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A Quantitative Study on the Relationship Between Players' Wellness, Mental and Physical Intensity in Youth Football Training in Malta

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Abstract

Effectively managing training intensity is of paramount importance for optimizing the health and performance of elite athletes. However, the existing body of research concerning the relationship between training intensity and wellness status in young football players remains limited. To address this gap, the present study involved a sample of 123 young football players and 8 coaches from the Malta Football Regional Hubs (MFRH) U12/13 and U14 groups. Participation in the study was voluntary, and each age group underwent two training sessions per week. The objective of this study was to investigate the connection between the wellness status, mental and physical intensity of football players, and the planned and perceived mental and physical intensity as reported by the coaches. The main findings revealed a negative association between the pre-training wellness scores of the football players and their perceived exertion of effort (RPE) following training, as well as the coaches' perception of RPE after training. This outcome suggests that coaches did not incorporate the wellness questionnaire into their training planning process. Furthermore, a negative correlation emerged between the football players' perceived RPE after training and their perception of mental fatigue, implying that mental fatigue can arise independently of the physical intensity of training. The study also found a positive correlation between the planned RPE scores reported by the coaches before training and the perceived RPE scores reported by the young football players after training. This indicates that the coaches were effective in both planning and controlling the training intensity. In conclusion, this study underscores the significance of employing wellness questionnaires as a means of managing training intensity in young football players.

Keywords: Coach Perception, Mental Fatigue, Training Intensity, Wellness Status, Youth Football Players

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Malta'da Genç Futbol Antrenmanlarında Oyuncuların Wellness, Mental ve Fiziksel Yoğunluğu Arasındaki İlişki Üzerine Nicel Bir Çalışma

Öz

Elit sporcuların sağlığını ve performansını optimize etmek için antrenman yoğunluğunu etkili bir şekilde yönetmek son derece önemlidir. Bununla birlikte, genç futbolcular arasında antrenman yoğunluğu ile sağlık durumu arasındaki ilişki üzerine yapılan mevcut araştırmalar sınırlıdır. Bu çalışma, Malta Futbol Bölgesel Merkezleri (MFRH) U12/13 ve U14 gruplarından 123 genç futbolcu ve 8 antrenörü içeren bir örneklemi kapsamaktadır. Çalışmaya katılım gönüllülük esasına dayanmaktadır ve her yaş grubu haftada iki antrenman seansına katılmaktadır. Bu çalışmanın amacı, futbolcuların sağlık durumu, zihinsel ve fiziksel yoğunluğu ile antrenörlerin planlanmış ve algılanan zihinsel ve fiziksel yoğunluğu arasındaki bağlantıyı araştırmaktır. Ana bulgular, futbolcuların antrenmandan önceki sağlık puanları ile antrenmandan sonra algıladıkları çaba harcama (RPE) ve antrenörlerin antrenmandan sonra algıladıkları RPE arasında negatif bir ilişki olduğunu ortaya koymuştur. Bu sonuç, antrenörlerin antrenman planlama sürecine sağlık anketini dahil etmediğini göstermektedir. Ayrıca, futbolcuların antrenmandan sonra algıladıkları RPE ile zihinsel yorgunluk algıları arasında negatif bir ilişki ortaya çıkmıştır, bu da zihinsel yorgunluğun fiziksel antrenman yoğunluğundan bağımsız olarak ortaya çıkabileceğini ima etmektedir. Çalışma ayrıca, antrenman öncesi antrenörler tarafından bildirilen planlanmış RPE puanları ile genç futbolcuların antrenmandan sonra bildirdiği algılanan RPE puanları arasında olumlu bir ilişki bulmuştur. Bu, antrenörlerin antrenman yoğunluğunu planlama ve kontrol etme konusunda etkili olduklarını göstermektedir. Sonuç olarak, bu çalışma, genç futbolcularda antrenman yoğunluğunu yönetmek için sağlık anketlerinin kullanılmasının önemini vurgulamaktadır.

Anahtar kelimeler: Antrenman Yoğunluğu, Antrenör Algısı, Genç Futbolcular, Mental Yorgunluk, Wellness Durumu,

Introduction

Football's physical and technical performance has continuously improved (Zhou et al., 2020). Despite the high level of unpredictability in the game, coaches strive to create predictable actions through training sessions (Delgado-Bordonau and Mendez-Villanueva, 2012). New approaches to teaching and learning football, such as game-based training, have emerged to prepare teams for competitive games (Clemente and Rocha, 2013). The development of a player in football is a complex process that involves various factors. According to the Four Corner Model outlined by the English Football Association (FA), a player's development is the interface between technical/tactical, psychological, physical, and social elements of the player's environment (Premier League, 2011, p.7). The Four Corner Model supports the FA's Long Term Player Development (LTPD) model and applies to players between the ages of five and twenty-one. Each of the four factors outlined in the Four Corner Model relies on the other (Oliveira, 2004). Football coaches have long recognized the need for training periodisation to manage athlete fatigue and ensure that all necessary concepts are trained. The annual periodisation training plan divides into more minor phases or sub-sectors, allowing coaches to allocate time and manage fatigue. The preparatory, competitive, and transition phases are the three phases of training, according to Bompa and Haff (2009). For football periodisation, the preparatory phase is further divided into general and specific preparation phases. In contrast, the competitive phase is split into the pre-competitive and competitive phases, as seen in Bompa and Buzzichelli's (2015) model.

An essential part of an athlete's preparation is the annual periodisation training plan, which coaches use to structure their training (Bompa and Buzzichelli, 2015; Issurin, 2010). When planning and implementing training programs, it is essential to consider the game's physical demands and the technical, tactical, and psychological factors that contribute to a player's overall performance. As noted by Oliveira (2004), every action in football requires a decision and a skill that needs specific movements performed by the player's will and emotional states. This underscores the importance of the Four Corner Model in player development, which considers the interplay between technical/tactical, psychological, physical, and social elements of a player's environment. In addition, effective training periodisation can help to ensure that every concept is trained while allowing for fatigue management and super-compensation, as well as reducing the risk of overuse injury (Bompa and Buzzichelli, 2015; Halson, 2014; Raiola and Tafuri, 2015). Tactically integrated approaches like tactical periodisation can also help to adjust the physical intensity in training while achieving the desired tactical outcomes (Delgado-Bordonau and Mendez-Villanueva, 2012). Over time, football coaches have developed different styles and methodologies to fit their philosophies, with tactical periodisation being a relatively new style (Delgado-Bordonau and Mendez-Villanueva,

2012). Tactical periodisation can increase or decrease physical intensity during training, improving performance (Gabbett and Whiteley, 2016). Borg invented the RPE (Rate of Perceived Exertion) scale back in 1970 to determine whether the exercise is "heavy or not" (Borg, 1998, p.29).

