Artículo original / Original Article

RELATIONSHIP BETWEEN MOTIVATION, INTENSITY, PERFORMANCE AND PHYSICAL FITNESS IN YOUTH ATHLETES

Relación entre la motivación, la intensidad, el rendimiento y la condición física en jóvenes deportistas

Pedro Sáenz-López Buñuel [1*], Juan Manuel García-Ceberino [2], Sebastián Fierro Suero [1], Anthony S. Leicht [3]

[1] Universidad de Huelva, España. [2] Universidad de Extremadura, España, [3] James Cook University, Australia

*** Correspondence:** psaenz@uhu.es

DOI: 10.17398/1885-7019.21.571

Recibido: 14/02/2025; Aceptado: 04/05/2025; Publicado: 30/12/2025

OPEN ACCESS

Sección / Section:
Social Science Applied to Sport

Editor de Sección / Edited by:
Sebastián Feu
Universidad de Extremadura

Citación / Citation:
Sáenz-López, P., García-Ceberino, J. M., Fierro-Suero, S., & Leicht, A. S. (2025). Relationship between motivation, intensity, performance and physical fitness in youth athletes. *E-balonmano Com, 21*(4), 571-582.

Fuentes de Financiación / Funding:
No funding reported by autor

Conflicto de intereses / Conflicts of Interest:
All authors declare no conflict of interest

Abstract

The intensity of sports training is key to many positive consequences. This study aimed to know how motivation, self-perceived physical fitness, and self-perceived performance correlate with the intensity that young sports people showed in a session. The sample consisted of 79 athletes with ages between 10 and 16. After the right procedure (bioethical) sports people filled out a short questionnaire about their current perceived motivation, and they trained with an inertial device and heart rate monitor, placed on their body, to measure external (Player Load per minute) and internal (heart rate) intensity. They also answered another scale about their contextual motivation, perception of their performance and perception of their physical fitness. The results showed a relationship between both contextual intrinsic and identified motivation with athletes' external intensity, which also correlated with, self-perceived physical fitness and self-perceived performance. Self-perceived physical fitness was 49% predictive of Player Load per minute ($r = 0.71$; $r2 = 0.49$; Cohen's $f2 = 0.96$, large; $RMSE = 0.19$; $F(1,77) = 76.7$; $p < 0.001$). Coaches can influence athletes' motivation to improve external intensity in sports training and their performance.

Keywords: Sports; sport training; self-determination theory; inertial movement unit.

Resumen

La intensidad del entrenamiento deportivo es clave en diversas consecuencias positivas. Este estudio tuvo como objetivo conocer cómo la motivación, la condición física auto-percibida y el rendimiento auto-percibido se correlacionan con la intensidad que los jóvenes deportistas muestran en una sesión. La muestra estuvo compuesta por 79 deportistas con edades comprendidas entre los 10 y los 16 años. Después del procedimiento adecuado (permisos y comisión de bioética), los deportistas rellenaron un breve cuestionario sobre su motivación situacional percibida y entrenaron con un dispositivo inercial, colocado en su cuerpo, para medir la intensidad externa (carga del jugador por minuto) e interna (frecuencia cardíaca). También respondieron otra escala sobre su motivación contextual, percepción de su rendimiento y percepción de su condición física. Los resultados mostraron una relación entre la motivación contextual, intrínseca e identificada con la intensidad externa de los deportistas que también correlacionó con la condición física auto-percibida y el rendimiento auto-percibido. La aptitud física auto-percibida fue un 49% predictiva de la carga de trabajo por minuto del jugador ($r = ,71$; $r2 = ,49$; Cohen's $f2 = ,96$, largo; $RMSE = ,19$; $F(1,77) = 76,7$; $p < ,001$). Los entrenadores pueden influir en la motivación de los atletas para mejorar la intensidad externa en el entrenamiento deportivo y su rendimiento.

Palabras clave: deportes, entrenamiento deportivo, teoría de la autodeterminación, dispositivo inercial de movimiento.

Introduction

The development of young athletes is multifactorial and based upon including physiological, technical, tactical, psychological, or contextual aspects (Abdullah et al., 2016; Gómez-Ruano et al., 2020; Sáenz-López et al., 2005; Sáenz-López et al., 2022). These characteristics are developed differently during unique sports training sessions. Thus, performance, physical fitness, and learning skills in young athletes depends upon the quality of training sessions (Baker et al, 2003). Physical-physiological demands through training intensity critically influences physical fitness (Aschendorf et al., 2018), and ultimately sport performance (Hernandez-Martin et al., 2020). Controlling the physical-physiological demands (i.e., intensity) and tasks during training enables the production of different adaptations (Felipe et al., 2021). Hence, it is necessary for practitioners to measure and value training intensity to improve the overall training adaptations (Barreira el al, 2017).

Training intensities or loads have been classified as either external (eTL) or internal (iTL) (Drew & Finch, 2016) to understand the physical and physiological demands of team sports (Hernandez-Martin et al., 2020; O'Grady et al., 2020. In many studies, the iTL has been measured through heart rate (HR) monitors (Camacho-Cardeñosa et al., 2017; García-Ceberino, 2022; Reina et al., 2019). The eTL has been assessed by distances, speeds, accelerations, etc. (Scott et al., 2013) from microsensors such as inertial measurement units (IMU). These devices include accelerometers, gyroscopes, and magnetometers (García-Ceberino, 2022; Reina et al., 2019) with Player Load (PL) being the most studied for eTL quantification (Gómez-Carmona et al, 2020). Both eTL and iTL have been recorded via IMUs and HR monitors, respectively, within team sports during training and competition (Bastida-Castillo et al, 2018; Calderón-Pellegrino et al., 2022; Schelling, & Torres-Ronda, 2016a) with eTL positively correlated with iTL (McLaren et al, 2018).

