©Journal of Sports Science and Medicine (2017) **16,** 280-285
http://www.jssm.org

Research article

Doubly Disadvantaged? The Relative Age Effect in Poland's Basketball Players

Krystian Rubajczyk ✉, Kamil Świerzko and Andrzej Rokita
Department of Team Games Sport, University School of Physical Education in Wroclaw, Poland

Abstract

The aim of this study was to identify the relative age effect (RAE) in young Polish male (n = 3849) and female (n = 3419) basketball players aged 14 to 22 years competing in the elite games of the Polish Youth Championships. The distribution of birth dates, body height, players' match statistics, and the results of teams participating in championships were identified. The RAE was observed in male and female group, regardless of players age. Nevertheless, the greatest disproportion in the distribution of dates of birth was found in U16 group of boys (V = 0.25, $p < 0.0001$). Significant differences in body height were identified in U14 and U16 groups of boys ($p < 0.0001$) and U14 group of girls ($p < 0.01$). The RAE was the most detrimental in the group of boys from teams ranked 9th or lower ($p < 0.0001$). The groups of male and female basketball players from the top 3 teams had the highest average body height ($p < 0.001$). In U14 boys, significantly higher match results and performance index ratings (PIR) were observed for players born in the first half of a calendar year. The research results show the impact of the RAE on the success of youth basketball teams in Poland. The month of birth, body height and sex may determine sporting achievements in youth basketball. Coaches should consider the chronological age and pubertal growth acceleration (APHV-age at peak height velocity) of players to optimize the process of identifying gifted basketball players, especially among boys of 14 years of age.

Key words: Basketball, youth basketball, maturity, sport success, relative age effect, talent identification.

Introduction

Categorizing players into respective age groups according to a cut-off date is typical of team sports (Baker et al., 2009). This process arises from the necessity of organizing the games for the purposes of competition among young athletes. This grouping leads to a situation in which players with even 12-month chronological age differences are competing against each other (Cobley et al., 2009). Consequently, there are considerable differences in the physical body structure of these athletes, which may hinder their development and promote disturbances in the process of sport talent identification (Williams and Drust, 2012). This situation results in the phenomenon of overrepresentation of players born in the quarter of a calendar year that is the closest to the cut-off date, called the relative age effect (RAE) (Delorme et al., 2010).

One of the main predictors of success in basketball is height (Silva et al., 2013; Torres-Unda et al., 2013). Additionally, anthropometric basketball players' body measurements are a key factor in selecting their position on the team (Ben Abdelkrim et al., 2010a; Drinkwater et al., 2008; Köklü et al., 2011). Therefore, the advantage in motor skills of relatively older players may disturb the assessment of a player's performance potential (Lockie et al., 2014; Sisic et al., 2016).

The existence of the RAE in basketball has been confirmed in youth and professional sports (Arrieta et al., 2016; Chittle et al., 2016; Delorme and Raspaud, 2009). However, this phenomenon has not been observed among the players of the national teams during the Olympics (Werneck et al., 2016). The only exception was the national team of France, where the occurrence of RAE among the entire population of basketball players was confirmed by another study (Delorme and Raspaud, 2009). Additionally, the RAE has not been reported in the National Collegiate Athletic Association (NCAA) in the United States (Chittle et al., 2016). Nevertheless, the RAE in European basketball is a phenomenon with a long-term influence, resulting in the overrepresentation of judges and coaches born in the first quarter of a calendar year (Schorer et al., 2011).

Skewed distribution of dates of birth was observed at any positon on the court regardless of sex (Arrieta et al., 2016). However, a basketball player's position in the field is related to body height and age at peak height velocity (APHV) (Ben Abdelkrim et al., 2010a). Additionally, boys enter their APHV much later than girls (Carvalho et al., 2011). Furthermore, a strong relation between the RAE and players' performance, called the PIR (performance index rating) index (Torres-Unda et al., 2016), has been observed. The statistical formula for calculating the PIR index generally classifies the player's performance and his/her impact on the team's performance. However, the PIR index may not have been sufficiently adjusted to the specific characteristics of youth basketball.

