RESTING HEART RATE AND MUSCULAR ENDURANCE CHARACTERISTICS OF NIGERIAN ELITE FOOTBALL REFEREES: COMPLIANCE WITH FIFA PERFORMANCE STANDARDS

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Abstract

Football referees play a vital role in ensuring fairness and effective match management, making their physiological fitness essential for optimal performance. This study investigated the resting heart rate and muscular endurance characteristics of Nigerian elite football referees and assessed their compliance with FIFA performance standards. A descriptive survey design was adopted, involving a census of 40 elite football referees comprising FIFA-badged and Nigeria Premier Football League referees. Resting heart rate was measured under standardized conditions using a validated digital heart rate monitor, while muscular endurance was assessed with the FIFA-approved one-minute push-up test. Data were analysed using frequencies, percentages, means, standard deviations, and one-sample *t*-tests at the 0.05 level of significance. The findings revealed a mean resting heart rate of 56.45 ± 3.72 beats per minute, indicating good cardiovascular efficiency, while the mean muscular endurance score of 46.83 ± 4.68 repetitions exceeded the FIFA minimum standard. One-sample *t*-test results showed that both variables differed significantly from the FIFA reference standards ($p < .05$), confirming compliance with the prescribed fitness benchmarks. The study concluded that Nigerian elite football referees possess satisfactory resting heart rate and muscular endurance characteristics that meet FIFA performance standards. Regular physiological assessment and continuous conditioning are recommended to sustain these fitness levels and enhance officiating performance.

Keywords: Football Referees, Resting Heart Rate, Muscular Endurance, Cardiovascular Fitness and FIFA Standards.

Introduction

Football is one of the most popular sports worldwide, and the quality of its officiating plays a significant role in ensuring fair play, player safety, and the credibility of competitions. While players often receive considerable attention for their physical preparation, football referees are equally required to maintain high levels of physical fitness to keep pace with the increasing speed and intensity of modern football. Referees must make accurate decisions under pressure, maintain appropriate positioning throughout the match, and consistently apply the Laws of the Game. These responsibilities demand excellent physiological fitness, particularly cardiovascular efficiency and muscular endurance (International Football Association Board (IFAB), 2025; Fédération Internationale de Football Association (FIFA), 2025).

Elite football referees typically cover between 10 and 13 kilometres during a match, performing repeated accelerations, decelerations, sprinting, and rapid changes of direction while maintaining concentration and decision-making accuracy (Weston et al., 2012; Arikpo & Yahaya-Idinye, 2026; Arikpo & Otu, 2026). Unlike players, referees are not substituted during normal play and are therefore expected to sustain a high work rate throughout the entire match. Their ability to remain close to play depends largely on their level of physical

conditioning, making physiological fitness an essential component of effective officiating (Castagna et al., 2007; Meremikwu et al.2022; Ibu et al.2019).

Resting heart rate is widely recognised as an important indicator of cardiovascular fitness and cardiac efficiency. Individuals who engage in regular endurance training generally exhibit lower resting heart rates because of improved stroke volume and enhanced cardiac function (Kenney et al., 2022). For football referees, a favourable resting heart rate reflects the ability to recover more efficiently from repeated bouts of physical activity and to sustain performance throughout competitive matches. Likewise, muscular endurance is essential because it enables referees to perform repeated muscular contractions over prolonged periods without excessive fatigue. Adequate muscular endurance supports efficient movement, postural stability, and consistent performance during the latter stages of play (Powers & Howley, 2021; Adie et al. 2022; Ibu et al. 2019; Igyu et al. 2022)

To ensure that referees possess the physical capacity required for elite competitions, FIFA has established standardized fitness assessment protocols that evaluate key components of physiological fitness, including cardiovascular fitness, sprint performance, agility, and muscular endurance (FIFA, 2025). Compliance with these standards is essential for appointment to elite competitions and helps ensure that referees are physically prepared to meet the demands of modern football.