The use of technological systems to monitor and manipulate intensity during training and competition has grown (Fox et al., 2017; Vasquez-Bonilla, et al., 2023) as they provide valuable and reliable information for practitioners (Boyd et al., 2011; Chambers et al., 2015). This monitoring can also help with the identification of fatigue, a major contributor to injuries, overtraining (Twist, & Highton, 2013) and psychological stress that can influence optimal performance (Clarke et al, 2013). Fatigue has resulted in reductions of high intensity activities during the latter stages of competitive matches (Camacho-Cardeñosa et al., 2017; Michalsik et al., 2014). While training at a similar or higher intensity to that of competition has been recommended for competition success (Montgomery et al., 2010; Povoas et al., 2012; Reina et al., 2020), many athletes struggle to maintain the same level of commitment during training as they do in competition (Reina et al., 2020), possibly due to motivation (Duque et al., 2022). Motivation, i.e., reasons why people carry out their behaviours and commit to an activity such as sport (Ryan & Deci, 2017) plays a crucial role to engage athletes during training sessions (Claver et al., 2015) with several theories proposed (Núñez & León, 2019).

According to Self-Determination Theory (SDT), one of the most widely used theories to support sports performance, different types of motivation based on the reasons or goals that give rise to an action (Moreno et al., 2007) exist along a continuum ranging from demotivation to extrinsic motivation to intrinsic motivation (Deci & Ryan, 2000). Demotivation is characterized by the lack of intention to take part while extrinsic motivation includes four types of regulations, i.e., external when the reasons are external, introjected due to feelings of guilt, identified by the benefits of the practice, and integrated when it is part of lifestyle (Deci & Ryan, 2000). Finally, intrinsic motivation, which is the most self-determined, occurs when an athlete participates for the mere interest or enjoyment in the activity itself (Lonsdale et al., 2008). As such, it is believed to be closely linked to sustained commitment to sports training.

This continuum can exist within three levels of orientation: global, contextual, and situational (Ryan & Deci, 2017). Núñez & León (2019) explained that global was the most general and stable motivational orientation that was related to the way that a person interacted with the context and, hence, with the personality. The contextual level was the motivational orientation to a specific human activity such as sport, education, or leisure (Núñez & León, 2019) with people usually developing moderately stable kinds of motivation in each context but that could also change over time due to social factors. In this study, contextual motivation refers to the type of motivation athletes have toward soccer or basketball. Finally, according to these authors, the most specific level was situational motivation, which was the concrete orientation of the person experienced during an activity at a given time. This kind of motivation was unstable and could change doing the same activity due to many personal, social, and environmental factors. Although the relationship (i.e., top-down effects) between contextual and situational motivation orientations has been reported in a range of circumstances, very little exists for sports and training (Núñez & León, 2019).

The influence of motivation on athletes' training intensity, particularly in young individuals, and its relationship with variables such as physical fitness and conditioning remains unclear. Gaining a better understanding of this connection could help support athletes and foster a positive attitude that may enhance performance. Thus, this study aimed to identify the relationship between an athlete's training intensity with their situational and contextual motivation, and self-perceived physical fitness, and performance. More specifically, this research aimed to examine whether higher training intensity is positively associated with greater levels of self-determined situational and contextual motivation in athletes; as it was hypothesised that higher training intensity would be positively correlated with increased levels of self-determined situational and contextual motivation in athletes. Secondly, it sought to investigate whether athletes with higher training intensity report greater self-perceived physical fitness and performance, based on the hypothesis that athletes with higher training intensity would report higher self-perceived physical fitness and self-perceived performance. Finally, the study aimed to explore whether athletes' motivation has a predictive or influencing role on both physical fitness and performance, in line with the hypothesis that athletes' motivation would influence both physical fitness and performance. This comprehensive framework would support practitioners in developing performance and success in athletes.

Materials y Methods

Study Design

An empirical study was conducted using a predictive associative strategy (Ato et al., 2013) in a natural sport context without manipulation of the variables by the researchers. Ethical guidelines according to the Declaration of Helsinki of 1975 (World Medical Association, 2022) (with subsequent amendments), and the Organic Law 3/2018 (December 5) were followed with the study approved by the local Research Ethics Committee (Andalusia, Spain, PRX22/00239). All participants and their parents provided written informed consent prior to engaging with the activities of this study.

Participants

The sample was composed of 79 youth athletes (20 females [25.32%] and 59 males [74.68%]) with their ages ranging from 10 to 16 years (M = 14.4; SD = 1.3 years). All participants were involved in competitive sports such as soccer (55; 69.6%) or basketball (24; 30.3%) during 2023 and 2024 for approximately 5 hours a week (M = 4.8; SD = 0.9).

Variables and Instruments

Situational Motivation. The Situational Motivation Scale (SIMS) (Guay et al., 2000) was completed by all participants. The scale consisted of 16 items that assessed intrinsic motivation, identified regulation, external regulation, and demotivation. Each item (e.g., item 1, "because I think this activity is interesting") was responded to by selecting from 1 (totally disagree) to 7 (totally agree) in response to the question: "Why are you doing this task/activity right now?".

Contextual motivation. The Behavioural Regulation in Sport Questionnaire (BRSQ) validated by Lonsdale et al. (2008) was completed by all participants. The questionnaire consisted of 24 items that assessed intrinsic motivation, integrated regulation, identified regulation, introjected regulation, external regulation, and demotivation. Each item (e.g., item 1. "Because I enjoy it", was responded to by selecting from 1 (totally disagree) to 7 (totally agree) to "I practise this sport…").

