.99$  kg/m<sup>2</sup>) and body fat ( $23.12 \pm .57\%$ ). Later, subjects performed an exhaustive exercise. Exercise protocol was an incremental treadmill exercise (Bruce protocol). Blood sampling were obtained before and after exercise and were drawn from an anticubital vein with subjects in the seated position. Paired t-tests were used to determine before versus after exercise differences, was set at 0.05. Data are presented as mean  $\pm$  ME of the mean.

**RESULTS** The concentration of IgA increased and were significant, but TNF $\alpha$  concentration not changed ( $P \leq 0.05$ ).

**DISCUSSION & CONCLUSION** The effect of exhaustive exercise on subjects was significant. This effect may be transient and related with intensity and duration. The results suggest that the exhaustive exercise induced changes in lymphocyte subsets but may not induced suppression immune function.

**KEY WORDS** exhaustive exercise, IgA, TNF $\alpha$ .

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## Effect of Vitamin-C supplementation on the immune system of active females

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**OBJECTIVE** Free oxygen radicals released by the elevated number of neutrophils and monocytes may influence the function of lymphocytes and contribute to the impaired function of the later cells. Thus, nutritional supplementation (with glutamine, carbohydrate, antioxidants, etc) may, in principal, influence exercise associated immune function. There is limited evidence of the role of exogenous antioxidants (vitamin C, vitamin E) in modulating immune function in exercise and virtually no evidence on endogenous antioxidants. The purpose of this paper is to present relevant information for assessing the effect of the usefulness of vitamin C in the cytokines IL1, IL6, TNF $\alpha$ , CD4, CD8, and IgA.

**METHODS** With the use of a double blind placebo design, the effect of vitamin C on the active females was studied. 20 active women (age  $21.6 \pm 1.71$  years, height  $161.45 \pm 2.71$  cm, weight  $57.25 \pm 6.99$  kg, and  $VO_2\max$   $34.18 \pm 2.7$  ml.kg<sup>-1</sup>.min<sup>-1</sup>) participated in the study. Blood sampling were obtained before and after the exercise period. The subjects participated in a 8-week incremental endurance training program. Supplementation began before and after the period of exercise. Granulated buffered vitamin C in water at a dosage of 0.6-1.0 g/day was ingested. Data was analyzed by t test.

**RESULTS** There were no significant changes in IL1, IL6, TNF $\alpha$ , CD4, CD8 and IgA concentration ( $P \leq 0.05$ ).

**DISCUSSION & CONCLUSION** Vitamin C supplementation may be beneficial for some of the subjects doing heavy exercise and experiencing frequent upper respiratory tract infections. The efficacy of vitamin C supplements in reducing the incidence of post race symptoms cannot be fully explained at this stage. It was concluded that, supplementation may induce changes in lymphocyte subsets, and immune cell function may result in significant alteration in T lymphocyte number, but their actual significance for immunity is seen controversially.

**KEY WORDS** supplementation, cytokines, immune cells

## Effects of static stretching on quadriceps peak torque and hip range of motion in professional football player

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**OBJECTIVE** Traditionally, static passive stretching has been used by coaches and athletes as a warm-up technique in an attempt to promote better performances.

However, the results of recent research have shown that passive muscle stretching can diminish the peak force output of subsequent maximal concentric contractions of the quadriceps. The purpose of study was to investigate the effects of static stretching on concentric, isokinetic leg extension peak torque (PT) at 60 and 300°·s<sup>-1</sup> and hip range of motion (ROM) in professional football player.

**METHODS** Fifteen professional football player were volunteered this study. All participants performed three static stretching protocols, in nonconsecutive training session. The stretching protocol consist of 30 seconds of three active and one passive static stretching session. Range of motion (ROM) was determined during knee flexion, using a goniometer. The peak torque of the dominant leg extensors was measured on a Biodex system 4 dynamometer at angular velocities of 60, 300°·s<sup>-1</sup>.

**Results** There was no significant differences pre (237.2±8 Nm at 60°·s<sup>-1</sup>, 142.1±4.5Nm at 300°·s<sup>-1</sup>) and post stretching PT (234.4±8.2Nm at 60 °·s<sup>-1</sup>, 141.5± 4.Nm 300 °·s<sup>-1</sup>) both isokinetic velocity. However it was hip ROM increased (p<0.05) post stretching (22.8±1.3) compare with pre stretching (21.6± 1.3).

**DISCUSSION & CONCLUSION** In conclusion static stretching did not significantly affect quadriceps peak torque ,but it can increase hip ROM

**KEY WORDS** Football player, Isokinetic, Peak torque, Static stretching, ROM

## Psychological stress induced gingival reactions with increased NO and FGF-b levels in handball players

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**OBJECTIVE** Sports competitions are associated with high anxiety levels which may result in accelerated periodontal destruction. Gingival crevicular fluid (GCF) is an important biological material for biochemical analysis since it is at close proximity to where periodontal disease begins. The increase in nitric oxide (NO) synthesis in saliva and periodontal tissue has been reported in inflammatory periodontal disease. Fibroblast growth factors (FGFs) are thought to play important roles in modulating the proliferation of structural cells in the periodontium and NO was shown to modulate growth factor release. Thus, our aim was to determine GCF NO and basic FGF (FGF-b) levels and the possible association with pre-competition stress induced periodontal reaction in elite competitive athletes.

**METHODS** 18 elite male handball players aged between 18-29 years participated in this study. Anxiety level of handball players during the half season break and just before the league championship match was determined by *Competitive State Anxiety Inventory-2 (CSAI-2)*. Periodontal clinical measurements and GCF samples were also obtained during the half season break and just before the league championship match. NO and FGF-b levels were analysed in GCF samples.

**RESULTS** According to CSAI-2, statistically significant differences between the two periods were found. GCF analysis yielded a significant increase both in NO and FGF-b levels just before the championship match compared to the levels obtained in half season break. Both periodontal (PI) and gingival indices (GI) were found to be increased at the evaluation just before the championship match. GI difference was statistically significant.

**DISCUSSION & CONCLUSION** The results of the present study indicated that competitive stress of athletes prior to a championship match may lead to gingival/periodontal disturbance accompanied by an increase in NO and FGF-b levels in GCF. Thus, stress management may be an important component of sports health and periodontal disease therapy.

## The acute effect of static, ballistic, and proprioceptive neuromuscular facilitation stretching on sprint performance

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**OBJECTIVE** The results of previous research have shown that muscle stretching prior to activity can diminish the peak force output of isometric contractions, explosive power and sprint performance. The purpose of this study was to compare the acute effects of different modes of stretching on sprint performance.

**METHODS** Twelve male taekwondo players (age, 15 ± 0.5 years) completed 4 different procedures in a randomized order, on different days, interspersed by a minimum of 72 hours of rest. Each session consisted of a standard 5-minute jog warm-up, accompanied by one of the subsequent conditions: (a) control, (b) proprioceptive neuromuscular facilitation (PNF) stretching (c) static stretching, and (d) ballistic stretching. The subjects performed 3 trials 10m and 20m prior to stretching and poststretching at 5, 15 and 20 minutes. Interactions between stretch interventions were analyzed using a repeated-measures analysis of variance. Post-hoc analysis was carried out using Bonferroni. Statistical analysis was carried out using SPSS, version 15 for Windows (SPSS, Inc., Chicago, IL). Significance was set at an alpha level of  $p < 0.05$ .

**RESULTS** Sprint performance time decreased after static and PNF stretching  $\text{app} = 0,05$  s and there was a smaller decrease after ballistic stretching  $\text{app} = 0,02$  s. However, sprint performance had fully recovered 15 minutes after static stretching. Additionally, while 20m performance returned to normal levels 15 minutes, the 10m performance had fully recovered 20 minutes after PNF stretching conditions.

**DISCUSSION & CONCLUSION** In conclusion, sprint performance is diminished for 15-20 minutes if performed after static or PNF stretching, whereas ballistic stretching has little effect on sprint performance. Consequently, PNF or static stretching should not be performed immediately prior to an explosive athletic movement.

**KEY WORDS** Flexibility, sprinting, stretching, static, ballistic, PNF, warm-up

## Comparison of the effect of sit-up exercises on different surfaces (Swiss ball and conventional floor) on abdominal muscle strength, balance and running economy in nonathlete women

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**OBJECTIVE** Usage of movable surfaces especially “swiss balls”, because of its unstable nature and increase in muscle activation, recently takes the attention of athletes, trainers and sport researchers. Swiss ball training improves physical and motor abilities and also it gives variety and attraction to ordinary training. The main purpose of this study was to compare the effect of sit-up exercises on different surfaces (swiss ball and conventional floor) on abdominal muscle strength, balance and running economy in nonathlete women.

**METHODS** The subjects were 22 nonathlete females (age: 21.59 ± 1.33 y, weight: 58.00 ± 7.27 kg and height: 163.14 ± 6.18 cm), who volunteered to take part in this research. They were all healthy and had no experience of swiss ball training. The tests were lifting the trunk and Double Straight Leg Lowering (D.S.L.L) to determine the strength of upper and lower portion of abdominal muscles respectively, EMG recordings of upper and lower portion of rectus abdominus and external oblique, evaluating static and dynamic balance thorough standing stroke and Star Excursion Balance Test (SEBT) and finally measurement of oxygen intake during modified Bruce test (by gas analyser) for determining the running economy. The experimental group 1 (n=7) performed conventional sit-up exercise on floor, the experimental group 2 (n=7) performed same exercise on swiss ball and the control group (n=8) continued their already lifestyle. The training schedule included 3 sessions per week for 10 weeks for both experimental groups. A two way repeated measures ANOVA with LSD post hoc test were used to analyze the data.

**RESULTS** Results show that the strength of upper and lower portion of abdominal muscles increased in both experimental groups with no significant difference between them. The significant rise was observed in activation (EMG recordings) of abdominal muscles in experimental group 1 and 2, also it was much more significant in experimental 2. There was no significant change in static balance, but the dynamic balance showed a significant rise in both experimental groups with no significant difference among them. At last the running economy just improved in experimental group 2.

**DISCUSSION & CONCLUSION** These findings revealed that swiss ball training may challenge the balance and control system. Also performing exercise on swiss ball may lead to improved recruitment of the core musculature and increased movement economy. Finally these findings suggest replacing swiss ball with conventional ones in sit-up exercise.