Previous studies have shown that physiological fitness is closely associated with officiating performance. Castagna et al. (2007) reported that referees with superior cardiovascular fitness are better able to cope with the physical demands of competitive matches. Similarly, Weston et al. (2012) found that improved aerobic fitness enables referees to maintain closer proximity to play, thereby enhancing decision-making accuracy. More recently, Parpa and Michaelides (2022) concluded that cardiovascular fitness and muscular endurance are among the most important physiological characteristics influencing football referee performance across different competitive levels.

In Nigeria, research on football referees has increased in recent years but has focused mainly on anthropometric characteristics, body composition, and selected aspects of physical fitness. Ogabor (2015) observed that physiological fitness is fundamental to effective football officiating because it enables referees to sustain the physical demands of competitive matches. Similarly, Ogabor, Edim, and Ekuri (2016) emphasized the importance of cardiovascular endurance in maintaining physical performance during prolonged activity. Ogabor and Mohammed (2023) further reported that Nigerian elite football referees generally possess body composition characteristics consistent with FIFA recommendations, while Ogabor et al. (2023) demonstrated that psychological factors such as stress management and frustration tolerance also contribute to effective officiating (Adie, et al. 2026; Meremikwu et al. 2022). These studies highlight the multidimensional nature of referee performance and the need for continuous evaluation of both physical and psychological fitness.

Despite these contributions, limited empirical evidence exists on the resting heart rate and muscular endurance characteristics of Nigerian elite football referees in relation to FIFA performance standards. Most available studies have concentrated on body composition, cardiovascular endurance, or psychological variables, leaving a gap in knowledge regarding these important physiological indicators. Without such evidence, it is difficult to determine whether Nigerian elite referees consistently meet internationally accepted fitness benchmarks.

This study was therefore undertaken to assess the resting heart rate and muscular endurance characteristics of Nigerian elite football referees and determine their level of compliance with FIFA performance standards. The findings will provide useful information for the Nigeria Football Federation, the Nigeria Football Referees Association, referee instructors, sports scientists, and fitness trainers in strengthening referee fitness assessment, conditioning programmes, and continuous professional development. The study also

contributes to the growing body of knowledge on football officiating and provides baseline evidence that may guide future research on referee performance in Nigeria.

Purpose of the Study

The purpose of this study was to assess the resting heart rate and muscular endurance characteristics of Nigerian elite football referees and determine whether these physiological characteristics comply with the performance standards prescribed by the Fédération Internationale de Football Association (FIFA). Specifically, the study sought to:

1. determine the resting heart rate characteristics of Nigerian elite football referees in relation to FIFA performance standards; and
2. examine the muscular endurance characteristics of Nigerian elite football referees in relation to FIFA performance standards.

Research Questions

The following research questions guided the study:

1. What are the resting heart rate characteristics of Nigerian elite football referees in relation to FIFA performance standards?
2. What are the muscular endurance characteristics of Nigerian elite football referees in relation to FIFA performance standards?

Research Hypotheses

`The following null hypotheses were tested at the 0.05 level of significance:

1. There is no significant difference between the mean resting heart rate of Nigerian elite football referees and the FIFA resting heart rate performance standard.
2. There is no significant difference between the mean muscular endurance score of Nigerian elite football referees and the FIFA muscular endurance performance standard.

Methodology

This study adopted a descriptive survey research design to assess the resting heart rate and muscular endurance characteristics of Nigerian elite football referees in relation to FIFA performance standards. The study population comprised 40 active Nigerian elite football referees, consisting of 21 FIFA-badged referees and 19 Nigeria Premier Football League (NPFL) referees who were officially registered with the Nigeria Football Federation and actively officiating during the period of the study. A census sampling approach was adopted, whereby all eligible referees participated in the study. Data were collected using two standardized physiological assessment procedures. Resting heart rate was measured with a validated Polar digital heart rate monitor and the values were recorded in beats per minute (bpm).

