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Research article

The Effect of Well-Being and Exercise Intensity on Enjoyment in Soccer Players

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Abstract

This study examined the relationship between well-being, exercise intensity, and enjoyment in soccer players. Seventy-seven players participated in this study. Participants performed the 30-15 Intermittent Fitness Test and took part in four training formats: 5v5 and 1v1 small-sided games (SSGs), long HIIT, and short HIIT. Enjoyment was measured using the Physical Activity Enjoyment Scale (PACES), well-being was assessed with the Nordic Musculoskeletal Questionnaire (SNQ), Profile of Mood States (POMS), Total Mood Disturbance (TMD), sleep duration, and Perceived Recovery Status (PRS). Exercise intensity was measured with heart rate (HR) and rate of perceived exertion (RPE). TMD predicted enjoyment across all training formats (β = -0.68 to -0.36, $p < 0.001$). Sleep duration predicted enjoyment in long HIIT (β = -.21, $p < 0.05$), SNQ predicted enjoyment in 1v1 SSGs (β = 0.29, $p < 0.05$), PRS predicted enjoyment in short HIIT (β = 0.20, $p < 0.05$), and RPE predicted enjoyment in long HIIT (β = -0.30, $p < 0.01$). The regression models were statistically significant across all conditions, indicating that 33% to 49% of the variance in enjoyment was explained by well-being and intensity. This study showed that TMD was the strongest predictor of enjoyment. Lower sleep duration and higher RPE reduced enjoyment in long HIIT. In 1v1 SSGs, greater SNQ was associated with higher enjoyment, while in short HIIT, a higher PRS resulted in higher enjoyment. However, potential confounding factors such as individual fitness levels, baseline mood, and training experience may have influenced these findings. Coaches should consider mood, sleep, recovery, and exertion when planning training to enhance enjoyment.

Key words: Psychological factors, training load, perceived exertion, recovery, team sports.

Introduction

Enjoyment of physical activity is a key factor influencing long-term adherence to exercise and sports participation. Enjoyment fosters intrinsic motivation, lowers perceived exertion, and promotes sustained engagement in physical activities (Teixeira et al., 2012). Enjoyment is both a psychological outcome and a motivational driver, influenced by multiple factors such as intensity, social context, and perceived competence (Bandhu et al., 2024). Previous research indicates that individuals who perceive exercise as more enjoyable are more likely to maintain adherence to training programs, demonstrate lower dropping rates, and experience improved psychological and physiological outcomes (Collado-Mateo et al., 2021). Specifically, positive affective responses to exercise predict better long-term adherence, while athletes who experience higher levels of enjoyment report better mental well-being and training compliance (Finne et al., 2022; Eather et al., 2023). Given the importance of these outcomes for athletes, extensive research has examined the psychological and physiological determinants of enjoyment. Empirical evidence suggests that well-being and exercise intensity influence enjoyment (Astorino and Vella, 2018; Bartlett et al., 2011; Greene and Petruzzello, 2015; Selmi et al., 2018; Ouergui et al., 2020); however, most studies have not concurrently examined both factors, particularly across diverse training formats. For instance, (Bartlett et al., 2011) and Ouergui et al. (2020) highlighted how different training modalities impact enjoyment through variations in exercise intensity, while Greene and Petruzzello (2015) and Astorino and Vella (2018) emphasized the role of affective responses during exercise. However, these findings are often studied in isolation, limiting the understanding of their interactive effects. Among these factors, well-being is particularly crucial for assessing overtraining and recovery in athletes.

Well-being is a fundamental component of athletic performance and training adaptation, encompassing both physiological and psychological dimensions. It reflects an athlete's capacity to recover from training, manage stress, and sustain optimal physical and mental states (Hooper and Mackinnon, 1995). Careful monitoring of training load, recovery, and psychological status fluctuations is essential for effective training periodization and performance optimization (Agostinho et al., 2015). Short-term well-being, which is often assessed in daily training contexts, serves as a key indicator of an athlete's readiness for physical exertion. Inadequate well-being has been linked to heightened fatigue, diminished motivation, and an increased risk of overtraining syndrome (Meeusen et al., 2013). Multiple factors influence athletes' well-being, including training load, sleep quality, and recovery status. Excessive training without sufficient recovery can disrupt physiological homeostasis, resulting in both physical and psychological exhaustion (Kellmann, 2010). Moreover, effective recovery strategies, including active recovery, cold-water immersion, massage, and carbohydrate supplementation, have been shown to enhance well-being by reducing muscle damage and fatigue, mitigating injury risk, and optimizing performance (Field et al., 2021).

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Empirical evidence suggests a bidirectional relationship between well-being and enjoyment, in which psychological factors, including mood and stress, serve as mediating variables (de Vries et al., 2022). Specifically, psychological states such as mood and stress influence how athletes interpret training stimuli and affective experiences (Jekauc et al., 2021). Positive mood states can improve perceptions of training as enjoyable, even when intensity is high, while elevated stress or poor mood may amplify feelings of fatigue or discomfort, reducing enjoyment (Selmi et al., 2023). Mood and stress levels modulate athletes' emotional responses to training by changing the balance between perceived challenge and psychological readiness (Janelle et al., 2020). Accumulated fatigue or inadequate recovery from overtraining impairs performance and increases athletes' perceived training burden, thereby reducing enjoyment of the sport (Kellmann, 2010). Mood and stress are key psychological determinants of enjoyment. For instance, research has shown that affective valence during exercise predicts post-exercise enjoyment (Greene et al., 2018). To assess well-being in sports science research, subjective self-reported measures like Hooper's Index are frequently used. This tool assesses daily fluctuations in fatigue, delayed onset muscle soreness, sleep quality, and stress levels, offering insights into an athlete's recovery status (Hooper and Mackinnon, 1995). Although Hooper's Index is widely utilized for assessing well-being and sensitive to subtle physiological and psychological changes, it primarily relies on subjective self-reports, potentially introducing bias and limiting accuracy. To address these limitations, recent studies advocate for integrating objective indicators to improve assessment accuracy (Kellmann, 2010; Saw et al., 2016).