Monitoring physical/training intensity is essential for coaches to understand the training or match intensity better and develop recovery strategies for athletes (Coutts et al., 2010; Bourdon et al., 2017). Physical intensity can be internal (biochemical and biomechanical stress on the body) or external (physical work produced by the body). Common methods of monitoring internal intensity include heart rate, oxygen consumption, and rate of perceived exertion, while power output, speed, and GPS are commonly used for external intensity monitoring (Bourdon et al., 2017). Both data types can provide greater insight into training stress and reduce the risk of injury (Borresen and Lambert, 2009; Bourdon et al., 2017). Tactical periodisation was developed by Vitor Frade with the primary intention of training/learning the game of football by representing its reasonable structure. This football structure considers the moments of the game (Delgado-Bordonau and Mendez-Villanueva, 2012). Therefore, tactical periodisation is relevant to this study since it focuses on the relationship between mental and physical intensity in football.

Coaches can monitor physical intensity using GPS and the rate of perceived exertion (RPE) scale (Coutts et al., 2010; Bourdon et al., 2017). While the methods mentioned above are all very valid, this literature review focuses mainly on RPE as it is the most practical and cheapest way to monitor intensity in a valid and reliable method. In fact, RPE is one of the methods used in this study's data collection. Furthermore, the RPE can be utilised as a stand-alone tool to monitor physical intensity (Haddad et al., 2017), allowing coaches to load the athletes accordingly and avoid excessive loading (Alexiou and Coutts, 2008). In addition, it is very understandable and can be used in most physical activities and sports of different ages and genders (Alexiou and Coutts, 2008; Haddad et al., 2017; Coutts et al., 2010). The athlete is presented with the scale approximately thirty minutes after finishing the training session and is asked to rate the workout (Foster et al., 2001).

Football players also require tactical thinking throughout matches and training sessions, as the game's complexity and training vary (Frade, 2003; Delgado-Bordonau and Mendez-Villanueva, 2012). Mental fatigue resulting from prolonged, mentally demanding activity can affect athletes' performance (Smith et al., 2015). Despite the importance of mental fatigue and its influence on player performance, there are gaps in the literature in this area. Mental intensity refers to the demand for mental operations and tasks imposed on an individual's mind by the environment. It can be studied based on intensity, type, duration, and frequency (Mellalieu et al., 2021). Mental effort is not solely a mental load due to task complexity but also the constrained time for task completion (Gaillard, 1993). Training stress involves a combination of physical and mental stress from internal

or external sources (Bompa and Haff, 2009). Mental indicators are more consistent and sensitive than physical ones, so coaches must consider increased psychological and physical fatigue when planning training (Saw et al., 2017; Bompa and Haff, 2009). Football players require high concentration and tactical thoughts during matches and training sessions. The complexity of the game and training varies, and different factors affect the complexity of the session. Mentally demanding and prolonged activity can lead to mental fatigue, hindering intermittent, high-intensity running performance, and even negatively affecting physical performance in intermittent sports. Mental fatigue can also hinder cognitive performance and full-body endurance in active male athletes, suggesting that practitioners consider athletes' mental fatigue to enhance performance (Smith et al., 2015; Slimani et al., 2018).

Training volume and intensity are the two parameters used to calculate training load from a physiological perspective (Coutts et al., 2010). This study proposes the idea of 'mental intensity' as a variable contributing to 'mental load.' Coaches must consider physical and mental fatigue when planning training (Bompa and Haff, 2009). Tools to calculate 'mental intensity' during training sessions should help coaches plan and adjust training (Thompson et al., 2018). Athlete self-reported measures, such as wellness questionnaires, can inform coaches about players' well-being (Taylor et al., 2012; Clemente et al., 2019; Wellman et al., 2019; Buchheit et al., 2013). The concept of well-being involves an individual's role in society and their physical, psychological, spiritual, social, and economic stability (World Health Organization, 2006). In top-level sports, athlete self-report measures are commonly used to monitor recovery, fatigue, training load/stress, and thus overall well-being. The most frequently used method is the wellness questionnaire, administered through questionnaires (Taylor et al., 2012; Clemente et al., 2019; Wellman et al., 2019; Buchheit et al., 2013).

Malone et al. (2017) found moderate relationships between a professional goalkeeper's training load and wellness questionnaire. However, limitations were noted due to technology not measuring diving and jumping and the need for new tools for measuring goalkeeper-specific training load. Saw et al. (2016) found no relationship between objective and subjective measures of athlete well-being, suggesting that both measures should be used. Slimani et al. (2018) found that mental fatigue negatively affects the aerobic and cognitive performance of male endurance athletes and advised athletes to avoid mentally fatiguing tasks before the performance. Smith et al. (2015) also found mental fatigue hinders performance in male athletes during intermittent running protocols. Boccolini et al. (2020) found similar results in football players during small-sided games, but with limitations including sub-elite participants and a small sample size.

While much research has focused on physical intensity and player wellness, less research is available on the mental load imposed on players (Thompson et al., 2018).

While most research on football has focused on the physical intensity that leads to fatigue (Thompson et al., 2018), measuring mental intensity has not been a priority. However, Malone et al. (2017) examined the relationship between a professional goalkeeper's training load and wellness scores. This study is the only one that has investigated the relationship between these two factors.

The main aim of this study is to determine the relationship between players' perceived wellness and physical and mental intensity in football, as well as coaches' planned and perceived physical and mental intensities. This study follows the recommendations of Thompson et al. (2018).

Furthermore, this study validates the Borg CR-100 scale, which measures or plans mental intensity from the athletes' and coaches' perspectives. During the literature search, no studies utilised the CR-100 scale to measure mental intensity in football. Furthermore, no study has measured the mental intensity of an individual or explored the relationship between wellness and mental and physical intensity in football players. Therefore, the main aim of this study is to determine whether a relationship exists between wellness and physical and mental intensity in football.

Materials and Methods

Selecting the Research Method

The research methodology involved selecting a quantitative approach to investigate the potential correlation between a player's well-being and physical and mental intensity. The data collected for these variables was exclusively numerical, indicating the adoption of a quantitative research method.

Participants

This study involved one hundred twenty-three young players and eight coaching staff members from the Malta Football Regional Hubs (MFRH) U12/13 and U14 groups, consisting of two head coaches, two assistant coaches, two goalkeeper coaches, and two physical trainers. Participation in the study was voluntary. Both age groups received two training sessions per week in the evenings, each session typically lasting an hour and a half. Data was collected from all players, including goalkeepers. Table 1 displays the number of participants for each hub and age group.