Training intensities (PL and HR). Playerload (neuromuscular eTL) is the most predictive variable of eTL and was assessed from reliable and validated IMUs (WIMU PROTM, RealTrack Systems-Hudl, USA) (Barreira et al., 2017; Schelling & Torres-Ronda, 2016b) located on the athlete's back (i.e., interscapular area) within a body-fitted vest. Accelerations (>2 m/s2) and decelerations (>2 m/s2) were recorded at 100 Hz and combined to produce a cumulative measure of the rate of change in acceleration (i.e., Playerload per minute). Heart rate was recorded using chest-mounted, GARMINTM monitors (Garmin Ltd., Olathe, KS, USA) sampling at a rate of 4 Hz. Both the IMU and HR devices were synchronized using ANT+ technology.

$$PL_n = \sqrt{\frac{(X_n - X_{n-1})^2 + (Y_n - Y_{n-1})^2 + (Z_n - Z_{n-1})^2}{100}}$$

Self-perception of Physical Fitness or Condition. The International Fitness Scale (IFIS), a 5-item scale, was used to measure self-perception of physical fitness in adolescents (Ortega et al., 2011). This tool requires participants to select from 1 "very poor" to 5 "very good" for each item (e.g., "My general physical fitness is:").

Self-perception of Performance. The Perceived Performance in Sports Questionnaire (PPSQ) was used (Almagro et al., 2020). This scale consists of 5 items (e.g., "I believe my performance is good") with each participant providing a response from 1 "totally disagree" to 5 "totally agree", in response to the question: “Overall, during the Competition:”.

Procedure

Prior to a 1-2 hours standard training session, the research team activated and synchronized the IMU system (WIMU PROTM) as previously described (Gómez-Carmona et al, 2020). Thereafter, participants were fitted with a body-fitted vest harness at the scapular level that housed the IMU and the chest-mounted heart rate monitor. Each participant then rested for 10 minutes followed by completion of all questionnaires.

The training session then proceeded as usual, with the coaches having full control over the design and organization of the training tasks. These included a warm-up, individual and cooperative activities with a ball, and a final game, reflecting a typical training session for these sports. During the session, researchers used S- VI-VOTM v.807 software (RealTrack Systems - Hudl, city, state, USA) to record the timing of each physical training task, excluding periods without motor activity such as hydration breaks or coach feedback. Upon completion of the training session, IMU and HR data were transferred to a laptop for further analysis using S- PROTM v.990 software (RealTrack Systems - Hudl, USA).

Data Analysis

First, the reliability and validity of the scales used was calculated using Cronbach’s alpha and McDonald’s Omega (Hu & Bentler, 1999). Descriptive statistics (means and standard deviations) were calculated for all variables. Univariate relationships amongst all variables were determined via Pearson correlation coefficients (95% confidence interval, CI), while multiple and simple linear regression analysis were performed to identify independent predictors (i.e., situational motivation, contextual motivation, self-perceived physical fitness, and self-perceived performance) of training intensities. All analyses were performed using SPSS (v.29.0; IBM Corp., Armonk, NY, USA) and Jamovi v.2.3 software (The Jamovi Project Jamovi, 2022).

We assessed the distributional assumptions of the variables both visually (through histograms and Q-Q plots) and statistically. The skewness and kurtosis values for all variables were within acceptable thresholds ($|z| < 1.96$), supporting approximate normality. Although some Kolmogorov–Smirnov tests were significant, likely due to the relatively large sample size, the distribution shapes did not exhibit severe deviations from normality.

We also evaluated the presence of potential outliers. Univariate outliers were examined using boxplots, while multivariate outliers were analyzed via Mahalanobis distance, leverage values, and Cook’s distance. Although a small number of cases exhibited higher influence, their impact on the main results was minimal. Therefore, they were retained in the analyses. Sensitivity analyses excluding these cases confirmed the robustness of the results.

Univariate relationships amongst all variables were determined via Pearson correlation coefficients (95% confidence interval, CI), while multiple and simple linear regression analysis were performed to identify independent predictors (i.e., situational motivation, contextual motivation, self-perceived physical fitness, and self-perceived performance) of training intensities. All analyses were performed using SPSS (v.29.0; IBM Corp., Armonk, NY, USA) and Jamovi v.2.3 software (The Jamovi Project Jamovi, 2022).

Results

The descriptives, Cronbach's alpha, and Omega coefficient for variables examined in the study are shown in Table 1.

Tabla 1. Descriptives of situational and contextual motivation, self-perceived physical fitness and performance, and training intensities or loads of one training session.

		M	*SD*	Min	Max	*α*	*ω*
Situational Motivation	Intrinsic Motivation	5.64	1.15	2.00	7.00	0.85	0.87
	Identified Regulation	5.90	0.90	3.75	7.00	0.77	0.79
	External Regulation	4.05	1.69	1.00	7.00	0.89	0.88
	Demotivation	2.45	1.42	0.14	5.75	0.86	0.86
Contextual Motivation	Intrinsic Motivation	6.54	0.47	5.06	7.00	0.54	0.58
	Integrated Regulation	6.36	0.81	1.75	7.00	0.87	0.89
	Identified Regulation	6.33	0.74	4.00	7.00	0.79	0.79
	Introjected Regulation	2.94	1.81	1.00	7.00	0.88	0.88
	External Regulation	1.66	1.05	1.00	5.25	0.87	0.88
	Demotivation	1.50	0.88	1.00	4.50	0.85	0.85
	Self-perceived Performance	3.89	0.85	1.80	5.00	0.90	0.90
	Self-perceived Physical Fitness	3.74	0.60	2.40	4.80		
Training demands eTL							
	PL/min	1.19	0.27	0.71	1.86		
iTL	HR maximum	176	11	138	198		
	HR average	152	12	124	184		

Note. eTL = External training intensity; iTL = Internal training intensity; PL/min = Player Load per minute; HR = Heart Rate; α = Cronbach's Alpha; ω= McDonald's Omega.