A player's age at puberty is a key distracting factor in the process of basketball selection (te Wierike et al., 2015). It has been observed that the weight of a basketball may considerably change the shooting strategy of young players (Arias et al., 2012). Therefore, players with a physical advantage over their peers may make more three-point attempts. Furthermore, there is a shooting technique in which the hands are held up high among young players, which may hinder effective defense for shorter players (Arias, 2012). Consequently, shorter players may choose to shoot from distances closer to the basket, often giving up long-distance shots completely. However, there has been no research identifying the RAE phenomenon considering effectiveness with regard to a shot zone in relation to a player's position during a game.

To address this research gap, the objective of the

Received: 30 January 2017 / Accepted: 06 May 2017 / Published (online): 01 June 2017

article is to identify the RAE in youth basketball games in Poland while taking into consideration the age, sex and the players' match statistics. Additionally, the aim of this study is to determine whether differences in the body height of players are associated with the success of the team. We hypothesized that the phenomenon of RAE occurs in the Polish Championships, regardless of sex and age of the basketball players.

Methods

Data collection

This study included 7268 young male and female basketball players from 591 teams registered in the official database of the Polish Basketball Association between 2013 and 2016. The analyzed players were from 14 to 22 years old and participated in the finals of the Polish Championships. The obtained data concerned the date of birth, body height and players' match statistics. The Central Statistical Office provided distributions of births in the Polish population (PP) between 1994 and 2003, which corresponded to the dates of birth in the analyzed groups. The data were obtained according to the Data Protection Act in Poland. All the research procedures were approved by the Research Ethics Committee of the University School of Physical Education in Wroclaw.

Procedures

To identify the date of birth distribution, the players were assigned to the subsequent quarters of a calendar year: Q1 (January–March), Q2 (April–June), Q3 (July–September), and Q4 (October–December). Furthermore, the players were divided into two halves of a year: H1 (January–June) and H2 (July–December). The dates of birth of female and male populations in Poland between 1994 and 2003, which correspond with the dates of birth of the players participating in the finals of the Polish Youth Basketball Championships, were arranged in a similar way. Additionally, the players were assigned to three categories according to the obtained results of teams: the best three teams of a particular category (TOP 3), teams ranked 4th-8th (4-8 PLACES) and others that did not qualify for the quarterfinals (9 or LESS).

The players' PIR was calculated according to the formula used by the International Basketball Federation (FIBA):

PIR = (Points + Rebounds + Assists + Steals + Blocks + Fouls Drawn) / (Missed Field Goals + Missed Free Throws + Turnovers + Shots Rejected + Fouls Committed)

Statistical analysis

The statistical analysis was carried out with the use of IBM SPPS statistical software (version 22.0, IBM SPSS, Armonk, NY, USA). The normality of distribution of variables was investigated with the Kolmogorov–Smirnov test with the Lilliefors correction. The significance of differences in the numbers in the particular quarters was analyzed with a chi-squared test (χ^2) among all the analyzed groups. The effect-size measure was calculated using Cramér's V measure. Differences in body height and match statistics were analyzed with ANOVA and Tukey`s post hoc test. The calculations used a confidence interval of $p < 0.05$.

Results

The distribution of the birthdates of male and female players is shown in Table 1. The RAE was observed in each of the analyzed groups. The most statistically robust RAE finding occurred in U16 group of boys ($V = 0.25$, $p < 0.0001$). The strength of the effect (V) of the RAE was the lowest in U22 female and U20 male players.

Table 2 shows the average body height of young female and male basketball players for each quarter. Significant differences in the average body height were recognized in U14 group of girls ($p < 0.01$) as well as U14 and U16 boys ($p < 0.0001$). Therefore, the half-yearly comparison showed a difference in the average body height of boys from U18 category ($p < 0.01$) born in the first half of a calendar year.

The differences in the mean match statistics of male and female basketball players are presented in Table 3. Significant differences were observed in each of the analyzed statistics in U14 group of boys. Additionally, the value of the PIR index was higher in U18 group of girls ($p < 0.001$) born in the first half of a calendar year.

