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Differences in 30-15 IFT test performance across playing positions and categories among adult professional soccer players

Diferencias en el rendimiento de la prueba 30-15 IFT entre posiciones de juego y categorías en futbolistas profesionales adultos

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Abstract. Objective: This study aims to assess the performance of professional soccer teams from different divisions and playing positions using the 30-15 intermittent fitness test (30-15 IFT). Methods: The sample comprised 84 male soccer players from first division teams A (1A) (n=21; mean age 23.5±5.2 years), first division B (1B) (n=42; mean age 23.0±5.0), and second professional division (2nd) (n=21; mean age 22.9±4.7 years). Performance was evaluated based on the final speed achieved in the 30-15 IFT (VIFT). Results: Significant differences were observed between 1A and both 1B and 2nd in VIFT (p=0.002, n2p=0.115). Additionally, differences were found between defenders and full-backs in VIFT (p=0.002, n2p=0.197). Conclusion: Performance in the 30-15 IFT varies across divisions, with 1A achieving the highest values. Moreover, full-backs demonstrated superior performance compared to defenders. These findings provide valuable insights for coaches, physical trainers, and sports scientists for optimizing training programs.
Keywords: soccer, exercise test, physical fitness, athletic performance

Resumen. Objetivo: Este estudio tiene como objetivo evaluar el rendimiento de equipos de fútbol profesional de diferentes divisiones y posiciones de juego utilizando la prueba intermitente de fitness 30-15 (30-15 IFT). Métodos: La muestra comprendió 84 futbolistas masculinos de equipos de primera división A (1A) (n=21; edad media 23.5±5.2 años), primera división B (1B) (n=42; edad media 23.0±5.0), y segunda división profesional (2ª) (n=21; edad media 22.9±4.7 años). El rendimiento se evaluó según la velocidad final alcanzada en la 30-15 IFT (VIFT). Resultados: Se observaron diferencias significativas entre 1A y tanto 1B como 2ª en VIFT (p=0.002, n2p=0.115). Además, se encontraron diferencias entre defensores y laterales en VIFT (p=0.002, n2p=0.197). Conclusión: El rendimiento en la 30-15 IFT varía entre divisiones, con 1A logrando los valores más altos. Además, los laterales demostraron un rendimiento superior en comparación con los defensores. Estos hallazgos proporcionan información valiosa para entrenadores, preparadores físicos y científicos del deporte en la optimización de programas de entrenamiento
Palabras clave: Fútbol, pruebas de esfuerzo, acondicionamiento físico, rendimiento atlético

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Introduction

Soccer is a sport with a sustained and intense pattern of intermittent actions. During the game, soccer players travel an average of 10 km at an intensity of 70% of maximum oxygen consumption (VO2max.) (Bangsbo et al., 2006). Likewise, sprints, accelerations, changes of direction, jumps, and shoots determine the success of the actions and are discriminatory between elite players and lower categories (Faude et al., 2012). The decreased effectiveness of technical actions typical of soccer has been reported after repeated high-intensity sequences (Ferraz et al., 2019; Kellis et al., 2006). Due to this, aerobic metabolism becomes a determining factor due to its influence on recovery between efforts (Bishop et al., 2011). Previous research has described differences in performance, both in aerobic and anaerobic actions, in players of different competitive levels (Slimani & Nikolaidis, 2017; Toselli et al., 2022) as well as between playing positions (Modric et al., 2020; Pérez-Contreras et al., 2022; Tereso et al., 2024; Velásquez-González et al., 2023).

Gas analysis is the gold standard for assessing VO2max. However, its accessibility is limited to laboratories and research centers (Bennett et al., 2016; Cherouveim et al., 2022). Furthermore, VO2max alone does not reflect the endurance of the soccer player but rather is the ability to maintain high running intensities (Buchheit et al., 2013). For this reason, field tests have a comparative advantage due to their low cost and implementation. Likewise, they provide running speeds associated with VO2max, which primarily reflect specific performance in the game (Bok & Foster, 2021). Regarding efforts that request the anaerobic pathway, speed tests, direction changes, and dynamic and static strength are widely used. Its use is related to controlling fitness and prescribing training loads (Dugdale et al., 2019; Hulse et al., 2013).