Correlations between situational and contextual orientations

Situational intrinsic motivation was positively correlated with situational identified motivation (r = 0.60; 95% CI (0.44 - 0.73); p < 0.001) and, in turn, negatively with situational external motivation (r = - 0.36; 95% CI (-0.54 - (-0.15)); p < 0.01) and situational demotivation (r = -0.42; 95% CI (-0.58 - (-0.22)); p < 0.001). Situational identified motivation was negatively correlated with situational demotivation (r = -0.40; 95% CI (-0.57 - (-0.20)); p < 0.001). Situational external motivation was positively correlated with situational demotivation (r = 0.36; 95% CI (0.15 - 0.54); p < 0.01) and contextual integrated motivation (r = 0.24; 95% CI (0.02 - 0.44); p < 0.05). Situational demotivation was positively correlated with contextual demotivation (r = 0.26; 95% CI (0.04 - 0.45); p < 0.05).

Contextual intrinsic motivation was positively correlated with contextual integrated motivation (r = 0.62; 95% CI (0.47 - 0.74); p < 0.001) and contextual identified motivation (r = 0.77; 95% CI (0.66 - 0.85); p < 0.001). In turn, contextual intrinsic motivation was negatively correlated with situational external motivation (r = - 0.31; 95% CI (-0.50 - (-0.10)); p < 0.01) and contextual demotivation (r = -0.26; 95% CI (-0.46 - (-0.04)); p < 0.05). Contextual integrated motivation was positively correlated with contextual identified motivation (r = 0.71; 95% CI (0.58 - 0.80); p < 0.001) and contextual introjected motivation (r = 0.23; 95% CI (0.01 - 0.43); p < 0.05). Contextual identified motivation was positively correlated with contextual introjected motivation (r = 0.26; 95% CI (0.04 - 0.45); p < 0.05). Contextual introjected motivation was positively correlated with contextual external motivation (r = 0.51; 95% CI (0.32 - 0.66); p < 0.001) and contextual demotivation (r = 0.23; 95% CI (0.01 - 0.43); p < 0.05). Contextual ex-ternal motivation was positively correlated with contextual demotivation (r = 0.59; 95% CI (0.42 - 0.72); p < 0.001).

Correlations between training intensities and types of motivations, and self-perceived physical fitness and performance

The eTL was not correlated (p > 0.05) with any situational motivation variable. In contrast, eTL was positively correlated with contextual intrinsic motivation (r = 0.25; 95% CI (0.03 - 0.44); p < 0.05) and contextual identified motivation.

The eTL was also positively correlated with self-perceived physical fitness (r = 0.71; 95% CI (0.58 - 0.80); p < 0.001) and performance (r = 0.39; 95% CI (0.18 - 0.56); p < 0.001).

There were no correlations (p > 0.05) between iTL (maximum and average HR) and any situational motivation variable. However, maximum HR (r = -0.27; 95% CI (-0.47 - (-0.06)); p < 0.05) and average HR (r = -0.25; 95%CI (-0.45 - (-0.03)); p < 0.05) were negatively correlated with contextual introjected regulator. There were no correlations (p > 0.05) between the iTL variables and self-perceived physical fitness and performance.

Self-perceived physical fitness was not correlated (p > 0.05) with any situational or contextual motivation variable. In contrast, self-perceived performance was positively correlated with contextual identified.

Linear Regression Models: Training intensities

Results for the final multiple linear regression modelling are shown in Table 2, with self-perceived physical fitness a significant (p < 0.001) predictor of PL/min (r = 0.72; r2 = 0.51; Cohen's f2 = 1.04, large; RMSE = 0.19; F(4,74) = 19.15; p < 0.001).

Tabla 2. Coefficients of the regression model analyzed.

					95%CI	
Predictor	**Estimator**	***SE***	***t***	***p***	**Inferior**	**Superior**
Intercept	-0.36	0.33	-1.11	0.27		
Contextual intrinsic	0.04	0.07	0.51	0.61	-0.19	0.32
Contextual identified regulation	0.02	0.05	0.46	0.65	-020	0.31
Self-perceived physical fitness	0.31	0.04	7.11	< 0.001***	0.48	0.86
Self-perceived performance	0.01	0.03	0.32	0.75	-0.16	0.22

Note. SE = Standard Error. * *p* < 0.05, ** *p* < 0.01, *** *p* < 0.001.

Creating simple linear regression models with one predictor variable (drawn from Table 2) and one dependent variable, self-perceived physical fitness was 49% predictive of PL/min (r = 0.71; r2 = 0.49; Cohen's f2 = 0.96, large; RMSE = 0.19; F(1,77) = 76.7; p < 0.001), contextual intrinsic motivation was 6% predictive of PL/min (r = 0.25; r2 = 0.06; Cohen's f2 = 0.06, small; RMSE = 0.26; F(1,77) = 5.01; p = 0.03), contextual identified motivation was 6% predictive of PL/min (r = 0.24; r2 = 0.06; Cohen's f2 = 0.06, small; RMSE = 0.26; F(1,77) = 4.80; p = 0.03), and self-perceived performance was 15% predictive of PL/min (r = 0.39; r2 = 0.15; Cohen's f2 = 0.18, medium; RMSE = 0.25; F(1,77) = 13.6; p < 0.001).

In terms of the iTL, although the simple linear regression modelling analyzed was statistically significant ($r = 0.27$; $r2 = 0.08$; Cohen's $f2 = 0.09$, small; $RMSE = 10.6$; $F(1,77) = 2.24$; $p = 0.02$), contextual introjected motivation was only 8% predictive of maximum HR and the average HR. Although the simple linear regression modelling analyzed was statistically significant ($r = 0.25$; $r2 = 0.06$; Cohen's $f2 = 0.06$, small; $RMSE = 11.8$; $F(1,77) = 5.23$; $p = 0.03$), contextual introjected motivation was only 6% predictive of average HR.

Discussion

The purpose of this study was to analyze the relationship between athlete's training intensity and situational and contextual motivation, physical fitness, and perceived performance. The results indicated a positive correlation between both contextual intrinsic and identified motivation within athletes' external intensity, which also showed a correlation with physical fitness and perceived performance. Psychological factors, such as motivation, help to enhance sports performance because they influence every area of sports training (Abdullah et al., 2016; Duque et al., 2020). For this reason, it is useful to understand the relationship between different types of motivation, especially between situational and contextual ones.