The distribution of birth dates of male and female players according to the place won by a team in the Polish Youth Championships is shown in Table 4. The RAE was observed in each category; it was the most visible in the group of boys from teams with the worst results ($p<0.0001$) and characterized by the largest disproportion of body height among players born in the first or fourth quarter of a calendar year ($p < 0.0001$). Height averages were the highest in the group of male and female players from the top 3 teams ($p < 0.001$) (Figure 1).

Table 1. Analysis of birth dates distribution by quarter of Polish youth basketball players between 2013 and 2016.

		Q1 (%)	Q2 (%)	Q3 (%)	Q4 (%)	TOTAL	χ^2_3	p	V	Effect
♀	U 14	430 (35.02)	319 (25.98)	304 (24.75)	175 (14.25)	1228	56.92	<.0001	.15	small
	U 16	318 (34.49)	269 (29.18)	207 (22.45)	128 (13.88)	922	47.55	<.0001	.16	medium
	U 18	268 (29.78)	270 (30.00)	213 (23.67)	149 (16.55)	900	23.61	<.0001	.11	small
	U 22	107 (29.00)	113 (30.62)	82 (22.22)	67 (18.16)	369	7.81	<.05	.10	small
♂	U 14	468 (38.27)	361 (29.52)	247 (20.19)	147 (12.02)	1223	101.26	<.0001	.20	medium
	U 16	388 (41.86)	271 (29.23)	179 (19.31)	89 (9.60)	927	112.98	<.0001	.25	medium
	U 18	341 (37.60)	276 (30.43)	178 (19.62)	112 (12.35)	907	72.70	<.0001	.20	medium
	U 20	277 (34.98)	213 (26.89)	171 (21.59)	131 (16.54)	792	29.31	<.0001	.14	medium

χ^2_3 – chi-squared test value; p – probability value; V – Cramer`s V value

Table 2. **Comparison of body height (cm) between categories of male and female basketball players at Polish youth basketball players between 2013 and 2016. Data are means (±SD).**

		Q1 (SD)	Q2 (SD)	Q3 (SD)	Q4 (SD)	Q1-Q4‡	Post hoc
♀	U 14	168.3 (7.1)	166.9 (8.2)	166.8 (7.4)	166.1 (6.9)	2.18	Q1=Q2=Q3>Q4* Q1,Q2>Q3,Q4**
	U 16	172.2 (7.2)	172.4 (7.2)	172.4 (7.45)	171.8 (6.5)	.42	Q1=Q2=Q3=Q4
	U 18	173.5 (7.3)	174.4 (6.5)	173.9 (7.8)	172.8 (6.4)	.73	Q1=Q2=Q3=Q4
	U 22	175.9 (6.5)	177.3 (7.1)	175.8 (7.7)	175.7 (7.1)	.19	Q1=Q2=Q3=Q4
♂	U 14	176.4 (10.3)	174.4 (9.6)	172.2 (9.8)	169.5 (9.4)	6.87	Q1>Q2>Q3>Q4*** Q1,Q2>Q3,Q4***
	U 16	184.8 (7.8)	185.3 (8.4)	184.2 (8.6)	181.2 (9.4)	3.66	Q1=Q2=Q3>Q4* Q1,Q2>Q3,Q4**
	U 18	188.8 (7.4)	189.9 (7.7)	187.6 (8.5)	188.4 (9.1)	.42	Q1=Q2=Q3=Q4 Q1,Q2>Q3,Q4*
	U 20	190.9 (7.7)	191.0 (7.6)	189.4 (8.5)	190.5 (8.7)	.41	Q1=Q2=Q3=Q4

*p<0.01, **p<0.001, ***p<0.0001 for post hoc Tukey Test. ‡ Height difference Q1 to Q4

Table 3. **Differences in the mean match statistics of male and female basketball players participating in Polish Youth Championship games in a half-yearly comparison ($H_1 – H_2$).**

		BH [cm]	PTS	AST	REB	STL	BLS	TO	PIR
♀	U 14	1.19*	.43	.02	.28	.08	.02	.05	.48
	U 16	.14	.69	.08	.37	.05	.01	.14	.52
	U 18	053	.80	.18*	.32	.18*	.01	.16	.95*
	U 22	085	.72	.16	.30	.15	.07	.20	.95
♂	U 14	4.39***	1.63**	.15	1.28***	.29**	.17***	.47***	2.22***
	U 16	1.81*	-.04	-.11	.20	.01	-.01	-.05	.05
	U 18	1.4*	.05	-.08	.12	.05	-.02	.04	-.21
	U 20	1.01	-.08	-.08	-.01	-.03	-.05	-.04	-.49

