Optimizing Performance: The Dynamics of Health and Exertion in Professional Football

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Abstract

Aim: This study aims to comprehensively examine health and Rating of Perceived Exertion (RPE) parameters in professional football players on match days. The research seeks to identify the relationships between these two crucial variables, offering practical guidance to enhance sports science and coaching practices and ultimately improve player performance.

Method: The study was conducted on 21 professional football players who participated in 35 league matches during the 2022-2023 season. The participants had an average age of 26.37 years, an average height of 182.52 cm, and an average weight of 74.14 kg, with 11 being foreign players and 10 being Turkish. The relationships between internal load (RPE) and variables such as sleep quality, fatigue perception, and muscle soreness (DOMS) were analyzed using a correlational research design.

Results: According to the results of the Spearman correlation analysis, no significant correlation was found between health measures and RPE parameters.

Conclusion: The absence of statistically significant relationships in the findings highlights the complexity of accurately capturing the interaction between wellness and RPE parameters. This result underscores the need for further research to explore whether alternative or supplementary methods might provide more nuanced insights. Sports scientists and coaches should remain cautious when adjusting training loads, recognizing the potential limitations of relying solely on RPE methods. Future studies could analyze the RPE and health data collected during different periods of the season from a long-term perspective, providing a clearer understanding of the changes between athletic performance and wellness.

Keywords: Soccer, wellness, rating of perceived exertion, training load, internal load.

Performansı Optimize Etme: Profesyonel Futbolda Sağlık ve Eforun Dinamikleri

Öz

Amaç: Bu çalışma, profesyonel futbolcularda maç günlerindeki sağlık ve Algılanan Zorluk Derecesi (RPE) parametrelerini kapsamlı bir şekilde incelemeyi amaçlamaktadır. Araştırma, bu iki önemli değişken arasındaki ilişkileri belirlemeyi hedefleyerek, spor bilimi ve antrenörlük uygulamalarını geliştirmek ve nihayetinde oyuncu performansını artırmak için pratik rehberlik sunmaktadır.

Yöntem: Çalışma, 2022-2023 sezonunda 35 lig maçında forma giyen 21 profesyonel futbolcu üzerinde gerçekleştirilmiştir. Katılımcıların yaş ortalaması 26,37 yıl, boy ortalaması 182,52 cm ve kilo ortalaması 74,14 kg olup, 11'i yabancı, 10'u ise Türk oyunculardan oluşmaktadır. Araştırmada, iç yük (RPE) ile uyku kalitesi, yorgunluk algısı ve kas ağrısı (DOMS) arasındaki ilişkiler korelasyonel bir araştırma tasarımı kullanılarak analiz edilmiştir.

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Bulgular: Spearman korelasyon analizi sonuçlarına göre, sağlık değerleri ile RPE parametreleri arasında istatistiksel olarak anlamlı bir ilişki bulunamamıştır.

Sonuç: Sonuçlarda istatistiksel olarak anlamlı ilişkilerin bulunmaması, wellness ve RPE parametreleri arasındaki etkileşimin doğru bir şekilde yakalanmasının zorluğunu vurgulamaktadır. Bu durum, alternatif veya tamamlayıcı yöntemlerin daha ayrıntılı içgörüler sağlayıp sağlayamayacağını araştırmak için daha fazla çalışmaya ihtiyaç olduğunu ortaya koymaktadır. Antrenörler ve spor bilimciler, antrenman yüklerini düzenlerken yalnızca RPE yöntemine güvenmenin potansiyel sınırlamalarını göz önünde bulundurmalı ve dikkatli olmalıdır. Gelecekteki çalışmalar, sezonun farklı dönemlerinde toplanan RPE ve sağlık verilerini uzun vadeli bir perspektifle analiz ederek, atletik performans ve welness hali arasındaki değişimleri daha net bir şekilde ortaya koyabilir.

Anahtar Sözcükler: Futbol, wellnes, algılanan zorluk derecesi, antrenman yükü, iç yük.