Table 1

Number of Participants

	Hub 1	
Coaches	**Players U12/13**	**Players U14**
4	41	21
	Hub 2	
4	42	19
	Total	
8	83	40

Setting Up the Field

During the study's design phase, the first author conducted meetings with two UEFA PRO coaches, one of whom holds a Ph.D. These coaches provided valuable assistance in framing the study and addressing relevant practical issues. Additionally, a football fitness coach with an MSc in Strength and Conditioning provided support. During these meetings, the fitness coach outlined the data he regularly collects from players and how and when he collects it, offering insight into the timing and method of data collection. The fitness coach also recommended a pilot test week for the initial data collection to ensure more accurate and reliable results, as many players were unfamiliar with the data input process. Additionally, the UEFA PRO coach with a Ph.D. aided in designing questionnaires for players and coaches, ensuring their clarity and efficiency.

Entry into the Field

At the outset of this study, a letter seeking permission to conduct the research was sent to the coordinator of the Malta Football Regional Hubs. Upon receiving consent, a meeting was held with all the participating players to provide them with a detailed overview of the study and the data collection process. The players were also allowed to ask questions regarding the research, which were addressed appropriately. Additionally, an instructional video was sent to parents/guardians and coaches to clarify the study's nature and the participants' role. Furthermore, this video served as a reference in case any issues or queries arose. Finally, a mobile app already used by the Malta Football Regional Hubs was utilized for communication between the researcher, players/parents/guardians, and coaches.

Subsequently, the participants were given an information letter to keep, along with a consent form to sign (see Appendices 1, 2, 3, and 4). All players and coaching staff consented to participate in the study, and the parents/guardians of each underage player also offered their consent. The players themselves also gave their consent to participate.

Data collection method

For this study, the RPE scale (CR-10) developed by Borg (1982) was employed to collect data on the physical intensity of individual sessions and entire days. In addition, the Borg CR-100 scale (Borg, 1998) was utilized to gather information on the mental intensity of each session and the whole day. Finally, the players' wellness was assessed using the wellness questionnaire developed by McLean et al. (2010), both before and after each session.

Data Collection Tools

In this study, the Borg CR-10 scale (Borg, 1982) was selected to collect data on physical intensity. The Borg CR-10 scale was deemed suitable for this study due to its versatility, simplicity, and cost-effectiveness. In addition, the scale is designed to measure intensities across various sports and is applicable for use across genders and age groups (Alexiou and Coutts, 2008; Haddad et al., 2017; Coutts et al., 2010). Hence, it was considered an appropriate choice for the current investigation.

The Borg CR-100 scale (Borg, 1998) was chosen due to its ability to measure an individual's effort experience and is commonly used to measure stress experiences (Borg, 2004). Despite the lack of studies that utilized this scale to measure mental intensities, Molander et al. (2013) suggest that it can be used to study the relationship between cognitive and motor processes, while Borg and Borg (2019) claim that it can measure the difficulty of mental tasks and understanding of instructions. Therefore, the Borg CR-100 scale was deemed suitable to measure mental intensity throughout the players' day and training session, indicating the mental load the coaching staff intends to impose on the players.

The third instrument selected for this study was the wellness questionnaire developed by McLean and colleagues (2010). Research suggests that this questionnaire is a highly effective data collection tool for team sports due to its low cost and ease of administration (McLean et al., 2010; Halson, 2014; Saw et al., 2016). In addition, some studies indicate that it may be more reliable than other monitoring methods (Saw et al., 2016; Thorpe et al., 2016). Thus, this questionnaire was deemed suitable for assessing each player's wellness before and after the training session.

Data Collection Process

From January 25th to February 28th, 2022, nine training sessions were conducted per age group twice a week unless training was cancelled. The sample size included 40 U14 players and 83 U12/13 players, accompanied by their coach, assistant coach, physical trainer, and goalkeeper coach. Before the commencement of the training program, a pilot test week was conducted, as

advised by the football fitness coach (Section 3.5), to ensure familiarity with the questionnaire and address any questions. The questionnaire was administered pre, post, and the day after each session to the players, while the coaches completed it pre- and post-session only. Tables 2 and 3 provide a detailed summary of the number of sessions in which each coach and player participated and filled out the questionnaire.

Table 2

Coaches' Data Set

	Hub 1 U12/13		Hub 1 U14		Hub 2 U12/13		Hub 2 U14		
	Pre	Post	Pre	Post	Pre	Post	Pre	Post	Total inputs
HC	9	9	9	9	9	9	9	9	72
AC	9	9	9	9	9	9	9	9	72
GKC	9	9	9	9	9	9	9	9	72
PT	9	9	9	9	9	9	9	9	72
Total inputs	36	36	36	36	36	36	36	36	288

HC-Head coach, AC-Assistant coach, GKC-Goalkeeper coach, PT-Physical trainer, Pre-before the session, and Post-after the session.

Table 3

Players' Data Set

	Hub 1 U12/13			Hub 1 U14			Hub 2 U12/13			Hub 2 U14			
	Pre	Post	DA	Pre	Post	DA	Pre	Post	DA	Pre	Post	DA	Total
Player	9	9	9	9	9	9	9	9	9	9	9	9	108

**DA-Day after*

The players and coaches were reminded each time to complete the questionnaire. Indeed, a message was sent with the link to the questionnaire and a timetable (Figure 11), thereby guiding them about when they needed to input their answers. This reminder was sent through the communication app already utilised by the Malta Football Regional Hubs.

Before the session	After the session	The day after the session
Between 2pm and 6pm	Between 5pm and 10pm	Between 5am and 10am

Figure 1. Player and Coach Timetable

Before the Session

Before the session, we collected data that could indicate the players' day at school regarding their mental state since they study core subjects like Maltese, English, and Mathematics. Further, necessary data was associated with their physical state since they have physical education lessons and extracurricular activities. we also needed data about their mood, stress, how they slept, if they were fatigued, and if they were sore.

Therefore, before the session, the players completed the wellness questionnaire (Mclean et al., 2010), the CR-100 (Borg, 1998) for mental intensity, and the CR-10 (Borg, 1982) for physical intensity. The players also gave the position they played with their respective clubs during their last game.

Meanwhile, before the session, the coaches completed the CR-100 (Borg, 1998) for mental intensity and the CR-10 (Borg, 1982) for physical intensity, according to how much they planned the session to be physically and mentally hard or easy.

After the Session

After the training session, the players filled in the CR-100 (Borg, 1998) for mental intensity and the CR-10 (Borg, 1982) to rate their perceived physical exertion of the session. The players further indicated their position during training and how much they learned.

The coaches completed the CR-100 (Borg, 1998) for mental intensity and the CR-10 (Borg, 1982) for physical intensity according to how much they perceived the players to have worked physically and mentally. The coaches also indicated how much they think the players learned.

