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Original Article

Effect of the contextual factors in competition on the performance of semi-professional soccer

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Abstract
Problem Statement: Soccer players may behave differently in competition depending on various characteristics of the environment around them, as well as the possible strengths and limitations of internal characteristics. In addition, there are some studies about the physical demands according to the results (winners vs. losers). **Approach:** Knowledge of contextual factors such as imbalance in decision making and physical behavior in soccer competition. **Purpose**: The aims of this study were to know the effect of contextual variables (match location, field dimensions, opponent level, and match outcome) on the physical performance of semi-professional soccer players and, to know the interaction between these factors to achieve sports success. **Methods**: One hundred forty events in Spanish male semi-professional soccer players during the 2021-2022 season were analysed. WIMU devices (SportTrack®) of 18 Hz. and SPRO software were used. T-test, one-way ANOVA, Chi-square, and logistic regression tests were performed. **Results**: A greater physical performance was shown when the team played at home and in large fields. Regarding the match outcome, players covered higher total distance and walking distance when they won ($p < .05$). In addition, the sports success in the competition was associated with the field dimensions and the opponent level (χ^2 [2, n=105] = 16.737, $p = .000$, χ^2 (2, n=96) = 8.304, $p = .016$; respectively). **Conclusions**: Contextual factors influenced the physical performance of semi-professional players in official competition. Field dimensions and opponent level affected the sports success in competition. This study has shown relevant information for the technical staff of the semi-professional soccer teams in order to propose new keys and ways of planning training sessions.
Key words: Football, location, match outcome, field dimension, GPS.

Introduction

Soccer is characterized as an intermittent sport, requiring athletes to execute a variety of explosive technical and tactical movements in a repetitive pattern (Turner & Stewart, 2014). The performance of these physical actions requires a complex physiological demand that subjects anaerobic and aerobic energy systems to high stress (Dolci et al., 2018). Therefore, the analysis of the physical demands of soccer is fundamental to be able to design the effective and appropriate training programs for players. Furthermore, the number of goals scored in a soccer match is the most objective measure of a team's offensive efficiency (Lago-Ballesteros et al., 2012). Therefore, due to the small number of goals scored in soccer, scoring first acquires great importance (Castellano, 2009; Castillo-Rodríguez et al., 2022). Currently, there is a wide scientific literature on the physical and physiological demands of players in competition (Castellano et al., 2012; Castillo-Rodríguez et al., 2020; Zhou et al., 2020).

These physical demands could be influenced by contextual factors of the competition, e.g., field dimensions (Gutierrez et al., 2017), scoring first goal (Olvera-Rojas et al., 2021), opponent level, match location and match outcome (Aquino et al., 2017; Castellano et al., 2011; Chmura et al., 2021; Oliva-Lozano et al., 2021; Teixeira et al., 2021). In addition to these factors, there are other game-derived variables such as playing style and playing system that can also influence the physical demands of players (di Salvo et al., 2013; Fernandez-Navarro et al., 2016; Tierney et al., 2016). These contextual variables influence the physical performance of elite professional soccer players (Guerrero-Calderón et al., 2021), although the effect of them on other players with different levels of expertise is unknown. This information is necessary to be able to rigorously plan training based on these contextual factors of the previous competition and those that might be encountered in the next one (Rago et al., 2021). Due to the fact that in the sport of soccer the final score is very reduced (Olvera-Rojas et al., 2021), the study of the effect of the contextual factors on the competition acquires great importance, because it has obvious consequences on the match outcome, determining, consecutively, the sports success (Lago-Peñas

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et al., 2016; Rumpf et al., 2017). There are several studies that establish relationships between different contextual factors and the match outcome, such as the location of the match (González-Rodenas et al., 2019; Lago-Peñas et al., 2016) and the level of the opponent (Bilek & Ulas, 2019; González-Rodenas et al., 2019). A positive correlation was identified between playing at home and winning the match (Lago-Peñas et al., 2016). However, during a soccer match, players experience all these contextual factors simultaneously, so, the studies focused on multifactorial analyses (Moura et al., 2014). The impact of match location on the match outcome varied depending on the opponent level (Bilek & Ulas, 2019). Another study showed that, playing at home and against high-level opponents implied a higher probability of achieving offensive penetration, although associations were not found in terms of creating scoring opportunities (González-Rodenas et al., 2019). Therefore, there was a significant relationship between match location, opponent level, and other contextual variables affecting team performance.