Introduction

The interplay of wellness and perceived exertion in professional football match-day performance is a critical aspect that directly impacts players' success on the field. In recent years, the evaluation of wellness and perceived exertion has garnered significant attention from sports scientists and coaches, aiming to optimize performance and reduce the risk of injury[1]. The Rate of Perceived Exertion (RPE) is a widely used subjective measure that reflects an athlete's perception of exercise intensity. At the same time, wellness parameters typically include fatigue, sleep quality, and muscle soreness[2]. Investigating the interaction between these variables on match days can provide valuable insights for tailoring training programs and recovery protocols.

Previous research has highlighted the importance of monitoring wellness parameters to predict performance outcomes and manage player load effectively. Foster et al highlighted that RPE serves as a dependable measure of exercise intensity, making it a versatile tool for monitoring training load across various sports disciplines[3]. Additionally, Saw et al. emphasized the significance of subjective wellness assessments, such as sleep quality and fatigue, in influencing an athlete's performance readiness. These studies advocate for a holistic approach to player monitoring, integrating physical and psychological dimensions to optimize training and performance[4].

Although the importance of wellness indicators and RPE metrics is well recognized, further investigation is essential to fully understand their interplay within the high-stakes environment of professional football matches. The fast-paced, physically demanding nature of football, particularly on match days when both physical and psychological stressors are at their highest, calls for a deeper examination of how these factors converge. This research seeks to address this gap by exploring the associations between wellness indicators—namely fatigue, DOMS (Delayed Onset Muscle Soreness), and sleep quality—and RPE among professional football players[5].

We hypothesize that significant relationships exist between wellness parameters and RPE on match days. Specifically, we anticipate that higher levels of fatigue and DOMS will correlate with higher RPE values, reflecting increased perceived exertion. Conversely, better sleep quality is expected to be associated with lower RPE values, indicating a more manageable perceived exertion[6]. By testing these hypotheses, the study seeks to provide empirical evidence to inform practical applications in sports science and coaching.

The outcomes of this study may offer valuable insights for developing effective strategies for managing the well-being and performance of professional football players. Effective monitoring and interpretation of wellness and RPE data can guide individualized training adjustments, optimize recovery strategies, and ultimately enhance performance while minimizing injury risk[7]. Moreover, this research contributes to the broader understanding of how subjective and objective measures can be integrated into athlete monitoring systems to support evidence-based decision-making in sports contexts[8]. This study addresses the critical need for a comprehensive evaluation of wellness and RPE parameters in professional football players on match days. By elucidating the relationships between these variables, we aim to provide actionable insights to enhance player performance and well-being, aligning with evolving sports science and coaching practices. This research seeks to bridge the gap in the current literature by offering a detailed analysis of wellness and exertion in the high-stakes environment of professional football.

Material and Methods

Participants

This study was conducted based on the athletes on the rosters for 35 league matches during the 2022-2023 season. The research involved 21 professional football players. Among the participants, 11 were foreign players, and 10 were Turkish players. The positions of the players varied. The average age of the players was 26.37±3.25 years, the average height was 182.52±4.34 cm, and the average weight was 74.14±6.34 kg. Ethics committee permission for the study was received from the Kütahya Dumlupinar University Review Board (Approval date- Number: 04.07.2024-309) and the study was conducted in accordance with the principles of the Declaration of Helsinki.

Study Design

To examine the relationships between internal load (RPE) and variables such as sleep quality, perceived fatigue, and muscle soreness (DOMS), a correlational research design was implemented. The Rating of Perceived Exertion (RPE) was recorded following each match using the 0–10 scale developed by Foster (1998)[3]. The same fitness coach measured Session-RPE (sRPE) across all matches with the 10-point scale. To evaluate internal load (IL), the sRPE-based method outlined by Foster et al. (2001) was utilized[9]. Players responded to the question, "How difficult was the match session?" 20 minutes after each match[10].

Following established guidelines, a psychometric questionnaire was distributed to assess general wellness indicators, focusing on perceived fatigue, sleep quality, and muscle soreness (DOMS). Players rated their responses on a 7-point scale, where 1 signified poor wellness and 7 represented excellent wellness, with increments of one point. These questionnaires were administered on paper and completed individually by the players before the pre-match meal[11,12].

