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THE VARIABILITY OF PHYSICAL DEMANDS IN LOCAL WOMEN'S FOOTBALL IN ALGERIA

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Abstract

Aim. This study aimed to identify and analyze the differences in physical performance standards during selected matches of the Algerian National Championship for Women's Football, focusing on one women's team. It evaluated full match data to understand the demands of maximum performance and provide updated insights into key changes between matches. High-performance requirements and maximum physical loads are essential benchmarks for training programs, helping to enhance fitness and manage training loads throughout the sports season. However, despite their significance, many studies in women's football have focused primarily on raw performance data. This has limited scientific understanding of how physical demands vary across different matches or contexts.

Methods. (18) Eighteen players from the same club (average age = 28 years) were observed over ten official matches. Performance data were collected using the GPS-based Global Location Tracking System (Field Wiz, 18 Hz). The study focused on total distance covered, high-intensity and very high-intensity running, sprinting distance, accelerations, decelerations, and peak speed. Data were analyzed across different levels: between matches, between opposing teams, by playing position, and by individual players, using SPSS for statistical processing.

Results. The findings revealed that physical performance varied significantly between matches and was influenced by several factors, including match context, team strategies, and individual player conditions. Among the variables, peak speed showed the most significant variation between matches, more than other physical metrics. This suggests that short bursts of high performance, such as sprinting at maximum speed, are more sensitive indicators of variation in physical load than overall distance or effort. The differences likely reflect both external and internal factors, such as psychological readiness, tactical systems, and match intensity.

Conclusions. The study concludes that peak speed is a critical and highly variable component of performance in women's football, indicating high physical and motor demands in short time frames. These findings highlight the importance of focusing on peak performance indicators rather than only total distance or average effort. Consequently, training programs should emphasize developing and managing peak physical efforts to better prepare female football players for the varying demands of competitive matches.

Keywords: Women's football, match to match variability, physical performance analysis.

Introduction

Monitoring physical requirements during matches in various sports season competitions depends largely on

the uses of modern technological techniques that have become a common practice and methodology adopted in the world of football (Carling, 2013). The measurement and evaluation of the external loads of different clubs of soccer's has evolved during matches in the last 10 years and this is somewhat related to the emergence and widespread spread of global positioning systems (GPS) (Whitehead et. al., 2018). Furthermore, following the changes and amendments approved by the FIFA Boards, it is in the interest to develop and improve performance directly by allowing the use of GPS during official matches of clubs and national teams (FIFA, 2015). The majority of studies in this field depend somewhat little in estimating the requirements and actual competitive physical characteristics in matches despite the high and increasing level of knowledge in the field of studying the characteristics required in matches, and this through abandonment or lack of reliance on several special sports movements (such as: Vertical strikes, defensive physical interventions, rapid performance through the frequency of steps in various positions, the motor sequence of the player's behavior in the execution of force and speed together), Data and statistics obtained after analytical procedures for the motor activity of players are a key criterion for future decisions to work on in building training programs, determining content and intensity of performance, setting short- and long-term goals, and also in terms of recovery and physical recovery in football accordingly (Al Haddad et. al., 2018), that the practice and performance in the sport of football is governed by several factors and trends of a dynamic nature changing from time to time can be predicted and other times their results and outputs are random through results. The physical performance of players or female players and the level at which the player or female player is affected by several factors related to the extent of physical-physiological-tactical-technical readiness and others, which leads to the fluctuation and reversal or change of these indicators from one match to another

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and on the basis of which the changes in the level of performance of footballers or female footballers. In this sense, studies have been conducted continuously in football, such as: (Bush et. al., 2015), (Carling et. al., 2016), (Oliva-Lozano et al., 2021), where this was confirmed and proven by calculating the coefficient of variation (CV) for certain indicators associated with physical performance (Novak et. al., 2021). While the number of researches and studies in this field is few and here we refer to the category of feminism, although both sexes women and men practice the same sports with their characteristics and requirements, some studies in other sports activities such as weightlifting (McGuigan et al., 2004), also cycling (Paton et al., 2006) The existence of a tendency to high variation and difference in the performance of women compared to the male element, where a recent study conducted on the national team of women's football indicated the existence of results represented in high repetitions and less variation in the characteristic or characteristic of acceleration where the coefficient of difference (cv = 17%) compared to the maximum speed and fast running where their results were respectively (cv = 34%), (cv = 56%) (Trewin et. al., 2018). The field of match analysis is no longer limited to the study of absolute values of performance during the entire game. In recent years, analysts and specialists have relied on movement requirements in particular and interesting instead of focusing on average match requirements as a criterion for physical evaluation, where they found that such values and results underestimate the importance of periods of performance with high intensity in matches. Thus, providing very limited information in the future programming of training and also how to deal with the schedule of competitions and therefore in order to measure and determine the difference between the matches in the physical variables to see whether the change in the match is natural or exceptional is linked to a large extent to the familiarity with the study of the requirements of physical efforts throughout the match (Oliva-Lozano et. al., 2021).