There is an association between competitive status and physical performance in soccer players. There are differences in VO2max between high-level professional soccer

players and those from less competitive leagues and between positions within the team (Modric et al., 2019, 2020; Slimani & Nikolaidis, 2017). Similarly, the number of sprints, accelerations, and direction changes is greater in world-class players (Di Salvo et al., 2010, 2013; Slimani & Nikolaidis, 2017). Thus, the assessment of performance profiles becomes one of the purposes to be developed by coaches and technical bodies since it allows them to discriminate between competitive levels and playing positions.

Given the demands of the competition calendar, applying tests that reflect both profiles separately becomes difficult (Scott et al., 2017). Due to this, those that incorporate running, changes of direction, and accelerations are appropriate strategies to assess the aerobic/anaerobic component of the soccer player (Bok & Foster, 2021). In this context, round-trip tests become relevant due to their specific race pattern, which incorporates the actions above. In particular, the use of the 30-15 Intermittent fitness test (30-15 IFT) has increased over time, and this is possibly due to its excellent reliability (intraclass correlation coefficient ≥0.80 and coefficient of variation ≤6%) (Grgic et al., 2021). Besides, VIFT explains performance in anaerobic tests in both the horizontal and vertical planes (Scott et al., 2017; Silva et al., 2022).

The performance in this test allows us to discriminate between positions and categories, providing information to identify weaknesses and design strategies that optimize performance. In this way, comparing performance between categories could guide technical teams on the physical differences between divisions and provide reference values. The objective of this study is to analyze the performance in the 30-15 IFT test in teams belonging to the first division A (1A), first division B (1B), second professional division (2nd) and between positions of the game. A proportional relationship between test performance and competitive level is hypothesized. As a complementary hypothesis, it is stated that midfielders are the ones who will present the greatest performance over defenders, full-backs, and forwards.

Methods

Sample

Eighty-four male professional soccer players belonging to a first division A (1A) (n=21; age 23.5±5.2 years; height 1.74±0.03 m; mass 77.1±7.3 kg), first division B (1B) (n=42; age 23.0±5.0; height 1.76±7.0 m; mass 74.1±7.6 kg) and second professional division (2nd) (n=21; age 22.9±4.7 years; height 1.75±3.4 m; mass 74.6±7.3 kg) participated in the study. To be included in the study, they had to meet the following criteria: a) Have participated in all training sessions since the beginning of the season; b) Do not present muscle injuries until three weeks before the evaluation. Before the start of the tests, the aim of the research and the procedures were verbally explained. All soccer players signed an informed consent form. The tests were part of the evaluations programmed by the respective teams, therefore the approval of the ethics committee was not necessary (Winter & Maughan, 2009). The study was carried out following the ethical guidelines of the Declaration of Helsinki.

Procedures

The evaluations were carried out within the preparation period before the start of their respective competitions: the second microcycle for 1A, the third microcycle for 1B, and the fifth microcycle for the second. All were conducted at 10:00 a.m., with ambient temperatures between 20°C and 23°C. The session began with a 10-minute warm-up by the physical trainers of each campus, consisting of joint mobility and dynamic stretching. For the 1A and 1B teams, the test was carried out on a natural grass surface with soccer shoes, while for the 2a team, it was on synthetic grass with jogging shoes.

30-15 intermittent fitness test (30-15 IFT)

The tests were performed using the protocol described by Buchheit, (2008). Players ran for 30 s, interspersed with 15 s passive recovery, between two lines 40 m apart at a pace determined by an audible signal. The test begins with a speed of 8.0 km/h with increments of 0.5 km/h every 30 s. Players were verbally encouraged to complete as many stages as possible. The test concluded when the player could not maintain the running pace or could not be in the 3 m zones arranged at the ends and center of the course for three consecutive times. The velocity achieved in the last completed stage was recorded as the VIFT.

Perception of effort

The rating of perceived effort was evaluated using the RPE scale (Borg CR-10 scale) proposed by Foster et al., (2001) immediately after the player's participation in the test. The trainers of the three teams regularly used this internal load control modality in their training sessions. Therefore, the athletes were familiar with the procedure.

