

# Tell me how and where you play football and I'll tell you how much you have to run

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**ABSTRACT:** The aim of this study was to describe the team accumulated physical response per minute considering only the effective playing time (EPT) attending to different contextual and strategic variables in the Spanish Football First Division (*LaLiga Santander*). A sample of 2,959 performances was included in the analysis, considering a 4-year period of analysis (from 2016–17 to 2019–20). The physical variables were: total distance covered with (DTminPOS) and without (DTminNOpos) possession of the ball, and distance covered at  $> 21 \text{ km}\cdot\text{h}^{-1}$  with possession (DT21minPOS) and without (DT21minNOpos). Two contextual variables, i.e. Place (Home/Away) and Score (Lost/Draw/Win), and two strategic variables, i.e. level of effective playing time (LevelETP) and level of possession of the ball (LevelPOS), were analysed. The teams ran more without possession of the ball than with possession; nevertheless, the teams that had less possession of the ball had higher values in the distance covered at  $> 21 \text{ km}\cdot\text{h}^{-1}$  with possession of the ball and vice versa. Furthermore, the strategic variables also had influence on the physical response (DT and DT21) of the teams, LevelETP and LevelPOS, although with interactive effects: longer playing time, less accumulated distance, and greater possession, greater accumulated distance in the defensive phase, both per min. The findings of this study may offer important practical implications to practitioners in order to assess physical performances of the players in matches, because it is crucial to integrate in the analysis the different contextual and strategic variables where the match has taken place to assess performances of the teams.

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## INTRODUCTION

Since computerized tracking systems were implemented in the professional soccer field, many studies have focused their attention on the analysis of physical demands [1]. Nevertheless, several years ago Carling [2] suggested that there is a need for a more pragmatic approach to interpreting the current body of time-motion analysis data. This proposal reveals the difficulty to account for the association between physical match-play response and success in professional soccer, the interpretation of the differences in time-motion analysis data across playing positions, and the use of the time-motion data to identify the presence of fatigue in match-play. In this line, Castellano [3] showed that the physical response (specifically the total distance covered during the match) is not related to the success obtained by the teams at the end of the championship (e.g., accumulated points). It seems that factors other than physical activity per se are more important in achieving success such as the number

of shots (but overall, their accuracy), the number of corners, and the number of passes and their efficiency [4, 5]. The inclusion in the model of the many potential confounding factors that can affect physical performance discussed in the academic literature (such as score, place) is necessary [2].

One of the main factors that influences distance covered is the effective playing time (EPT) of the match [6]. Usually, the EPT accounts for a little over 50% of the total match time [6]. Consequently, a time-motion analysis based on EPT (~70% of workload corresponds to this period) can provide more precise information about a player's physical activity, which may have direct repercussions for the match outcome [6]. Therefore, not considering EPT could lead to a bias when it comes to connecting physical demands with team performance. On the other hand, having or not having the ball in the football is crucial, clearly indicating different phases of

the game, attack and defence. The results of some studies that have examined the differences between the two phases of play (attack and defence) show that the distance covered by better teams when they have the ball is greater than that covered by the worst teams [7, 8, 9]. However, better teams run more in ball possession because they have more possession and therefore they have more time to run in this phase of the match. There seems to be increasing evidence that style of play has a clear effect on the physical response of players [10, 11], although the results are inconclusive. Therefore, relativizing the physical response to each minute of ball possession or non-possession could be another interesting strategy for an adequate interpretation of competitive physical response.

The results of the academic literature emphasize the importance of accounting for contextual variables such as opponent level (e.g., high, medium and low), match location (e.g., at home or away) and match status (e.g., winning, drawing or losing), among others, during the assessment of the physical response of soccer performance [1, 9, 12, 13]. These studies showed that soccer players perform significantly less high intensity activity when winning than when losing or drawing [1, 12], suggesting that teams use their maximal physical capacity during the match just when it is essential (pacing effect). In some phases of the match, when losing for example, teams are obligated to try alter the score, and then they might increase the rhythm of the game with the aim of reversing the unfavourable position [12]. With respect to match location (e.g., home or away), no definitive conclusion can be drawn from the previous studies. While Castellano *et al.* [1] did not find significant differences for distances covered at different speed categories, Lago-Peñas *et al.* [12] found that differences existed in physical response. This incongruence could be explained by the influence of the interaction with the other contextual variables; probably, as with the previous contextual variable (Score), the probability of the home teams winning the match was greater and so they needed to cover less distance than the rivals. To date, no study has evaluated the effect of contextual variables on distance covered in football considering the effective playing time and possession of the ball from a relative approach (per minute), which has critical importance in the physical performances of the players in team sports. For that reason, the aims of this study were: first, to find out if teams cover more distance in ball possession or not, both in total distance and in high-speed running ( $> 21 \text{ km}\cdot\text{h}^{-1}$ ), only considering the EPT; second, to determine whether strategic and contextual variables such as the level of EPT, the teams' level of possession of the ball, the match location (home/away) and the final match score (draw/lose/win) affect the team's physical response; and third, to assess whether there is a correlation among the physical responses of teams when they have possession of the ball and when they do not. The results of the present study would allow football professionals to assess the physical response in competition as a consequence of the particular competitive scenarios in order to prepare players/teams during the training process.

## MATERIALS AND METHODS

### *Experimental approach to the problem*

An observational analytic study consisting of a longitudinal 4-year study including all teams from the Spanish Football First Division was performed. Data collection was carried out from the season 2016–17 to 2019–20, using the computerized multi-camera tracking system TRACAB. Analysis of variation of total and high-speed running distances per min were performed between independent variables (LevelEPT, LevelPOS, Place, and Score) separately and in interaction.