The Day after the Session

The day after the session, the players completed only the wellness questionnaire (Mclean et al., 2010). This was done because we wanted to gather data on the effect of the session mentally and physically the day after. Unfortunately, here the coaches did not fill out any questionnaires.

Table 4

Variables Assessed in This Study

Before the session	After the session	Day after the session
Wellness - Fatigue	Player - RPE	Wellness - Fatigue
Wellness – Sleep	Player - RPME	Wellness – Sleep
Wellness – Soreness	Player – Learn	Wellness – Soreness
Wellness – Stress	Coaches - RPE	Wellness – Stress
Wellness - Mood	Coaches - RPME	Wellness - Mood
Wellness - Total	Coaches – Learn	Wellness - Total
Player - RPE	Integer 1	
Player - RPME	Integer 2	
Coaches - RPE	Integer 3	
Coaches - RPME	Integer 4	

Integer 1: *Player perceived (post-session) RPE (CR-10) – Head coach perceived (post-session) RPE (CR-10),* ***Integer 2:*** *Player perceived (post-session) RPE (CR-10) – Assistant coach perceived (post-session) RPE (CR-10),* ***Integer 3:*** *Player perceived (post-session) RPE (CR-10) – Physical trainer perceived (post-session) RPE (CR-10),* ***Integer 4:*** *Player perceived (post-session) RPE (CR-10) – Goalkeeper coach perceived (post-session) RPE (CR-10)*

Data Analysis

This study utilised a descriptive correlational design, thereby enabling us to determine the different variables and establish whether a relationship exists. The data met the normal distribution assumptions. Physical and mental training load was not measured, but only the intensity of both variables was considered. The difference between the coaches' planned and perceived intensity, was calculated for both the mental and physical. Meanwhile, the five wellness factors were calculated in total, as suggested by Mclean et al. (2010), and were also taken into account individually. PSPP was used as a statistical analysis software for sampled data to assess the relationship between the variables. A bivariate correlation test was also performed to determine existing relationships between the variables outlined in Table 7. The outcome produced by PSPP indicated the significance, whether a positive or negative relationship and the strength of that relationship.

Ethical Considerations

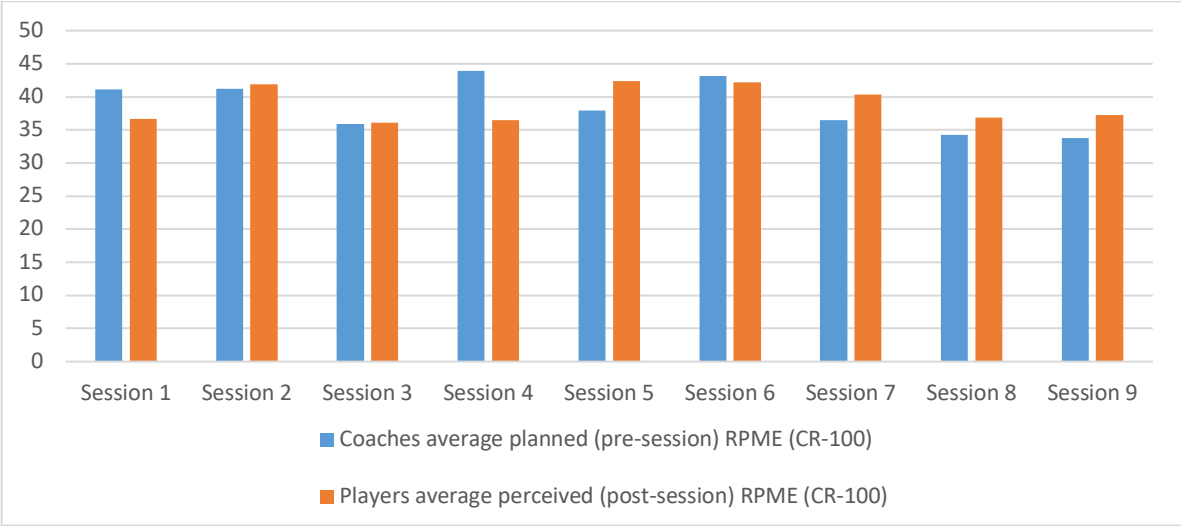
Following a statement of intent, ethical clearance was obtained from the Malta College of Arts, Science, and Technology (MCAST) Ethics Committee.

Results

Descriptive Analysis

Coaches' average planned (pre-session) RPME (CR-100) vs. players' average perceived (post-session) RPME (CR-100)

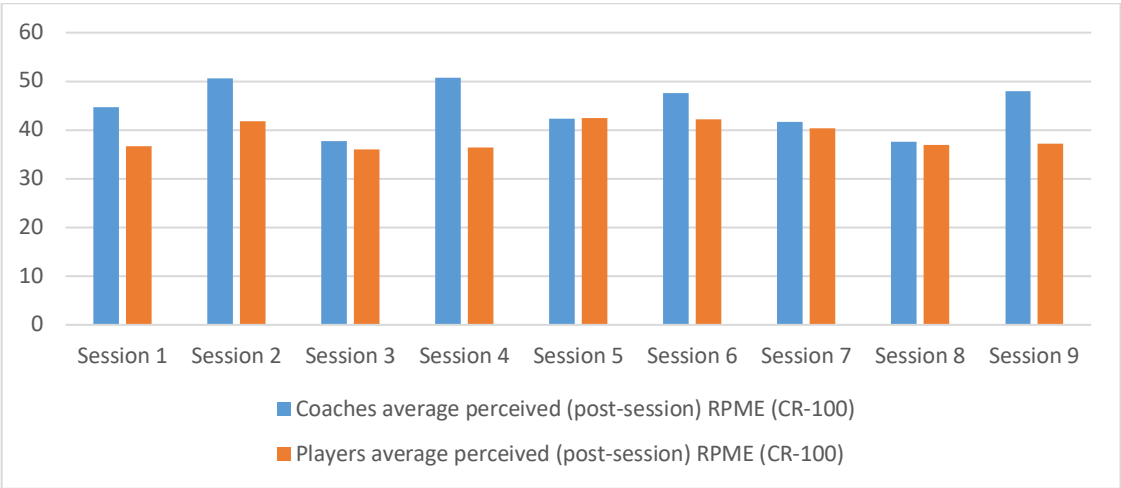
The coaching staff's average perceived (post-session) RPME and the players' average perceived (post-session) RPME are shown in Figure 12. When observing the graph, one can notice that, except for session three, the coaches' planning and players' perception of mental intensity varied. Therefore, further statistical testing was done in the form of a bivariate correlation to test this relationship.