Focusing on sports training, intrinsic motivation has been positively related to training intensity and athlete´s perceived performance (Duque et al., 2022). The more self-determined motivation athletes possess, the more committed they are with undertaking their sports training (Camacho & Almagro-Torres, 2024; Moreno et al., 2007). In the current study, eTL was significantly correlated with contextual intrinsic motivation and contextual identified motivation. Hence, players who enjoyed their sport (intrinsic motivation), and athletes who believed that playing sport gave them some benefits (identified motivation), trained at a higher intensity (i.e., greater distance covered and volume). However, no situational motivation variable was correlated with eTL. This type of motivation can change as a result of many factors (Núñez & León, 2019). For ex-ample, motivation can be altered by the coach's feedback or the activities undertaken during the training session (Balaguer et al., 2012; Sánchez-Sánchez et al., 2014). Situational motivation can be improved through positive feedback or giving more autonomy to athletes (Rampinini et al., 2007). Thus, the training environment produced by the coach can influence athletes' situational motivation. If young athletes perceive a controlling coach-created climate, they may feel thwarted by basic psychological needs and decrease intrinsic motivation (Balaguer et al., 2012). It has been shown that instructional interventions that focused on the SDT improved intrinsic motivation during physical activity contexts (Manninen et al., 2022). Hence, it is important to create a climate in which athletes feel basic psychological needs are satisfied to improve intrinsic motivation (Almagro et al., 2012).

Interestingly, there were no significant correlations between iTL and any situational or contextual motivation variable (except introjected motivation). Heart rate is influenced by several physiological and environmental variables such as fitness level, fatigue or ambient temperature, which may not directly reflect an athlete's motivational state. In introjected motivation, athletes internalize external pressures to perform activities to gain self-esteem or avoid guilt (Camacho & Almagro-Torres, 2024; Moreno et al., 2007). This kind of extrinsic motivation in sports could result in a greater HR and effort by athlete during training (Endo et al., 2023). Social factors, such as the influence of the coach, play an important role in athletes' motivation and may help explain some results (Balaguer et al., 2012). Further studies may elaborate upon the current results to better understand how situational motivation changes during training and the factors that regulate it.

Motivation governs human behaviour in terms of intensity, direction, and persistence during activity or movement (Deci & Ryan, 2000); hence, it significantly influences an athlete's performance (Claver et al., 2015). In the current study, contextual identified motivation, where athletes recognize the value of the sport and usually enhance their own perception of performance (Almagro et al., 2020), was positively correlated with self-perceived performance. Previously, these authors reported that identified motivation was a significant predictor of perceived performance with athletes internalizing the importance of their sport for improved performance. Within the SDT framework, identified motivation was stated as a predictor of positive consequences such as performance, due to the satisfaction of basic psychological needs

(Deci & Ryan, 2000). Particularly, one of these basic psychological needs, perception of competence, allows people to feel mastery and effectiveness in their skills, in this case in sports abilities (Ryan & Deci, 2017; Macías-León et al., 2023). Subsequently, when coaches enable the satisfaction of basic psychological needs, providing autonomy to the athletes, enhancing their perception of competence and offering positive relationships, self-determined motivation may improve (Balaguer et al., 2012) and consequently performance Almagro et al. (2020).

Performance is negatively influenced by mental and physical fatigue with athletes' motivation moderating this relationship during sports training (Brietzke et al., 2021). In the cur-rent study, training intensity (eTL) was positively correlated with self-perceived performance and physical fitness with better perceived physical condition predicting more movement (i.e., eTL) in players during sports training. Similar relationships have been confirmed in other studies involving basketball athletes (Antoranz et al., 20205; Duque et al., 2022) with physical fitness likely driving this outcome (i.e., athletes who have a better perception of physical fitness may feel that they can produce a better performance). Perceived physical fitness and self-efficacy were reported to be positively related due to the confidence that superior physical fitness gives athletes (Larumbe-Zabala et al., 2020). Therefore, athletes may train harder to im-prove their physical fitness because they understand that the physical demands of their competition require a high performance (Hernandez-Martin et al., 2020; Michalsik et al., 2014). Physical fitness, such as aerobic and anaerobic capacities, are key for performance in many team sports with the control of training load crucial (Aschendorf et al., 2018).

While this study has identified important relationships between motivation, and self-perceptions of physical fitness and performance during training, some limitations should be acknowledged. Firstly, the current study was limited by a relatively small sample size of youth athletes and an imbalance in gender distribution and sports. Future investigations with larger and more diverse athletic populations will extend the current results for greater practical application. Secondly, playing positions or roles within team sports were not examined in the current study and may have impacted upon an individual's psychological state. Therefore, future research could explore the influence of player roles on psychological variables, such as motivation, during sports training, could yield further insights into sports performance. Such elaboration could be pivotal in understanding and enhancing performance across a variety of sport contexts.

Conclusions

The current study identified positive associations between contextual intrinsic and identified motivation, and athletes' external training intensity that demonstrated the important role of internal motivational factors in driving higher levels of effort and engagement in training. Additionally, external training intensity, physical fitness, and perceived performance relationships emphasised the importance of training in-tensity to improve self-perceived physical fitness and performance. Finally, the positive correlation between contextual identified motivation and perceived performance highlighted the potential benefits of fostering more autonomous, self-determined forms of motivation amongst athletes. These results underscore the multifaceted nature of the motivational processes that underly sports-related outcomes and contribute to a deeper understanding of the role of motivation in athletic training and performance. Satisfying basic psychological needs such as autonomy, competence and relatedness may enable coaches to enhance athletes' eTL and ultimately performance.