Exercise intensity is a crucial yet inconsistently examined determinant of enjoyment (Ekkekakis et al., 2011). Although high-intensity interval training has been associated with greater enjoyment in controlled settings (Bartlett et al., 2011), supramaximal intensities may paradoxically diminish affective valence (Greene and Petruzzello, 2015; Astorino and Vella, 2018). These discrepancies may arise due to differences in training formats, individual fitness levels, and training experience, all of which shape how athletes perceive varying intensity levels (Oliveira et al., 2013). Specific training formats, such as 5v5 small-sided games and HIIT, can lead to different levels of intensity and enjoyment due to their inherent structure and demands. 5v5 small-sided games typically involve moderate intensity with frequent high-intensity actions during dynamic play, requiring a balance of aerobic and anaerobic energy systems (Clemente et al., 2014). The social interaction and team dynamics within SSGs may further increase enjoyment through the sense of competition and teamwork (Farhani et al., 2022). In contrast, HIIT sessions generally involve brief, maximal efforts followed by rest or low-intensity periods, which may induce higher perceived exertion, resulting in greater post-exercise enjoyment (Atakan et al., 2021). Identifying these factors is essential for training programs that balance exercise intensity and enjoyment.

Most studies evaluating subjective exercise intensity utilize the RPE scale, which offers valuable insights into an athlete's perceived training load (Foster et al., 2017). Relying solely on subjective measures may not fully capture the physiological demands of exercise. To obtain a more comprehensive assessment, incorporating objective physiological markers, such as heart rate (HR), is essential (Schneider et al., 2018). For instance, the use of the percentage of heart rate reserve (%HRreserve) to quantify exercise intensity, accounts for both resting and maximal heart rate, providing a more individualized and precise measure across athletes (Buchheit and Laursen, 2013). By integrating both subjective and objective measures, this approach improves the monitoring of athletes' physiological responses and well-being, offering deeper insights into the relationship between exercise intensity and enjoyment.

Despite the well-established role of enjoyment in sports, the specific mechanisms by which physiological and psychological factors influence enjoyment, particularly across different training formats, remain underexplored. Exercise intensity and psychological demands vary across different training formats (Bartlett et al., 2011; Oliveira et al., 2013). This research gap underscores the need to further investigate the relationship between well-being, exercise intensity, and enjoyment in soccer players across training formats. Understanding this relationship can inform the development of personalized training strategies aimed at optimizing both performance and psychological outcomes in soccer players. Investigating multiple training formats further enhances the generalizability of findings. Therefore, this study aims to explore the relationship between well-being, exercise intensity, and enjoyment among soccer players across four distinct training formats. Given the well-documented associations between well-being, exercise intensity, and enjoyment, we hypothesize that well-being indicators (SNQ, TMD, PRS, sleep duration) and exercise intensity measures (RPE, %HRreserve) will significantly predict enjoyment levels (PACES scores).

Methods

Study design

This study utilizes a cross-sectional design to examine the impact of subjective well-being indicators and exercise intensity on soccer players' perceived enjoyment. A convenience sampling method was employed to recruit 80 players from the China University Football Association (CUFA), with 77 completing all training sessions. Each player completed a fitness assessment using the 30-15 Intermittent Fitness Test ($30\text{-}15_{IFT}$), followed by four distinct training sessions (5v5 SSGs, 1v1 SSGs, long HIIT, and short HIIT) conducted over two weeks. All sessions were conducted between 16:00 and 18:00 on an outdoor artificial turf field. Before each session, players completed a well-being questionnaire and then performed the FIFA 11+ (Level 3) standardized warm-up routine. Heart rate (HR) was continuously monitored during training using an optical heart rate sensor (INSAIT KS System, GenGee, China). Immediately after each session, participants reported their rating of RPE and completed the PACES questionnaire to assess their subjective training experience. All scales used in this study were validated Chinese-language versions. Table 1 presents the data collection points.

Table 1. Data collection points.

Baseline	Before each session	During each session	After each session
Age (years) Height (cm) Body weight (kg) HRrest (beat·min^{-1}) HRmax (beat·min^{-1}) V_{IFT} (Km·h-1)	SNQ TMD Sleep duration (h) PRS	HRmean (beat·min^{-1})	RPE PACES

Note: HRrest = Resting Heart Rate; HRmax = Maximum Heart Rate; V_{IFT} = Velocity achieved in the 30-15 Intermittent Fitness Test; SNQ = Standardized Nordic Questionnaire; TMD = Total Mood Disturbance; PRS = Perceived Recovery Status; HRmean = Mean Heart Rate; RPE = Rating of Perceived Exertion; PACES = Physical Activity Enjoyment Scale.

All study procedures adhered to the Declaration of Helsinki and were approved by the Medical Ethics Committee of Xiamen University (Approval Number: XDYX202406K34). The trial was prospectively registered in the Chinese Clinical Trial Registry (Registration Number: ChiCTR2400087494). Before participation, all players provided written informed consent voluntarily.

Participants

The required sample size was estimated using G*Power (version 3.1.9.7) for linear multiple regression (fixed model, R^2 deviation from zero). An a priori power analysis indicated that a minimum of 46 participants was required to detect an effect size of $f^2 = 0.35$ at $\alpha = 0.05$, with power $(1-\beta) = 0.80$ and six predictors. The effect size was derived from a preliminary study involving 17 participants. In that pilot study, the correlations between predictors and the outcome variable were -0.718, 0.011, 0.122, -0.213, -0.400, and 0.099, with a multiple correlation coefficient (ρ^2) of 0.262.