BH – body height; PTS – points per game; AST – assists per game; REB – rebounds per game; STL – steals per game; BLS – blocks per game; TO – turnovers per game. *p<0.01, **p<0.001, ***p<0.0001 for post hoc Tukey Test

Table 4. **Distribution of birth dates of players compared to the teams' results in the Polish Youth Basketball Championships.**

		Q1 (%)	Q2 (%)	Q3 (%)	Q4 (%)	TOTAL	HEIGHT Q1-Q4‡ [cm]	χ^2_3	p	V	Effect
♀	**TOP 3**	154 (34.4)	122 (27.2)	111 (24.8)	61 (13.6)	448	,48	22.10	<.0001	.16	medium
	4-8 PLACES	222 (30.7)	235 (32.5)	155 (21.4)	112 (15.5)	724	1.03	29.44	<.0001	.14	small
	9 OR LESS	747 (33.2)	614 (27.3)	540 (24.0)	346 (15.4)	2247	.73	80.31	<.0001	.13	small
♂	**TOP 3**	166 (35.9)	135 (29.2)	103 (22.3)	59 (12.7)	463	1.15	29.73	<.0001	.18	medium
	4-8 PLACES	302 (38.3)	220 (27.9)	159 (20.2)	108 (13.7)	789	.40	53.46	<.0001	.18	medium
	9 OR LESS	1006 (38.7)	766 (29.5)	514 (19.8)	311 (12.0)	2597	3.50***	221.44	<.0001	.21	medium
Polish Population†		53362(25.3)	54879(26.0)	5557 (26.3)	47233(22.4)	211046					

χ^2_3 – chi-squared test value; p – probability value; V – Cramer`s V value, *p<0.01, **p<0.001, ***p<0.0001 for post hoc Tukey test, †births per year in 1995-2003, ‡ Height difference Q1 to Q4

Discussion

The aim of this article was to identify the distribution of birthdates among male and female players participating in elite basketball games in Poland. We assumed that the RAE phenomenon will be strongly visible among young Polish basketball players. The skewed distribution of the birthdates of male and female players was observed regardless of an age category. Additionally, a difference in the average heights and match statistics in the group of players born in the first half of a year was recognized. This study shows the difference in body height between players born in different quarter of the calendar year in the youngest basketball players.

The results of our study are consistent with the findings of Arrieta et al. (2016), who showed a strong RAE phenomenon in youth teams of European countries. Accordingly, the nature of disparities in the distributions of dates of births and their decreasing in the older groups are consistent with reports concerning German elite youth basketball competitions (Steingröver et al., 2017). Furthermore, differences in body height in players born in different quarters of a year were similar to those of French populations of male and female basketball players (Delorme and Raspaud, 2009). Previous studies have shown significant differences in players' body heights between the selected group of players (elite) and players with lower skill levels (non-elite) (Drinkwater et al., 2007; Torres-Unda et al., 2013). Therefore, the results of this study suggest that discrimination against shorter players is associated with the results of youth basketball teams. This phenomenon especially affects players who were born in the last quarter of a calendar year. This condition may stem from the fact that a chronological age and age at peak high velocity are key factors influencing the body heights of young basketball players (te Wierike et al., 2015).

The process of talent identification is multivariate and strongly influenced by body height, motor abilities and basketball skills (Hoare, 2000). In addition, basketball