Author Contributions: All authors have contributed equally to this work. All authors have read and approved the published version of the manuscript.

References

Abdullah, M. R., Musa, R. M., Maliki, A. B. H. M. B., Kosni, N. A., & Suppiah, P. K. (2016). Role of psychological factors on the performance of elite soccer players. *Journal of Physical Education and Sport, 16*(1), 170-176. http://dx.doi.org/10.7752/jpes.2016.01027

Almagro, B. J., Sáenz-López, P., & Moreno-Murcia, J. A. (2012). Perfiles motivacionales de deportistas adolescentes españoles. Revista de Psicología del Deporte, 21(2), 223-231. https://archives.rpd-online.com/article/view/782.html

Almagro, B. J., Sáenz-López, P., Fierro-Suero, S., & Conde, C. (2020). Perceived performance, intrinsic motivation and adherence in athletes. *International Journal of Environmental Research and Public Health, 17*(24), 9441. https://doi.org/10.3390/ijerph17249441

Antoranz, Y., Del Campo, J., Durán-Rodríguez, H., Jiménez-Reyes, P. & Jiménez, S.L. (2025). Correlation among repeated sprint ability, vertical force-velocity profile, and 30-15 IFT performance in elite youth basketball players. *E-Balonmano Com Journal Sports Science, 21*(1), 13-26. https://doi.org/10.17398/1885-7019.21.13

Aschendorf, P. F., Zinner, C., Delextrat, A., Engelmeyer, E., & Mester, J. (2018). Effects of basketball-specific high-intensity interval training on aerobic performance and physical capacities in youth female basketball players. *The Physician and Sports Medicine, 4*7(1), 65-70. https://doi.org/10.1080/00913847.2018.1520054

Ato, M., López-García, J. J., & Benavente, A. (2013). Un sistema de clasificación de los diseños de investigación en psicología. *Anales de Psicología, 29*(3), 1038-1059. https://doi.org/10.6018/analesps.29.3.178511

Baker, J., Horton, S., Robertson-Wilson, J., & Wall, M. (2003). Nurturing sport expertise: factors influencing the development of elite athlete. *Journal of Sport Science and Medicine, 2*(1), 1-9. https://pubmed.ncbi.nlm.nih.gov/24616603/

Balaguer, I., González, L., Fabra, P., Castillo, I., Mercé, J., & Duda, J. L. (2012). Coaches' interpersonal style, basic psychological needs and the well-being of young soccer players: A longitudinal analysis. *Journal of Sports Sciences, 30*(15), 1619-1629. http://dx.doi.org/10.1080/02640414.2012.731517

Barreira, P., Robinson, M. A., Drust, B., Nedergaard, N., Raja Azidin, R. M. F., & Vanrenterghem, J. (2017). Mechanical Player Load™ using trunk-mounted accelerometry in football: Is it a reliable, task-and player-specific observation? *Journal of Sports Sciences, 3*5(17), 1674-1681. https://doi.org/10.1080/02640414.2016.1229015

Bastida-Castillo, A., Gómez-Carmona, C. D., Hernández-Belmonte, A., & Pino-Ortega, J. (2018). Validez y fiabilidad de un dispositivo inercial (WIMU PROTM) para el análisis del posicionamiento en balonmano. *E-balonmano Com, 14*(1), 9-16. https://dialnet.unirioja.es/servlet/articulo?codigo=6408741

Boyd, L. J., Ball, K., & Aughey, R.J. (2011). The reliability of MinimaxX accelerometers for measuring physical activity in Australian football. *International Journal of Sports Physiology, 6*(3), 311-321. https://doi.org/10.1123/ijspp.6.3.311

Brietzke, C., Vinicius, Í., Franco-Alvarenga, P.E., Canestri, R., Fagundes, M., Rodrigues, L.E., Viana, B., Meireles, T. & Oliveira, F. (2021). Proof-of-Concept and test-retest reliability study of psychological and physiological variables of the mental fatigue paradigm. International *Journal of Environmental Research and Public Health, 18*(18), 9532. https://doi.org/10.3390/ijerph18189532

Calderón-Pellegrino, G.; Gallardo, L.; Garcia-Unanue, J.; Felipe, J.L.; Hernandez-Martin, A.; Paredes-Hernández, V.; Sánchez-Sánchez, J. (2022). Physical demands during the game and compensatory training session (md + 1) in elite football players using global positioning system device. *Sensors, 22*(10), 3872. https://doi.org/10.3390/s22103872

Camacho, A. & Almagro-Torres, B.J. (2024). Motivational factors, self-esteem and intention to be physically active in sports vocational training students. (2024). *E-Balonmano Com Journal Sports Science, 20*(3), 331-342. https://doi.org/10.17398/1885-7019.20.331.

Camacho-Cardeñosa, M., Camacho-Cardeñosa, A., Martínez-Guardado, I.; Olcina, G., Brazo-Sayavera, J. (2017). Analyses of internal load during an adolescent female handball season. *E-balonmano Com, 13*(1), 69-76.

Chambers, R., Gabbett, T. J., Cole, M. H., & Beard, A. (2015). The use of wearable microsensors to quantify sport specific movements. *Sports Medicine, 45*(7), 1065-1081. https://doi.org/10.1007/s40279-015-0332-9

Clarke, N., Farthing, J. P., Norris, S. R., Arnold, B. E., Lanovaz, J. L. (2013). Quantification of training load in Canadian football: application of session-RPE in collision-based team sports. *The Journal of Strength y Conditioning Research, 27*(8), 2198-2205. https://doi.org/10.1519/JSC.0b013e31827e1334

Claver, F., Jiménez, R., Conejero, M., García-González., L., y Moreno, M. P. (2015). Cognitive and motivational predictors of performance in game actions in young volleyball players. *European Journal of Human Movement, 35*, 68-84. https://www.eurjhm.com/index.php/eurjhm/article/view/361