The aims of this study were to know the effect of contextual factors, i.e., match location, field dimensions, opponent level and match outcome, on the physical performance of semi-professional soccer players and, to know the interaction that could exist between contextual factors to achieve the sports success.

Material and methods

Participants

One-hundred forty events in competition data were collected from 22 official matches on 21 male semi-professional soccer players (26.1 ± 5.7 years; 176.3 ± 3.6 cm; 73.3 ± 5.7 kg) during the 2021-2022 season. Only data corresponding to official matches were used. Goalkeepers were excluded from the analysis due to the obvious differences in their physical demands with respect to the other playing positions. Players were informed about the aim of this study and informed consent was obtained in the same day. This study was followed the guidelines of the Declaration of Helsinki (2013), and it was approved by the Ethics Committee of the University of Granada (Number 471/CEIH/2018).

Instruments and procedure

GPS devices of 18 Hz (WIMU Pro, RealTrack Systems, Almería, Spain) were used to collect data during the matches. Before the start of the match, all devices were calibrated following the manufacturer's instructions. The instructions were: first, place the device on a flat surface; then turn it on without the surrounding magnetic devices; finally, wait for the device to beep again to signal that it was ready. At that point, the devices were placed in the back pocket of the light vest worn by the players. The validity and reliability had been previously tested (Muñoz-Lopez et al., 2017). Once the session is over, the data are transferred to the SPRO software and uploaded to the WIMU PRO CLOUD for subsequent physical performance analysis.

In order to compare the physical demands of the players in the different contexts, independently of the playing time, absolute and relative variables were analysed. The physical demands were: maximum speed (MaxS), number of accelerations (ACC), number of decelerations (DEC), both considered as the number of decreases/increases in speed equal to or greater than 2 m/s2; total distance covered (TD); distance covered walking (WalkD), distance covered between 0 and 7 km/h; low speed running distance (LSRD), distance covered between 7 and 14 km/h; medium speed running distance (MSRD), distance covered between 14 and 18 km/h; high speed running distance (HSRD), distance covered between 18 and 21 km/h; very high speed running distance (VHSRD), distance covered between 21 and 24 km/h; and sprint distance (SPD), distance covered above 24 km/h.

In addition, four context factors were analysed: location of the match, level of the opponent, match outcome and field dimensions. The location of the match referred to whether the match was played at "home" or "away". The level of the opponent was classified according to the ranking position at the time of the match and was classified into "top-ranked" (1st to 6th ranked), "medium-ranked" (7th to 13th) and "worst-ranked" (14th to 19th), equitably. The result of the match was recorded as "win", "draw" or "lose". Finally, the field dimensions are classified into 2 levels based on the median of all fields played on: "large field" (area ≥6231m2) and "small field" (area ≤6230m2).

Statistical analysis

The statistical package SPSS for Windows version 23 (IBM SPSS Statistic, Chicago, USA) and Microsoft Office Excel (Microsoft Corp., Redmond, Washington, DC, IL, USA) were used. The Kolmogorov-Smirnov test was used to verify the normality of the variables. The sample size in each group was adequate ($n \geq 20$) to apply the central limit theorem, which gave normally distributed sample means (Altman, 1990). Paired t-test was performed to assess the difference between physical demands according to the match location (home and away). One-way ANOVA test was performed to find differences of the physical demands of competition with the final outcome (win, draw, lose). The effect size in the ANOVA was presented by $\eta 2$ and was interpreted using the following criteria: minimal effect ($\eta 2 \leq .02$), moderate effect ($.02 < \eta 2 \leq .09$) and strong effect ($\eta 2 > .09$) (Lakens, 2013). As for the effect size for t-tests, they were interpreted with Cohen's d values: small effect ($d < .20$), moderate effect ($.20 \leq d < .80$) and large effect ($d \geq .80$) (O'Donoghue, 2013). Correlation tests of the physical demands with the factors of field dimensions, team ranking, and final score were performed. In addition, Chi-square (□2) and Cramer's V effect size tests were conducted to estimate associations between

opponent level, match location and field dimensions with match outcome. Finally, a logistic regression test was performed between field dimension as a discrete variable (large or small) and the match outcome deleting the possibility of draw (win or lose), through the odds ratio values. The level of significance established was $p < .05$.