To account for potential attrition, 80 male soccer players were initially recruited. Three players were later excluded for failing to attend all sessions, leaving 77 participants, which remained above the minimum required for adequate statistical power. The participants had a mean (± SD) age of 20.64 ± 1.56 years, a mean height of 179.68 ± 5.29 cm, and a mean weight of 71.73 ± 6.52 kg, corresponding to a mean BMI of 22.20 ± 1.62. The mean resting heart rate (HRrest) was 56.14 ± 5.12 bpm, while the mean maximum heart rate (HRmax) was 188.35 ± 6.05 bpm. The mean velocity attained in the 30-15 intermittent fitness test (V_{IFT}) was 19.64 ± 1.46 km/h.

Eligibility criteria required players to belong to the same team for each training session, report no injuries or illnesses in the preceding month, have no physical or cognitive impairments, abstain from medication use, and refrain from alcohol consumption for at least one month before the study. Participants were excluded if they failed to consistently attend training sessions or developed illnesses or injuries during the study period.

Anthropometric measurement and cardiorespiratory assessment

Participants wore a T-shirt and shorts, removed their shoes, and underwent height and weight assessments using a calibrated SECA 213 stadiometer (Seca GmbH & Co. KG, Hamburg, Germany) for height (cm) and a Tanita BC-558 digital scale (Tanita Corporation, Tokyo, Japan) for weight (kg). Participants then lay supine for 10 minutes, during which the lowest recorded HR was designated as the resting HR (HRrest).

To enhance measurement reliability, participants refrained from strenuous activity for 48 hours before fitness testing. All assessments were conducted outdoors on an artificial turf field between 16:00 and 18:00, with an average temperature of 22 ± 2.45°C and a relative humidity of 54 ± 19.06%. After completing a Level 3 FIFA 11+ warm-up, participants rested for three minutes before the test. The $30\text{-}15_{IFT}$ was then administered, consisting of repeated 30-second shuttle runs at progressively increasing speeds, each separated by a 15-second rest interval. Players ran between two lines spaced 40 meters apart, following audio signals. The test was terminated when a player failed to maintain the required speed for three consecutive intervals. The highest completed velocity was recorded as V_{IFT} (Buchheit et al., 2010). During the $30\text{-}15_{IFT}$, the highest recorded HR was designated as the maximum HR (HRmax). The 30-15 IFT was specifically chosen for this study due to its ecological validity and practicality in soccer-specific contexts (Buchheit, 2008; Čović et al., 2016; Thomas et al., 2016; Bruce and Moule, 2017). Moreover, it provides an individualized reference value (VIFT), which allows for accurate prescription of HIIT intensity based on each player's fitness level. This individualization is critical for ensuring consistency in training load across players during both long and short HIIT sessions, making it particularly suitable for studies involving soccer-specific HIIT programming (Buchheit, 2010). This assessment was conducted exclusively for HIIT programming purposes and was not included in the data analysis, as it was beyond the scope of the present study.

Well-being

Musculoskeletal symptoms were evaluated using the validated SNQ (Kuorinka et al., 1987). Participants reported any pain or discomfort experienced in the past seven days across nine anatomical regions (neck, shoulders, elbows, hands/wrists, upper back, lower back, hips/thighs, knees, and ankles/feet) by responding "yes" or "no," concerning a body manikin for guidance. A composite score (0–9) was then computed to represent the total number of painful sites.

Mood state was assessed through the abbreviated 40-item POMS, which has been validated as a time-sensitive measure suitable for competitive athletes (Grove and Prapavessis, 1992). This version consists of 40 adjectives representing seven mood states—tension, depression, fatigue, vigor, confusion, anger, and esteem-related affect—based on recent experiences. Participants rated each adjective on a five-point scale ranging from 0 (not at all) to

4 (extremely). The Total Mood Disturbance (TMD) score was computed by summing the negative subscales (tension, depression, anger, fatigue, confusion), subtracting the positive subscales (vigor, esteem-related affect), and adding a constant of 100 to prevent negative values. Sleep duration was objectively recorded using accelerometer bracelets (Huawei Band 6, Shenzhen, China), which players wore from 21:30 onward on the night before training. The recorded sleep duration was subsequently verified with each participant. Perceived recovery status was assessed before each training session using the PRS scale (Laurent et al., 2011). The PRS scale ranges from 0 to 10, with 0 indicating very poor recovery or extreme fatigue and 10 representing optimal recovery or high energy levels.

Training intervention

All training sessions were conducted outdoors on artificial turf between 16:00 and 18:00, under average environmental conditions of 23.19 ± 3.06°C and 59.25 ± 22.99% relative humidity. Before each session, participants completed a well-being questionnaire and performed the standardized FIFA 11+ warm-up (Level 3), followed by a three-minute recovery period. They then participated in either small-sided games (SSGs) or high-intensity interval training (HIIT). In the SSGs, each player occupied an area of 175 m², a dimension chosen to enhance decision-making, movement intensity, and player engagement (Riboli et al., 2020). Two SSG formats were implemented: a 5v5 + goalkeeper format (SSGs) on a 50 × 35 m pitch with seven-a-side goals, and a 1v1 + goalkeeper format (SSGs) on a 25 × 14 m pitch with five-a-side goals. Each format lasted 25 minutes. In 5v5 SSGs, the session consisted of four four-minute bouts, each separated by a three-minute passive recovery. In 1v1 SSGs, each session included eight one-minute bouts separated by two-minute recovery periods, with a five-minute rest between the fourth and fifth bouts. The offside rule was not applied. Goalkeepers, due to their distinct training requirements, were excluded from the analysis. Two coaches positioned around the field provided additional balls to ensure continuous play, while participants were encouraged to exert maximal effort and maintain ball possession. The HIIT sessions also lasted 25 minutes and followed two distinct training protocols. The long HIIT protocol consisted of four four-minute intervals performed at 80% of V_{IFT}, each followed by a three-minute passive recovery period. The short HIIT protocol included eight one-minute intervals at 95% of V_{IFT}, each followed by a two-minute recovery, except for a five-minute rest between the fourth and fifth intervals.