Coaches' average perceived (post-session) RPME (CR-100) vs. players' average perceived (post-session) RPME (CR-100)

Figure 2. Coaches' average planned (pre-session) RPME (CR-100), compared with the players' average perceived (post-session) RPME (CR-100)

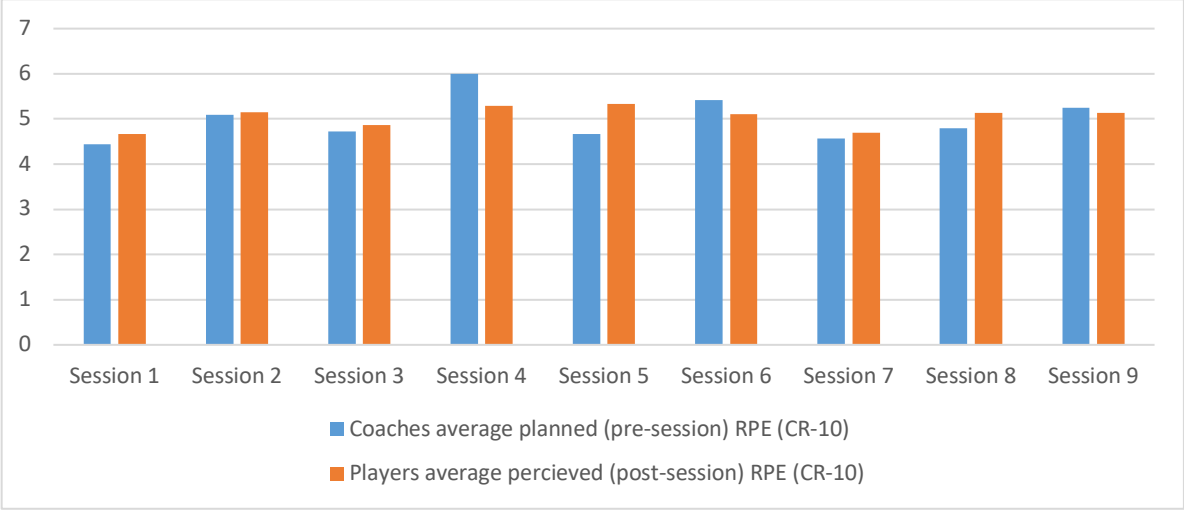
Regarding the coaches' perceived (post-session) RPME, as seen in Figure 13, the coaches always perceived the players as working harder mentally than the players felt during the sessions, except for session five. The coaches' lowest perceived (post-session) RPME average was in sessions three and eight, with thirty-seven, while the highest was in sessions two and four, with fifty, with an overall average of forty-four.



Coaches' average planned (pre-session) RPE (CR-10) vs. players' average perceived (post-session) RPE (CR-10)

Figure 3. Coaches' Average Perceived (post-session) RPME (CR-100), Compared with the Players' Average Perceived (post-session) RPME (CR-100)

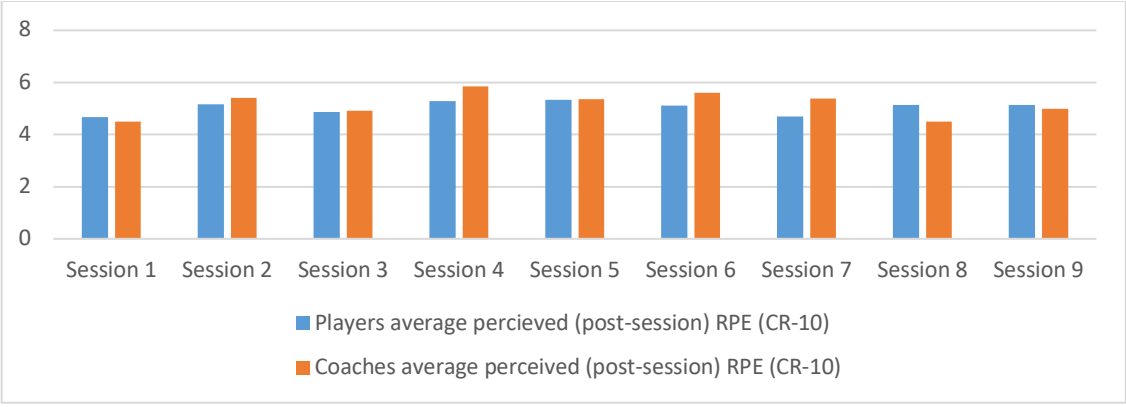
The coaching staff's planned (pre-session) RPE and the players' perceived (post-session) RPE are graphed in Figure 14. Throughout all the sessions, the coaches' planning matched the players' perception of the session. Nevertheless, this is not the case in session four, where the coaches planned the session to be a six RPE, while the players perceived the session to be a five RPE. Except for session four, all the sessions were planned and perceived as either a four or five, which is a solid or heavy session according to the CR-10 scale by Borg (1982).



Coaches' average perceived (post-session) RPE (CR-10) vs. players' average perceived (post-session) RPE (CR-10)

Figure 4. Coaches' Average Planned (pre-session) RPE (CR-10), Compared with the Players' Average Perceived (post-session) RPE (CR-10)

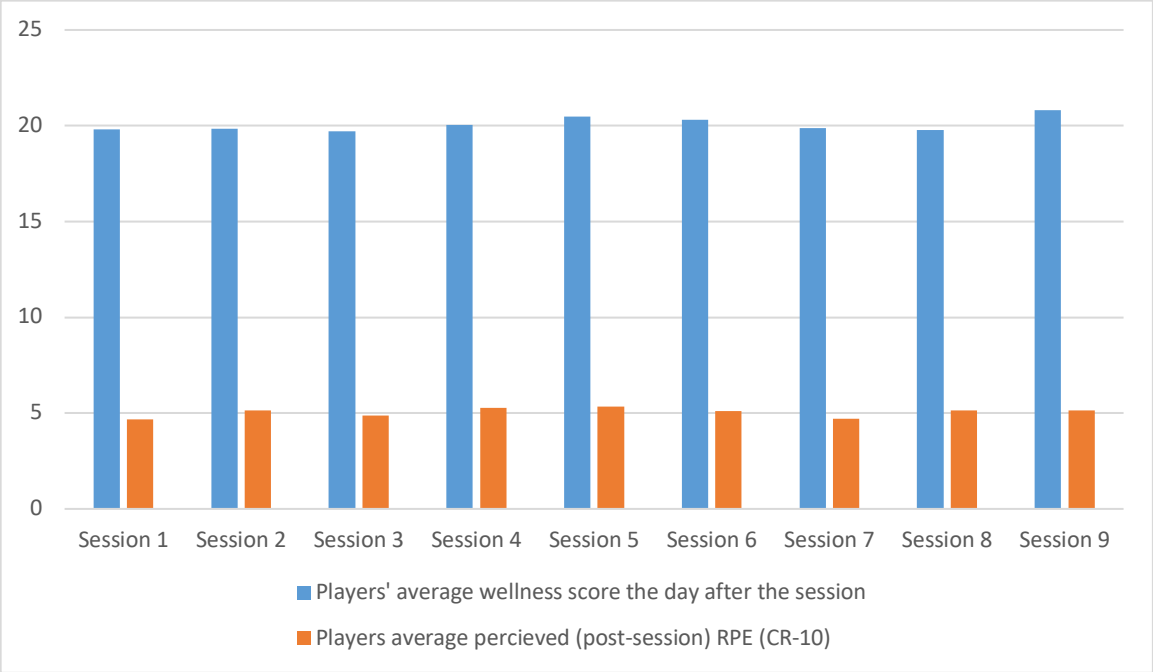
When comparing the players' average perceived (post-session) RPE with the coaches' average perceived (post-session) RPE (Figure 15), it can be noticed that in sessions four, six, seven, and eight, the coaches' perceived intensity did not match that of the players.



