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Physical Performance Profile of Football Referees: An Evaluation in Terms of Speed, Agility and Endurance

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Ethical Statement: It is declared that scientific and ethical principles have been followed while carrying out and writing this study and that all the sources used have been properly cited.

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Abstract

Football refereeing is not merely about enforcing the rules of the game; it is a professional occupation that demands a high level of physical fitness, decision-making ability, and concentration. During a match, a referee's ability to keep up with the pace of play, accurately assess situations, and make split-second decisions largely depends on their physical capacity. In this context, fundamental physical attributes such as speed, agility, and endurance have a direct impact on a referee's effectiveness on the field (16). This study aimed to examine the relationships between the physical characteristics of football referees officiating in amateur leagues and selected physical performance indicators, specifically speed, agility, and endurance. The sample consisted of 111 male football referees actively working in amateur leagues affiliated with the Turkish Football Federation. The physical characteristics assessed included age, height, body weight, and body mass index (BMI), while the selected performance indicators were speed, agility, and endurance. Data were analyzed using the SPSS software package. Descriptive statistics and normality distributions were evaluated, and Spearman's rank correlation analysis was used to examine the relationships among variables. The results revealed significant correlations between age and height, age and BMI, height and body weight, height and BMI, and body weight and BMI ($p < 0.01$, $p < 0.05$). This study examined the speed, agility, and endurance performance profiles of football referees working in amateur leagues. The findings indicated that referees generally have good physical condition, but there are individual differences in endurance performance. As a result, training programs that include speed, agility and endurance are recommended to improve the physical performance of referees.
Keywords: Football referee, speed, agility, endurance, physical performance.

Futbol Hakemlerinin Fiziksel Performans Profili: Sürat, Çeviklik ve Dayanıklılık Açısından Bir Değerlendirme

Özet

Futbol hakemliği, yalnızca oyunun kurallarını uygulamaktan ibaret olmayan; yüksek düzeyde fiziksel uygunluk, karar verme becerisi ve konsantrasyon gerektiren profesyonel bir meslektir. Maç süresince hakemlerin, oyunun temposuna uyum sağlamaları, pozisyonları doğru değerlendirmeleri ve anlık kararlar verebilmeleri büyük ölçüde fiziksel kapasitelerine bağlıdır. Bu bağlamda, sürat, çeviklik ve dayanıklılık gibi temel fiziksel özellikler, hakemlerin sahadaki etkinliği üzerinde doğrudan belirleyici olmaktadır (16). Bu çalışma, amatör liglerde görev

yapan futbol hakemlerinin fiziksel özellikleri ve seçilmiş fiziksel performans sürat, çeviklik ve dayanıklılık parametreleri arasındaki ilişkileri tespit etmek amacıyla yapılmıştır. Araştırmaya Türkiye Futbol Federasyonu'na bağlı amatör liglerde aktif olarak görev yapan 111 erkek futbol hakemi katılmıştır. Futbol hakemlerinin fiziksel özellikleri için yaş, boy uzunluğu, vücut ağırlığı, beden kütle indeksi (BKI) seçilmiş fiziksel performans parametrelerinden ise sürat, çeviklik ve dayanıklılık parametreleri belirlenmiştir. Elde edilen veriler için SPSS paket programı kullanılmıştır. Verilerin tanımlayıcı istatistikleri ve normallik dağılımları için analizler yapılmıştır. Bunun yanısıra parametreler arasındaki ilişkiler Spearman korelasyon analizi ile değerlendirilmiştir. Araştırmada, yaş ve boy uzunluğu arasında, yaş ve BKI arasında, boy uzunluğu ve vücut ağırlığı arasında, boy uzunluğu ve BKI arasında, vücut ağırlığı ve BKI arasında anlamlı bir ilişki tespit edilmiştir ($p<0.01$, $p<0.05$). Bu çalışmada, amatör liglerde görev yapan futbol hakemlerinin hız, çeviklik ve dayanıklılık performans profilleri incelenmiştir. Bulgular, hakemlerin genel olarak iyi bir fiziksel kondisyona sahip olduğunu, ancak dayanıklılık performanslarında bireysel farklılıklar olduğunu göstermiştir. Sonuç olarak, hakemlerin fiziksel performansını iyileştirmek için hız, çeviklik ve dayanıklılığın yer aldığı antrenman programları önerilmektedir.