To minimize potential bias toward specific training formats, players were randomly assigned to different session orders. This randomization was achieved using a computer-generated random number sequence, which assigned players to one of four groups. Each group completed the sessions in a different order. Specifically, some players completed 5v5 SSGs, long HIIT, 1v1 SSGs, and short HIIT; others started with long HIIT, followed by 5v5 SSGs, short HIIT, and 1v1 SSGs; while another group began with 1v1 SSGs, followed by short HIIT, 5v5 SSGs, and long HIIT. This randomization procedure was carried out by an independent researcher who was not involved in the data collection or analysis, ensuring the process was unbiased and transparent.

Measurements of exercise intensity

Exercise intensity was objectively measured by continuously recording each player's HR during training sessions (excluding the warm-up) using an optical heart rate monitor (INSAIT KS System, GenGee, China). HR data were collected continuously from the start to the end of each HIIT and SSG session, and the mean heart rate (HRmean) was calculated. To provide a more accurate representation of a player's exercise intensity, the %HRreserve was used and calculated as follows (Karvonen, Kentala and Mustala, 1957):

$$\%\text{HRreserve} = \frac{\text{HRmean} - \text{HRrest}}{\text{HRmax} - \text{HRrest}} \times 100$$

Additionally, the rating of RPE was recorded immediately after each session using the Borg CR10 scale (Borg, 1998), a validated tool for reliably quantifying effort in athletic contexts. To minimize potential peer influence, players reported their rating of RPE individually. Although subjective, the RPE scale provides valuable complementary insights into exercise intensity when combined with objective physiological measures.

PACES

Five minutes after each session, players completed the PACES to assess their enjoyment of the training. They rated their immediate feelings about the training session using an 18-item, 7-point bipolar scale, with 11 items reverse-scored. The total enjoyment score, ranging from 18 to 126, was calculated by summing all item ratings, with higher scores reflecting greater enjoyment (Kendzierski and DeCarlo, 1991).

Data analysis

All statistical analyses were conducted using SPSS (version 26.0, IBM). Descriptive statistics, including means and standard deviations, were calculated for all key variables. Before conducting multiple regression analyses, the assumptions of linear regression were tested. Linearity was evaluated using partial regression plots and a scatterplot of studentized residuals against predicted values. The independence of residuals was assessed using the Durbin-Watson statistic to detect autocorrelation. Homoscedasticity was assessed by examining a scatterplot of studentized residuals against unstandardized predicted values. Multicollinearity was assessed using tolerance values and variance inflation factors (VIF), with tolerance values expected to exceed 0.1 and VIF values remaining below 10. Potential outliers and influential data points were identified based on studentized deleted residuals (±3 SD), leverage values (>0.2), and Cook's distance (>1). The normality of residuals was evaluated using Q-Q plots.

Four separate multiple linear regression analyses were conducted to examine the effects of sleep duration, SNQ scores, PRS scores, TMD scores, %HRreserve, and RPE ratings on PACES scores across different training conditions (5v5 SSGs, 1v1 SSGs, long HIIT, and short HIIT). Each regression model included these six predictors and was evaluated using R^2, adjusted R^2, and F-tests to assess overall model fit and explanatory power. For each predictor, unstandardized regression coefficients (B), standard errors (SE), standardized coefficients (β), 95% confidence intervals (CIs), and p-values were reported. Statistical significance was set at $\alpha = 0.05$, with p-values below this threshold indicating statistical significance. Effect sizes were reported as adjusted R^2, with values of 0.02, 0.13, and 0.26 representing small, medium, and large effects, respectively (Cohen, 1988).

Results

Four multiple regressions were run to predict PACES score from sleep duration, SNQ score, PRS score, TMD score, %HRreserve, and rating of RPE. Linearity was confirmed through partial regression plots and a scatterplot of studentized residuals against predicted values. The independence of residuals was verified using the Durbin-Watson statistic, which yielded values of 1.693 (5v5 SSGs), 1.799 (1v1 SSGs), 1.621 (long HIIT), and 1.524 (short HIIT). Homoscedasticity was confirmed through visual inspection of a scatterplot of studentized residuals against unstandardized predicted values. No evidence of multicollinearity was found, as indicated by tolerance values exceeding 0.1. Studentized deleted residuals exceeding ±3 standard deviations were found in 5v5 SSGs (1 case), long HIIT (1 case), and short HIIT (1 case), while no such cases were observed in 1v1 SSGs. Leverage values greater than 0.2 were found in 5v5 SSGs (1 case), 1v1 SSGs (3 cases), long HIIT (3 cases), and short HIIT (2 cases). No values for Cook's distance exceeded 1. The assumption of normality was met, as assessed by a Q-Q Plot. Table 2 shows the descriptive statistics of all variables. Figure 1 shows the correlation matrix of variables.

Table 2. Descriptive statistics of all variables.