Players' average perceived (post-session) RPE (CR-10) vs. players' average total wellness score of the day after the session

Figure 5. Coaches' Average Perceived (post-session) RPE (CR-10), Compared with the Players' Average Perceived (post-session) RPE (CR-10)

From Figure 16, one can see that the average total wellness scores on the day after the session are excellent when compared to the players' average perceived (post-session) RPE, considering that the players perceived all the sessions as a four or five intensity on the CR-10 scale, which is rated as a heavy session (Borg, 1982).



Players' total wellness scores (pre-session) vs. the difference between the players' perceived (post-session) RPE (CR-10) and the coaches' perceived (post-session) RPE (CR-10)

Figure 6. Players' Average Total Wellness Scores the Day After the Session Compared with The Players' Average Perceived (post-session) RPE (CR-10)

We hypothesised that players' total wellness score (pre-session) significantly impacts the difference between coaches' perceived RPE (post-session) and players' perceived (post-session) RPE. This hypothesis follows Gallo et al. (2015) 's suggestion that coaches should know the condition of their players before planning the session, thus also knowing what to expect in terms of intensity from certain players.

To test this, the first author determined the difference between the players' and coaches' perceived (post-session) RPE scores (listed as INT for each coach). This difference was then compared to the players' total wellness scores (pre-session). When compared, it resulted in negative

correlations, with the head coach (INT1) (r=-.187), with the assistant coach (INT2) (r=-.269), with the physical trainer (INT3) (r=-.231), and with the goalkeeper coach (INT4) (r=-.311). This is illustrated in Figure 12.

Table 5

Players' Total Wellness Score (Pre-Session) Correlated with the Difference between the Players' Perceived (post-session) RPE (CR-10) and the Coaches' Perceived (post-session) RPE (CR-10)

Variables	1	2	3	4
1) INT1	1			
2) INT2	0.92**	1		
3) INT3	0.93**	0.95**	1	
4) INT4	0.91**	0.95**	0.92**	1
5) Wellness	-0.18**	-0.26**	-0.23**	-0.31**

Correlation is significant at p<0.01,* ***Integer 1: *Player perceived (post-session) RPE (CR-10) – Head coach perceived (post-session) RPE (CR-10),* ***Integer 2:*** *Player perceived (post-session) RPE (CR-10) – Assistant coach perceived (post-session) RPE (CR-10),* ***Integer 3:*** *Player perceived (post-session) RPE (CR-10) – Physical trainer perceived (post-session) RPE (CR-10),* ***Integer 4:*** *Player perceived (post-session) RPE (CR-10) – Goalkeeper coach perceived (post-session) RPE (CR-10)*

These findings show that when the players' total wellness scores (pre-session) were high, the discrepancy between the players' and coaches' perceived (post-session) RPE was small, while when the players' total wellness scores were low, this discrepancy was huge. Therefore, it could be the case that the coaches' perceptions in this particular study are total assumptions because the wellness questionnaire was not utilised to inform session planning accordingly, thus leading the coaches to assume that the players are fresh and ready to endure a heavy session. So, these findings may suggest using the wellness questionnaire to plan the physical intensity of the session according to the players' level of wellness (Gallo et al., 2015).

The players' total wellness score (pre-session) was negatively correlated (r=-.182) to the players' perceived (post-session) RPE (Figure 13). This confirms the result above because if the player's total wellness (pre-session) is high, the player will go for the session fresh, thus perceiving the session as not that hard. Conversely, if the player's total wellness score (pre-session) is low, the player is most likely tired and would feel the session is tough. This confirms Ungureanu et al. (2021) 's finding that the wellness of the athlete pre-session influences the internal training load (RPE x duration of the session).

Table 6

Players' Total Wellness Score (pre-session) Correlated with the Players' Average (post-session) RPE (CR-10)

Variables	Wellness
Players' Perceived CR10	-0.18**

***Correlation is significant at p<0.01*

Players' perceived (post-session) RPE (CR-10) vs. players' perceived (post-session) RPME (CR-100)

One of my hypotheses was that players' perceived (post-session) RPE is significantly positively related to players' perceived (post-session) RPME. This hypothesis stems from the thought that if the player is working hard physically in the session, any mental effort is perceived as challenging due to the complexity and constrained time in which the task, in this case, an exercise in training, has to be performed (Gaillard, 1993).

When comparing the players' perceived (post-session) RPE and the players' perceived (post-session) RPME (Figure 14), the hypothesis was not confirmed, as the bivariate correlation test did not show significance (r=-.022, p=.586) between the two variables.

Therefore, whether the session's level of intensity is low or high, data shows, it had nothing to do with how the players feel mentally. It could be the case that the exercises in training were not that complex or constrained with time to induce mental effort.

Table 7

Players' Perceived (post-session) RPE (CR-10) Correlated with the Players' Perceived (post-session) RPME (CR-100)

Variables	Players' Perceived CR100
Players' Perceived CR10	-0.02

Players' perceived (post-session) RPE (CR-10) and RPME (CR-100) vs. players' learning perception

Two other hypotheses stated that players' perceived (post-session) RPE is significantly negatively related to players' learning perception, and that players' perceived (post-session) RPME is significantly positively associated with players' learning perception (post-session). To test these hypotheses, the three variables were compared (Figure 15).

It transpired that these hypotheses were not confirmed either. Instead, the players' average perceived (post-session) RPE positively correlated with learning perception (r=.168), meaning that the players learn more with higher physical intensity. One could say this is possible since the players worked so hard physically that they might think they have learnt a lot, despite that not being the case.

On the other hand, the players' perceived (post-session) mental intensity is not correlated with learning perception (r=-.009). Again, another hypothesis was not confirmed. It is thus right to

deduce that the way players perceive the session for mental intensity has nothing to do with their perceived learning.