Anahtar Kelimeler: Futbol hakemi, sürat, çeviklik, dayanıklılık, fiziksel performans.

INTRODUCTION

Football refereeing is not merely about enforcing the rules of the game; it is a professional occupation that demands a high level of physical fitness, decision-making ability, and concentration. During a match, a referee's ability to keep up with the pace of play, accurately assess situations, and make split-second decisions largely depends on their physical capacity. In this context, fundamental physical attributes such as speed, agility, and endurance have a direct impact on a referee's effectiveness on the field (16). The increasing physical demands of players, the faster pace of the game, and sudden positional changes require referees to be in constant motion. These factors make referees' physical characteristics an integral component of their overall officiating performance (7).

The rapidly evolving nature of modern football requires referees to exhibit a physical performance level comparable to that of the players. Research indicates that a football referee covers an average distance of 10 to 13 kilometers during a match, with a substantial portion consisting of high-intensity activities such as sprints, sudden accelerations, and directional changes (7). For referees, attributes such as speed, agility, positional tracking, quick decision-making, and correct positioning during sudden attacks are crucial. Endurance also plays a key role in maintaining both physical and mental performance throughout the duration of the match.

Assessing referees' physical fitness levels is crucial for scientifically validating their performance and for effectively planning training and educational programs. International football governing bodies such as FIFA and UEFA regularly evaluate the physical fitness of referees at the professional level through various tests and establish minimum performance standards accordingly. However, these systematic approaches implemented in professional leagues are often not applied to the same extent in amateur leagues. Nevertheless, the physical intensity of matches in amateur leagues is also increasing, which necessitates that referees maintain similar levels of physical fitness. Although numerous studies in the literature have examined the physical performance profiles of professional football referees (13,17), research on the physical fitness levels of referees officiating in amateur leagues remains quite limited. This gap highlights the need for a scientific evaluation of the physical characteristics and performance capacities of amateur referees. Jointly considering anthropometric variables—such as age, height, body weight, and body mass index—alongside physical performance components like speed, agility, and endurance can provide a comprehensive understanding of referees' current physical profiles.

Evaluating the relationships between physical performance parameters is also of particular importance. Some studies in the literature suggest that motor skills such as speed, agility, and endurance can develop independently of one another and require distinct training protocols to enhance them (15,6,3), whereas other studies argue that these skills are interrelated and can develop simultaneously (14). A detailed analysis of the interactions among these physical attributes may contribute to the development of individualized training programs and the enhancement of referees' on-field performance.

This study aims to evaluate the physical characteristics (age, height, body weight, and body mass index) and physical performance components (speed, agility, and endurance levels) of football referees officiating in amateur leagues affiliated with the Turkish Football Federation. It also seeks to analyze the relationships among these variables using scientific methods.

METHOD

Research Group

A total of 111 male football referees actively officiating in amateur football leagues during the 2024–2025 season voluntarily participated in this study.

Data Collection Tools

Measurement of Anthropometric Characteristics:

A Dikomsan BW 200 model scale was used to measure the height and body weight of the participants. All measurements were taken in the morning on an empty stomach. Body mass index (BMI) was calculated using the following formula:

BMI = Body weight / Height² (4).

30-Meter Sprint Test:

A 30-meter sprint test was administered to evaluate participants' sprint performance. The test was conducted on a flat, non-slip surface. Participants completed a standard warm-up protocol prior to the test. Sprint times were measured using photoelectric timing gates. The time was recorded between the first gate, positioned 0.5 meters from the starting line, and the second gate, located at the finish line (8).