Deci, E. L., & Ryan, R. M. (2000). The «what» and «why» of goal pursuits: Human needs and the self-determination of behaviour. *Psychological Inquiry, 11*(4), 227-268. https://doi.org/10.1207/S15327965PLI1104_01

Drew, M. K., & Finch, C. F. (2016). The relationship between training load and injury, illness and soreness: a systematic and literature review. *Sports Medicine, 46*(6), 861-883. https://doi.org/10.1007/s40279-015-0459-8

Duque, V. H., Mancha-Triguero, D., Ibáñez-Godoy, S. J., & Sáenz-López, P. (2022). Motivación, inteligencia emocional y carga de entrenamiento en función del sexo y categoría en baloncesto en edades escolares. *Cuadernos de Psicología del Deporte, 22*(2), 15-32. https://doi.org/10.6018/cpd.450341

Duque, V., Reina Román, M., Mancha, D., Ibáñez, S., & Saenz-Lopez, P. (2020). Relación de la carga de entrenamiento con las emociones y el rendimiento en baloncesto formativo (Relation of training load with emotions and performance in formative basketball). *Retos. Nuevas Tendencias en Educación Física, Deporte y Recreación,* (40), 164-173. https://doi.org/10.47197/retos.v1i40.82441

Endo, T.; Sekiya, H.; & Raima, C. (2023). Psychological pressure on athletes during matches and practices. *Asian Journal of Sport and Exercise Psychology, 3*(3), 161-170. https://doi.org/10.1016/j.ajsep.2023.07.002.

Felipe, J.L.; Garcia-Unanue, J.; Gallardo, L.; Sanchez-Sanchez, J. (2021). Tracking Systems Used to Monitor the Performance and Activity Profile in Elite Team Sports. *Sensors, 21*(24), 8251. https://doi.org/10.3390/s21248251

Fox, J., Scanlan, A., & Stanton, R. (2017). A review of player monitoring approaches in basketball: Current trends and future directions. *The Journal of Strength Conditioning & Research, 31*(7), 2021-2029. https://doi.org/10.1519/JSC.0000000000001964

García-Ceberino, J. M., Bravo, A., de la Cruz-Sánchez, E., & Feu, S. (2022). Analysis of Intensities Using Inertial Motion Devices in Female Soccer: Do You Train like You Compete? *Sensors, 22*(8), 2870. https://doi.org/10.3390/s22082870

Gómez-Carmona, C. D., Pino-Ortega, J., & Ibáñez-Godoy, S. J. (2020). Design and validity of a field test battery for assessing multi-location external load profile in invasion team sports. *E-balonmano Com, 16*(1), 23-48. http://ojs.e-balonmano.com/index.php/revista/article/view/509

Gómez-Ruano, M. A., Ibáñez, S. J., & Leicht, A. S. (2020). Editorial: performance analysis in sport. *Frontiers in Psychology, 11*, 611634. https://doi.org/10.3389/fpsyg.2020.611634

Guay, F., Vallerand, R.J., & Blanchard, C. (2000). On the assessment of situational intrinsic and extrinsic motivation: The Situational Motivation Scale (SIMS). *Motivation and Emotion, 24*(3), 175-213. https://doi.org/10.1023/A:1005614228250

Hernandez-Martin, A.; Sanchez-Sanchez, J.; Felipe, J.L.; Manzano-Carrasco, S.; Majano, C.; Gallardo, L.; Garcia-Unanue, J. (2020). Physical demands of u10 players in a 7-a-side soccer tournament depending on the playing position and level of opponents in consecutive matches using Global Positioning Systems (GPS). *Sensors, 20*(23), 6968. https://doi.org/10.3390/s20236968

Hu, L.T., & Bentler, P.M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6*(1), 1-55. https://doi.org/10.1080/10705519909540118

Larumbe-Zabala, E., Esteve-Lanao, J., Cardona, C. A., Alcocer, A. & Quartiroli, A. (2020). Longitudinal analysis of marathon runners' psychological state and its relationship with running speed at ventilatory thresholds. *Frontiers in Psychology, 11*, 545. https://doi.org/10.3389/fpsyg.2020.00545

Lonsdale, C., Hodge, K., Rose, E. A. (2008). The Behavioral Regulation in Sport Questionnaire (BRSQ): Instrument development and initial validity evidence. *Journal of Sport y Exercise Psychology, 30*(3), 323-355. https://doi.org/10.1123/jsep.30.3.323

Macías-León, K., Camacho-Carranza, Ángel, Paramio-Pérez, G., & Almagro, B. J. (2023). Apoyo a la autonomía, necesidades psicológicas y consecuencias motivacionales en jóvenes deportistas. *e-Motion: Revista de Educación, Motricidad e Investigación, 2*1, 45-65. https://doi.org/10.33776/remo.vi21.8076

Manninen, M., Dishman, R., Hwang,Y., Magrum, E., Deng, Y., & Yli-Pipperi, S. (2022). Self-determination theory based instructional interventions and motivational regulations in organized physical activity: A systematic review and multivariate meta-analysis. *Psychology of Sport & Exercise, 62*(2), 102248. https://doi.org/10.1016/j.psychsport.2022.102248

McLaren, S.J., Macpherson, T.W., Coutts, A.J., Hurst, C., Spears, I.R., Weston, M. (2018). The relationships between internal and external measures of training load and intensity in team sports: a meta-analysis. *Sports Medicine, 48*(3), 641-658. doi: https://doi.org/10.1007/s40279-017-0830-z

Michalsik, L.B., Madsen, K., Aagaard, P. (2014). Match performance and physiological capacity of female elite team handball players. *International Journal of Sports Medicine Int J Sports Med, 35*(7), 595-607. https://doi.org/10.1055/s-0033-1358713

Montgomery, P. G., Pyne, D. B., & Minahan, C. L. (2010). The physical and physiological demands of basketball training and competition. *International Journal of Sports Physiology Performance, 5*(1), 75-86. https://doi.org/10.1123/ijspp.5.1.75