	5v5 SSGs	1v1 SSGs	Long HIIT	Short HIIT
Sleep (h)	7.18±1.44	7.07±1.48	7.00±1.38	6.94±1.51
SNQ (A.U.)	1.65±1.23	1.70±1.37	1.38±1.23	1.81±1.36
PRS (A.U.)	5.51±2.30	5.25±2.58	4.84±2.24	5.05±2.44
TMD (A.U.)	96.95±22.72	96.83±25.28	97.31±21.15	99.73±26.67
%HRres (%)	71.04±7.27	65.43±8.78	74.99±6.98	63.86±6.91
RPE (A.U.)	4.86±2.13	6.04±2.14	6.05±2.08	5.14±2.18
PACES (A.U.)	91.90±19.04	92.70±18.44	79.42±20.97	83.18±22.95

Note: SSGs = Small-Sided Games; HIIT = High-Intensity Interval Training; PACES = Physical Activity Enjoyment Scale; SNQ = Standardized Nordic Questionnaire; PRS = Perceived Recovery Status; TMD = Total Mood Disturbance; %HRres = percentage of heart rate reserve; RPE = Rating of Perceived Exertion; A.U.: arbitrary units.

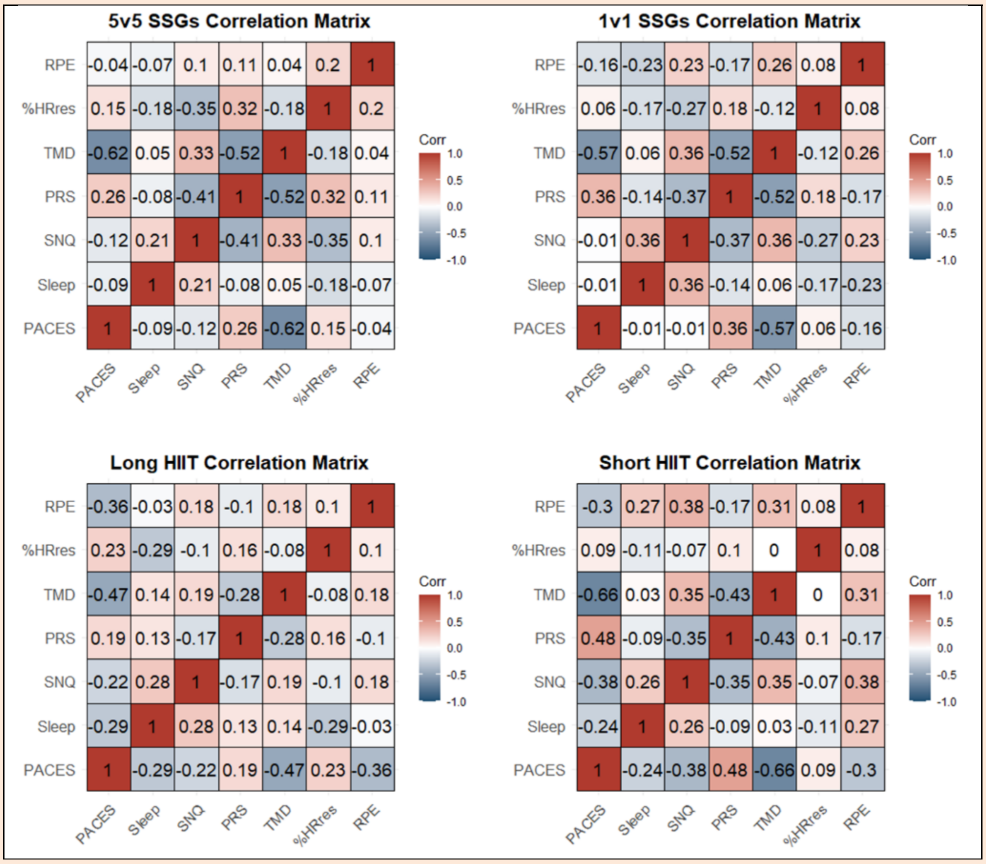

Figure 1. Correlation matrix of variables. Note: SSGs = Small-Sided Games; HIIT = High-Intensity Interval Training; PACES = Physical Activity Enjoyment Scale; SNQ = Standardized Nordic Questionnaire; PRS = Perceived Recovery Status; TMD = Total Mood Disturbance; %HRres = percentage of heart rate reserve; RPE = Rating of Perceived Exertion.

Table 3. Multiple regression results for PACES score.

PACES	5v5 SSGs	1v1 SSGs	Long HIIT	Short HIIT	β (Range)
	B, SE, 95% CI	B, SE, 95% CI	B, SE, 95% CI	B, SE, 95% CI	
Constant	138.88***, 24.60 [89.82, 187.93]	126.01***, 20.57 [84.98, 167.04]	117.58***, 28.44 [60.87, 174.30]	131.23***, 22.56 [86.25, 176.22]	
Sleep (h)	-.997, 1.26 [-3.51, 1.51]	-.854, 1.34 [-3.52, 1.81]	-3.23*, 1.60 [-6.42, -.04]	-2.63, 1.33 [-5.29, .02]	-.07 to -.21,
SNQ (A.U.)	1.95, 1.68 [-1.40, 5.29]	3.96*, 1.58 [.82, 7.11]	-.326, 1.73 [-3.78, 3.13]	-1.06, 1.63 [-4.31, 2.20]	-.06 to .29
PRS (A.U.)	-.592, .96 [-2.50, 1.32]	1.01, .81 [-.61, 2.64]	.583, .96 [-1.33, 2.50]	1.92*, .88 [.16, 3.68]	-.07 to .20
TMD (A.U.)	-.568***, .09 [-.75, -.39]	-.416***, .08 [-.58, -.25]	-.354**, .10 [-.55, -.16]	-.456***, .08 [-.62, -.29]	-.68 to -.36
%HRres (%)	.237, .27 [-.30, .78]	.070, .21 [-.35, .49]	.467, .30 [-.13, 1.07]	.158, .278 [-.40, .713]	.03 to .16
RPE (A.U.)	-.327, .87 [-2.05, 1.40]	-.602, .91 [-2.41, 1.21]	-3.04**, .98 [-4.99, -1.09]	-.414, .99 [-2.38, 1.55]	-.30 to -.04
R^2	.41	.38	.39	.53	
Adjusted R^2	.36***	.33***	.34***	.49***	