Results

Paired *t*-tests were calculated for paired samples according to the location of the competition (home or away) (table 1). TD and MSRD values were significantly higher in soccer players participating as home players ($p = .028$, $d = .38$; $p = .012$, $d = .43$, respectively). In addition, HSR and SPD values were also higher, although marginally significant ($p = .056$, $d = .32$; $p = .053$, $d = .33$).

Table 1. Mean and standard deviation of physical demands depending on the match location.

Variables	Home (n = 72)	Away (n= 68)	*t*	*p*	*d*
TD (m/min)	100.64 ± 9.72	96.71 ±11.22	2.215	.028*	.38
WalkD (m/min)	41.38 ± 4.00	41.53 ±5.54	-.181	.857	-.03
LSRD (m/min)	38.13 ± 7.69	36.47 ±7.89	1.265	.208	.21
MSRD (m/min)	12.45 ± 3.15	11.13 ±3.02	2.537	.012*	.43
HSRD (m/min)	4.60 ± 1.39	4.14 ±1.47	1.926	.051*	.32
VHSRD (m/min)	2.33 ± 1.08	2.14 ±1.17	1.014	.313	.17
SPD (m/min)	1.73 ± 1.37	1.31 ±1.17	1.954	.050*	.33
ACC (nº/min)	1.74 ± 0.34	1.78 ±0.38	-.630	.530	-.11
DEC (nº/min)	1.74 ± 0.35	1.80 ±0.40	-1.033	.303	-.16
Sprint (nº/min)	0.11 ± 0.08	0.09 ±0.07	1.530	.128	.27
MaxS (km/h)	28.92 ± 2.39	28.46 ±2.49	1.121	.264	.19

* $p \leq .05$; TD: total distance covered; WalkD: distance covered walking; LSRD: low speed running distance; MSRD: medium speed running distance; HSRD: high-speed running distance; VHSRD: very high-speed running distance; SPD: sprint distance; ACC: number of accelerations; DEC: number of decelerations; Sprint: number of sprints; MaxS: maximum speed.

A Pearson coefficient correlation test was carried-out between the physical variables and the field dimensions (table 2), taking the competition outcome (win, lose or draw) as a control variable. TD ($r = .167$, $p = .049$), MSRD ($r = .170$, $p = .046$), and SPD ($r = .158$, $p = .056$) correlated with the field dimensions. Subsequently, a simple linear regression test was performed between field dimension and SPD, finding a scant 3% of the explained variance predicting performance by field ($R^2 = .029$, SEE = 1.27, $p = .044$), yielding an equation of SPD = -1.010 + (0.170*dimension). On the other hand, the correlation test between the physical variables and the classification of the teams was carried out, and no significant results were found.

Table 2. Correlations between field dimension and physical demands in competition.

TD	WalkD	LSRD	MSRD	HSRD	VHSRD	SPD	ACC	DEC	Sprint	MaxS
.136	-.038	.086	.176*	.149*	.051	.179*	-.067	-.088	.121	.118

* $p \leq .05$; TD: total distance covered; WalkD: distance covered walking; LSRD: low speed running distance; MSRD: medium speed running distance; HSRD: high-speed running distance; VHSRD: very high-speed running distance; SPD: sprint distance; ACC: number of accelerations; DEC: number of decelerations; Sprint: number of sprints; MaxS: maximum speed.

In addition, one-way ANOVA test was performed on the physical demands with the competition outcome (table 3). Significant differences were obtained in the TD ($p < .05$, $\eta^2 = .05$) and WalkD ($p < .05$, $\eta^2 = .05$).

Table 3. One-way ANOVA test (match outcome) of physical demands in competition.