**KEY WORDS** swiss ball, abdominal strength, balance, EMG, running economy

## **The effects of regular aerobic training on blood paraoxonase and arylesterase activities and blood lipid and lipoprotein levels in women and the role of pon1-192 polymorphism on these effects**

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**OBJECTIVE** Regular aerobic training has positive effects on high density lipoprotein (HDL), of which antioxidant, antiatherogenic and protective effects for coronary heart disease (CHD) are well known. However, the effects of regular aerobic training on more recent risk factors of CHD such as blood paraoxonase (PON1) and arylesterase (AREST) that are associated with and responsible for the antioxidant potential of HDL, and the role of PON1-192 polymorphism on these potential effects in women are yet to be determined. The objective of this study was to determine the effects of regular aerobic training on blood PON1, AREST enzyme activities and lipid and lipoprotein profiles in premenopausal women and whether potential effects depended on the PON1-192 phenotype.

**METHODS** Subjects included 91 middle-aged, healthy, non-menopausal females who regularly performed aerobic exercise at least three times a week for a long period of time (EG, n=50) and those who did not do any exercise, to serve as controls (CG, n=41). Groups were analyzed for anthropometrical (body weight, height, body mass index, body fat ratio) and physiological (resting heart rate, blood pressure, maximal oxygen consumption) parameters. Activities of PON1, salt-stimulated paraoxonase (TSPON1), AREST and AREST activities of HDL and subgroups were determined in fasting venous blood by kinetic methods. Classical risk factors of CHD, including fasting serum triglyceride, total cholesterol (TC), HDL cholesterol (HDL-K) and its subgroups (HDL2-K, HDL3-K) levels were determined by standard enzymatic-colorimetric methods. Phenotyping of subjects for PON1-192 polymorphism were carried out based on TSPON1/AREST ratio. Subjects of aerobic exercise and control groups were classified as QQ with low activity, QR heterozygote, RR with high activity and R carriers [(RT)=(QR+RR)].

**RESULTS** No significant differences in serum PON1 and AREST activities and HDL and subgroups' AREST activities were found between EG and CG groups ( $p>0.05$ ). However, with regard to PON1-192 polymorphism, PON1 ( $p<0.01$ ) activity was significantly and HDL3-AREST activity (23%,  $p>0.05$ ) was non-significantly higher in QQ phenotype in the exercise group, compared to the CG group. No significant differences in the serum total AREST activity were noted between the three phenotype groups. EG group's serum HDL-K ( $p<0.05$ ), HDL3-K ( $p<0.05$ ), TC ( $p<0.001$ ), and LDL-K ( $p<0.01$ ) measurements were significantly higher than the CG. Further, regarding PON1-192 polymorphism, TC ( $p<0.01$ ) and LDL-K ( $p<0.05$ ) levels in the exercise QQ group and TC ( $p<0.05$ ) and HDL-K ( $p<0.05$ ) parameters in the exercise RT (QR+RR) group were significantly higher in comparison to those of the CG. No significant differences in classical risk factors of CHD were found between the control phenotype groups ( $p>0.05$ ).

**DISCUSSION & CONCLUSION** Significant beneficial effects of long-term aerobic exercise on serum lipids and lipoproteins and PON1 enzyme activity were demonstrated in middle-aged premenopausal women. However, these effects depend on the PON1-192 phenotype.

**KEYWORDS** Aerobic training, paraoxonase, arylesterase, PON1-192 polymorphism, HDL and subgroups' cholesterol and arylesterase values, middle aged premenopausal women

## **Doping and professional road cycling: Perspective of cyclists versus team managers**

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**OBJECTIVE** Doping has been a big problem in Sport in the last decades and especially in Cycling. Scandals related to doping have decreased the status and credibility of cycling for the spectators and fans. In the last decade national and international institutions have spent a lot of resources on fighting against doping, while press has been also really interested in informing about doping cases. But while the cyclist is seen as the only guilty in this issue, there is no information about what cyclists think in the matter comparing it with coaches' perspective.



**METHODS** A total of 55 subjects (20 Spanish Professional road Cyclists -PC- and 35 coaches or team managers -TM-) participated in this study. All of them were voluntarily and anonymously interviewed and recorded following a close protocol focused on their opinions about doping. All the records were written and analyzed by means of AQUAD Five software (Analyses of Qualitative Data) to obtain the different categories and importance.

**RESULTS** The categories were divided by group: for PC the main responsible agents that evoke doping were 1) Team Managers, 2) Doctors, and 3) the cyclists, while for the TM the responsible were the 1) pressure of sponsors, 2) cyclists, 3) team managers, and 4) doctors. Both groups pointed out that media was not impartial treating all the sports, and cycling was worse treated than specially football, swimming or athletics. Also, both groups suggested that at the beginning the business was around pro-doping, and nowadays they feel it is in anti-doping. While for PC the most important way to change this tendency is to educate from the early ages, for TM it is to make a bigger effort in anti-doping control and tests. For both groups the way cyclists have been controlled is inhuman and much harder than in other sports. Both groups recognize doping has a large tradition in cycling, although both think that nowadays this issue is more controlled than ever before.

**DISCUSSION & CONCLUSION** Both PC and TM think similarly about doping issue in cycling. The main difference is that cyclists think that TM are more responsible than PC, and the opposite do TM. Also, both groups think that cycling has been badly treated by anti-doping agencies and media. To treat this problem PC believe in education from earliest ages, and TM believe in more repression and control. It can be argued that intervention programs are needed to educate the youngest cyclists, parents and their social environment, coaches and team managers, or doctors, at the same time control tests need to be increased but also humanized.

**KEY WORDS** doping, cycling, opinion, coaches, cyclists

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## **Treatments for osteochondral lesions of the ankle: A long term follow up and retrospective clinical and radiographic evaluation of pre and postoperative factors influencing prognosis**

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**OBJECTIVE** Osteochondral lesions of the ankle result from rotational injuries of the ankle in athletes. The purpose of this study is to evaluate the results of arthroscopic treatment of ankle osteochondral lesions and to define the clinical and arthroscopic factors influencing prognosis.

**METHODS** From 1993 to 2002 a total of 108 patients underwent 132 arthroscopic procedures for diagnosis and treatment of osteochondral lesions of the ankle. The evaluations included a pre and postoperative clinical scoring, radiographic evaluation including pre and postoperative anterior- posterior, lateral and mortise view of the ankle, as well as CT and MRI of the ankle. Operative techniques included: microfractures technique (81 patients), fixation of the lesions using poly-lactic acid "Biofix" rods (17 patients), diagnostic arthroscopy followed by cartilage lesions shaving (16 patients), retrograde drilling of the lesion to the subchondral bone (12 patients), bone graft filling of subchondral cysts (4 patients), osteochondral autografts (OATS, 2 patients).

**RESULTS** Traumatic etiology of the lesions was found to be associated with postero-medial talar lesions ( $p < 0.012$ ). Significant clinical and radiographic improvements comparing pre and post operative CT scoring ( $p < 0.005$ ), plane radiographs ( $p < 0.01$ ) and clinical score ( $p < 0.003$ ). No correlation was found between the x-ray CT findings and arthroscopic grading. Clinical improvements were found to correlate directly with CT grading ( $p < 0.05$ ). Fixation technique with "Biofix" was found to be associated with postoperative subchondral cyst formation detected on plane radiographs and on CT ( $p < 0.0001$ ). Tibial and talar "kissing lesions" correlated with poor pre operative clinical score ( $p < 0.05$ ). Lesions with sclerosis and or cyst on x-ray or CT before operation, appeared to have less clinical improvement with surgery ( $p < 0.05$ ).

**DISCUSSION & CONCLUSION** Ankle x-rays and CT plays a limited role in planning the intra-operative procedure. Findings like sclerosis and subchondral cyst carry less favorable prognosis, which is not reflected in the current classifications. Arthroscopy is a valuable tool for evaluation and treatment of ankle osteochondral lesions. The operative technique should be selected according to arthroscopic findings and the surgeon should be prepared to tailor the different types of treatment to each lesion.

**KEY WORDS** cartilage, ankle, microfracture, arthroscopy

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## **Blood pressure (BP), heart rate (HR) and rate pressure product (RPP) responses during recovery from resistance and endurance exercise.**

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**OBJECTIVE** The purpose of this investigation was to examine BP responses, HR and RPP during recovery from endurance and resistance exercise in order to differentiate effects due to exercise type, duration and intensity.

**METHODS** Twenty normotensive healthy young males participated in the present study. All participants engaged in regular physical activity <2 h per week. Participants were randomly divided into endurance and resistance exercise groups of 10 participants each. At the beginning of the study, participants of endurance group underwent a maximal cycle ergometer exercise test, with 30 W increments every 3 min until volitional exhaustion. Peak oxygen consumption (VO<sub>2</sub> peak) was recorded. 1RM test At least 10 days prior to the experiments, participants of resistance group underwent a 1RM test for the five dynamic constant external resistance exercises were performed using free weights or a universal weight machine station. Participants of resistance group underwent, in a random order, three experimental sessions: resistance exercise at LOW (RL) and HIGH intensity (RH), and LOW SHORT volume (RLS). Participations of endurance group performed, in a random order, three experimental sessions: endurance exercise at LOW (EL: 40% of VO<sub>2</sub> peak), and HIGH intensity (EH: 80% of VO<sub>2</sub> peak), and LOW SHORT duration (ELS).

**RESULTS** During resting trial BP, HR and RPP did not change significantly. Baseline SBP and DBP were similar in all exercise trials. In EL, EH and ELS, SBP and DBP decreased similarly at all time points compared to the resting value. In RL, RH and RLS, when SBP values were compared to values at rest, post-exercise SBP values showed a significant decrease that lasted up to 60 min, whereas post-exercise DBP presented no change after RL, RH and RLS trials. MBP decreased similarly during recovery periods after exercise in the EL, EH and ELS exercise trials, and remained significantly below baseline values for 50 min after RL, RH and RLS exercise trials. HR changes were observed in all the exercise trials. Baseline HR was similar in all exercise trials. In comparison with the pre-exercise values, HR remained significantly above baseline values for 30 min after EL, RL and 60 min after EH and RH exercise trials, respectively. EL provoked a decrease in HR at 70-90 min, but this decrease was not statistically significant. Baseline RPP was similar in all exercise trials. In comparison with the pre-exercise values, RPP remained significantly above baseline for 30 min after EL, RL and 50 min after EH and RH exercise trials. EL provoked a decrease in RPP at 70-90 min, but this decrease was not statistically significant.