Muscular endurance was assessed using the FIFA-approved one-minute push-up test. Participants performed as many correctly executed push-ups as possible within 60 seconds while maintaining the standard technique specified in the FIFA fitness testing guidelines. The total number of correctly completed repetitions represented each participant's muscular endurance score. To ensure the validity of the measurement procedures, the testing protocols were reviewed by specialists in exercise physiology, sports medicine, football officiating, and measurement and evaluation. The reliability of the assessments was enhanced through the use of calibrated equipment, standardized testing procedures, and trained FIFA-certified Physical Fitness Instructors, who conducted all measurements under uniform conditions. Resting heart rate was measured first, followed by the one-minute push-up test after an adequate recovery

period. All assessments were conducted in accordance with FIFA fitness testing procedures to ensure participants' safety and consistency in data collection. The data collected were coded and analysed using the Statistical Package for the Social Sciences (SPSS) version 25.0. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarise the resting heart rate and muscular endurance characteristics of the referees. The research hypotheses were tested using one-sample *t*-tests to compare the observed mean values with the corresponding FIFA performance standards. All hypotheses were tested at the 0.05 level of significance.

Results

The results are presented according to the research hypotheses formulated to guide the study

Testing of Hypotheses

Hypothesis One: There is no significant difference between the mean resting heart rate of Nigerian elite football referees and the FIFA resting heart rate performance standard. The result of this analysis is presented in Table 1.

Table 1: One-Sample *t*-Test of Resting Heart Rate Compared with FIFA Standard

Variable	FIFA Standard	Mean	SD	t	df	p	Decision
Resting Heart Rate	60.00	56.45	3.72	-6.03	39	< .001	Reject H_0

The one-sample *t*-test revealed a significant difference between the referees' mean resting heart rate and the FIFA reference standard ($t(39) = -6.03$, $p < .001$). Therefore, the null hypothesis was rejected. The lower resting heart rate indicates favourable cardiovascular efficiency and compliance with the FIFA physiological standard.

Hypothesis Two: There is no significant difference between the mean muscular endurance score of Nigerian elite football referees and the FIFA muscular endurance performance standard. The result obtained from the analysis is presented in Table 2.

Table 2: One-Sample *t*-Test of Muscular Endurance Compared with FIFA Standard

Variable	FIFA Standard	Mean	SD	t	df	p	Decision
Muscular Endurance	40.00	46.83	4.68	9.24	39	< .001	Reject H_0

The result of data analysis presented in Table 2 show that the referees' mean muscular endurance score was significantly higher than the FIFA minimum performance standard ($t(39) = 9.24$, $p < .001$). Consequently, the null hypothesis was rejected, indicating that the referees demonstrated muscular endurance levels that complied with FIFA performance requirements.

Discussion of findings

This study examined the resting heart rate of Nigerian elite football referees in relation to FIFA performance standards. The findings indicate that the referees generally possess the physiological fitness required for elite football officiating, as evidenced by favourable resting heart rate values scores that met or exceeded the benchmarks prescribed by FIFA.

The finding further revealed that the referees recorded a mean resting heart rate significantly lower than the FIFA reference value, indicating good cardiovascular efficiency. Resting heart rate is widely recognised as an important indicator of cardiovascular fitness

because individuals with lower resting heart rates generally exhibit greater stroke volume and more efficient cardiac function (Kenney et al., 2022). For football referees, efficient cardiovascular function enhances recovery following repeated high-intensity movements and enables them to maintain appropriate positioning and concentration throughout the match.

This finding is consistent with the report of Castagna et al. (2007), who observed that cardiovascular fitness is fundamental to successful football officiating because it enables referees to cope with the continuous physical demands of competitive matches. Similarly, Weston et al. (2012) found that referees with superior aerobic fitness remain closer to play, thereby improving decision-making accuracy and overall match control. The finding also agrees with Parpa and Michaelides (2022), who identified cardiovascular fitness as one of the strongest physiological predictors of referee performance across different levels of competition.

