Goal! What happens before and after the goal?: The demands of competition before and after a goal are different from the average match.

Running heading: External load before and after the goal

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Abstract

The objectives were: 1) compare the external load before and after a goal with average match demands, and 2) analyze differences in response of players pre and post goal scored and conceded. 23 official matches of twenty-two youth professional soccer players (age= 20.6 ± 1.8 years, weight= 73.0 ± 7.1 kg, and height= 1.80 ± 7.4 m) were monitored. With Global Positioning System (GPS) were obtained the Distance Covered (DC), DC >21 $km \cdot h^{-1}$, DC >24 $km \cdot h^{-1}$, Player Load, accelerations and decelerations (±2-3 $m \cdot s^{-2}$ and ±3 $m \cdot s^{-2}$) during the mean of the matches (Team) and in the 5 and 10 minutes before (Pre5 and Pre10) and after (Post5 and Post10) the goals scored and conceded. DC >24 $km \cdot h^{-1}$ was higher to the Team in all periods independently of the goal status ($p \leq 0.05$). Similarly, Team showed lower DC >21 $km \cdot h^{-1}$ than Pre5 in goals scored and Post5 in goals conceded ($p \leq 0.05$). DC, Player Load (except, Pre10), as well as much of the accelerations and decelerations periods were reduced when the goal was conceded ($p \leq 0.05$). Similarly, accelerations and decelerations were reduced in Post5 when the goal was scored, including accelerations between 2-3 $m \cdot s^{-2}$ in Post10 and higher than 3 $m \cdot s^{-2}$ in Pre5 ($p \leq 0.05$). Comparing the same period of scoring or conceding a goal, small differences were observed with higher values during goals scored ($p \leq 0.05$). Around goal moments, players' external load change compared to the match average, varying depending on whether the goal is scored or conceded, and the period analyzed.

Keywords: monitoring, scoring, conceding, high-speed running, sprint, performance.

Introduction

Sports performance is multifaceted, complex, and often unpredictable.[1] Specifically, football competition is especially susceptible to randomness, to the extent that some authors view football matches as a stochastic process.[2] The randomness inherent in this sport has prompted many studies to focus on identifying the performance determinants and defining the elements that determine success in competition.[1,2] Of all the aspects related to performance, scoring a goal is the most decisive action in soccer,[3] as it is considered the most important single factor determining the results in this sport. It becomes the key variable related to success[4,5] and even the sole purpose of teams.[6] Due to its importance, this aspect has received significant attention from the scientific literature.[5] A recent work has demonstrated that goal scoring, along with other elements such as shooting accuracy and ball possession, are determinants in creating an effective offensive play and in the final outcome of the match.[7]

A significant line of research related to goals in football focuses on the impact of scoring on the final match outcome. A study analyzing the five major domestic leagues in Europe found that when the home team scores the first goal, they win 84% of the matches, while the away team achieves the same result in 76% of cases.[8] This highlights the importance of scoring first as it significantly increases the likelihood of winning in football. Other researchers, however, have examined the timing of goals during matches. A previous study,[9] which analyzed 14 FIFA World Cups (1966-2018), indicated that out of 1,880 goals scored, a greater percentage occurred in the second half compared to the first (56.3% vs. 41.1%, respectively). It is also widely recognized that the last 15 minutes of the game (from the 76th to the 90th minute) is the period when the highest number of goals are scored.[10,11] Additionally, studies have investigated the location from which goals

are scored and probability of scoring a goal. Regarding the area of the field where goals are scored, a study that analyzed 795 goals from 320 matches played in five successive FIFA World Cup tournaments (1998–2014) reported that 53.6% of goals were scored inside the penalty area, 23.8% within the goal area, 14.6% outside the penalty area, and 8% from penalties.[11] Concerning the probability of scoring a goal, predictive studies have shown that it increases when shots on target are made, when an early away goal is scored at the beginning of the match, or when the referee issues a red card.[12]

On the other hand, it is important to highlight that one of the aspects that occupies the most time for professional staff is analyzing the types of actions that lead to goals and the preceding action before a goal is scored. In one of the previously mentioned articles, it was shown that 70.5% of all goals were scored from open play, while 29.5% were preceded by set pieces. Of the goals scored from open play, 55.8% resulted from a teammate's pass, while 44.2% were the outcome of individual actions.[9] With respect to the physical action preceding a goal, previous authors have stated that goals tend to be preceded by high-intensity and high-speed actions (such as a straight sprint, jump, rotation, or sprint with a change of direction) performed by either the scorer or the assistant.[13–17]