**DISCUSSION & CONCLUSION** The main findings of this study were: (a) a single bout of endurance and resistance exercise provoked PEH in young normotensive humans; however, decrease of SBP following resistance exercise were shorter in duration compared to endurance exercise, and DBP was significantly reduced only after endurance exercise; (b) intensity and duration of endurance exercise and intensity and volume of resistance exercise dose not plays a significant role in determining the occurrence or the magnitude and duration of PEH; (c) endurance exercise of low intensity (EL), decreased HR and RPP levels during the recovery period, although this decrease was not statistically significant. The absence of a BP fall during the non-exercise control trial shows that, in fact, the decreased BP levels after exercise are due to the exercise effect and not to the normal diurnal BP variations. Base of previous research, the effect of resistance exercise on recovery BP is not well understood. If this duration of response is achieved with the exercise indicated here, a regimen of mild exercise (especially endurance exercise) may be helpful for the management of hypertension.

**KEYWORDS** Hypertension; Resistance exercise; Endurance exercise; Cardiovascular responses

## **The effects of creatine supplementation on performance and hormonal response**

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**OBJECTIVE** It is unknown through what mechanism of action creatine supplementation produces an ergogenic effect. Based on the fact that creatine supplementation results in a rapid increase in body mass and fat-free mass, it has been hypothesised that creatine induces hypertrophy through endocrine mechanisms. Hence, the purpose of this study was to determine the influence short-term creatine supplementation on performance and hormonal responses to short-term sprint running performance.

**METHODS** Twenty healthy young males amateur runners (mean age: 21 years) volunteered to participate in this study. Before to beginning the study, subjects randomly divided to creatine supplementation (CR) or a placebo (PL) group. The subjects had the following characteristics [(mean  $\pm$  SD)]: CR group: age 21.75 $\pm$ 1.32 years; height 176.32 $\pm$ 64.35; body mass 69.16 $\pm$ 8.65 kg; percent body fat 16.12 $\pm$ 4.12%. PLgroup: age 20.83 $\pm$ 1.73 years; height 175.60 $\pm$ 3.22; body mass 69.12 $\pm$ 10.46 kg; percent body fat 16.92 $\pm$ 5.25%. Testing (100 and 200 m sprint time) occurred before and at the end of 6 days of supplementation. After pre-testing (1 day later), subjects were provided with capsules containing either creatine monohydrate (Creatine Fuel®, Twin Laboratories, Inc., Hauppauge, NY) or identical powdered cellulose placebo. Blood serum (testosterone, cortisol and GH samples) were obtained, pre and after 6 days of supplementation. The values of the various parameters studied were analyzed by means of the t test for unpaired and paired samples according to the case, with the level of significance set at  $p < 0.05$  for all statistical procedures. Data are reported as mean $\pm$ SEM.

**RESULTS** Although mean running times of CR group in the running performance were decreased (beforeperiod: 11.86 $\pm$ 3.9 second, 22.82 $\pm$ 4.9 second, after-period: 11.23 $\pm$ 5.8 second, 22.67 $\pm$ 9.4 second, in the 100 m and 200 m, respectively), but this decrease was statistically significant only in the 100 m sprint test ( $p < 0.05$ ). CR group gained significantly more body mass (0.68 $\pm$ 0.11 kg) and fat-free mass (0.55 $\pm$ 0.05 kg) compared with the PL group. No significant changes were observed in GH, testosterone and cortisol from before to after-supplementation in both groups of CR and PL ( $p < 0.05$ ).

**DISCUSSION & CONCLUSION** Our data suggest that under the experimental conditions used short-term creatine supplementation increase runners performance in amateur runners. However, the lack correlation among performance improvement and hormonal responses address it seems unlikely that performance improvements to creatine supplementation are hormonally mediated and systemic changes via hormonal alterations have been ruled out. However, some evidence suggests a role for human growth hormone. Therefore, this topic requires further investigation.

**KEYWORDS** Runners performance; Creatine supplementation; Anabolic hormones; Hormonal responses

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## Effect of pilates training on body composition and flexibility in healthy and sedentary women

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**OBJECTIVE** The purpose of this study is to investigate effects of pilates mat exercise during 8 weeks on body composition and flexibility of sedantary and healthy females.

**METHODS** The subjects were 30 women with the mean age of 28.45 $\pm$ 01, mean height of 163.87 $\pm$ 6.37 cm and mean weight of 58.83 $\pm$ 04.71 kg and control group included randomly selected 30 women in the similar ages and have not participated regularly in any training exercises. The subjects participated in the study voluntarily and were new members for a pilates class. They performed modern pilates mat exercise 3 times a week during 8 weeks accompanied by a trainer, who had 3 years of certification in pilates. The control group (n=30) didn't participate in any training. The tests were done before and after 8 weeks. Body composition was determined(TBF-300 A Japan). Standard anthropometric methods were used for measurements (Anthropometric Standardization Reference Manuel procuders). Posterior body flexibility was determined by sit-and-reach test.

**RESULTS** After 8 weeks, no significant change occurred in body composition ( $p > 0.05$ ) No significant differences were observed in all BIA's variables; fat mass ( $p > 0.001$ ), total body water ( $p > 0.001$ ), fat free mass ( $p > 0.001$ ), body fat ratio ( $p > 0.001$ ) and impedance ( $p > 0.001$ ). There was significant change in posterior body flexibility ( $p < 0.001$ ). No significant changes were found for the control group.

**DISCUSSION & CONCLUSION** Pilates mat exercises were found to be an effective training method that causes significant changes in posterior body flexibility in healthy and sedentary females. This study showed that no significant changes were observed in body composition.

**KEYWORDS** pilates, body composition, anthropometry, flexibility, women

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## The changes of body composition in professional soccer players during a competition half-season

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**OBJECTIVE** The aim of this study is to evaluate the changes of body composition in professional soccer players, measured by bioelectrical impedance, during a competition half-season.

**METHODS** We measured the body composition of 25 professional soccer players (age, 25,52 ±4.11) three times by bioelectrical impedance (InBody 720), at the beginning of training process (phase of conditioning), before competitions (after the phase of conditioning) and at the end of the season (after the competitions) during a period of 6 months. We measured: BW (body weight), FFM (fat free mass), SLM (soft lean mass), TBW (total body water), ICW (intracellular water), ECW (extracellular water), protein, mineral, BFM (body fat mass), SMM (skeletal muscle mass), BMI (body mass index), WHR (waist-hipratio), VFA (visceral fat area), BCM (body cell mass), BMC (bone mineral content), BMR (basal metabolic rate), AMC (arm muscle circumference), AC (arm circumference), FS (fitness score).

**RESULTS** There were increase in FFM, SLM, TBW, ICW, ECW, proteins, minerals, SMM, BCM, BMC, BMR, AMC, FS, and decrease in BW, BFM, BMI, PBF, FMA and AC, after the phase of conditioning, but only the decrease in PBF (12,94 to 10,38 %) was significant ( $p < 0.05$ ). At the end of the season, the trend was inverse, without any significance.

**DISCUSSION & CONCLUSION** The results show that, conditioning phase of training process was improved by diet (increase in proteins, water, minerals and absolute muscle mass; decrease in absolute and relative fat mass) and training process (increased fitness score). New nutritional and training strategies during the phase of competitions are needed for these players.

**KEYWORDS** body composition, soccer players, bioelectrical impedance, nutrition, training process

## Hand and grip dimensions in elite female junior tennis players

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**OBJECTIVE** The aims of this study were: a) to describe the parameters of the dominant hand size and handgrip of the racket, b) to test the correlations between hand size, handgrip and the measure of optimal theoretical handgrip to get the highest strength value proposed by Ruiz et al., and c) to test the differences between the values of the 12 top-ranking tennis players and the rest.

**METHODS** This study includes 62 elite female tennis players under 16 (U16) from 28 national teams. They were grouped according to their competing results; the first 12 tennis players and the rest ranked players. We obtained the transverse dimension of the hand. (The distance between the tip of the thumb and the little finger on extended hand). To known total handgrip dimension, the grip and the use of overgrip were taken into account.

**RESULTS** No correlations were observed between the transverse measure of the hand (19.97±1.31) and the total value of the handgrip (11.15±0.20). There was a slight correlation (0.097;  $p < 0.05$ ) between the optimal theoretical grip for the dynamometry test (6.09±0.33) and the values of the size of the handgrip (3.55±0.06), the transversal measure of the hand and the base of the perimeter of the handgrip (10.92±0.20) ( $p = 0.091$ ). No differences were found for any variable between the groups.

**DISCUSSION & CONCLUSION** No relationships were found between the size of the handgrip and the dimension of the hand, and the studied variables and the theoretical optimum handgrip dimension for manual dynamometry test. No differences were found in any variable among the groups. It seems that U16 tennis players choose their handgrip without taking their hand dimensions into account.

**KEYWORDS** Hand, grip, tennis, young



## Flexibility characteristics of tennis performance players

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**OBJECTIVE** The purpose of this study is to investigate the differences in the flexibility of right and left sides of the performance tennis players based on the measurements of quadriceps flexibility, hamstring flexibility, gastrocnemius flexibility and internal-external rotation of shoulders.

**METHODS** The subjects of the study consisted of 50 females with mean age of  $10.60 \pm 0.07$  years old, height of  $147.47 \pm 0.83$  cm, weight of  $41.39 \pm 0.36$  kg and 43 male players with mean age of  $10.70 \pm 0.14$  years old, height of  $146.82 \pm 0.82$  cm, weight of  $39.99 \pm 0.82$  kg. Female players have been playing tennis for  $3.91 \pm 1.40$  years and the age that they started playing tennis is  $6.72 \pm 1.05$  years old. Male players have been playing tennis for  $4.18 \pm 1.38$  years and their age that they started playing tennis is  $6.56 \pm 0.94$  years old. All of the 93 subjects joined the study voluntarily and were players for the domestic teams that participated in the Türkiye Tennis Championship. The control groups consisted of 60 juniors (30 females and 30 males) who were in the same of age group and have not participated regularly in any training exercises. The flexibility measurements consisted of sit and reach flexibility, quadriceps flexibility, hamstring flexibility, gastrocnemius flexibility, shoulder internal rotation and shoulder external rotation. Body composition was determined by bioelectrical impedance analysis (BIA). Standard anthropometric methods were used to determine body mass, body height and body weight measurements.