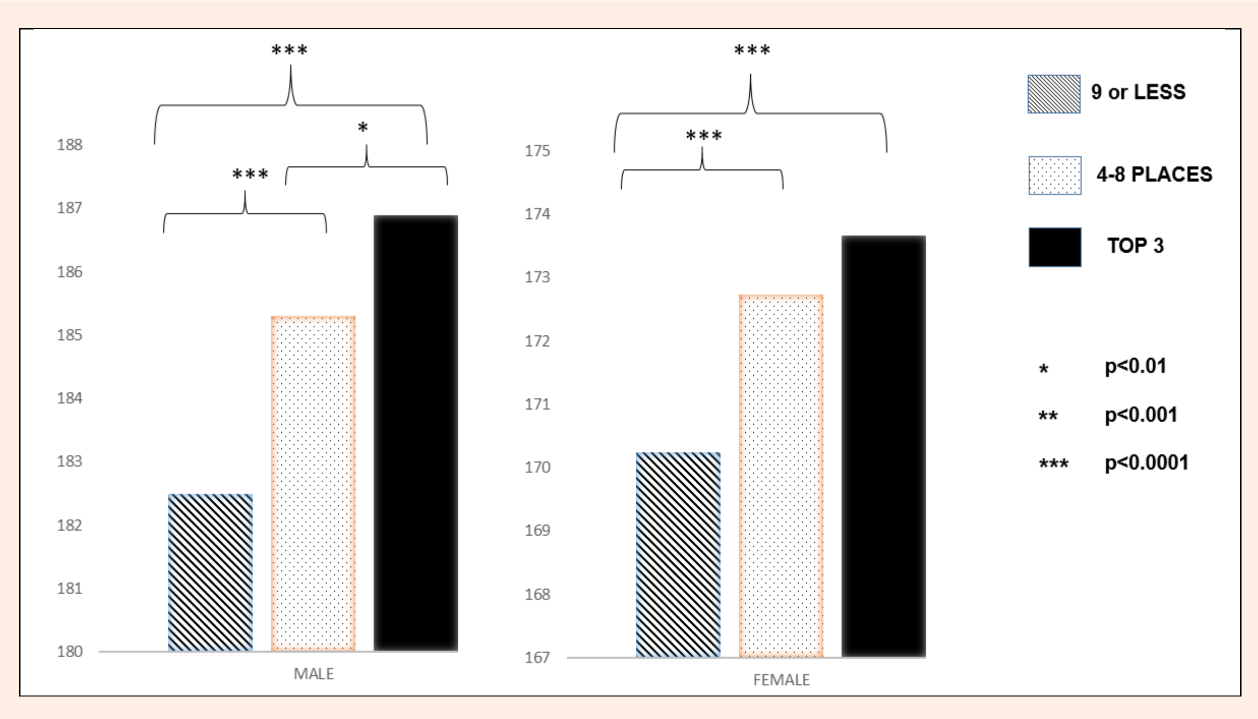

Figure 1. Differences in the body heights of young male and female basketball players in Poland stratified by the results of each team.

requires from the player to take a high frequency of high-intensity movements in 24 seconds of action. (Ben Abdelkrim et al., 2010b; Marcelino et al., 2016). The discussed players seem to be "doubly disadvantaged" due to discrimination with regard to the quarter of birth and body height. Additionally, the RAE as well as differences in body heights in the analyzed groups are more significant in boys from U14 and U16 groups, who enter their age at peak high velocity later than girls (Carvalho et al., 2011). Thus, a talented boy playing basketball with a much younger chronological age and delayed entry into APHV may have difficulties with effective performance on the court. This difficulty is related to the fact that higher values of blocks and effectiveness on two-point shots are features distinguishing winning teams from failing teams in youth boys' games (Lorenzo et al., 2010). This correlation is confirmed by the results of the present study that showed significant differences in the PIR of U14 players born in different halves of a calendar year. Differences in the distribution of birthdates and body heights of young female basketball players from successful teams are less visible than in boys because of the dynamics of puberty in girls, which are different than that in boys. A two-and-a-half-year delay in bone development at the age of puberty has been demonstrated in boys in relation to girls (Baptista et al., 2016). Accelerated stabilization of the ultimate girls' body heights is reflected in a faster blurring of differences between body height and the quarter of birth than in older boys' categories. This phenomenon is also confirmed by the results of this study, which revealed a lack of significant differences in the body heights of female players based on the quarter of the year in which they were born or between body heights and match statistics in U16 category and higher.