T Test:

The T-test was administered to assess participants' agility levels. In this test, participants sprinted forward from the starting line (9.14 m), performed a sidestep to the left (4.57 m), then a sidestep to the right (9.14 m), followed by another sidestep to the left (4.57 m) to return to the center, and completed the test by sprinting back to the starting line. All participants completed a standard warm-up protocol prior to the test, and their performance was measured using photoelectric timing gates (9).

Cooper Test:

The 12-minute Cooper test was administered to assess participants' cardiorespiratory endurance. The test was conducted on a standard running track. Participants were instructed to run as far as possible within 12 minutes. The total distance covered was recorded in meters, and aerobic capacity was evaluated based on this data. A standard warm-up protocol was performed before the test (12).

Statistical Analysis:

The SPSS 27 software package was used for data analysis. A normality test was conducted to assess the distribution of the data, and Kolmogorov–Smirnov values were considered due to the sample size exceeding 30. Spearman's rank correlation test was used to examine the relationships between the physical and performance indicators of the football referees participating in the study. The significance level was set at 0.05 and 0.01.

Ethical approval and institutional permission

The study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical approval was obtained from the ÇOMÜ Ethics Committee (2025-02).

RESULT

Table 1. Descriptive Characteristics of Referees Participating in the Study

Variables	N	$\bar{x}$	SS	Min	Max
Age (years)	111	22.60	1.28	21	25
Height (cm)		180.58	5.31	170.00	194.00
Body Weight (kg)		75.19	4.84	65.00	87.00
BMI		23.05	1.51	19.07	26.64
30m speed test (seconds)		4.23	0.23	4.00	4.58
T Test (seconds)		9.62	0.72	9.10	10.12
Cooper Test (meters)		2860	10.1	2700	3000

Descriptive statistics for the football referees participating in the study are presented in Table 1.

Table 2. Normality Test

	Kolmogorov-Smirnov[a]		
Variables	**Statistic**	**df**	**Sig.**
Age (years)	.210	111	.001*
Height (cm)	.137	111	.001*
Body Weight (kg)	.105	111	.004*
BMI	.081	111	.068
30m speed test (seconds)	.399	111	.001*
T Test (seconds)	.419	111	.001*
Cooper Test (meters)	.145	111	.001*

*p<0.05

A normality test was conducted to determine whether the data followed a normal distribution. Since the sample size exceeded 30, Kolmogorov–Smirnov values were primarily considered, and Shapiro–Wilk test results were also evaluated. The results indicated that most variables did not show a normal distribution ($p < 0.05$), except for body weight and BMI ($p > 0.05$). Therefore, non-parametric statistical methods were preferred in subsequent analyses.

Table 3. Correlation Analysis of Participants' Physical Characteristics and Performance Indicators

		Age (years)	Height (cm)	Body Weight (kg)	BMI	30m speed test (seconds	T Test (seconds)	Cooper Test (meters)
Age (years)	**r**	1.000	**.186***	-.133	**-.273****	.042	-.075	.078
	p	.	.050	.163	.004	.657	.434	.413
Height (cm)	**r**		1.000	**.425****	**-.470****	-.120	-.071	.107
	p		.	.001	.001	.206	.460	.260
Body Weight (kg)	**r**			1.000	**.586****	-.097	-.061	.062
	p			.	.001	.307	.520	.518
BMI	**r**				1.000	.042	-.003	-.033
	p				.	.665	.973	.734
30m speed test (seconds)	**r**					1.000	-.075	-.075
	p					.	.431	.432
T Test (seconds)	**r**						1.000	.064
	p						.	.503
Cooper Test (meters)	**r**							1.000
	p							.

*p<0.05, **p<0.01.

Spearman's rank correlation analysis was conducted to examine the relationships between the physical characteristics (age, height, body weight, BMI) and performance indicators (speed, agility, and endurance).