**RESULTS** According to the results of comparison of flexibility measures; there were no significant differences in quadriceps flexibility, hamstring flexibility and shoulder external rotation ( $p > 0.05$ ) between right and left sides of female players, whereas there were significant differences in gastrocnemius flexibility ( $p < 0.05$ ) and shoulder internal rotation ( $p < 0.001$ ) between right and left sides of female players. There were no significant differences in quadriceps flexibility and hamstring flexibility ( $p > 0.05$ ) between right and left sides of male players, whereas there were significant differences in gastrocnemius flexibility ( $p < 0.05$ ), shoulder internal rotation ( $p < 0.001$ ) and shoulder external rotation ( $p < 0.05$ ) between right and left sides of male players.

**DISCUSSION & CONCLUSION** According to this study, tennis training causes significant differences between the right and left extremity in flexibility tests.

**KEYWORDS** tennis player, body composition, anthropometry, flexibility

## Analysis of isokinetic knee extension / flexion strengths in Turkish super league soccer players

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**OBJECTIVE** Most soccer players have a favoured foot for kicking the ball, and it is believed that this preference may lead to an asymmetry in the strength of the lower extremities. This study was designed to determine whether asymmetry in strength is present in the legs of soccer players and to contribute a normative isokinetic strengths database of lower extremities by using Cybex Humac NORM isokinetic dynamometer for Turkish Super League soccer players.

**METHODS** One hundred fifty two professional soccer players (age  $25.2 \pm 4.1$  years ; height  $180.9 \pm 6.2$  cm; body weight  $77.72 \pm 6.81$  kg ) were studied. The isokinetic strength of knee flexors (hamstrings; H) and knee extensors (quadriceps; Q) was measured using an isokinetic dynamometer at angular velocities of 60, 180, 240 and 300 deg/s (Con/Con mode). The concentric strength ratio (Hconc/Qconc) were computed.

**RESULTS** We compared right with the left leg and stronger with weaker leg. Significant differences to be founded in the comparison of stronger leg to weaker leg in Torque to Body Weight Ratios ( % BW ) extension 240 deg/sec , % BW flexion 240 deg/sec , % BW flexion 60 deg/sec , Peak Torque ( PT ) flexion 240 deg/sec , PT flexion 60 deg/sec ( $p < 0.05$ ). On the other hand we have not found a significant differences between %BW extension 60 deg/sec, PT extension 60 deg/sec , PT extension 240 deg/sec . However no significant differences were found between the left and right leg values ( $p > 0.05$ ).

**DISCUSSION & CONCLUSION** The strength characteristics in the lower extremities of these players revealed a difference between the stronger and weaker extremities. However musculoskeletal abnormality was defined as a contralateral strength imbalance greater than 10%. There was a statistical significance between stronger and weaker legs strength although this difference is in the range of 10 % and the results of Turkish players are similar to that reported previous research. On the other hand, 54 of 152 players (36%) were found to have at least one musculoskeletal abnormality which consisted of a contralateral strength imbalance of greater than 10% in one or more specific muscle groups.

It appears that soccer training produces a unique lateral dominance in these players. This type of information may be of value in preseason evaluations of other soccer players as well as in the rehabilitation of injured players. The Hconc/Qconc strength ratio varies from 69% to 74% depending upon the angular velocity of movement nevertheless limitation of this study was the absence of the dynamic control ratio (Hecc/Qconc).

**KEYWORDS** isokinetic dynamometer, soccer, hamstring, quadriceps, torque

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## **A comparison of the sit-and-reach and the modified sit-and-reach tests as measures of hamstring extensibility in young adults.**

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**OBJECTIVE** Several research papers have proposed the modified sit-and-reach test (MSR) as an alternative method of measuring hamstring muscle extensibility. The purpose of this study was to examine and to compare the hamstring criterion-related validity (concurrent validity) between the MSR and the sit-and-reach test (SR).

**METHODS** Seventeen and three males (mean age:  $22.9 \pm 3.4$  years) and 78 females (mean age:  $23.2 \pm 3.9$  years) were asked to perform two trials of MSR test, SR test, and straight leg raise test (left and right leg) (criterion measure of hamstring extensibility) in a randomized order. The SR and MSR scores were recorded with an SR box (ACUFLEX I Flexibility tester). Scores from each test were then correlated with the criterion measure. Pearson correlation coefficients were used to define the relationships between MSR and SR with respect to straight leg raise.

**RESULTS** Correlation values between the MSR and straight leg raise (left and right leg, respectively) were low for males ( $r = 0.39-0.45$ ,  $p < 0.01$ ) and moderate for females ( $r = 0.62-0.63$ ,  $p < 0.01$ ). The correlation values between the SR test and straight leg raise were slightly greater in both males ( $r = 0.50-0.56$ ,  $p < 0.01$ ) and females ( $r = 0.72-0.75$ ,  $p < 0.01$ ).

**DISCUSSION & CONCLUSION** The practitioners may employ the traditional SR over the MSR to measure hamstring extensibility, because the SR reaches better criterion-related validity as a measure of hamstring muscle extensibility in males and females, and the measurement protocol is easier.

**KEYWORDS** hamstring muscles, measurement, sit-and-reach tests, straight leg raise test.

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## **Comparison of the forward reach score among several sit-and-reach tests.**

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**OBJECTIVE** Several sit-and-reach tests are commonly used in health-related physical fitness to evaluate the hamstring extensibility. The purpose of the study was to compare the forward reach score among different sit-and-reach tests.

**METHODS** Seventy and seven males (mean age:  $23.1 \pm 3.9$  years) and 71 females (mean age:  $23.3 \pm 4.2$  years) were asked to perform two trials of back-saver sit-and-reach left (BSL) and right (BSR), sit-and-reach (SR), toe-touch (TT), and V sit-and-reach tests (VSR) in a randomized order. The forward reach score was measured with a sit-and-reach box (ACUFLEX I Flexibility tester). To standardize the measuring scale, a standard meter rule was placed with the reading of 0 cm in line with the heel position.

**RESULTS** The mean values of forward reach score were  $-0.95 \pm 0.83$  (BSL),  $-0.44 \pm 0.86$  (BSR),  $-0.59 \pm 0.92$  cm (SR),  $-3.74 \pm 0.95$  (TT), and  $-5.00 \pm 1.01$  (VSR) in males, and  $6.25 \pm 0.96$  (BSL),  $5.96 \pm 1.01$  (BSR),  $6.29 \pm 1.09$  cm (SR),  $4.23 \pm 1.17$  (TT), and  $4.68 \pm 1.32$  (VSR) in females. The repeated measures ANOVA revealed significant differences in the main effects of forward reach score among the sit and reach tests in males and females ( $p < 0.001$ ). Significant differences ( $p < 0.001$ ) were found in forward reach score between several pairwise comparisons in males (SR-TT, SR-VSR, TT-BSR, TT-BSL, BSR-VSR, BSL-VSR). However, in females significant differences ( $p < 0.001$ ) were only found between two pairwise comparisons (SR-TT, TT-BSL).

**DISCUSSION & CONCLUSION** Administration procedures of sit-and-reach tests (uni- or bilateral, sitting or standing, measuring with or without box, parallel or V position) influence the forward reach score in males, although the females showed more homogenous values.

**KEYWORDS** hamstring extensibility, fitness testing, sit-and-reach.

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## 7 weeks of swimming training are sufficient to enhance sprint performance

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**OBJECTIVE** The preparation for a major competition is an important concern of coaches and athletes. In addition, it is not always clear the effects of training in the performance and how it affects different training components. Hence, the aim of this study was to evaluate the evolution in sprint performance during a training macro cycle in age-group swimmers.

**METHODS** The sample comprised twenty four age-group swimmers of the same swimming team. Their mean (standard deviation) age, body mass, height and 100 m freestyle personal best was 12.0 (0.72) years old, 41.43 (6.88) kg, 1.51 (0.09), 72.75 (7.49) s, respectively. The evaluations occurred during 9 weeks of swimming training in the first macro cycle. During this period the subjects performed 54 training units (6 units per week). The swimmers performed 208.6 km, corresponding to a mean value of 23.18 km per week and 3.86 km per training unit. In all weeks, the performance in two trials of a 25 m front crawl all out test, with 15 min of rest, was recorded. This evaluation occurred always at the same day of the week for each swimmer. The best performance was used to assess the effects of training. A repeated-measures analysis of variance with Bonferroni adjustment was used to analyze the differences between the mean values of each week performance. The significance level was set at  $p < 0.05$ .

**RESULTS** The sprint performance did not change during the first 6 weeks of preparation (week 1: 16.74 (2.04) s, week 2: 16.85 (2.23) s, week 3: 16.88 (2.38) s, week 4: 16.56 (2.14), week 5: 16.97 (2.40), week 6: 16.57 (2.05);  $p > 0.05$ ). In the last 3 weeks the performance in the 25 m front crawl test was improved when compared with the first week (week 7: 16.41 (2.28) s, week 8: 16.41 (1.21) s, week 9: 16.18 (2.09) s;  $p < 0.05$ ), although the major changes occurred at the last week of preparation.

**DISCUSSION & CONCLUSION** It seems that in age-group swimmers 7 weeks of specific swimming training enables improving swimmer's sprint performance. Although this protocol was only conducted in front crawl technique, these data could be used by coaches to program the training season and the evolution of the load components. However, it seems interesting to enlarge this study to other swimmers of different level and to analyse these data in other swimming techniques, rather than the front crawl stroke.

**KEYWORDS** Sprint, training control, age-group swimmers.

## The relationship of anthropometrical characteristics and front crawl performance in male age-group swimmers

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**OBJECTIVE** Swimming performance is affected by several factors including the swimming technique, the swimmer's functional and metabolic characteristics and the level of training accomplishment. However, performance is also depending on the swimmer's anthropometrical characteristics. The body shape, body size and body composition can play an important role to achieve higher performances. Therefore, the aim of this study was to analyse the relationship between anthropometrical characteristics and the performance in front crawl events in male age-group swimmers.