Men's and women's basketball differ in demands of physical requirements for players (Sampaio, et al., 2004). Furthermore, the players' physical advantage, could be crucial in men's basketball (Ribeiro et all., 2016). The results of our study show a different nature of the changes in the distribution of birth dates in youth basketball players due to gender. It depends not only on the PHV start time but also on non-linear development of motor skills (i.e. isometric strength), as in boys. (Buchanan et al., 2003; Ioakimidis et al., 2004). Therefore, it is reasonable to create dedicated solutions for each gender to minimize the phenomenon of RAE in youth basketball. In Poland, young male and female players take part in the central games from the age of 14. During that time, the first selection to national teams begins. The latest findings of Jakovljevic et al. (2016) showed tremendous differences in anthropometric constitution and agility in boys who reach puberty early, normally and late at the age of 14 years. A greater than 20-cm difference in body height and a 12-cm advantage in vertical jumping may constitute a great hindrance to talented basketball players who reach the age of puberty late. In the youth groups, the selection of players who score the highest number of points during a game clearly favors taller players. This correlation has been confirmed by the research of Erčulj and Štrumbelj (2015), who indicated that the distance from the basket is a determinant of effectiveness of shots in youth basketball. Additionally, these authors report a higher frequency of dribbling and cutting in senior games. In this case, disproportions in the anthropometric constitution of guards may considerably limit the effectiveness of these actions because of players who reach their puberty age late. In summary, the RAE is present in every category of the game, regardless of the age of the players. However, the differences in body height related to the quarter in which a player was born are visible only in younger categories. The later entry of boys into the APHV may be connected with the discrimination in successful youth basketball teams against players who grow up more slowly. A player born in the last quarter of a calendar year who reaches his puberty age late seems to be "doubly disadvantaged." In girls, this "double discrimination" may occur around the ages of 11and 12 years.

Limitations

The current study had some limitations. Firstly, this study concerns only the analyzed distribution of birth dates in youth basketball in Poland, without taking into consideration the mechanisms of players` selection for teams. Therefore, it seems reasonable to include the wide social context of the phenomenon of RAE in Poland in future studies.

Conclusion

The biological development of boys and girls is different. Thus, it is necessary to create comprehensive strategies to minimize the RAE phenomenon in basketball, for each sex separately. In relation to the results of this study, coaches evaluating the potential of young boys playing basketball should be especially focused on players who are 14 years old. For example, many talented boys, U14 players, may be rejected in the process of selection because of the RAE and slower physical development. At the same age, most of the girls playing basketball are already close to the end of puberty. Trainers should carefully observe decisions made by the player during a game and their tactical context. The evaluation of shooting effectiveness may be disrupted by differences in anthropometric indices and the motor skills of their opponents.

Acknowledgment

This study is in line with current laws in the Poland. There is no conflict of interest, and this study did not use sources of funding.

References

Arias, J.L. (2012) Performance as a function of shooting style in basketball players under 11 years of Age. *Perceptual & Motor Skills* **114**, 446-456.

Arias, J.L., Argudo, F.M. and Alonso, J.I. (2012) Effect of basketball mass on shot performance among 9-11 year-old male players. *International Journal of Sports Science & Coaching* **7**, 69-80.

Arrieta, H., Torres-Unda, J., Gil, S.M. and Irazusta, J. (2016) Relative age effect and performance in the U16, U18 and U20 European basketball championships. *Journal of Sports Sciences* **34**, 1530-1534.

Baker, J., Schorer, J., Cobley, S., Bräutigam, H. and Büsch, D. (2009) Gender, depth of competition and relative age effects in team sports. *Asian Journal of Exercise & Sports Science* **6**, 1-7.

Baptista, F., Rebocho, L.M., Cardadeiro, G., Zymbal, V. and Rosati, N. (2016) Sex- and maturity-related differences in cortical bone at the distal radius and midshaft tibia evaluated by quantitative ultrasonography. *Ultrasound in Medicine & Biology* **42**, 2043-2049.

Ben Abdelkrim, N., Chaouachi, A., Chamari, K., Chtara, M. and Castagna, C. (2010a) Positional role and competitive-level differences in elite-level men's basketball players. *Journal of Strength and Conditioning Research* **24**, 1346-1355.

Ben Abdelkrim, N., Chaouachi, A., Chamari, K., Chtara, M. and Castagna, C. (2010b) Positional role and competitive-level differences in elite-level men's basketball players. *Journal Of Strength And Conditioning Research* **24**(5), 1346-1355.