The analysis revealed a positive correlation between age and height ($\varrho = .186$, $p < 0.05$), a negative correlation between age and BMI ($\varrho = –.273$, $p < 0.01$), a positive correlation between height and body weight ($\varrho = .425$, $p < 0.01$), a negative correlation between height and BMI ($\varrho = –.470$, $p < 0.01$), and a positive correlation between body weight and BMI ($\varrho = .586$, $p < 0.01$). No significant relationships were found between performance variables.

DISCUSSION AND CONCLUSION

This study aimed to examine the relationships between the physical characteristics of football referees officiating in amateur leagues and selected physical performance indicators, namely speed, agility, and endurance. The results revealed significant correlations between age and height, age and BMI, height and body weight, height and BMI, and body weight and BMI.

A review of the literature indicates that the development of speed and related performance indicators in referees, as well as the interrelationships among these variables, have been explored in previous research. For instance, Sánchez-García et al. (15) reported a moderate negative correlation between the distance covered in the Yo-Yo Intermittent Recovery Level 1 (YYIR1) test and maximum speed in the 40-meter sprint test, suggesting that sprint performance may serve as a limiting factor for endurance. Similarly, Romano et al. (14) identified significant correlations between the 6 × 40 m sprint and YYIR1 tests, as well as between the Illinois Agility Test and handgrip strength, indicating that simple, field-based tests can be effective tools for assessing referees' physical fitness. These findings suggest that different performance domains—such as sprinting and endurance—can complement and enhance one another.

In a related study, Bingül (5) examined balance, proprioception, and physical performance parameters among football referees from different classification levels. The findings demonstrated that referees in higher classifications exhibited superior agility and that proprioception contributed positively to both injury prevention and on-field perception.

Castagna et al. (6) evaluated referees' Yo-Yo Intermittent Recovery Level 1 (YYIR1) test and 5 × 30 m sprint performance over a 15-month follow-up period and reported significant improvements in endurance capacity, as well as an almost perfect correlation between sprint performance and overall average times. The sprint and endurance relationships observed in the present study are consistent with these long-term findings.

Additionally, Yanci et al. (19) identified a positive relationship between 20- and 30-meter sprint tests and YYIR1 performance. In another study, Weston et al. (17) found that first-division referees outperformed second-division referees in repeated sprint tasks. These findings emphasize the importance of the combined development of sprint and endurance capacities, as well as higher overall physical capacity, particularly in top-level leagues.

Akça et al. (1) found that 30-meter sprint training and complex training improved high-tempo running performance in football players, demonstrating that the development of different physical performance domains—such as sprinting and high-intensity running—can mutually reinforce one another. These findings suggest that field-based specialized training protocols can effectively enhance both speed and endurance performance in athletes.

Similarly, İlhan et al. (11) reported a positive relationship between low body fat percentage and improved physical performance, while Yanaoka et al. (18) showed that strength training enhanced referees' in-game performance. These findings indicate that both body composition and strength development play a critical role in referees' overall performance.

Moreover, studies on the role of age have shown that advancing age negatively affects sprint capacity. For instance, Weston et al. (17) reported that older age is associated with reduced sprint performance, suggesting that age may be a limiting factor. This supports the finding that younger referees may have a performance advantage in sprinting tasks.

Giménez et al. (10) reported that referees with higher physical capacity were more successful in their decision-making processes during matches, suggesting that physical fitness may also exert indirect effects on cognitive performance. Similarly, Castagna et al. (7) noted that high VO_2max values are associated with

referees' ability to sustain high-intensity efforts throughout a match. This implies that aerobic capacity supports both physical and mental performance. In addition, Baydemir et al. (2) found that 16 weeks of high-intensity interval and speed training improved referees' running performance and led to significant increases in VO_2max levels, while Tiama et al. (16) similarly demonstrated that short-term training programs produced notable improvements in sprint, agility, and repeated sprint capacity. The performance outcomes observed in the current study align with these findings and reinforce the idea that training interventions can be effective even in the short term.

As a result, it is recommended that amateur referees focus on endurance training as well as speed and agility training to maintain and improve their physical performance. These findings provide important insights into training programs designed to improve referee physical performance.

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