**METHODS** The sample comprised sixteen male age-group swimmers of the same swimming team. Their mean (standard deviation) age, body mass and height was 12.50 (0.51) years old, 42.93 (7.73) kg, 1.52 (0.10) m, 72.75 (7.49) s, respectively. The following anthropometrical characteristics were evaluated: height, body mass, span, torso and waist circumferences, body mass index, fat mass (kg), fat mass (%), and lean mass (kg). The personal best of the swimmers in 100 m, 200 m, 400 m, 800 m and 1500 m short course front crawl events were related to the anthropometrical data. Pearson correlation coefficient was used to determine these relationships. The significance level was set at  $p < 0.05$ .

**RESULTS** A significant correlation ( $p < 0.05$ ) was found between the 100 m performance and height ( $r = 0.83$ ), span ( $r = 0.75$ ), fat mass % ( $r = 0.65$ ) and lean mass ( $r = 0.71$ ). Moreover, a significant correlation was found between the 200 m performance and height ( $r = 0.72$ ), span ( $r = 0.70$ ), body mass ( $r = 0.53$ ) and lean mass ( $r = 0.69$ ). No significant correlations were found between 400 m, 800 m and 1500 m performance and the anthropometrical parameters. Moreover,

torso and waist circumferences and body mass index were not correlated to the freestyle performance in any of the analysed events.

**DISCUSSION & CONCLUSION** In male age-group swimmers the performance in short distance events (100 m and 200 m) seems to be dependent on anthropometrical characteristics. The same situation seems not to occur with middle distance events (400 m, 800 m and 1500 m). Hence, the swimmers who presented higher values of height, span, body mass and lean mass presented best times in 100 m and 200 m freestyle events. On the other hand, higher values of fat mass seemed not to be profitable for these events.

**KEYWORDS** Anthropometry, freestyle events, male, age-group swimmers.

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## The effect of pilates exercises on the lumbar hyperlordosis degree in 15-18 years old girl students

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**OBJECTIVE** It is believe that Pilates exercises are suitable for athletes, the general population, and people with medical conditions because of it can enhances strength and flexibility, improves postural status and peripheral mobility. However, there are few study to support these statements. The aim of this study is to investigate the effects of pilates exercises on the lumbar hyperlordosis in the student girls 15-18 yr.

**METHODS** To determine the normal range of lumbar lordosis, Spinal mouse was used to measure the lumbar lordosis of students age 15-18 years. The mean of lordosis was 39.05 degree and SD= 11.05, so in the present study, the normal range of lumbar lordosis to take into by 50.10 (M+SD) degree. 27 subjects were selected in which lumbar lordosis was more than 50.10 degree. After two months pilates exercises (eight weeks, three session per week and one hour per session), lumbar lordosis was measured again as a post test trial. Data were analyzed by the paired-sample T test using the SPSS software.

**RESULTS** It is observed a significant decreases in lumbar lordosis ( $t=7.36$ ;  $p\leq 0/05$ ) and significant increases in local endurance of abdominal muscles ( $t = -8.18$ ;  $p\leq 0/05$ ) and flexibility of back muscles ( $t = -9.86$ ;  $p\leq 0/05$ ) after pilates exercises.

**DISCUSSION & CONCLUSION** Pilates exercises significantly decrease the lumbar hyperlordosis in the 15 -18 yr. old girl students, and it is concluded that pilates exercises have a potential role to improve the student's postural abnormalities.

**KEY WORDS** Pilates Exercise, Postural Abnormality, Lumbar Hyperlordosis

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## Motor abilities in visually impaired adolescents with different level of physical activity

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**OBJECTIVE** The visually handicapped children are less physically active than their sighted peers. Vision as well the level of physical activity affect the motor performance. Participation in sports may provide an opportunity for children to improve their motor skills. The aim of this study was to examine the motor abilities of adolescents with visual impairments and to clear up their association with sports participation.

**METHODS** 51 adolescents (26 girls and 20 boys) with visual impairments, mean age 16.1 years (SD 1.24) were measured. They were divided in two groups – with low level of physical activity - participating only in two physical education lessons per week, and physically active - practicing extracurricular sports. Height and weight were measured. The following EUROFIT tests were used: handgrip strength, standing broad jump, flexed arm hang, sit-ups, plate tapping, sit-and-reach. The running speed was measured by 50-m distance run.

**RESULTS** There wasn't statistical difference in the anthropometrical parameters of the children from both groups. The results showed significantly higher ( $p<0.05-0.01$ ) scores for physically active boys and girls from the tests for flexibility, speed of limb movement, trunk strength, muscular endurance and running speed. The difference between sedentary and physically active children was not significant ( $p>0.05$ ) for handgrip strength. Explosive leg power of the practicing sports boys was statistically significant higher than those of sedentary, but the results of girls from both groups were no statistically different.

**DISCUSSION & CONCLUSION** Our results indicate that sports participation improves motor abilities of children with visual impairments, which could increase the likelihood of independence.

**KEYWORDS** motor abilities, visually impaired adolescents, Eurofit tests

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## **Incremental exercise tests and mechanical work: Negligible interactions?**

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**BACKGROUND** Endurance exercise tests considered a gold standard to determine submaximal and maximal endurance performance. Incremental tests are preferred to evaluate lactate thresholds and ramp tests are focused on maximal power output and oxygen uptake. Physical critiques using the RIEMANN-Integral to differentiate both test designs are lacking.

**OBJECTIVE** The area under the power-time-graph applies to  $W=P*dt$  and becomes a smooth curve for an infinite minimal time: An ideal ramp. With respect to this consideration, we hypothesize: The smaller the increment, the longer a subject might perform mechanical work for the same global increase of physical power.

**METHODS** 10 unspecific trained male students performed two randomized incremental exercise tests until maximal exhaustion. One test protocol increased 20W per minute and the other test 60W per 3 minutes. Recreational time between both tests was defined by one hour. The MANOVA with the grouping variable TEST was performed to evaluate statistical interaction between exercise time, maximal power and maximal oxygen uptake. Univariate analyses were additionally performed for each parameter.

**RESULTS** The MANOVA revealed a slight but not significant interaction ( $F=2,8; p=0,2$ ). The univariate analysis also revealed no statistical difference between both tests for exercise time, maximal power and oxygen uptake. But in tendency, we observed a difference for  $VO_2max$  ( $F=1,8; p=0,1$ ) due to our hypothesis.

**DISCUSSION & CONCLUSION** The differences of the increments between both tests of either 20W per minute or 60W per 3 minutes were too small to reveal statistical difference. Nevertheless, the question of mechanical work according to the test should be included beside physiological justifications.

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## **The effects of 12, 18, 24 hours of sleep deprivation on simple, choice reaction time and anaerobic power of college students athletes**

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**OBJECTIVE** The purpose of this study was to evaluate the effects of 12, 18, 24 hours of sleep deprivation on simple, choice reaction time and anaerobic power of college student athletes.

**METHODS** Eight healthy right-handed college student athletes with the mean age of 22.3 years voluntarily participated in the study following the approved of the local ethics committee. The subjects fully informed of the procedures. The pre-test included simple reaction time (SRT), choice reaction time (CRT) and anaerobic power (Wingate) test. The participants did not consume any stimuli such as coffee, tea, and cacao during the experiment.

**RESULTS** The results of data analysis showed no significant increase in simple reaction time (SRT) following 12, 18 hours of sleep deprivation, respectively. However, after 24 hours of sleep deprivation, SRT significantly increased. In addition, there was no significant increase in choice reaction time after 12 hours of sleep deprivation, but it did significantly increased after 18 and 24 hours of sleep deprivation, respectively. No significant decrease in anaerobic power was also found after 12, 18 hours of sleep deprivation, but it decreased significantly following 24, hours of sleep deprivation.

**KEYWORDS** Sleep Deprivation, Anaerobic Power, Simple Reaction Time (SRT), Choice Reaction Time (CRT).

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## **Acute effect of vibration and PNF stretching technique on flexibility**

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**OBJECTIVE** Flexibility is defined as the range of motion of a joint or series of joints. Local vibration and the hold-relax Proprioceptive Neuromuscular Facilitation (PNF) maneuver have been used as methods to increasing joint range of motion. The purpose of the present study was to examine the acute effect of local vibration and PNF on flexibility and to compare the two methods.

**METHODS** Ten female recreational athletes participated in this study (age:  $25.4 \pm 1.34$  yrs). After a standardized warm-up participants performed the sit-and-reach test, which was used as an indicator of flexibility. The best of three trials was used as the test value. Then the subjects executed either the vibration (V) or the PNF maneuver (P) in a randomized and counterbalanced order. In condition V participants performed hamstrings stretching, one leg at a time, on a vibration platform for 30 sec with characteristics: frequency 30 Hz and amplitude 2 mm. In condition P participants lay supine and an experienced trainer passively stretched the hamstrings with the contract-relax technique until the subjects reported pain. The duration of each contraction was 10 sec separated by 10 sec of relaxing. Sit-and-reach test was performed immediately after condition V or P. Differences between the two conditions and before - after the intervention were examined using t-test. Results are presented as mean  $\pm$  SE.

**RESULTS** After the V and P condition the sit-and-reach score was significantly higher ( $V = 29 \pm 1.89$  cm and  $P = 27.7 \pm 2.18$  cm) compared with the sit-and-reach scores before the intervention ( $V = 26.5 \pm 2.25$  cm vs  $P = 24.8 \pm 2.42$  cm).

**DISCUSSION & CONCLUSION** According to the results either local vibration or PNF can be used as methods for increasing flexibility. The above mentioned increase could be attributed to: a) increase in pain threshold, b) increase in blood flow and temperature and c) induced relaxation of the stretched muscle.

**KEYWORDS** Vibration, PNF, Flexibility

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## What method do secondary physical education students prefer to develop aerobic capacity?

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University of Granada, Spain

**OBJECTIVE** In Physical Education lessons students have to be motivated to reach the recommended intensity to develop aerobic endurance. In this study we tested different methods to reach the requested intensity evaluating the motivation of the students and the subjective perception of their intensity.

**METHODS** Fifty secondary-school children (32 boys, 18 girls; mean age of 17 years) took part in the study. Subjects participated in an 8-week endurance training program (2-3 h/week at approx. 85%  $VO_2$  max), using different methods of training (continuous constant running -CCR-, Fartlek -FTK-, Circuit Training -CT- and Interval Training -IT-). The study was conducted during the PE lessons. During the sessions, individual heart rate was continuously monitored (5s interval) using a heart rate monitor (Polar S810). Subjects were asked which method of training was their favourite one or was considered by them more motivational; also, they were asked about the intensity perceived according to the training method used (Borg's CR10 scale, from 0 -no intense- to 10 -extremely intense-).