Buchanan, P.A. and Vardaxis, V.G. (2003) Sex-Related and Age-Related Differences in Knee Strength of Basketball Players Ages 11-17 Years. *Journal of Athletic Training* **38**(3), 231-237.

Carvalho, H.M., Coelho-e-Silva, M.J., Gonçalves, C.E., Philippaerts, R.M., Castagna, C. and Malina, R.M. (2011) Age-related variation of anaerobic power after controlling for size and maturation in adolescent basketball players. *Annals of Human Biology* **38**, 721-727.

Chittle, L., Horton, S. and Dixon, J.C. (2016) Time out or fast break? The relative age effect in NCAA Division I basketball. *Journal of Sport Behavior* **39**, 107-125.

Cobley, S., Baker, J., Wattie, N. and McKenna, J. (2009) Annual age-grouping and athlete development: a meta-analytical review of relative age effects in sport. *Sports Medicine* **39**, 235-256.

Delorme, N., Boiché, J. and Raspaud, M. (2010) Relative age effect in elite sports: methodological bias or real discrimination? *European Journal of Sport Science* **10**, 91-96.

Delorme, N., Chalabaev, A. and Raspaud, M. (2011). Relative age is associated with sport dropout: evidence from youth categories of French basketball. *Scandinavian Journal of Medicine & Science in Sports* **21**, 120-128.

Delorme, N. and Raspaud, M. (2009) The relative age effect in young French basketball players: a study on the whole population. *Scandinavian Journal of Medicine & Science in Sports* **19**, 235-242.

Drinkwater, E.J., Hopkins, W.G., McKenna, M.J., Hunt, P.H. and Pyne, D.B. (2007) Modelling age and secular differences in fitness between basketball players. *Journal of Sports Sciences* **25**, 869–878.

Drinkwater, E.J., Pyne, D.B. and McKenna, M.J. (2008) Design and interpretation of anthropometric and fitness testing of basketball players. *Sports Medicine (Auckland, NZ)* **38**, 565-578.

Erčulj, F. and Štrumbelj, E. (2015) Basketball shot types and shot success in different levels of competitive basketball. *PLoS One* **10**, e0128885.

Hoare, D.G. (2000) Predicting success in junior elite basketball players--the contribution of anthropometic and physiological attributes. *Journal of Science and Medicine in Sport / Sports Medicine (Australia)* **3**, 391-405.

Ioakimidis, P., Gerodimos, V., Kellis, E., Alexandris, N. and Kellis, S. (2004). Combined effects of age and maturation on maximum isometric leg press strength in young basketball players. *The Journal Of Sports Medicine And Physical Fitness* **44**(4), 389-397.

Jakovljevic, S., Macura, M., Radivoj, M., Jankovic, N., Pajic, Z. and Erculj, F. (2016) Biological maturity status and motor Performance in fourteen-year-old basketball players. [Estado de Madurez Biológica y Desempeño Motriz en Jugadores de Baloncesto de Catorce Años de Edad.] *International Journal of Morphology* **34**, 637-643.

Köklü, Y., Alemdaroğlu, U., Koçak, F.Ü., Erol, A.E. and Fındıkoğlu, G. (2011) Comparison of chosen physical fitness characteristics of Turkish professional basketball players by division and playing position. *Journal of Human Kinetics* **30**, 99-106.

Lockie, R.G., Jeffriess, M.D., McGann, T.S., Callaghan, S.J. and Schultz, A.B. (2014) Planned and reactive agility performance in semiprofessional and amateur basketball players. *International Journal of Sports Physiology and Performance* **9**, 766-771.

Lorenzo, A., Gómez, M.Á., Ortega, E., Ibáñez, S.J. and Sampaio, J. (2010) Game related statistics which discriminate between winning and losing under-16 male basketball games. *Journal of Sports Science & Medicine* **9**, 664-668.

Marcelino, P.R., Aoki, M.S., Arruda, A.F.S., Freitas, C.G., Mendez-Villanueva, A. and Moreira, A. (2016) Does small-sided-games' court area influence metabolic, perceptual, and physical performance parameters of young elite basketball players? *Biology of Sport* **33**(1), 37-42.