Data

The data for this study were collected over a 9-month period from athletes playing for a football team comprising 21 players. During this period, a total of 35 official competition matches were played. The data collection focused on various aspects of player

performance, wellness, and RPE measures. Overall, this comprehensive data collection approach provided a robust dataset for analyzing player performance's physical and psychological aspects over the competitive season.

Statistical Analysis

In this study, the Shapiro-Wilk test was applied to assess the normality of the data. The results indicated that the data did not follow a normal distribution, necessitating the use of non-parametric statistical methods, which are more appropriate for analyzing data that do not meet the assumptions of normality.

Spearman's correlation analysis was employed to examine the relationship between wellness and RPE parameters, as it is robust against non-normal data distributions and does not rely on linearity assumptions. The interpretation of the correlation coefficient was as follows: $r < 0.1$ indicates no significant relationship; $0.1 < r \leq 0.3$ denotes a small effect; $0.3 < r \leq 0.5$ indicates a moderate effect; $0.5 < r \leq 0.7$ shows a large effect; $0.7 < r \leq 0.9$ reflects a very large effect; and $r > 0.9$ represents an almost perfect correlation. Statistical significance was determined at a threshold of $p \leq 0.05$ for all tests. The entire data processing and analysis were conducted using the R programming language, ensuring accuracy and reproducibility in handling non-parametric methods suitable for the dataset.

Results

The descriptive statistics of the dataset are outlined in Table 1, while Figures 1 through 4 illustrate the distribution of the data across different weeks. In Figure 5, information about Spearman correlation analysis is presented. The correlation between fatigue and RPE is insignificant ($r = -0.075$, $p = 0.04$), insignificant between DOMS and RPE ($r = -0.047$, $p = 0.21$), insignificant between Sleep Quality and RPE ($r = 0.026$, $p = 0.48$). There are statistically significant relationships between wellness parameters. The correlation between fatigue and DOMS is significant ($r = 0.748$, $p < 0.001$), significant between Fatigue and Sleep Quality ($r = -0.356$, $p < 0.001$), insignificant between DOMS and Sleep Quality ($r = -0.353$, $p < 0.001$).

Table 1. Descriptive statistics

	Mean	95% Confidence Interval Mean		Std. Deviation	Shapiro-Wilk	P-value of Shapiro-Wilk
		Upper	Lower			
Fatigue	3.043	3.140	2.947	1.308	0.909	< .001
DOMS	2.634	2.727	2.542	1.261	0.884	< .001
Sleep Quality	5.494	5.579	5.409	1.156	0.877	< .001
RPE	3.850	4.072	3.629	3.015	0.922	< .001

DOMS: Delayed onset muscle soreness; RPE: Rating of Perceived Exertion

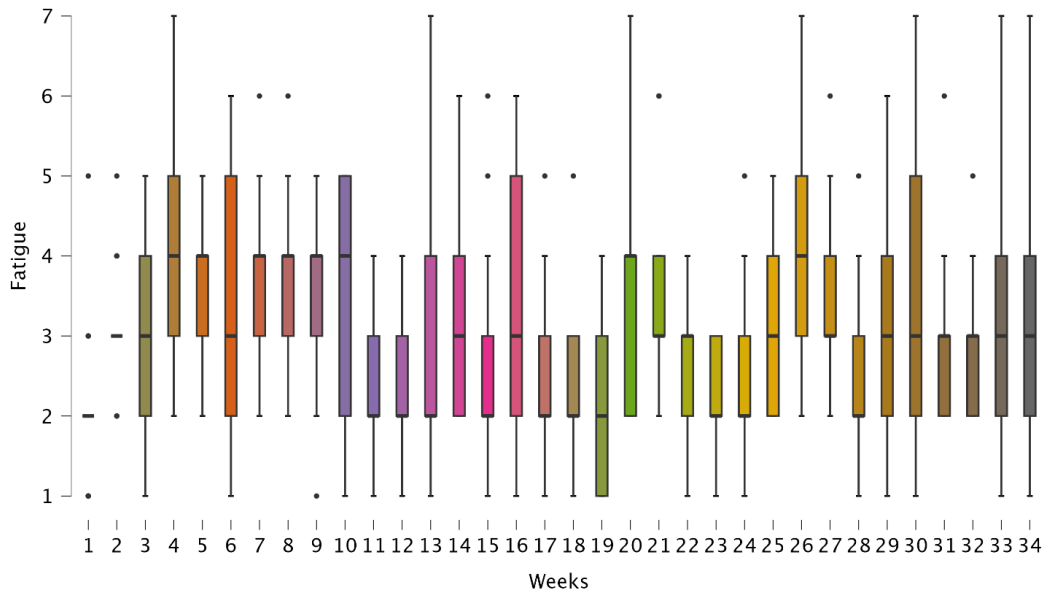**Figure 1.** Distribution of fatigue values according to weeks