**RESULTS** To develop aerobic endurance, first it was preferred CT method (35.4%), followed by IT (25.0%), CCR (16.7%), FTK (12.5%), and "all the methods equally" (10.4%). The training method that students perceived as more intense was FTK ( $7.27 \pm 1.39$ ), followed by "all the methods equally" ( $7.21 \pm 1.10$ ), CCR ( $6.92 \pm 1.64$ ), IT ( $6.77 \pm 2.09$ ), and CT ( $6.75 \pm 1.97$ ). While for the boys the less intense method was CCR, for the girls it was CT, although there were no significant differences with regard to the other methods. In general, the PE lessons focused on the improvement of the aerobic endurance are perceived as very intense (7 on CR10 scale).

**DISCUSSION & CONCLUSION** The training method to develop aerobic endurance during the PE lessons and considered more motivational by most of the students is CT, as well as it is perceived as the less intense. It seems that motivation plays an important role in the perception of effort. The use of heart rate monitors as an objective measure of exercise intensity in PE is effective and can be very useful to teach the students how to control their own physical activity intensity, and also to motivate them during PE classes.

**KEYWORDS** Aerobic Endurance, Training Method, Perceived Effort, Motivation, Physical Education.

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## The effect of LPG massage as a complement of aerobics in decreasing women's body sizes

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**OBJECTIVE** The increase in body weight which comes with the aggregation of lipids in body is considered as obesity. According to Baskerek; obesity occurs when the amount of fat cells in the body goes above the average level and it depends on the ingredient lipids in any of the fat cells and also the entire number of fat cells in the body. The methods

that nowadays are used to prevent obesity or to treat obesity are: nutritional diets, skin needling, drug prescription, behavioral treatment, liposuction and massage.

**METHODS** Using simple random sampling, 30 women were selected as the sample group. After measuring the weight and height of the participants, their Body Mass Indicator (BMI) was calculated and following this, the participants were split into two 15 member groups based on the BMI.

**RESULTS** There is a difference between the effect of aerobic activities and the aerobic activities plus massaging with LPG device in removal of the fats in waist, abdomen, hips and the thighs.

**DISCUSSION & CONCLUSION** There was a difference between the circumferences of body organs during the pre-test and post test periods. The results coming from this paper revealed that there was a conspicuous decrease in the circumferences of body organs in participants of the two groups caused by tedious exercises in which all of giant muscles were engaged in the activity. The conclusions made by Tark (2006), Lora and Mazikas (2003), Fern Strom (2006) and Oguri (2004) tend to approve our findings.

**KEYWORDS** LPG massage, limb circumferences, aerobics, women

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## **Eccentric calf muscle training for the treatment of chronic achilles tendinosis**

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**OBJECTIVE** Overuse injuries involving the Achilles tendon are common, especially among runners. The majority of Achilles tendon overuse injuries occur in men, and they occur at a higher rate in middle-aged athletes than do most other overuse injuries.

**METHODS** We prospectively studied the effect of eccentric calf muscle training in 18 athletes (men; mean age, 35.7 ± 6.2 years) who had the diagnosis of chronic Achilles tendinosis with a long duration of symptoms despite conventional nonsurgical treatment. Calf muscle strength and the amount of pain during activity were measured before onset of training and after 8 weeks of eccentric training. At week 0, all patients had Achilles tendon pain not allowing running activity, and there was significantly lower eccentric and concentric calf muscle strength on the injured compared with the noninjured side.

**RESULTS** After the 8-week training period, all 18 patients were back at their preinjury levels with full running activity. A comparison group of 15 recreational athletes with the same diagnosis and a long duration of symptoms had been treated conventionally, i.e., rest, changes of shoes or orthoses, physical therapy, and in all cases also with ordinary training programs. There was a significant decrease in pain during activity, and the calf muscle strength on the injured side had increased significantly and did not differ significantly from that of the noninjured side.

**DISCUSSION & CONCLUSION** Our treatment model with eccentric calf muscle training has a very good short-term effect on athletes in their early forties. A literature review indicated that there are no prospective studies on eccentric calf muscle training in patients with Achilles tendinopathies.

**KEYWORDS** Eccentric training, calf muscle, Achilles Tendinosis

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## **Postural balance in elite volleyball players**

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**OBJECTIVE** Ankle sprain is the most common acute injury in volleyball players. The ability of person to maintain the center of gravity (COG) can be an important predictor of ankle sprains. We aimed to evaluate the role of body height, body weight and age on overall stability index in males and females.

**METHODS** We have measured the overall stability index using Biodex Balance System in 271 professional volleyball players (112 males, 161 females). Linear regression model was used.

**RESULTS** The regression model was statistically significant in both sexes (in males  $R^2=0.24$ ,  $F=11.26$ ,  $p<0.00001$ ; in females  $R^2=0.51$ ,  $F=55.14$ ,  $p<0.000001$ ). Body mass was significant predictor of overall stability index in both sexes (for males  $t=3.68$ ,  $p<0.001$ , for females  $t=11.46$ ,  $p<0.00001$ ). Increasing body mass is correlated with increasing overall stability index in both sexes. We have also noticed the stronger influence of body mass on overall stability index in females (Beta value females vs. males was 0.81 vs. 0.41). To further investigate the role of body weight on overall stability index, subjects were assigned to four weight status categories according to the WHO categorization (underweight, normal weight, overweight, obese) by using BMI. Univariate ANOVA with Bonferoni adjustment was used to evaluate the influence of different weight status categories on OSI. OSI was significantly different among subjects from different weight categories in both sexes (in males  $F=3.04$ ,  $p<0.05$ ; in females  $F=31.44$ ,  $p<0.000001$ ).

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**DISCUSSION & CONCLUSION** The main finding of our study indicates that OSI is highly correlated with body mass in both sexes, and that the influence in females is more prominent. There is also significant increment in OSI from underweight to obese subjects, so different weight categories differ in OSI, and this effect was most characteristic for senior female players. Increase of OSI with body weight can probably be explained by the higher gravitational torque produced by the larger body mass. When strength of muscles is not compromised they will be able to cope with higher gravitational torque, but injured or weak muscles won't be able to do so, and this will result in loss of postural balance and possible fall.

**KEYWORDS** Stability index, OSI, BMI

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## **The results of a novel technique of II generation ACI (autologous chondrocytes implantation) in the knee and ankle after sports injuries**

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**OBJECTIVE** The purpose of the study is to evaluate the clinical results and MRI of a novel II generation autologous chondrocytes implant, for cartilage repair in knees and ankles after sports injuries.

**METHODS** We use a matrix-assisted, fibrin hyaluronic acid-based implant containing autologous chondrocytes propagated with a unique growth factor variant to maintain their chondrogenic potential. The scaffold is a porous open channel structure enabling a three dimensional distribution of the cells and full thickness repair. Twenty three patients aged 17-50, with cartilage lesions 20 in the knee and four in the ankle, diagnosed by MRI underwent arthroscopy and biopsy from the antero-lateral margin of the intercondylar notch and from the distal margin of the talus respectively. Two to three weeks later, it was implanted through a small 4-5cm longitudinal parapatellar incision or 3-4 cm of longitudinal antero-medial incision of the ankle. Deep lesions were treated with two layers. Rehabilitation included 3-6 weeks of non-weight bearing and CPM, followed by 3 weeks of partial weight. Full activities were resumed at 4-6 months and follow-up was 14-46 months.

**RESULTS** At diagnosis all patients scored under 4 points in the subjective ICRS questionnaire improving to over 6 post operation. The IKDC score for the patients who suffered from knee injuries improved from grades C and D before the operation to A or B post operation. Second look arthroscopy and biopsy on two knees due to pain and sensation of catching, showed excellent coverage, full integration and new hyaline-type cartilage. One year post operative MRI, showed good integration of the graft with signs of bone edema at the implantation site.

**DISCUSSION & CONCLUSION** This new method of autologous cartilage implantation is safe, effective and user-friendly both for the patient and the surgeon. The short time from biopsy to implantation and good to excellent clinical outcome further encourage the continued use of this technique and product. The use of this new method of ACI II generation in twenty three patients who treated in the knee and the ankle showed after follow-up of 14-46 months good and excellent results using the ICRS questionnaire and IKDC score. MRI showed good integration of the graft and two biopsies showed hyaline-type cartilage. This method is safe and effective.

**KEYWORDS** cartilage, sports injury, knee, ankle, arthroscopy

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## **A vibrational therapy for chronic back pain: The relevance of synchronism and its mathematical modelling**

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Cell vibrations and corresponding time patterns are well-established diagnostics for cell activity in cardiology and sports medicine. The microvibrations in skeletal muscle cells, being observed already years ago (Univ. Erlangen) with high resolution videomicroscopes also represent a body-specific time pattern or rhythm in specific "frequency windows" (8Hz -12Hz). The absence of these microvibrations in outer space missions as well as in degenerative tissue processes indicates their relevance for physiological transport processes (logistic) in the extracellular matrix space. In this contribution we introduce a new treatment approach, exemplarily at chronic back pain patients, showing, how cellular coherence is re-established by an external entrainment process, leading to a synchronous cooperation through all hierarchic levels of time, process and space. We explain the physiological background, introduce the medical device, patented at the Univ. of Erlangen, and report on recent simulation results from a mathematical model that lead to a better understanding of the underlying synchronism what is obviously a basic mechanism of life.

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## The effect of radial shock-wave therapy in professional soccer players with different types of insertionitis

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**OBJECTIVE** Insertionitis is a fairly common state diagnosed in professional soccer plyers, occurring due to enhanced volume and intensity of the training process, and increased number of tournaments and competitions. Although there are numerous modes of treatment for rapid resolution of insertionitis, it is often found to be quite persistent. The aim of the study is to evaluate the effect of radial shock-wave therapy on insertionitis in professional soccer players.

**METHODS** Thirty professional soccer players with different types of insertionitis (insertionitis of the hamstrings, insertionitis of the adductors, insertionitis of the quadriceps) were evaluated in this study. They underwent focused shock wave treatments of the concerning areas, with 2000 shocks of 2,5 Bar intensity and a frequency of 10Hz. Visual analogue scoring was done in three pain categories, at baseline, after 10 days and three months after treatment.