Moreno, J. A., Cervelló, E., González-Cutre, D. (2007). Young athletes' motivational profiles. *Journal of Sports Science and Medicine, 6*(2), 172- 179. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3786237/

Núñez, J.L. & León, J. (2019). Testing the relationships between global, contextual, and situational motivation: A longitudinal study of the horizontal, top-down, and bottom-up effects. *Revista Psicodidáctica, 23*(1), 9-16. http://dx.doi.org/10.1016/j.psicod.2017.07.003

O'Grady, C. J., Fox, J. L., Dalbo, V. J., & Scanlan, A. T. (2020). A systematic review of the external and internal workloads experienced during games-based drills in basketball players. *International Journal of Sports Physiology Performance, 15*(5), 603-616. https://doi.org/10.1123/ijspp.2019-0785

Organic Law 3/2018, of 5 December, on the protection of personal data and the guarantee of digital rights (2018). *Boletín Oficial del Estado, 294*, 119788-119857.

Ortega, F.B.; Ruiz, J.R.; España-Romero, V.; Vicente-Rodriguez, G.; Martínez-Gómez, D.; Manios, Y., Béghin, L.; Molnar, D., Widhalm, K.; Moreno, L.A.; Sjöström, M.; & Castillo, M.J. (2011). HELENA study group. The International Fitness Scale (IFIS): usefulness of self-reported fitness in youth. *International Journal of Epidemiology, 40*(3), 701-11. https://doi.org/10.1093/ije/dyr039

Povoas, S. C., Seabra, A. F., Ascensao, A. A., Magalhaes, J., Soares, J. M., & Rebelo, A. N. (2012). Physical and physiological demands of elite team handball. *Journal of Strength and Conditioning Research, 26*(12), 3365-3375. https://doi.org/doi:10.1519/JSC.0b013e318248aeee

Rampinini, E., Impellizzeri, F. M., Castagna, C., Abt, G., Chamari, K., Sassi, S. & Marcora, S. M. (2007). Factors influencing physiological responses to small-sided soccer games. *Journal of Sports Sciences, 25*(6), 659-666. http://dx.doi.org/10.1080/02640410600811858

Reina, M., García-Rubio, J., & Ibáñez-Godoy, S. J. (2020). Training and Competition Load in Female Basketball: A Systematic Review. *International Journal of Environmental Research Public Health, 17*(8), 2639. https://doi.org/10.3390/ijerph17082639

Reina, M., Mancha-Triguero, D., García-Santos, D., García-Rubio, J., & Ibáñez-Godoy, S. J. (2019). Comparación de tres métodos de cuantificación de la carga de entrenamiento en baloncesto. *Revista Internacional de Ciencias del Deporte, 15*(58), 368-382. https://doi.org/10.5232/ricyde2019.05805

Ryan, R., M. & Deci, E. L. (2017). *Self-Determination Theory: basic psychological needs in motivation, development, and wellness*. Guilford Publications.

Sáenz-López, P., Ibáñez, S., Giménez, J., Sierra, A., & Sánchez, M. (2005). Multifactor characteristics in the process of development of the male expert basketball player in Spain. *International Journal of Sport Psychology, 36*(2), 151-171.

Sáenz-López, P., Moncada, J., & Cordero, R. (2022). Relación de la intensidad en los entrenamientos con el rendimiento deportivo, la condición física y variables emocionales (Relationship of intensity in sport training with sports performance, physical fitness and emotional variables). *Retos. Nuevas Tendencias en Educación Física, Deporte y Recreación, 47*, 156–163. https://doi.org/10.47197/retos.v47.94259

Sánchez-Sánchez, J., Luis, J. M., Guillén, J., Martín, D., Romo, D., Rodríguez, A. & Villa, J. G. (2014). Efecto de la motivación del entrenador sobre la carga interna y el rendimiento físico de un juego de fútbol reducido. *Cuadernos de Psicología del Deporte, 14*(3), 169-176. https://doi.org/10.4321/S1578-84232014000300018

Schelling, X. & Torres-Ronda, L. (2016a). An integrative approach to strength and neuromuscular power training for basketball. *Strength & Conditioning Journal, 38*(3), 72-80. https://doi.org/10.1519/SSC.0000000000000219

Schelling, X., & Torres-Ronda, L. (2016b). Accelerometer load profiles for basketball-specific drills in elite players. Journal of Sports Science Medicine, 15(4), 5855–591. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5131211/

Scott, B. R.; Lockie, R. G.; Knight, T. J.; Clark, A. C., Janse de Jonge, X. A. K. (2013). A comparison of methods to quantify the in-season training load of professional soccer players. *International Journal of Sports Physiology and Performance, 8*(2), 195–202. https://doi.org/10.1123/ijspp.8.2.195

The Jamovi Project Jamovi (2022) (Version 2.3) [*Computer Software*]. https://www.jamovi.org

Twist, C., & Highton, J. (2013). Monitoring fatigue and recovery in rugby league players. *International Journal of Sports Physiology Performance, 8*(5), 467-474. https://doi.org/10.1123/ijspp.8.5.467

Vásquez-Bonilla, A. A., Urrutia, S., Bustamante, A., & Romero, J. F. (2023). Control del entrenamiento con datos GPS y medidas subjetivas de fatiga y recuperación en futbolistas hondureños durante un periodo preparatorio para los Juegos Olímpicos de Tokio 2020/2021. *MHSalud, 20*(2). https://doi.org/10.15359/mhs.20-2.3. https://www.redalyc.org/journal/2370/237074466003/html/

World Medical Association (2022). *WMA Declaration of Helsinki – ethical principles for medical research involving human subjects*. https://www.wma.net/policies-post/wma-declaration-of-helsinki-ethical-principles-for-medical-research-involving-human-subjects/