Statistical Analysis

The data was checked for normality using the Shapiro-Wilk test. The homogeneity of the variables was analyzed using Levene's test. The mean and standard deviation were used to present the descriptive values. The differences between the factors' division and playing position were analyzed using a two-factor ANOVA test to see the interaction effects between factors. If main and interaction effects were found, Bonferroni post-hoc tests were performed. Effect sizes were expressed as partial eta squared (n^2_p). All statistical analyses were conducted using SPSS version 29 software, with an alpha level of 5% established.

The normality of the variables was assessed by analyzing the standardized residuals through the Kolmogorov-Smirnov

test (p>0.05) and Q-Q plots, where the assumption of normality was met. Therefore, descriptive statistics will be presented as mean and standard deviation. Equality of variances was assessed using Levene's test, where the assumption of homogeneity was met (p>0.05). A two-way ANOVA was employed to examine differences between the division and playing position factors and to assess interaction effects between factors. Bonferroni post-hoc tests were conducted in case of significant main or interaction effects. Effect sizes were expressed as partial eta squared (η^2p) and interpreted categorically using the following thresholds: trivial <0.01; small 0.011 to 0.06; moderate 0.061 to 0.14; and large >0.141(Lakens, 2013). For post-hoc comparisons, effect size was calculated as Cohen's d, and the following thresholds were used for categorization: trivial 0 to 0.2; small 0.21 to 0.6; moderate 0.61 to 1.2; large 1.21 to 2; and very large >2 (Hopkins et al., 2009). All statistical analyses were performed using SPSS version 29, with an alpha level of 5% established. Figures were created using JASP software (version 0.17.2.0) and GraphPad (GraphPad Prism version 10.0.0 for Windows, GraphPad Software, Boston, Massachusetts USA).

Results

Table 1 displays the descriptive statistics for VIFT across divisions. Large differences were found between the 1st, 1b, and 2nd divisions in VIFT (p=0.002, η^2p=0.166). Post-hoc analysis revealed significantly higher values with moderate effects for 1a compared to 1b and 2a (p<0.05) (Figure 1). Moderate interaction effects were observed, although they did not reach significance (p=0.2, η^2p=0.115). Figure 1 illustrates the effect sizes along with their 95% confidence intervals.

Table 1.
Descriptive and inferences statistical for divisions.

Variables	1A	1B	2nd	Divisions			Interaction		
	M (SD)	M (SD)	M (SD)	F	p	n^2_p	F	p	n^2_p
VIFT (km/h)	22.2[a,b] (1.37)	21.1 (0.88)	21.2 (0.93)	6.789	0.002	0.166	1.474	0.200	0.115

[a] difference with 1B; [b] differences with 2nd; Medium M; SD standard deviation; F for ANOVA; n^2_p eta partial squared.

Table 2.
Descriptive and inference statistics for positions.

Variables	Defenders	Forwards	Full-backs	Midfielders	Divisions		
	M (SD)	M (SD)	M (SD)	M (SD)	F	p	n^2_p
VIFT (km/h)	20.8[f] (0.89)	21.5 (1.25)	21.9 (1.07)	21.6 (1.03)	5.549	0.002	0.197

[f] differences with full-back p<0.05; M differences with midfielder p<0.05; Medium M; SD standard deviation; F for ANOVA; n^2_p partial eta squared.

Table 2 presents the descriptive statistics for VIFT across playing positions. Significant differences were observed among positions in VIFT (p=0.002, η^2p=0.197). Post-hoc analysis revealed moderate to large differences between defense and both lateral and midfielder positions (p<0.05) (Figure 2). Figure 2 displays the effect sizes along with their 95% confidence intervals.