**RESULTS** The composite pain score decreased from 8.3 to 2.9. The results were excellent in 18, good in 6 and fair in 6 of the athletes. Fifteen of the athletes reported complete pain relief after 10 days and three months. The overall satisfaction rate was 67%. None of the patients developed neuro-vascular complication, one patient developed subcutaneous haematoma.

**DISCUSSION & CONCLUSION** Resulting in prompt pain relief and enabling complete regaining of locomotory function in professional soccer plyers, RSW can be considered a reasonable treatment for different types of insertionitis.

**KEYWORDS** athletes, insertionitis, radial shock wave, visual analogue scoring

## The effect of radial shock wave therapy on trigger points in athletes with cervical and low back pain

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**OBJECTIVE** Cervical and low back pain is frequent symptom in athletes due to physical loads and impacts, may cause different types of sports injuries. The treatment is usually connected with different modalities of physical therapy according to the type of disorder, avoiding radial shock wave therapy (RSWT) as a contraindication using it over the spine. The aim of this study is to evaluate the effects of RSWT in athletes with cervical and low back pain.

**METHODS** We evaluated 36 athletes with cervical and low back pain as a result of different types of disorders. Group 1 underwent standard therapy protocols and in Group 2, we added focused shock wave treatments on the trigger points of the concerning areas. Visual analogue scoring was done in three pain categories, at baseline, after 10 days and three months after treatment, in both groups.

**RESULTS** The composite pain score decreased from 8.5 to 3.5 in group 1 and from 8.5 to 2,7 in group 2. The results were excellent in 10, good in 3 and fair in 5 of the athletes in group 1. In group 2, they were excellent in 12, good in 4 and fair in 2. Complete pain relief after 10 days and three months in 12 athletes in group 1 (with overall satisfaction rate of 66%) and in 14 athletes in group 2 (with overall satisfaction rate of 78%).

**DISCUSSION & CONCLUSION** It seems that RSWT on trigger points in athletes with cervical and low back pain could be a reasonable additional therapy in standard therapy protocol.

**KEYWORDS** athletes, cervical pain, low back pain, radial shock wave, visual analogue scoring

## Effect of warm water exercise training in cardiorespiratory capacity and peripheral and central chemoreceptor sensitivity in heart failure

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**OBJECTIVE** Heart Failure is characterized by increased ventilation during exercise, which is positively to increased peripheral and central chemoreceptor sensitivity. Exercise in warm water, as a rehabilitation program has been considered in heart failure with osteo-muscular system disorders and old patients. However, few data are available about benefits of water therapy in heart failure patients. We studied the effect of training in warm water to the physical capacity response and peripheral and central chemoreceptor sensitivity in heart failure patients.

**METHODS** Methods and Materials: 8 patients with compensated idiopathic heart failure, age  $48 \pm 10$  years, ejection fraction  $29 \pm 6\%$ , and NYHA I-III were submitted pre and post training to maximal treadmill cardiopulmonary exercise test. The second day, patients were submitted pre and post training to treadmill 6-minute cardiopulmonary walking (6 WT) with isocapnic hypoxia 12% O<sub>2</sub> (ih) and hyperoxic hypercapnia 5% CO<sub>2</sub> (hh) sensitivity (controlled-temperature room 21-23°C). The training program included 12 weeks of warm water exercise (31°C swimming pool).

**RESULTS** The training program was well tolerated with no adverse events. The patients improved their peak VO<sub>2</sub> in mlO<sub>2</sub>/kg/min (from  $19.4 \pm 4.9$  to  $22.3 \pm 2.8$ ,  $p=0.01$ ); exercise time in minute (from  $12 \pm 3.5$  to  $16 \pm 2.8$ ,  $p<0.000$ ); O<sub>2</sub>pulse in mlO<sub>2</sub>/bpm (from  $11.7 \pm 2.5$  to  $13.2 \pm 2.5$ ,  $p=0.02$ ). The heart rate and ventilatory response to exercise did not improve (pre  $134 \pm 24$  and post  $135 \pm 20$  bpm,  $p=ns$ ; pre  $57 \pm 22$  and post  $63 \pm 15$  l/min,  $p=ns$ , respectively). The saturation of peripheral oxygen (SpO<sub>2</sub>) pre and post training during 6 WT with isocapnic hypoxia 12% O<sub>2</sub> was pre  $77 \pm 3\%$  and post  $75 \pm 4\%$ . Area under curve for heart rate (ih pre  $767 \pm 95$  and post  $741 \pm 70$ , hh pre  $713 \pm 79$  and post  $681 \pm 48$ ), ventilation (ih pre  $157 \pm 38$  and post  $154 \pm 30$ , hh pre  $209 \pm 51$  and post  $196 \pm 49$ ), and the distance of 6-minute walking (ih pre  $0.14 \pm 0.03$  and post  $0.16 \pm 0.03$  mph, hh pre  $0.16 \pm 0.04$  and post  $0.18 \pm 0.04$  mph) did not differ between pre and post training for isocapnic hypoxia and hyperoxic hypercapnia.

**DISCUSSION & CONCLUSION** Physical training in warm water improved exercise capacity in heart failure patients. However, exercise training in warm water did not decrease peripheral and central chemoreceptor sensitivity in these patients with heart failure.

**KEYWORDS** heart failure, water pool, exercise training

## Physical fitness inflected white paralysis through a training complex of coach, kids and parents.

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**OBJECTIVE** Studies show that the poor movement in kids leads to paralysis which in turn affects their growth in general. Movement is an important element in the natural growth and development of human beings and the children who lack movement capabilities are deprived of this merit.

**METHODS** the sample consists of 37 teenagers (boys & girls) inflected with diplegia spastic. They were assigned to two groups based on thrombly CA test (1983), one experimental group and one control group. Different instruments were used in the study such as thrombly CA, an attitude questioner for the parents shtrass myrse and the dynamometer approach.

**RESULTS** the results showed that there is a significant difference between the control and experimental groups in the post tests. The findings demonstrate on the improvements achieved by the experimental group.

**DISCUSSION & CONCLUSION** through training the coach, the kids and the parents, one can improve the levels of skills among the given subjects. Also, the confidence level of the parents can be boosted. The results seen to be consistent with the findings reported in rehabilitation centers.

**KEYWORDS** Physical fitness, paralysis, parents

## **The comparison of anthropometric characteristics and physical performances of soccer teams that participate in under 14 age group with different success levels in Antalya region**

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**OBJECTIVE** The purpose of this study is to compare anthropometric characteristics and physical performances of soccer teams that participate in under 14 age group with different success levels in Antalya region.

**METHODS** The subjects of the study consisted of volunteer 60 soccer players. Every team consisted of 15 soccer players. The football teams, which participated in this study, were divided into 2 groups by their ranking. There were 24 teams in the competition. The 1st and the 2nd ranking teams formed the 1st group (age mean; 13.57±01.85 years, height mean; 164.39±05.71 cm, weight mean; 53.19±06.74 kg) and 23rd and the 24th teams formed the 2nd group (age mean; 13.89±01.73 years, height mean; 163.34±05.18 cm, weight mean; 54.67±04.96 kg). Standard anthropometric methods were used to determine body mass, body height and all of skinfold and circumference measurements. All of the anthropometric measures were based on Anthropometric Standardization Reference Manual procedures. The following tests for physical performances were used; Hand strength test, leg and back strength test, audio-visual reaction time test, vertical jump test and 20m. sprint test. Hand strength was tested by the hand dynamometer, leg and back strength was tested by the leg and back dynamometer, audio-visual reaction time was tested by New Test 2000, vertical jump was tested by jumpmeter and 20m sprint test was tested by photocell.

**RESULTS** According to the results of comparison of anthropometric measures of 1st. and 2nd groups; there were significant differences in skinfold thickness and length measurements ( $p<0.001$ ), circumference measurements of calf and biceps ( $p<0.001$ ) between 1th. and 2nd. groups of soccer players, whereas there were no significant differences in circumference measurements of thigh, ankle, forearm and wrist ( $p>0.05$ ) between 1th. and 2nd. groups of soccer players. There were significant differences in all performance tests ( $p<0.001$ ) between 1th. and 2nd. groups of soccer players.

**DISCUSSION & CONCLUSION** Differences of anthropometric characteristics in soccer players of U-14 age group were effective on performances.

**KEYWORDS** soccer player, body composition, anthropometry, physical performance, soccer level

## **Anthropometric characteristics, body composition and somatotype of Spanish under 14 tennis players**

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**OBJECTIVE** Because of an early specialisation in different competitive sports, it is important to know the anthropometric characteristics, body composition and somatotype of young athletes. Few studies have examined physical characteristics related to playing tennis in youth (Elliot et al., 1990, Australian J Sci Med Sport, 22, 87-92; Sánchez-Muñoz et al., 2007, British J Sports Med, 41, 793-799). The purposes of this study were (1) to describe the anthropometric characteristics, body composition and somatotype of Spanish under 14 (U14) tennis players, and (2) to compare the anthropometric data, body composition and somatotype of the first 8 classified players on the U14 ranking with the rest ranked players.

**METHODS** A total of 123 (60 males and 63 females) Spanish U14 tennis players participated in this study (who were competing at the U14 National Tennis Championship). According to gender, athletes were also divided into two groups, the first 8 ranked and the rest players. A total of 17 anthropometric variables were recorded for each subject. Somatotype was assessed using the Heath-Carter method, and body composition (% body fat, % muscle mass) was assessed using surface anthropometry.

**RESULTS** In girls, no significant difference was found in any variable. The first 8 male players showed significantly less fat than the rest subjects. Also, significant differences were found for triceps, biceps and thigh skinfolds ( $p=0.007$ ;  $p=0.037$ ;  $p=0.008$ , respectively), and for % body fat ( $p=0.047$ ), between the first 8 and the lower ranked. The mean somatotype of male U14 tennis players could be defined as ectomesomorphic (2.3 (1.0), 4.6 (1.0), 3.9 (1.1)), and the mean somatotype of female U14 tennis players could be defined as endomesomorphic (4.3 (1.1), 4.4 (0.8), 2.6 (0.8)). Significant differences were found in the endomorphic component between the first 8 male and the lower ranked players ( $p=0.030$ ).