Variables	Lose (n=28)	Draw (n=35)	Win (n=77)	***F***	***p***	η^2
TD (m/min)	97.42 ± 11.2	95.39 ±11.4[W]	100.7 ± 9.7[D]	3.408	.036*	.05
WalkD (m/min)	41.08 ± 4.35	39.91 ±5.77[W]	42.29 ± 4.31[D]	3.159	.046*	.05
LSRD (m/min)	36.64 ±8.16	35.89 ± 6.78	38.23 ± 8.08	1.206	.303	.02
MSRD (m/min)	11.58 ±3.40	11.72 ± 3.59	11.93 ± 2.87	.143	.867	.00
HSRD (m/min)	4.26 ± 1.57	4.24 ± 1.46	4.48 ± 1.40	.463	.630	.00
VHSRD (m/min)	2.15 ± 1.29	2.04 ± 0.99	2.36 ± 1.13	1.048	.354	.02
SPD (m/min)	1.72 ± 1.38	1.58 ± 1.41	1.44 ± 1.20	.523	.594	.01
ACC (nº/min)	1.73 ± 0.35	1.67 ± 0.31	1.82 ± 0.38	2.056	.132	.03
DEC (nº/min)	1.75 ± 0.38	1.67 ± 0.31	1.82 ± 0.39	1.954	.146	.03
Sprint (nº/min)	0.10 ± 0.82	0.10 ± 0.80	0.10 ± 0.69	.026	.974	.00
MaxS (km/h)	29.1 ± 2.28	28.7 ± 2.55	28.6 ± 2.46	.452	.637	.01

* $p \leq .05$; TD: total distance covered; WalkD: distance covered walking; LSRD: low speed running distance; MSRD: medium speed running distance; HSRD: high-speed running distance; VHSRD: very high-speed running distance; SPD: sprint distance; ACC: number of accelerations; DEC: number of decelerations; Sprint: number of sprints; MaxS: maximum speed.

The relationship between the opponent level (classification) and the match outcome had been studied using a Chi-square test (table 4): χ^2 (2, n=96) = 8.304, p = .016. The effect size was small to medium (Cramer's V = .294). When teams were higher in the rankings (classification), the evaluated team could lose the match at a higher rate (+5.1) and, win the match at a lower rate than average (-5.1). However, when the opposing team is ranked among the bottom of the category, the probability of losing is lower than average (-5.4), and the probability of winning the match is much higher than average (+5.4). In addition, the Chi-square test was performed to estimate associations between the match location (home or away) and the match outcome, and no significant results were found. The relationship between field dimensions and match outcomes was significant (χ^2 [2, n=105] = 16.737, p = .000). The effect size was medium (Cramer's V = .399). When the field dimensions were large (area > 6231m^2) the probability of winning the match was below average (-8.5) and the probability of losing is above average (+8.5). However, when the field dimensions were small (area < 6231m^2), the evaluated team could lose the match with a lower proportion (-8.5) and win the match with a higher proportion than average (+8.5).

Table 4. Contingency table of opponent's level and match outcome.

Match outcome		Classification			Dimensions	
		Top-ranked	Medium-ranked	Bottom-ranked	Small	Large
Lose	Count	13	9	6	0	28
	Count expected	7.9	8.8	11.4	8.5	19.5
	% within RESULT	46.4%	32.1%	21.4%	0%	100%
	% within CLASSIFICATION	48.1%	30.0%	15.4%	0%	38.4%
	% of total	13.5%	9.4%	6.3%	0%	26.7%
Win	Count	14	21	33	32	45
	Count expected	19.1	21.3	27.6	23.5	53.5
	% within RESULT	20.6%	30.9%	48.5%	41.6%	58.4%
	% within CLASSIFICATION	51.9%	70.0%	84.6%	100%	61.6%
	% of total	14.6%	21.9%	34.4%	30.5%	42.9%

Finally, after the previous analysis, a logistic regression test was performed, eliminating the possibility of a draw too, and leaving only the elements of win or lose. In this sense, taking the factor of field dimensions as large or small, considering the median of the dimensions in which the competition has been developed, an odds ratio value of 1.481 was obtained, meaning that the team evaluated when played on small fields was 1.481 times more likely to lose.

Discussion

The aims of this study were to analyse the effect of contextual variables (match location, field dimensions, opponent level and match outcome) on the physical performance of semi-professional soccer players and to find out the interaction between contextual factors in achieving the sports success. The results of this study demonstrated that contextual variables such as match location, field dimensions and match outcome could have an impact on the physical demands of players during competition. Furthermore, it was shown that the match outcome could be predictable based on contextual factors.

This study showed that the location of the match (home or away) affected the physical demands of soccer players in competition. When playing at home, players had higher TD, MSRD, HSRD and SPD values. These data were similar to some recent studies, as they claimed that match location affected TD and distance run at different intensities (Oliva-Lozano et al., 2021; Teixeira et al., 2021). However, other studies in professionals argued that the values of distance covered at different speed ranges were higher, although without statistical differences (Aquino et al., 2017) and others, that these values were similar (Castellano et al., 2011; Chmura et al., 2021).