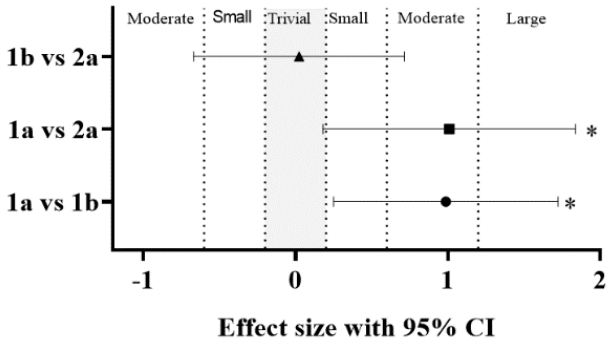

Figure 1. The effect sizes, along with their 95% confidence intervals, between categories.

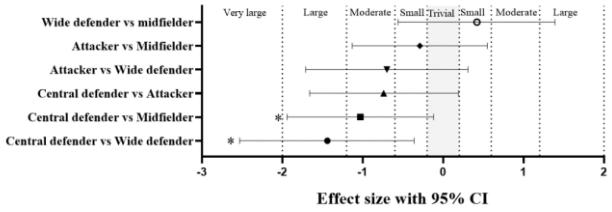

Figure 2. The effect sizes, along with their 95% confidence intervals, between playing positions

Discussión

The purpose of this study was to compare performance in the 30-15 IFT test in teams belonging to 1A, 1B, and 2nd of the Chilean professional soccer league. In the same way, there is a comparison between playing positions. The results suggest that performance is proportional to the competitive level and is affected by position on the playing field.

Endurance is crucial in soccer player performance, especially in recovery between high-intensity efforts, being a key component of physical fitness (Bishop et al., 2011; Stølen et al., 2005). For this reason, analyzing the physical profile according to the competitive level becomes interesting when designing training strategies according to the requirements. Along these lines, various studies have described the differences in resistance capacity between competitive levels, these being directly proportional (Slimani et al., 2019; Slimani & Nikolaidis, 2017; Tønnessen et al., 2013). In agreement, our findings account for this, given that 1A players present higher performances compared to 1B and 2nd. Regarding anaerobic efforts, a relationship has been observed between repeated sprints, changes of direction, and anaerobic reserve speed with performance in the 30-15 IFT test (Ingebrigtsen et al., 2014; Scott et al., 2017; Silva et al., 2022). First-division soccer players present greater covered distances, number of

high-intensity runs, and explosive efforts in general (Di Salvo et al., 2013; Krustrup et al., 2003), an aspect that could explain our results.

Concerning Regarding the comparison by playing position, the defenses, full-backs, and midfielders are the ones who present the highest performance in the test. Guerrero-Calderón et al., (2022) recently analyzed loads in first-division soccer players and found that midfielders lead in medium-high and very high-intensity races, according to other authors (Dolci et al., 2020; Modric et al., 2019). However, a particular finding is associated with the greater performance presented by the full-backs. It is proposed that some contextual factors, such as the quality of the opponent, the tactical disposition, and the momentary result of the match, influence running performance (Bok & Foster, 2021; Konefał et al., 2023; Tierney et al., 2016). Due to the 30-15 IFT running pattern, the test performance could be related to match distance and the ability to repeat sprints between other anaerobic actions. It has been described that, due to their tactical role, the external players (defenders and midfielders) cover greater distances by sprinting (Alonso-Callejo et al., 2022; Di Salvo et al., 2010). Our results indicate that the full-back and defenders present the highest VIFT. However, these are significant only concerning the defenders.

The present study has some limitations. The evaluations were carried out at different times of each macrocycle, so the accumulated loads of each team and the different surfaces may have influenced the results. Therefore, the results may not reflect the maximum performance of the footballers. Future studies should incorporate other physical fitness tests to perform a more in-depth analysis of the physical performance profile according to categories.

Conclusion

From the results obtained, it is concluded that there are differences in the performance of the IFT 30-15 test between categories, with players belonging to the first division being those with a higher VIFT. From the point of view of the playing position, the full-back position presents greater performance within the team, with the category not influencing this difference. This background information is useful for coaches, physical trainers, and sports scientists for better training load programming. However, other studies should cover soccer players from other continents and female players.

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Declaration of interest

The authors declare that there are no conflicts of interest and no funding or research grants were received during study, research, or assembly of the manuscript.

Availability of data and materials

Datasets and materials used are available from the corresponding author upon request.

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