### *Subjects*

This study was elaborated using the teams' performances from the Spanish Football First Division (*LaLiga Santander*) for four seasons (from 2016–17 to 2019–20). Those matches where the information required was not available were excluded (e.g., technical errors). As a result, out of a possible 3,040 teams' performances (4 seasons \* 380 matches \* 2 teams' performances in each match), a total of 2,959 teams' performances were included in the analysis. Data were obtained from the Spanish Professional Football League, which authorised the use of the variables included in this investigation. In accordance with its ethical guidelines, this investigation does not include information that identifies football players. Data were treated in accordance with the Declaration of Helsinki, and the Ethics Committee on Humans (CEISH) of the University approved their use.

### *Physical variables*

The present study analysed the physical response considering the total distance and distance  $> 21 \text{ km}\cdot\text{h}^{-1}$  covered by teams exclusively in the effective playing time (EPT). Similar to a previous study [10], time in possession of the ball was also considered to analyse the physical demand. In this sense, two different moments of the game, possession and non-possession of the ball, were used to calculate the distance covered by all players of the team in each match. In order to compare the physical demands in matches of different durations of EPT, distances covered were relativized per minute. As a result, four physical variables were obtained: total distance covered in possession (DTminPOS) and without possession (DTminNOPOS) of the ball, and distance covered at  $> 21 \text{ km}\cdot\text{h}^{-1}$  in possession (DT21minPOS) and without possession of the ball (DT21minNOPOS).

### *Contextual and strategic variables*

Four independent variables (contextual and strategic variables) were included in the study: two contextual variables, i.e. match location (Place) and match score (Score), and two strategic variables, i.e. level of effective playing time (LevelEPT) and level of possession (LevelPOS). With respect to the contextual variable match location, and in line with previous studies [14], matches played at home and away were distinguished. With respect to the final outcome or match score [6], it was divided into three levels, e.g., based on whether the team wins, loses or draws the match. Regarding strategic variables,

the EPT and POS of the matches were grouped by percentiles in three levels. Each match was classified in one of the three LevelEPT considering the time spent in play in the match: less than 46.4 min (percentile 25%), between 46.5 and 56.1 min (percentiles >25% & <75%), and more than 56.2 min (percentile 75%), being coded as lowEPT, mediumEPT and highEPT, respectively. Also, three LevelPOS levels were established grouping teams' performances in low, medium and high ball possession, regarding the difference between teams in the time spent in possession of the ball with respect to the rival: less than -7.2 min (percentile 25%), between -7.1 and 7.1 min (percentiles >25% & <75%), and more than 7.2 min (percentile 75%), being coded as lowPOS, mediumPOS and highPOS, respectively. The number of records included is described in Table 1.

### Procedures

Time-motion data were obtained by the computerized multi-camera tracking system TRACAB (ChyronHego, New York, USA) and duration of the ball possession was obtained by OPTA Sportsdata (Opta Sports, London, UK), both using Mediacoach software. The reliability of the OPTA system has been previously proved [15] and the reliability of the TRACAB video-tracking system has also been recently tested for

physical demand [16, 17], showing a good quality of the data. The generated reports were exported into Microsoft Office Excel (Microsoft Corporation, Washington, USA). A matrix was configured and later analysed using the software JASP version 0.13 (University of Amsterdam, <https://jasp-stats.org/>, Amsterdam, The Netherlands).

### Statistical analyses

Descriptive statistics data from variables were presented using mean and standard deviation. Tests for normality (Shapiro–Wilk) and equality of variances (Levene's) were applied. The analysis of variance (ANOVA) for independent samples was used to test for differences in the physical responses (DTmin and DT21min) between independent variables (LevelEPT, LevelPOS, Place, and Score). Also a Pearson correlation analysis was implemented among physical responses: DTminPOS, DTminNOPOS, DT21minPOS and DT21minNOPOS. As proposed by Hopkins [18], the following qualitative correlation descriptors were used: trivial (0–0.09), small (0.1–0.29), moderate (0.3–0.49), large (0.5–0.69), very large (0.7–0.89), nearly perfect (0.9–0.99), and perfect (1). The level of significance was set at  $p < 0.05$ .

**TABLE 1.** Distribution of the records according to the contextual and strategic variables.

Place	Score	LevelPOS	LevelEPT			Total
			lowEPT	mediumEPT	highEPT	
Home	Lost	lowPOS	7	35	16	58
		mediumPOS	45	84	25	154
		highPOS	14	48	18	80
	Draw	lowPOS	9	26	14	49
		mediumPOS	56	67	19	142
		highPOS	15	51	27	93
	Win	lowPOS	30	71	55	156
		mediumPOS	136	206	77	419
		highPOS	37	126	104	267
Away	Lost	lowPOS	41	133	109	283
		mediumPOS	147	218	78	443
		highPOS	34	80	60	174
	Draw	lowPOS	19	55	27	101
		mediumPOS	66	75	21	162
		highPOS	13	29	14	56
	Win	lowPOS	15	54	21	90
		mediumPOS	48	90	25	163
		highPOS	9	41	19	69
Total			741	1,489	729	2,959

Note: lowEPT (>46.4 min), mediumEPT (>46.5 & <56.1 min) and highEPT (>56.1 min) are low, medium and high level of effective playing time (EPT), respectively; and, lowPOS (<-7.2 min), mediumPOS (>-7.1 & <7.1 min) and highPOS (>7.2 min) are low, medium and high level of possession of the ball, respectively.