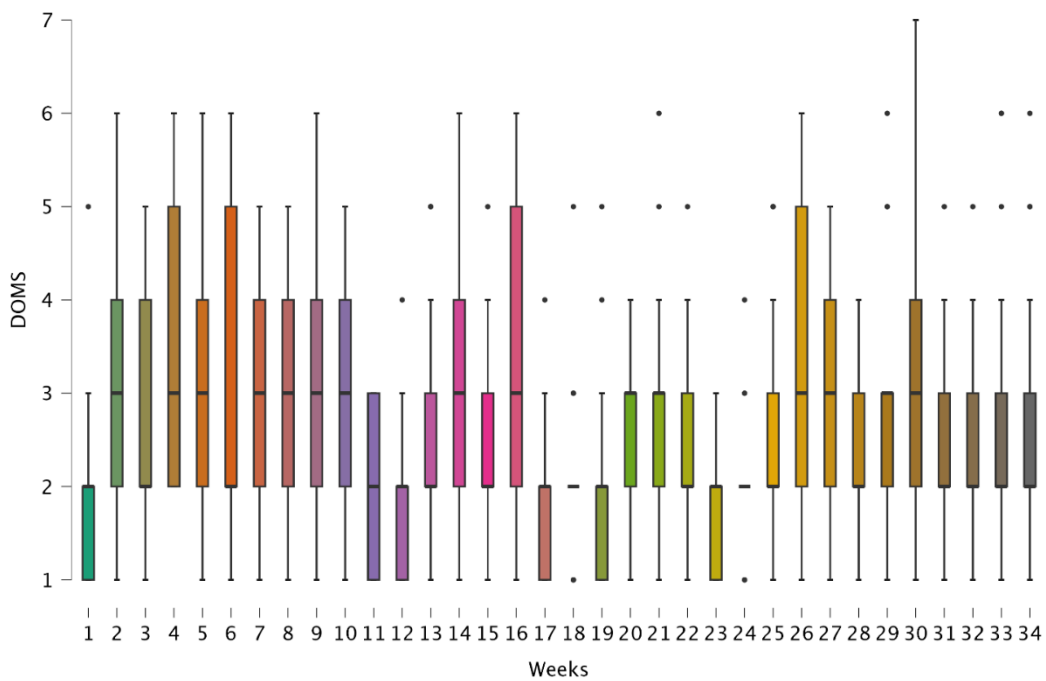**Figure 2.** Distribution of DOMS values according to weeks

Figure 3. Distribution of sleep quality values according to weeks
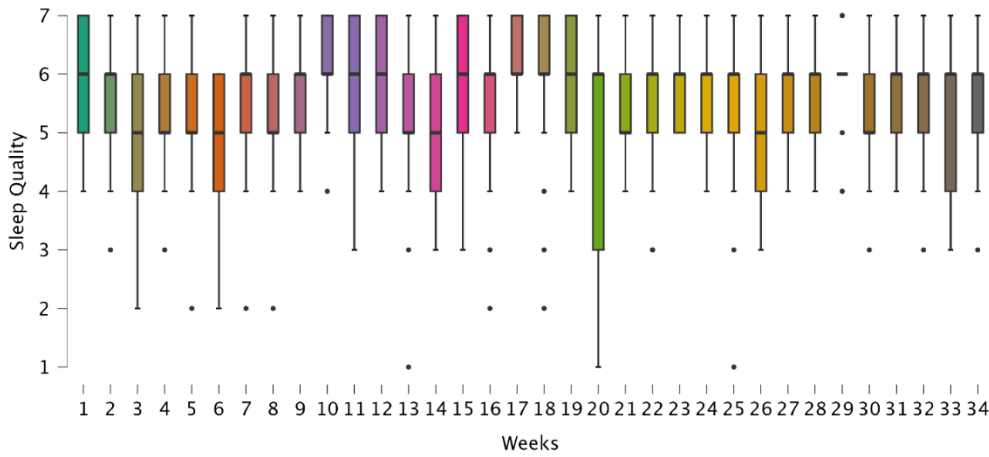