On the other hand, the field dimensions influenced some physical variables. In competitions on fields with large dimensions, TD, MSRD and SPD were higher. In professional players, it was also concluded that a greater TD and MSRD were covered, although no significant differences were found with respect to SPD (Gutierrez et al., 2017). In this sense, previous studies that analysed the load associated with small-sided games coincided in pointing out that an increase in the playing surface resulted in a greater TD covered by players (Hulka et al., 2016). Although both categories (professional and semi-professional) showed significant differences, it may be that in semi-professional soccer players the differences were greater due to the lack of homogeneity in the field dimensions. The smallest field in the category had a surface area of 5510 m2 while the largest is 7245 m2.

The level of the opponent showed no significant effect on the physical demands of the competition. In line with these results, recent studies concluded that differences were only found in the TD covered by midfielders and forwards (Chmura et al., 2021; Teixeira et al., 2021). However, there was controversy in this fact, as it had been shown that players covered higher TD and at different intensities, reaching higher MaxS and

performing higher actions at high intensity against higher level opponents (Aquino et al., 2017; Castellano et al., 2011).

In relation to the effect found on the match outcome of the physical demands to which the players had been exposed during the match, they covered higher TD and WalkD when the match was won. These results were consistent with those found in other studies, who also found higher HSRD and MaxS values (Aquino et al., 2017), or higher HSRD covered by midfielders and wingers (Teixeira et al., 2021). In controversy with these results, other authors argued that players had a similar activity profile regardless of the result in all playing positions (Chmura et al., 2021), or even that more HSRD was covered when were defeated (Castellano et al., 2011; Oliva-Lozano et al., 2021). In conclusion, match outcomes obtained a relationship only with TD and different speed ranges, while drawn matches tended to require less physical performance. However, there was a lack of agreement among studies, as the relationship between match outcome and competition demands is highly dependent on other contextual variables such as opponent level and match location (Aquino et al., 2017; Castellano et al., 2011; Chmura et al., 2021; Oliva-Lozano et al., 2021; Teixeira et al., 2021) or game-derived variables such as game system or style (di Salvo et al., 2013; Tierney et al., 2016).

The present study also analysed the association between different contextual factors and success in the competition. When the evaluated team played with the top-ranked teams, there was a lower probability of winning and a higher probability of losing. In contrast, when the opposing team was at the bottom of the rankings, the probability of losing and drawing was lower than average, and the probability of winning was higher. These results were supported by a study where it was shown that the level of the opponent significantly affected the team's performance (Bilek & Ulas, 2019). Another factor that had an influence on the match outcome was the field dimension. There was a significant association between field dimensions and match outcomes.

The evaluated team was more likely to win when playing on large fields than on small fields. This research approach has not been previously studied in professionals, and in semi-professional players it could have a great impact on the sports success, and represents an added value of this study, due to the heterogeneity existing in the field dimensions in this category. The dimension differences between fields made it difficult for the teams to implement their game style as they had to continuously adapt to the field of the next match. On the other hand, there was not association between the match location and the match outcomes. In the same vein, a study concluded that playing home or away does not affect the creation of scoring chances (González-Rodenas et al., 2019), however, other authors concluded that the team playing at home was more likely to win the match (Lago-Peñas et al., 2016).

Although the effect of contextual variables on the physical performance of semi-professional players and their association with sports success has been studied, this study had certain limitations. The results obtained belonged to a single team. Furthermore, playing positions had not been considered to establish differences between the dependent variables. Future research could be encouraged recruiting a larger sample in order to perform two-ways ANOVA and include the playing position factor. However, this study has provided valuable information due to the effect size of the results that support the effect of contextual factors in high-level competitive soccer.

Conclusions

The main findings of this study showed that the contextual factors in competition, i.e., field dimensions, match outcomes, and match location affected the physical demands of semi-professional soccer players, thus influencing their sports success in competition. Technical staffs of semi-professional teams should take this information into account in order to rigorously plan training according to these contextual factors of the previous and the following competitions and, assess how these factors could affect the success of the team in order to benefit from them or try to counteract these effects according to each situation.

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Conflicts of interest statement

The author(s) have no conflicts of interest relevant to this article.

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