Note: Model = "Enter" method in SPSS Statistics; B = unstandardized regression coefficient; CI = confidence interval; LL = lower limit; UL = upper limit; SE B = standard error of the coefficient; β = standardized coefficient; R^2 = coefficient of determination; SSGs = Small-Sided Games; HIIT = High-Intensity Interval Training; PACES = Physical Activity Enjoyment Scale; SNQ = Standardized Nordic Questionnaire; PRS = Perceived Recovery Status; TMD = Total Mood Disturbance; %HRres = percentage of heart rate reserve; RPE = Rating of Perceived Exertion; A.U.: arbitrary units.

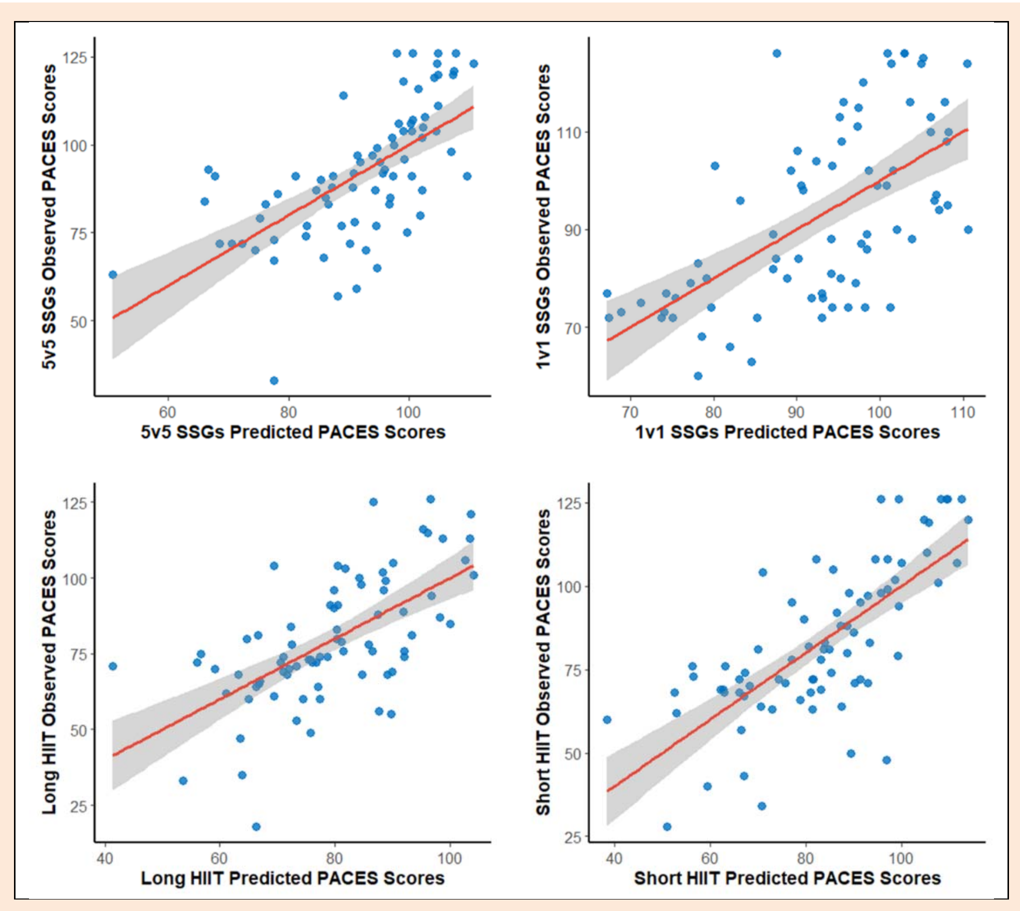

Figure 2. Observed PACES scores vs. predicted PACES scores. Note: SSGs = Small-Sided Games; HIIT = High-Intensity Interval Training; PACES = Physical Activity Enjoyment Scale.

The results of the multiple regression analyses for PACES under different training formats are summarized in Table 3. The overall models were statistically significant across all conditions: 5v5 SSGs: F (6, 70) = 8.095, p < 0.001, R^2 = 0.41, adjusted R^2 = 0.36; 1v1 SSGs: F (6, 70) = 7.260, p < 0.001, R^2 = 00.38, adjusted R^2 = 0.33; Long HIIT: F (6, 70) = 7.474, p < 0.001, R^2 = 0.39, adjusted R^2 = 0.34; Short HIIT: F (6, 70) = 13.092, p < 0.001, R^2 = 0.53, adjusted R^2 = 0.49. These results indicate that the predictors collectively explained a substantial proportion of variance in PACES scores. Figure 2 shows the observed PACES scores vs. the predicted PACES scores.

Figure 3 shows the effect of predictors on PACES scores. Across all conditions, Total Mood Disturbance

(TMD) was consistently a significant negative predictor of PACES (β range: -0.68 to -0.36, $p < 0.001$), suggesting that lower mood disturbance was associated with higher enjoyment. Sleep duration negatively predicted PACES in long HIIT (β = -.21, $p < 0.05$), but was not significant in the other conditions. SNQ emerged as a significant positive predictor of PACES in 1v1 SSGs (β = 0.29, $p < 0.05$), suggesting that players with more musculoskeletal symptoms reported higher enjoyment, a trend not observed in other conditions. PRS significantly predicted PACES in short HIIT (β = 0.20, $p < 0.05$), implying that players with a higher sense of recovery experienced greater enjoyment in this training format. RPE was a significant negative predictor in long HIIT (β = -0.30, $p < 0.01$), indicating that players who perceived higher exertion reported lower enjoyment. This effect was not significant in other conditions. %HRreserve was not a significant predictor in any condition. Overall, the models demonstrated moderate to strong explanatory power.