Objectives

Based on the above, this study aims to achieve two main objectives:

1. Know the source of the difference in the standards of physical performance during some matches of the Algerian national championship for women's football for one of the women's teams based on the full values of the match and the requirements of maximum performance.
2. Propose and establish reference values that help explain changes in physical performance during matches.

Methods

Highlights

- Identified significant differences in physical performance between matches for the players of the Constantine women's football club.
- Among the physical performance metrics analyzed, peak speed showed the greatest variability between matches compared to other measures, such as total distance covered or distance covered at varying intensities.
- Peak speed, as a reflection of short bursts of maximum physical performance, proved to be more critical and distinct indicator of high performance. This contrasts with the relatively consistent effort required for long-duration, lower-intensity activities throughout a match.
- The application of the GPS system (Field Wiz, 18Hz) (Data-Driven Insights), and SPSS statistical analysis allowed for a comprehensive assessment of performance metrics, offering valuable insights into the physical demands of competitive women's football at the national level.

Participants and match samples. This study was applied after obtaining the official verbal and written approval by the officials and the administrative and technical staff of the sports club Constantine for women's football, which is active in the first national section of the Algerian national championship for the 2023-2024 sports season. While the number of official matches using the Global Location Tracking System (GPS), Field Wiz frequency type 18 Hertz, where the accuracy and reliability of this system has been pre-verified and approved with acceptable levels of error (less than 5%) according to similar studies, such as the study of: Beato (2018). During the matches, each player wore a special jacket containing a sensor technology tool installed at the top of the back between the shoulder bones, and the devices were activated before the start of the matches each time for 05 minutes, excluding them from analysis, according to the recommendations of manufacturers and also the experiments of previous studies (Lozano et. al., 2020).

Data analysis (manipulation). After obtaining the digital results using the GPS device associated with the performance, it was transferred to the statistical processing program of information and data (SPSS). In order to arrive at the standard judgment of the values obtained and their attribution to cognitive truth, the matches for the study have been dealt with separately through the performance requirements associated with the study variables, and goalkeepers have also been excluded from the analytical study and the identification of playing centers (Axis defender = 04 players, backhand = 04 players, defensive midfielders = 03 players, attacking midfielders = 03 players, attacking position = 04 players) Based on these criteria, the final sample consisted of 18 players whose analytical data included 10 official matches from the first national division competitions of the national championship for the 2023-2024 sports season.

Table 1. The list of female players and playing centers

NUMBER:	*PLAYER CENTER:*
01	Axis Defender

02	Axis Defender
03	Axis Defender
04	Axis Defender
05	Backhand
06	Backhand
07	Backhand
08	Backhand
09	Defensive Midfielders
10	Defensive Midfielders
11	Defensive Midfielders
12	Attacking Midfielders
13	Attacking Midfielders
14	Attacking Midfielders
15	Attacking Position
16	Attacking Position
17	Attacking Position
18	Attacking Position

Physical performance indicators. We have based our analysis on physical criteria and characteristics by: Total distance covered; Distance Covered at High Intensity; Distance Covered at Very High Intensity; Distance Covered in Sprints; Distance Covered in Accelerations and decelerations; Peak Speed. These two opposite properties of acceleration and deceleration are positive or negative variations in velocity, exceeding 2,26m/s, with a very short voltage interval in the range of 0.3s, and speed thresholds have been determined based on previous research (Strauss, Sparks & Pienaar, 2019). With the exception of the maximum speed feature, the results of all variables were used to analyze both the performance during the various phases of the match and the highest movement requirements (high physical exertions), and through this the length of the performance time of one minute was used to analyze the high physical exertions based on the results (Doncaster et. al., 2020), where time periods of one minute of performance showed high levels if compared to 03 minutes and 05 minutes.

Statistical analysis methods. After extracting the physical measurements of the study, the Data and information were transferred to the Statistical Data Processing Program (SPSS) to perform a computational analysis of the values obtained. The aim of this analysis is to understand the difference in physical performance between the teams competing with the original team. The positions of the female players in the game, the players (female footballers), as well as the measured matches, as well as the limitation and determination of reference values and ratios that give explanations regarding changes in performance.

- In order to analyze the data in the SPSS program, Linear Mixed Model was used, it is the most appropriate way to process the data in the form of a link to each other. For example, here we find: Digital data of the player, whatever its position (specific player) across several games.
- In order to improve the accuracy of the results, REML was used. (Restricted Maximum Likelihood).
- Use QQ-plots to check the appropriateness of forms.
- In order to get the difference in performance, it was expressed by Standard Deviation, coefficient of variation and other percentages.