Table 8

Players' Perceived (post-session) RPE (CR-10) and RPME (CR-100) Correlated with the Players' Learning Perception

Variables	1	2	3
1) Player Perceived CR10	1		
2) Player Perceived CR100	-0.02	1	
3) Player Learning Perception	0.16**	-0.09	1

***Correlation is significant at p<0.01*

Comparing all the coaches' planned (pre-session) RPE (CR-10)

Building on Sciortino (2020) 's study of the relationship between the coach and physical trainer's predicted session physical load (volume x intensity; Coutts et al., 2010), we were intrigued to check whether a relationship exists between all the coaches' planned (pre-session) RPE.

As can be seen in Figure 16, when compared, all the coaches' planned (pre-session) RPE have significantly (p=.000) and positively correlated (r=.859, r=.837, r=.796, r=.869, r=.916, and r=.852). This means that the coaches most agreed when seeing the session plan regarding how physically complex the session would be, confirming Sciortino (2020) 's study.

Table 9

Correlating all the Coaches' Planned (pre-session) RPE (CR-10)

Variables	1	2	3
1) CO1 Planned CR10	1		
2) CO2 Planned CR10	0.85**	1	
3) CO3 Planned CR10	0.87**	0.86**	1
4) CO4 Planned CR10	0.79**	0.91**	0.85**

***Correlation is significant at p<0.01; CO1 – Head coach, CO2 – Assistant coach, CO3 – Physical trainer, CO4 – Goalkeepers coach*

The coaches' planning had a further significant (p=.000) and positive correlation (r=.687 head coach, r=.711 assistant coach, r=.744 physical trainer, r=.356 goalkeeper coach) with the players' perceived (post-session) RPE (Figure 17). Therefore, the coaches' planned (pre-session) RPE of the session was mainly similar to the players' perceptions (post-session). This question always intrigued us whether the intensity that coaches plan is genuinely reflected in the players' perceptions. However, this result confirms that the coaches, if they truly understand what each number of the CR-10 scale represents, can most of the time plan the session according to the intensity they desire, thus confirming Sciortino (2020) 's findings. However, we believe this also depends on the country and the past experiences of the coach. Some countries might see the intensity differently, which would warrant a study in its own right.

Table 10

Correlating all the Coaches' Planned (pre-session) RPE (CR-10) with the Players' Perceived (post-session) RPE (CR-10)

Variables	1	2	3	4
1) CO1 Planned CR10	1			
2) CO2 Planned CR10	0.85**	1		
3) CO3 Planned CR10	0.83**	0.86**	1	
4) CO4 Planned CR10	0.79**	0.91**	0.85**	1
5) Player Perceived CR10	0.66**	0.71**	0.74**	0.35**

***Correlation is significant at p<0.01; n_1=641, n_2=478, n_3=460, n_4=202, n_5=496; CO1 – Head coach, CO2 – Assistant coach, CO3 – Physical trainer, CO4 – Goalkeepers coach*

Correlating all the coaches' planned (pre-session) RPME (CR-100).

With the same intention as Sciortino (2020) 's study to study the relationship between the coach and physical trainer's predicted session physical load (volume x intensity; Coutts et al., 2010), We were interested to find out if there is a relationship between all the coaches' planned (pre-session) RPME.

When comparing all the coaches' planned (pre-session) RPME, one can notice from Figure 18 that some were significantly (p=.000) positively correlated, namely, the head coach with the goalkeeper coach (r=.569), an assistant coach with the physical trainer (r=.296) and goalkeeper coach (r=.621), and physical trainer with goalkeeper coach (r=.476). Conversely, others were not correlated: the head coach with the assistant coach (p=.072, r=.082) and the physical trainer (p=.230, r=.056). Unlike physical intensity, where coaches agreed on the session's intensity most of the time, this was not the case for mental intensity. This could indicate that the mental intensity concept is new to the coaches.

Table 11

Correlating all the Coaches' Planned (pre-session) RPME (CR-100)

Variables	1	2	3	4
1) CO1 Planned CR100	1			
2) CO2 Planned CR100	0.08	1		
3) CO3 Planned CR100	0.050	0.29**	1	
4) CO4 Planned CR100	0.56**	0.62**	0.47**	1

***Correlation is significant at p<0.01; n_1=641, n_2=483, n_3=458, n_4=212, CO1 – Head coach, CO2 – Assistant coach, CO3 – Physical trainer, CO4 – Goalkeepers coach*

Although the coaches disagreed when planning, when compared to the players' perceived (post-session) RPME scores, all the coaches' scores, were significantly (p=.000) positively correlated (r=.275 for the head coach, r=.161 for the assistant coach, r=.202 for the physical trainer, and r=.282 for the goalkeeper coach) as seen in Figure 19. This finding is exciting now. There is something that possibly shows us that the players can feel this concept of mental intensity, despite

perhaps arguing that the result is not genuinely reliable since the players are doing this for the first time. Although the coaches did not all agree with each other, the players felt the session's mental intensity as the coaches had planned it, which further strengthens Mellalieu et al. (2021) 's suggestion to further study mental intensity through the intensity, type, duration, and frequency with which it is placed on the athlete.

Table 12

Correlating all the Coaches' Planned (pre-session) RPME (CR-100) with the Players' Perceived (post-session) RPME (CR-100)

Variables	1	2	3	4
1) CO1 Planned CR100	1			
2) CO2 Planned CR100	0.85**	1		
3) CO3 Planned CR100	0.83**	0.86**	1	
4) CO4 Planned CR100	0.79**	0.91**	0.85**	1
5) Player Perceived CR100	0.66**	0.71**	0.74**	0.35**

***Correlation is significant at p<0.01; n_1=641, n_2=483, n_3=458, n_4=212, n_5=496; CO1 – Head coach, CO2 – Assistant coach, CO3 – Physical trainer, CO4 – Goalkeepers coach*

Players' factors of wellness scores (pre-session) vs. players' perceived (pre-session) day RPME (CR-100)

When comparing all the players' factors of wellness scores (pre-session) with the players' perceived (pre-session) day's RPME going into the session, two significant (p=.000) negative correlations emerged (Figure 20), namely mental intensity with fatigue (r=-.166) and mental intensity with stress (r=-.140). This means that whenever the mental intensity of the players' day was high, fatigue and stress were rated as low, thus signalling that the player was tired or stressed. We opine that this is a fascinating finding as it is beginning to show that mental intensity has to do with stress, which is a critical mental component, and with feeling tired (fatigue).