**DISCUSSION & CONCLUSION** When comparing the first 8 and the lower ranked U14 tennis players of both genders, no significant differences were observed in any measured item for the girls. On the other hand, significant differ-

ences were observed in skinfolds, % body fat, and endomorphic component between the first 8 and the lower ranked boys, whereby the first 8 were less fat than the lower ranked players. These differences could be due to time spent in training between the best tennis players (“more professionals”) and the rest.

**KEYWORDS** anthropometric, body composition, somatotype, tennis, young

## **Investigating the effect of aquatic aerobic training on the speed of walking in high & low degree Multiple Sclerosis patients**

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**OBJECTIVE** MS is a weakening and chronic illness of nerve system. In a research done by Kileff and Ashburn (2005) on 8 MS patients showed that a program of 8 week aquatic exercise could improve the speed of walking in low degree MS patients. Purpose of this study investigate and compare the rate of effect an aquatic exercise for 8 weeks, on speed walking (SOW) in female MS patients with high and low degree.

**METHODS** From 120 MS patients, 46 people on the basis of illness degree and age range were selected randomly. The average period of the disease was (41) and age rang was between (20-50) years. They were divided in two experimental groups with EDSS 1-4 (15 people) and EDSS 4.5-6.5 (11 people) and two control groups with high and low EDSS (10 people). The experimental group participated in the exercise for 8 weeks, each week three sessions with intensity of 40-50 percent of the maximum heart rate. Measure the SOW in experimental and controlled groups before and after exercise. The gathering data were analyzed by using descriptive statistic and dependent /independent t- test.

**RESULTS** According to the results of the study the effect of exercises in SOW of M.S patients with high & low degree was the same and significant difference was observe in their difference of means of their SOW ( $p=0/001$ ) a significant difference was found between SOW variable in pre-test and post-test of experimental group with high EDSS (0.003) & low EDSS (0.044). There was no significant difference between SOW variable in pre-test of post test of control group with high degree (0.469) and low degree (0.087).

**DISCUSSION & CONCLUSION** Considering the results of this research, this has caused in an improvement in the SOW of MS patients, so it seems necessary to apply an aquatic exercise for such patients. Therefore, it is recommended these exercises to be used by specialists as a supplementary remedy beside medical treatments for MS patients.

**KEYWORDS** Multiple sclerosis - aquatic exercise - speed of walking

## **Muscle ergoreflex involved during exercise did not contribute to ventilatory response in heart failure with optimized treatment**

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**OBJECTIVE** The muscle ergoreflex has been postulated as a link between muscle metabolic changes and the abnormal responses in hemodynamic, ventilation and autonomic tone in heart failure (HF). Beta-blocker (BB) improves hemodynamic and decrease ventilatory response, but had no effect on exercise capacity. However, no data are available about ergoreflex on exercise in HF under optimized BB therapy. We investigated the ergoreflex in the leg during treadmill 6-minute cardiopulmonary walking test (6W) in CHF with optimized treatment receiving BB compared with control group.

**METHODS** We compared ergoreflex between 17 pts with CHF, EF 29±7%, NYHA I-III, peak  $VO_2$  20±6 ml/kg/min and 7 healthy controls, peak  $VO_2$  30±3 ml/kg/min. The evaluation of ergoreflex activity included two cardiopulmonary 6W performed in random order: with and without regional circulatory occlusion (RCO). Recovery with RCO was compared to recovery no-RCO.

**RESULTS** There were significant differences in 6W distance between RCO and no-RCO (CHF 289±125



to 306±95, p=0.03 and control 386±97 to 418±97 meters, p=0.02, respectively). Heart rate and VO<sub>2</sub> in the end 6W RCO and no-RCO did not show statistic differences (HF: HR, 93±11 to 92±10 bpm; VO<sub>2</sub>, 10.6±3.5 to 10.4±3 and control: HR, 90±4 to 91±5 bpm; VO<sub>2</sub>, 11.6±2 to 12.7±2).

**DISCUSSION & CONCLUSION** Respiratory response during 6W was increased in HF when compared with control. The ergoreflex activity in the leg and 6W exhibited a non-significant contribution to recovery period in both HF and control. Over activation of the ergoreflex seems not contribute to an excessive ventilation response during 6W, that reflect daily activity, in optimized BB HF.

**KEYWORDS** Exercise, heart failure, muscle ergoreflex

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## Interval exercise training benefit on body composition and physical fitness in young obese women

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**OBJECTIVE** Exercise training is one of the main interventions in overweight people in order to reduce and maintain the gained weight. We aiming to demonstrate that interval exercise training programs based on cardiopulmonary exercise test (CPX) recommendation of Training Zones increase physical fitness and improve body composition in young obese women.

**METHODS** 40 young obese women university students (average BMI of 30.7 kg/m<sup>2</sup>) from 18 to 25 years old, were included the study. Physical fitness and aerobic capacity of subjects was determined performing a maximal CPX (Cortex Metalyzer 3B) on bicycle ergometer. We measured peak oxygen uptake (VO<sub>2</sub> peak) and oxygen uptake corresponding to anaerobic threshold (VO<sub>2</sub> AT). Multifrequency segmental bioimpedance device (InBody 720) was used to analyze body composition and recording PBF, visceral fat area (VFA) and waist to hip ratio (WHR). All subjects participated in a 6 months interval exercise training consisted in 3 times per week of 60 minutes at extensive and intensive endurance intensity zone, completed by 1 minute interval in development intensity zone for every 5 minutes of training.

**RESULTS** Using the paired t test to compare the data at baseline and at the end of the study, we noticed a significant improvement in body composition: PBF decreased (from 42.4±6.5 to 40.2±7 %, p=0.023) along with VFA (from 116±52 to 103±48 cm<sup>2</sup>, p=0.002) and WHR (from 0.87±0.05 to 0.86±0.05, p=0.013). We also noticed a very significant improvement of physical fitness (VO<sub>2</sub> peak increased from 1.78±0.3 to 2.07±0.37 l/min, p<0.0001) and aerobic capacity (VO<sub>2</sub> AT increased from 1.24±0.27 to 1.49±0.28 l/min, p=0.0002).

**DISCUSSION & CONCLUSION** 6 months of interval exercise training increase physical fitness and improve body composition in young obese women. Adjusting the physical training according to CPX recommendation of Training Zones together with the feedback offered by using heart rate monitors, leads to an important increase of aerobic capacity.

**KEYWORDS** Interval exercise training, obese women

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## Aerobic performance and morphological modifications after 4 months's physical activity program in elderly women

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**OBJECTIVE** Research clearly shows that physical activity (PA) is an important factor to develop and maintain good health and adequate body functions in older people. In this context, the purpose of this study was to determine aerobic performance and morphological modifications after a 4 month physical activity program (PAP) in elderly.

**METHODS** Forty subjects divided in two groups (control, n=20; and experimental, n=20) were evaluated twice, at the beginning and after a 4-month-activity program period. This program called "+ age + health" consists of 3 week sessions of one hour each, based on walking and aerobic exercises. The control group had, at its first evaluation, the followings characteristics: average body mass 68kg±15, 28±5 BMI, 37%±5 body fat, 2.2kg±0.4 bone mass, 42%±9 lean body mass and did 129 repetitions ± 46 on a 2-Minute Step Test (2MST). The assessment of anthropometric and morphological variables was measured through an electrical bioimpedance scale (TANITA - BC 545). Aerobic endurance was evaluated from a 2MST [1].

**RESULTS** In the control group only the percentage of body fat changed significantly, and increased over time. In the experimental group we found a positive relationship between PAP and the majority of morphological variables. The percentage of variation changed in: body fat ( $-4.3\% \pm 7.6$ ,  $p=0.014$ ), bone mass ( $2.4\% \pm 3.1$ ,  $p=0.004$ ) and 2MST ( $33.6\% \pm 63.1$ ,  $p=0.023$ ). In the remaining variables there were no significant modifications.

**DISCUSSION & CONCLUSION** The significant modification in 2MST after the activity period means that the aerobic performance can be improved in elderly, and attenuates the negative effects of age. Moreover, the benefits of PAP can be seen by positive alterations registered in lean body mass and in the percentage of body fat.

**KEYWORDS** Elderly, aerobic performance, physical activity

#### REFERENCE

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## Effects of winning / losing on competitive stress physiological markers in elite sports-women

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**OBJECTIVE** In humans, hormonal responses to winning/losing and their relationships to mood and status change have mostly been examined in professional athletic competitions, we investigated the effects of winning and losing on saliva composition.

**METHODS** The subjects were 10 healthy female university students who were members of a handball club. Profiles of mood states (POMS) and Salivary samples were obtained before (Pre), during of competition (Competition), and after competition (Post). Salivary cortisol, dehydroepiandrosterone (DHEA), and total protein levels in the samples were determined by ELISA and EIA, respectively. After finishing each game, the competitiveness of the game was evaluated using questionnaires.

**RESULTS** In the samples taken after playing handball, there was an increase in the levels of salivary cortisol, regardless of whether the subject won or lost, and the tendency was more pronounced in competitive games.

**DISCUSSION & CONCLUSION** Our results suggest that stress response is intimately linked with competition and could be used to determine which players are more capable of handling stress in a competitive environment and the athlete's anxiety level relative to winning or losing.

**KEYWORDS** Winning/losing, Cortisol, Mood

## Maternal voluntary exercise in during pregnancy modulate of pain responses in Rat Offspring

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**OBJECTIVE** In this study the effects of maternal voluntary running (WVR) and forced swimming (FS) during pregnancy on pain responses in offspring has been evaluated.

**METHODS** The pregnant female Wistar rats ( $n=30$ , 10 for each group) were randomly assigned into three groups: the sedentary control group, WVE group and the FS group. Each of the WVR rat was given access to a running wheel which was freely rotated against a resistance of 100g, for during pregnancy. Also the swimming pool was filled with water at 32°C and the rats in the swimming group were forced to swim for 10 min once a day for 5 days. After delivery of mothers and pups reach to 2 month age, Hot Plate and Tail Flick tests were used to study the pain responses by measure of classic criteria.

**RESULTS** Results indicated that WVR of mother during pregnancy and FS during pregnancy modulate pain responses in off spring ( $p<0.05$ ).

**DISCUSSION & CONCLUSION** Finding above showed that WVR and FS during pregnancy have modulated and decreased of pain reaction in offspring that for clear of mechanisms need to further researches.

**KEYWORDS** Voluntary exercise, Pain, Swimming, Pregnancy, Rat