Table 2. Variable physical requirements by variables in the study through statistical type (SD-CV)

		VARIABILITY			
Statistical Type:	*Physical demands:*	*Between-match (10 matches)*	*Between-competing teams*	*Between-position*	*Between-women's player*
SD	TDC (m)	425	454	411	389
	DChi (m)	120	130	115	109
	DCvhi (m)	65	72	58	55
	DCS (m)	50	60	48	44
	DC acc/dec (m)	110	166	103	123
	PS (m/s)	0,4	0,5	0,3	0,35
CV	TDC (m)	4,12	4,60	4,03	3,6

	DChi (m)	9,7	3,5	9,1	10,1
	DCvhi (m)	5,77	6,3	9,7	11,1
	DCS (m)	10,27	17,65	10,09	13,2
	DC acc/dec (m)	3,8	5,11	2,99	12,2
	PS km/s)	0,2	1,1	0,1	4,7

SD: Standard Deviation; CV: Coefficient of Variation; TDC: Total Distance Covered; DChi: Distance Covered at High Intensity; DCvhi: Distance Covered at Very High Intensity; DCS: Distance Covered in Sprints; DC acc/dec: Distance Covered in Accelerations and decelerations; PS: Peak Speed.

Results

A detailed analysis of physical performance variables across 10 official matches was conducted, focusing on full-match data and a specific 10-minute high-performance segment. The statistical analysis used raw values along with standard deviation (SD) and coefficient of variation (CV) to assess differences across player positions, matches, individual players, and opposing teams. The coefficient of variation (CV) for the full match ranged from 0.1% to 17.65%. The lowest CV was observed in peak speed (PS) across different player positions (0.1%), indicating minimal variation in this metric between positions. In contrast, the highest CV was related to the distance covered at high-speed running between competing teams, estimated at 17.65%, revealing significant variability based on the opposition. The sprint distance variable showed greater variability across different player positions, with CV values ranging from 0.3% to 12.2%. This highlights that players in attacking roles (offensive midfielders, wingers, and forwards) had higher and more variable physical demands than their defensive counterparts. Additionally, large individual differences were observed among players for several variables, such as total distance covered, accelerations/decelerations, and peak speed, suggesting disparities in fitness levels and in-game physical responses.

Discussions

The findings of this study confirm the presence of significant variations in physical performance among female football players based on match context, position, and opponent, aligning with results from previous research. For instance, Oliva-Lozano et. al. (2020) highlighted that peak physical demands vary across playing positions and match contexts, which supports our findings of high CV values in sprinting distance and between-team differences in high-speed running. The minimal variation in peak speed between positions in our study contrasts slightly with theirs, possibly due to differences in playing style or tactical organization. Gonçalves (2018) emphasized the importance of positional roles in explaining physical demand variations. Our data confirmed this, as offensive players consistently recorded higher variations in sprint distances, supporting the claim that attacking roles entail greater physical intensity and variability. Additionally, Baptista et al. (2022) reported significant inter-individual variability in physical performance among elite female players, particularly regarding acceleration, deceleration, and total distance. Our findings strongly correlate with this, indicating that even within the same team, players exhibit wide differences in fitness and physical output, emphasizing the need for individualized training and load management strategies. Together, these comparisons reinforce the significance of tailoring physical preparation to position-specific and player-specific demands to optimize performance in elite women's football.

Conclusions

Based on the results of this study, it was found that the physical performance of the female football players of the sports club Constantine in the matches of the national championship of the study is influenced by a number of different factors that reflect the difference in performance between the matches and the level at which the players or the team, it turns out that the requirements associated with peak speeds showed a greater difference between matches than other studied physical requirements. This reflects the impact of differences in the characteristics of physical pregnancy of all kinds (internal, external, psychological) in matches as well as the strategy and system of play. On the other hand, data related to peak speed (PS) and this is related to high performance showed greater variation and variation than data related to overall performance. (Total distance of physical characteristics in the study) of the match, which indicates the large differences in high performance through the requirements of peak speed, which is in short periods of time in which the player carries out the highest amount of physical and motor performance an important and significant standard compared to the physical efforts exerted for long periods and limited intensities in various situations throughout the course of the match. This study is an important reference for trainers and specialists in the field of physical performance analysis where they provide values and reference data that allow them to review most of the forms and types of differences and changes in the players and their reflection on the level of performance. Here we explain that the results provide the technical director and his coaching staff that the difference in performance is not a negative thing, but a key factor and an integral part of the nature of team sports, which requires a great degree and a high level of adaptation and diversity. On the ground and in practice, it is preferable for the coach or technical director of the Algerian women's football teams not to follow a single approach in dealing and also to avoid relying on standards and characteristics of consistent in the performance outputs of the players and focus instead on providing and creating varied and renewed training each time in different methods in order to enhance the efficiency of the player in performance taking into account the principle of individual differences and the needs of each player.

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Availability of Data

The data, results and outputs of this study are available to researchers and interested parties upon reasonable request, taking into account the ethical controls and confidentiality standards associated with the use of the data. For this purpose, and to obtain an additional copy or other information, a request may be made by contacting the lead authors, providing the purpose of use and also explaining how the data to be collected will be used. The study is committed to providing reference data to enhance scientific transparency and support future studies as stipulated by the Data Protection and Scientific Studies Law.

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