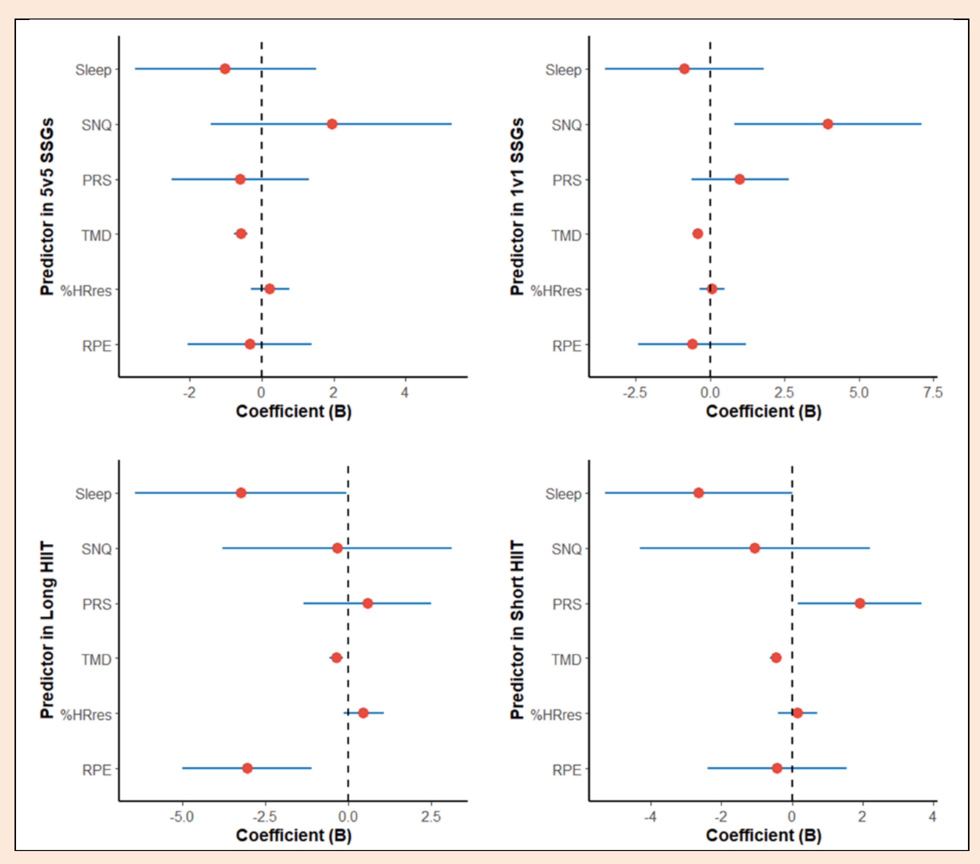

Figure 3. Effect of predictors on PACES scores. Note: SSGs = Small-Sided Games; HIIT = High-Intensity Interval Training; PACES = Physical Activity Enjoyment Scale; SNQ = Standardized Nordic Questionnaire; PRS = Perceived Recovery Status; TMD = Total Mood Disturbance; %HRres = percentage of heart rate reserve; RPE = Rating of Perceived Exertion.

Discussion

This study aimed to investigate the relationship between well-being, exercise intensity, and enjoyment among soccer players across four training formats (5v5 SSGs, 1v1 SSGs, long HIIT, and short HIIT). The findings partially confirmed our hypothesis, as well-being indicators (TMD, PRS, sleep duration, and SNQ) and RPE significantly predicted enjoyment levels. However, %HRreserve was not a significant predictor. The main findings revealed that TMD consistently and negatively predicted enjoyment across all training formats, indicating that lower mood disturbance was associated with higher perceived enjoyment. Additionally, sleep duration negatively predicted enjoyment in long HIIT, musculoskeletal symptoms positively predicted enjoyment in 1v1 SSGs, perceived recovery levels positively predicted enjoyment in short HIIT, and RPE negatively predicted enjoyment in long HIIT.

The consistent negative associations between TMD and enjoyment across all training formats show that players' mood status is dependent on athletes' subjective training intensity. This finding aligns with previous research highlighting the impact of psychological factors on enjoyment in sports (Antonio, 2023; Martín-Rodríguez et al., 2024). Specifically, higher levels of negative mood states, such as tension, depression, and anger, were associated with lower enjoyment suggesting that athletes' emotional well-being is relevant to their perception of training intensity (Selmi et al., 2023) Negative emotional states increase the perception of exertion by influencing central nervous system processing and increasing attentional focus on discomfort rather than on physical exercise engagement (Stults-Kolehmainen and Sinha, 2014; Behrens et al., 2023). Additionally, when athletes experience mood disturbances, it leads to decreased motivation and engagement, which may reduce perceived enjoyment levels

(Martín-Rodríguez et al., 2024). Overall, coaches should prioritize strategies to improve athletes' mood states, such as implementing mindfulness/meditation sessions and ensuring sleep hygiene strategies.