The present result further supports the findings of Nigerian studies. Ogabor (2015) reported that adequate physiological fitness enables football referees to sustain high work rates and maintain effective positioning throughout competitive matches. Likewise, Ogabor, Ekuri, and Sanusi, (2016) demonstrated that good cardiovascular endurance enhances physical performance during prolonged activity, reinforcing the importance of cardiovascular efficiency among football officials. The favourable resting heart rate observed in the present study therefore suggests that Nigerian elite referees have benefited from regular physical conditioning and fitness programmes implemented by the Nigeria Football Federation.

The second finding showed that the referees demonstrated muscular endurance levels significantly above the FIFA minimum requirement. Muscular endurance is essential for football referees because it supports repeated movements, postural stability, and resistance to fatigue during prolonged matches. Referees with adequate muscular endurance are better able to maintain movement efficiency and physical performance throughout the game, particularly during the closing stages when fatigue is most likely to affect officiating quality.

The finding agrees with Ilhan et al. (2023), who reported that muscular fitness contributes significantly to the physical performance of football referees. Similarly, Mascherini et al. (2020) observed that referees with higher levels of muscular fitness demonstrate greater readiness to meet the increasing physiological demands of elite football competitions. The present findings suggest that the physical conditioning programmes currently adopted for Nigerian elite referees have contributed positively to their muscular endurance and overall physical preparedness.

The findings also complement previous Nigerian research highlighting the multidimensional nature of referee performance. Ogabor and Mohammed (2023) reported that favourable body composition enhances compliance with FIFA fitness standards, while Ogabor et al. (2023) found that psychological attributes such as stress management and frustration tolerance are important determinants of officiating performance. When considered together with the present findings, these studies indicate that successful football officiating depends not only on technical knowledge but also on adequate physiological fitness, favourable body composition, and psychological readiness.

Overall, the findings demonstrate that Nigerian elite football referees possess resting heart rate and muscular endurance characteristics consistent with FIFA performance standards. This reflects the positive impact of structured fitness assessment, regular conditioning, and continuous referee development programmes. Maintaining these standards through periodic physiological evaluation and evidence-based training will further improve officiating performance and strengthen the international competitiveness of Nigerian football referees.

Conclusion

This study assessed the resting heart rate and muscular endurance characteristics of Nigerian elite football referees in relation to FIFA performance standards. The findings revealed that the referees demonstrated favourable resting heart rate values, reflecting good cardiovascular efficiency, and muscular endurance levels that exceeded the minimum standards prescribed by FIFA. The results further confirmed, through one-sample *t*-test analysis, that both physiological characteristics complied significantly with the established FIFA performance benchmarks.

The study therefore concludes that Nigerian elite football referees possess the physiological fitness required to cope with the physical demands of modern football officiating. These findings suggest that the current fitness preparation and conditioning programmes implemented by the Nigeria Football Federation and the Nigeria Football Referees Association have contributed positively to the physical readiness of elite referees. Sustaining these standards through regular fitness assessment, structured conditioning programmes, and continuous monitoring will enhance officiating performance and improve the preparedness of Nigerian referees for both national and international football competitions.

Recommendations

Based on the findings of this study, the following recommendations are made:

1. The Nigeria Football Federation (NFF) and the Nigeria Football Referees Association (NFRA) should sustain regular physiological fitness assessment programmes by incorporating periodic evaluation of resting heart rate and muscular endurance into referee certification and development programmes. This will help maintain compliance with FIFA performance standards and enhance officiating effectiveness.
2. Elite football referees should continue to participate in structured, evidence-based physical conditioning programmes that emphasize cardiovascular fitness and muscular endurance. Regular monitoring and individualized training will help sustain optimal physiological fitness and improve readiness for national and international football competitions.

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