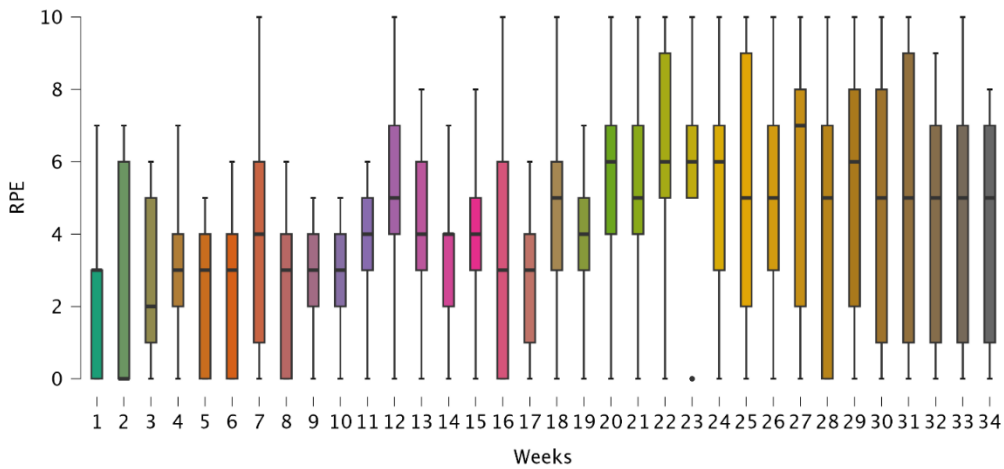**Figure 4.** Distribution of RPE values according to weeks

Figure 5. Scatter plot of the relationships between fatigue, DOMS, sleep quality, and RPE values according to players (* p < .05, ** p < .01, *** p < .001)
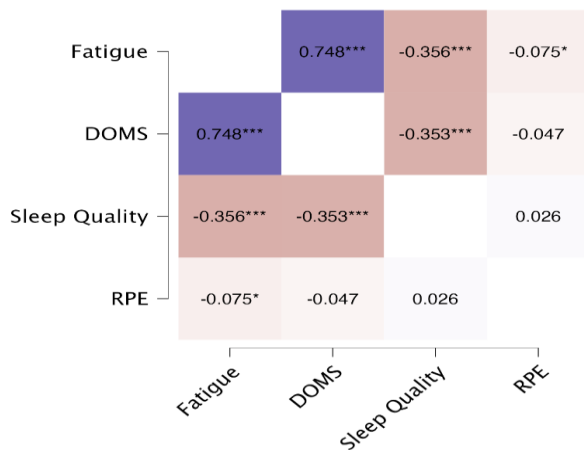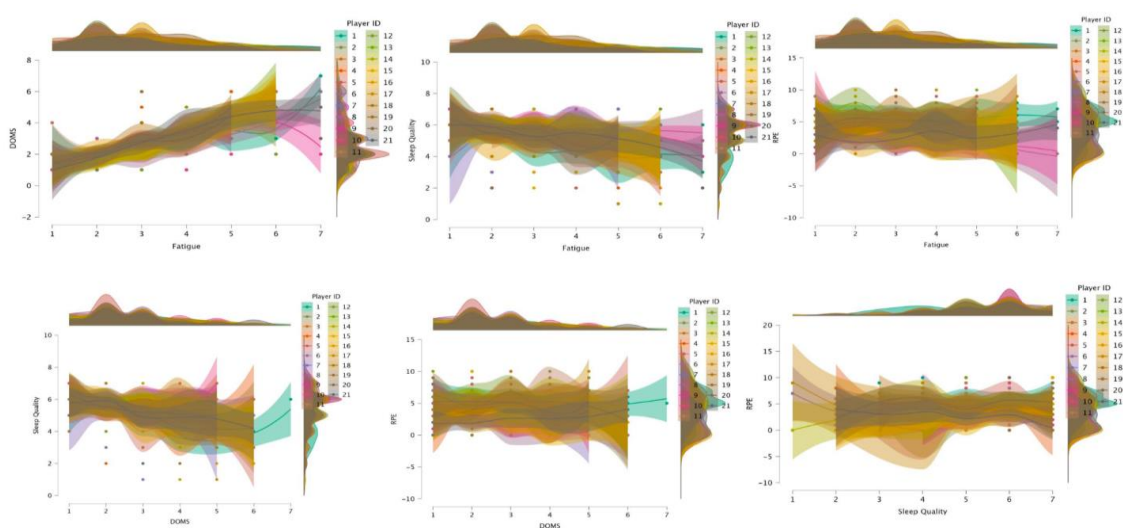
Figure 6. Scatter plot of the relationship between wellness and RPE values according to players