The negative prediction of enjoyment by sleep duration in long HIIT, found in the present study, suggests that insufficient sleep may diminish enjoyment during prolonged high-intensity exercise. This finding is in concordance with studies that have found positive associations between sleep duration and better physical performance and well-being levels (Kirschen et al., 2020; Clemente et al., 2021). Despite previous studies showed that the specific demands of long HIIT, which involves sustained high-intensity effort, might increase the negative effects of sleep deprivation on perceived enjoyment (Alarcón-Gómez et al., 2021; Kong et al., 2024), other studies showed that HIIT sessions result in better enjoyment levels than moderate continuous regimens (Thum et al., 2017; Min et al., 2021). While HIIT is generally associated with higher enjoyment due to its time efficiency and post-exercise affective benefits (e.g., endorphin release), the intensity and duration of individual HIIT sessions may influence this response differently (Saanijoki et al., 2018). That is, studies reporting higher enjoyment for HIIT may have used shorter or lower-intensity intervals, minimizing the impact of sleep duration on affective responses (Min et al., 2021). However, it is important to consider that long HIIT sessions demand sustained high-intensity effort over a prolonged duration, which could increase the physiological and psychological strain on athletes, particularly when sleep is insufficient (Atakan et al., 2021). This increased strain may be exacerbated during long HIIT compared to shorter formats, as players may experience heightened fatigue, greater reliance on anaerobic energy systems, and increased metabolic stress (Valstad et al., 2018), which may increase the negative effects of sleep deprivation on enjoyment (Alnawwar et al., 2023). Additionally, inter-individual differences, such as training status, sleep quality, and psychological resilience, may moderate the relationship between sleep and exercise enjoyment, further contributing to the observed contrasting findings (Dolezal et al., 2017).

Moreover, the present study found a positive association between musculoskeletal symptoms (SNQ scores) and enjoyment in 1v1 SSGs format. This finding contrasts with the general expectation that physical discomfort negatively impacts enjoyment (LaRowe and Williams, 2022). However, while pain and discomfort would be expected to reduce enjoyment, the competitive nature of 1v1 SSGs may have limited the negative impact of musculoskeletal symptoms. This may be due to the highly engaging and competitive nature of 1v1 scenarios, which can enhance psychological stimulation and intrinsic motivation, potentially overriding physical discomfort (Selmi et al., 2020; Baskerville et al., 2024). Athletes may also perceive discomfort as a sign of effort, challenge, or progress, contributing to a sense of accomplishment and greater enjoyment (Martín-Rodríguez et al., 2024).

Furthermore, the positive prediction of enjoyment by PRS scores in short HIIT suggests that athletes who feel well-recovered tend to enjoy short, high-intensity training sessions. This aligns with the understanding that adequate recovery improves physical and psychological readiness (Li et al., 2024). Given that, coaches should emphasize recovery protocols, such as proper nutrition, hydration, and active recovery, to ensure athletes are adequately prepared for high-intensity training. Finally, the present study showed that higher RPE values are associated with lower enjoyment levels during long HIIT. Long HIIT sessions demand sustained efforts at high intensities, which results in higher neuromuscular fatigue and metabolic stress (Fiorenza et al., 2019). As higher RPE values likely indicate greater physical strain, it can reduce positive affective responses and enjoyment (Oliveira et al., 2018). The high metabolic demands of long HIIT may also lead to an increased reliance on anaerobic energy pathways, elevating blood lactate levels and causing discomfort and higher perceived exertion (Jacob et al., 2022), both of which negatively influence enjoyment. For such reasons, coaches should manage exercise intensity to mitigate excessive exertion and maintain athletes' enjoyment during long HIIT sessions.

This study has several limitations that should be acknowledged. The use of self-reported measures, such as the PACES, RPE, PRS, SNQ, and TMD, may introduce potential biases. While validated questionnaires were used, objective measures could complement these findings. The sample was limited to male soccer players from CUFA, which may limit the generalizability of the findings to other populations. Future research should consider including female athletes and athletes from diverse sports and competitive levels. Despite these limitations, this study has some practical implications to acknowledge. The negative impact of TMD on enjoyment levels shows the relevance and the need for implementing mood-regulating techniques, such as mindfulness/meditation sessions. Coaches should also prioritize sleep hygiene, especially before long HIIT, to maintain a good enjoyment level. The positive association between musculoskeletal symptoms and enjoyment levels in 1v1 SSGs suggests that this type of small format can help athletes stay motivated despite the presence of musculoskeletal discomfort. Additionally, managing perceived recovery and adjusting exercise intensity is crucial to prevent fatigue and ensure higher enjoyment levels. However, factors such as individual fitness levels (VIFT), resting and maximum heart rate, and BMI could have influenced how players experienced exercise intensity and enjoyment.

Conclusion

This study demonstrated that TMD was consistently the strongest negative predictor of enjoyment across all conditions. In long HIIT, lower sleep duration and higher perceived exertion were associated with reduced enjoyment. In 1v1 SSGs, greater musculoskeletal symptoms predicted higher enjoyment, while in short HIIT, a higher perceived recovery positively influenced enjoyment. Moreover, individual differences such as athletes' baseline fitness levels, psychological resilience, and coping mechanisms may also influence how mood disturbances or sleep deprivation impact enjoyment, highlighting the need for individualized approaches in training prescription and recovery strategies.

These findings suggest that coaches should effectively program exercise intensity and manage mood and well-being factors to improve players' enjoyment levels and optimize their training process.

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Key points

- Mood disturbance (TMD) consistently predicted lower enjoyment across all training formats, indicating that athletes with better emotional well-being tend to perceive their training as more enjoyable, particularly in relation to training intensity.
- Insufficient sleep negatively impacted enjoyment during long HIIT, while musculoskeletal discomfort was positively associated with enjoyment in 1v1 SSGs. In short HIIT, athletes who felt well-recovered reported higher enjoyment levels.
- Higher perceived effort during long HIIT sessions was linked to lower enjoyment, highlighting the importance of managing training intensity and ensuring recovery to maintain athletes' positive affective responses.

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