Ribeiro, H.V., Mukherjee, S. and Zeng, X.H. (2016) The Advantage of Playing Home in NBA: Microscopic, Team-Specific and Evolving Features. *PloS One* **11(3),** e0152440.

Sampaio, J., Godoy, S.I. and Feu, S. (2004) Discriminative power of basketball game-related statistics by level of competition and sex. *Perceptual and Motor Skills* **99(3 Pt 2),** 1231-1238.
Schorer, J., Neumann, J., Cobley, S.P., Tietjens, M. and Baker, J. (2011) Lingering effects of relative age in basketball players' post athletic career. *International Journal of Sports Science & Coaching* **6**, 143-148.
Silva, D.A.S., Petroski, E.L. and Gaya, A.C.A. (2013) Anthropometric and physical fitness differences among Brazilian adolescents who Practise Different Team Court Sports. *Journal of Human Kinetics* **36**, 77-86.
Sisic, N., Jelicic, M., Pehar, M., Spasic, M. and Sekulic, D. (2016) Agility performance in high-level junior basketball players: the predictive value of anthropometrics and power qualities. *The Journal of Sports Medicine and Physical Fitness* **56**, 884-893.
Steingröver, C., Wattie, N., Baker, J., Helsen, W.F. and Schorer, J. (2017) The interaction between constituent year and within-1-year effects in elite German youth basketball. *Scandinavian Journal of Medicine & Science In Sports* **27(6),** 627-633.
te Wierike, S.C.M., Elferink-Gemser, M.T., Tromp, E.J.Y., Vaeyens, R. and Visscher, C. (2015) Role of maturity timing in selection procedures and in the specialisation of playing positions in youth basketball. *Journal of Sports Sciences* **33**, 337-345.
Torres-Unda, J., Zarrazquin, I., Gil, J., Ruiz, F., Irazusta, A., Kortajarena, M., Seco, J. and Irazusta, J. (2013) Anthropometric, physiological and maturational characteristics in selected elite and non-elite male adolescent basketball players. *Journal of Sports Sciences* **31**, 196-203.
Torres-Unda, J., Zarrazquin, I., Gravina, L., Zubero, J., Seco, J., Gil, S.M., Gil, J. and Irazusta, J. (2016). Basketball performance is related to maturity and relative age in elite adolescent players. *Journal of Strength and Conditioning Research* **30**, 1325-1332.
Werneck, F.Z., Coelho, E.F., de Oliveira, H.Z., Ribeiro Júnior, D.B., Almas, S.P., de Lima, J.R.P., Matta, M.O. and Figueiredo, A.J. (2016) Relative age effect in Olympic basketball athletes. *Science & Sports* **31**, 158-161.
Williams, A.M. and Drust, B. (2012) Contemporary perspectives on talent identification and development in soccer. *Journal of Sports Sciences* **30**, 1571-1572.

Key points

- The RAE was identified in all groups competing in the elite games of the Polish Youth Championships.
- Height averages were the highest in the group of male and female players from the top 3 teams.
- The research results show the impact of the RAE on the success of youth basketball teams in Poland.
- It is necessary to create comprehensive strategies to minimize the RAE phenomenon in basketball, for each sex separately.

AUTHOR BIOGRAPHY

Krystian RUBAJCZYK
Employment
Assistant, University School of Physical Education in Wroclaw, Department of Team Sport Games
Degree
MSc
Research interests
Identification of the REA in team sports
E-mail: krystian.rubajczyk@gmail.com

Kamil ŚWIERZKO
Employment
Assistant, University School of Physical Education in Wroclaw, Department of Team Sport Games
Degree
MSc
Research interests
Talent identification in team sports, motor abilities
E-mail: kamil.swierzko@gmail.com

Andrzej ROKITA
Employment
Professor, University School of Physical Education in Wroclaw, Department of Team Sport Games
Degree
PhD, DSc
Research interests
The use of the "EDUball" educational ball in primary schools. Talent identification in team sports.
E-mail: andrzej.rokita@awf.wroc.pl

🖂 **Krystian Rubajczyk**
Department of Team Games Sport, University School of Physical Education, Wroclaw, Poland