Discussion

This study investigated the relationship between RPE and wellness parameters in football players. As a result of statistical analyses, no correlation was found between RPE and wellness values. The correlation between fatigue and RPE was not significant (r= -0.075, p=0.04); between DOMS and RPE was not significant (r= -0.047, p=0.21); between sleep quality and RPE was not significant (r=0.026, p=0.48). There are statistically significant relationships between health parameters. The correlation between fatigue and DOMS is significant (r=0. 748, p<0.001), between Fatigue and Sleep Quality is significant (r= -0.356, p<0.001), between DOMS and Sleep Quality is significant (r= -0.353, p<0.001).

The responses to the stresses created on the organism during the activities of athletes constitute the burden of training[13]. The amount of training load is directly related to the degree of difficulty perceived physiologically by the athlete. RPE is among the methods that measure the intensity athletes perceive during training[14]. The effect of increasing or decreasing RPE values in training is not limited to acute effects in athletes. Increased or decreased RPE values in training can affect the wellness values of athletes[15]. Stressor factors created on the organism can affect daily life after training so that athletes can adapt to training physiologically[16]. During training, RPE values and wellness scores are also widely used to monitor the intensity of athletes' training and the resulting effects on daily life[17].

Several studies by sports scientists have examined the relationships between RPE parameters and wellness values[7,15,18]. It has been reported that there is a relationship between training loads and wellness scores of American football players, and the findings should be considered in the individualization of training[15]. In another study, the relationship between training loads and wellness scores of professional football players was examined, and statistically significant results were found[19]. A study conducted on Australian football players revealed a connection between training loads and pre-

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training wellness indicators[18]. In another study examining the effects of wellness scores on training output, he emphasized the utility of simple, non-invasive wellness measures and their potential to reduce player training output in elite footballers[7]. Another important finding of this study is that a decrease in wellness scores corresponded to a significant decrease in training performance for the players in the present study[7]. This study's findings show no relationship between wellness scores and training load values, contrary to those presented in previous studies. The variation in findings between our study and previous research may stem from differences in the composition or characteristics of the participant groups involved. At the same time, this study used only the RPE tool as a training load measurement tool. In other studies, wearable technologies were used to record training load. The fact that we did not determine the training load only with RPE in this study is among the limitations of this study. In future studies, it is recommended to compare training loads and wellness values obtained through advanced wearable technologies beyond the RPE method. In addition, sports scientists can analyze the changes in the obtained data in different periods of the season.

Conclusion

The recommendations for future research hold significant value. It is crucial to explore how integrating wearable technology could address the limitations of this study, particularly in capturing more objective and granular training load data. Highlighting these advancements will enhance the reliability and applicability of the findings in diverse athletic contexts. Future studies could analyze the RPE and health data collected during different periods of the season from a long-term perspective, providing a clearer understanding of the changes between athletic performance and wellness.

For coaches and sports scientists, it is reiterated that the careful organization of training loads is essential. While RPE values remain a practical and widely-used tool for monitoring training loads, incorporating data from wearable technologies can provide complementary insights. This dual approach could lead to more effective training strategies, ultimately improving athlete performance and reducing the risk of overtraining.

Financial Resources

Conflict of Interest

The authors declare that there are no personal or financial interests that could be perceived as a conflict of interest in relation to this study.

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