Therefore, although this has never been applied to a sport setting to measure and plan the mental intensity of a session or the players' day, this finding shows us that it needs to be researched more in this field as it currently sheds some light on the necessity of having a mental intensity tool to measure the extent of the players' mental fatigue from the coaches' tactical input.

Table 13

Players' Factors Of Wellness Scores (pre-session) Correlated With The Players' Perceived (pre-session) Day RPME (CR-100)

Variables	1	2	3	4	5
1) Fatigue pre-session	1				
2) Sleep pre-session	0.47**	1			
3) Soreness pre-session	0.53**	0.34**	1		
4) Stress pre-session	0.45**	0.34**	0.42**	1	
5) Mood pre-session	0.40**	0.43**	0.34**	0.47**	1
6) Player Perceived CR100 pre-session	-0.16**	-.08*	-0.12**	-0.14**	-0.03

***Correlation is significant at p<0.01; n_1=686, n_2=684, n_3=677, n_4=674, n_5=685*

Conclusion

Primary Goals of This Study

The central hypothesis of this study was, 'Players' wellness, mental and physical intensity have a relationship.' To test this hypothesis, this study examined several secondary hypotheses, including the coaches' planning (pre-session) and perception (post-session) of mental and physical intensity, to inform the central hypothesis. This study is the first to examine the relationship between these three variables.

One of the main findings of this study is that the players' total wellness scores (pre-session) and the difference between the players' perceived (post-session) RPE and the coaches' perceived (post-session) RPE were negatively correlated (r=-.187 for the head coach, r=-.269 for the assistant coach, r=-.231 for the physical trainer, and r=-.311 for the goalkeeper coach). This finding shows that, tired or not, the coaches probably always assumed that the players were fresh to endure a heavy session because the wellness questionnaire was not utilised to inform session planning accordingly. This finding confirms Gallo et al. (2015) 's suggestions to use the wellness questionnaire to plan and adjust the physical intensity of the session. This result is further confirmed when comparing the players' total wellness scores (pre-session) to the players' perceived (post-session) RPE, which had a negative correlation (r=-.182). Therefore, the physical intensity perceived by the players (post-session) is dependent on the wellness scores (pre-session), thus confirming Ungureanu et al.'s (2021) findings that the wellness of the athlete pre-session influences the internal training load (RPE x duration of the session).

Another interesting finding is that the players' perceived (post-session) RPE and the players' perceived (post-session) RPME did not correlate, achieving a negative correlation (r=-.022). Therefore, if the session is high or low physically, data shows that this does not interfere with how much the players feel tired mentally. Furthermore, the players' perceived (post-session) RPME did not correlate with learning perception (r=-.009). Therefore, how players perceive the session for mental intensity has nothing to do with their perceived learning.

When analysing the coaches' results, all the coaches' planned (pre-session) RPE had strong correlations (r=.859, r=.837, r=.796, r=.869, r=.916, and r=.852). This means that the coaches mostly agreed when seeing the session plan regarding how physically hard the session would be. Furthermore, this planning positively correlated with the players' perceived (post-session) RPE (r=.687 with the head coach, r=.711 with the assistant coach, r=.744 with the physical trainer, and r=.356 with the goalkeeper coach). This result confirms that the coaches, if they truly understand

what each number on the CR-10 scale represents, can usually plan the session according to the desired intensity, thus confirming Sciortino (2020) 's findings.

When examining mental intensity, some coaches' planned (pre-session) RPME positively correlated with each other (head coach with goalkeeper coach (r=.569), an assistant coach with the physical trainer (r=.296), and goalkeeper coach (r=.621), and physical trainer with goalkeeper coach (r=.476). Conversely, others were not correlated. This indicates that the mental intensity concept is new to the coaches. Although the coaches disagreed when planning compared to the players' perceived (post-session) RPME scores, all the coaches' scores were positively correlated (r=.275 with the head coach, r=.161 with the assistant, r=.202 with the physical trainer, and r=.282 with the goalkeeper coach). Consequently, the players can feel this concept of mental intensity, despite perhaps arguing that the result is not genuinely reliable since the players are doing this for the first time. Two negative correlations emerged when comparing all the players' factors of wellness scores (pre-session) with the players' perceived (pre-session) day's RPME going into the session, namely, RPME with fatigue (r=-.166) and RPME with stress (r=-.140). This finding is beginning to show that mental intensity is related to stress, a critical mental component, and feeling tired (fatigue). Finally, the study found a relationship between the players' wellness and mental and physical intensity. This further strengthens the argument that, when planning training, the coach must consider the increase in mental and physical fatigue (Bompa and Haff, 2009) and should use the wellness questionnaire to plan and adjust training (Gallo et al., 2015).

Limitations

The first limitation that can be mentioned in this study is that not all the players and coaches were familiar enough with the data collection tools. Yet, I mitigated this by including a test week pilot project before starting the official data collection process. When realising that players were still finding it hard. I further mitigated this by sending another instructional video after the pilot test week while also answering questions made by the participants using a mobile app. More information about this can be found in the methodology section.

Another limitation is that the players and the coaches had never heard about mental intensity. This was a new concept to them as it is to the existing literature and practice. Therefore, despite consistently explaining this tool and how to use it, one could question the extent of the results' reliability. An Intraclass Correlation Coefficient (ICC) test can be performed in future research (using the same or new data sets) to help validate the CR100 as a tool to measure the Rate of Perceived Mental Exertion during football training. However, this tool was chosen because its official documentation tells us that this scale can determine the strength of an experience of either

pain, effort, and even the difficulty of mental tasks, as well as the understanding of instructions (Borg, 1998; Borg and Borg, 2019). Lastly, it is worth highlighting that this was my first-time conducting research, which is a limitation in itself, notwithstanding my rigour and serious tentative to perform to high standards and follow numerous suggestions by various experienced researchers, sports scientists, and my tutor.

Suggestions

One of the above limitations ushers in a suggestion: the reliability of the mental intensity tool used. If researched further for practicality and use, possibly using an Intraclass Correlation Coefficient (ICC) test to validate it, this tool would greatly benefit measuring and planning mental intensity. In addition, other studies should also look at its relationship to stress and fatigue, as a negative correlation was found between these variables. Further studies should also look at the RPE from the perspectives of different physical trainers and coaches. For example, the background and maybe the country of the physical trainer or coach could affect how he plans and perceives the physical intensity of the session. Lastly, future studies could explore a senior professional or amateur football team and, subsequently, compare these results. Of course, this can also be applied to different sports, groups, or individuals.

Ethics Committee

Ethics review board: MCAST

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Authors' contributions

The study design: First Author, Second Author, Third Author

The data collection: First Author and Second Author

The data analysis: First Author, Second Author, Third Author

Writing the report: First Author, Second Author, Third Author

Conflicts of interest

The authors declare that they have no competing interests.

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