However, the reality of physical performance in goal-scoring actions is not entirely clear. Although a study demonstrated that the first goal of a match can be predicted by the teams' running performance with high accuracy, with a stronger relationship for total running distance compared to running at higher velocities or in possession,[18] it is not precisely known whether there is a relationship between the running demands of players and scoring in football. Currently, no studies have been conducted that describe the actions

involved in scoring and conceding a goal, as well as the time-motion characteristics of a football team in the moments before and after these events. However, some previous studies have examined the context and preceding actions leading to a goal.[17,19,21] For this reason, the objectives of the study were (1) to compare the demands before and after a goal with the average match demands of the soccer matches in periods of 5 and 10 minutes and (2) to analyse the differences response of the soccer players pre and post goal scored and conceded.

Materials and Methods

Subjects

The research was carried out within a Spanish youth professional soccer team throughout the 2019/2020 season. The team comprised 22 football players with an average age of 20.6 ± 1.8 years, weight of 73.0 ± 7.1 kilograms, and height of 1.80 ± 7.4 meters. These individuals competed at a semi-professional level in a Spanish third division football club. All players possessed a minimum of 10 years of soccer experience, with some regularly participating with the first team in the Spanish First Division during both training and competitive events.

For analysis, only data from players who completed the full match were included, excluding those who were substituted or injured during the matches. The study encompassed 23 official matches of the season during which participants were closely monitored. All players were briefed on the protocol and research objectives, and their involvement was voluntary, anonymous, and confirmed through the signing of an informed consent form. The acquired data formed part of the daily monitoring process for the players, making them highly accustomed to the tools used in this study. According to

126 the nature of the study, ethics committee authorization was not required,[19] but the authors
127 nonetheless followed the ethical standards outlined in the Declaration of Helsinki to
128 conduct this study.

129 **Procedures**

130 The research employed a quasi-experimental descriptive retrospective study design to
131 thoroughly investigate and analyze the locomotor and mechanical response experienced
132 by soccer players in the periods leading up to and following a goal. All data pertained to
133 official matches of the season. The design, procedure, and operation of the data registers
134 were monitored by an external evaluator, independent of the technical staff, to ensure
135 optimal conditions during their execution. After the matches, the mean external load of
136 players who completed the full match was obtained (Team). Similarly, when a goal was
137 scored, the minute of the match was used as the reference point and the external load of
138 the players was recorded during the previous 10 (Pre10) and 5 (Pre5) minutes period, as
139 well as during the following 5 (Post5) and 10 minutes (Post10) period. For example, if a
140 goal occurred in the 25th minute, Pre10 consisted of the external load of players during
141 the 15-25 period, Pre5 consisted of the external load during the 20-25 period, Post5
142 consisted of the external load during the 25-30 period, and Post10 consisted of the
143 external load during the 25-35 period. If a goal was scored during minutes that did not
144 fall within any of these periods (for example, the first or last 5 or 10 minutes of each half),
145 the corresponding period was excluded from the analysis. Moreover, the data were
146 categorized based on whether the goal was scored by the studied team (scored goals) or
147 the opposing team (conceded goals) (see, Figure 1). If a new goal was scored during the
148 period following a previous goal, a new reference point was established, resulting in
149 overlapping time intervals until the completion of the initial 5 or 10 minute post-goal
150 periods. The regular weekly training regimen at the club's facilities involved five sessions

lasting around 90 minutes each, following a consistent structure on Monday, Wednesday, Thursday, Friday, and Saturday. Additionally, one match per week was typically scheduled for Sunday, except when matches occurred on Saturday. In such cases, only four training sessions took place on Monday, Wednesday, Thursday, and Friday. The day following the match was used to compensate the training load of substitute players. The highest training load was applied during the middle of the week (Wednesday or Thursday), while a tapering strategy was implemented during the two days preceding the match to minimize potential accumulated fatigue. The Global Positioning System (GPS) waistcoats were distributed 30 minutes before the warm-up, coinciding with the footballers passing through the technical room for weigh-in. Following each match, the principal investigator would retrieve the devices, recording and analyzing the data from each measurement individually.

Material and Measures

Height and weight data were measured on multiple occasions throughout the season using SECA 213 stadiometer (SECA, Hamburg, Germany) and Tanita RD-545 HR scale (Tanita Corp., Tokyo, Japan), respectively. External load was monitored using a GPS system (WIMU Pro, RealTrack Systems, Almería, Spain) with a sampling rate of 10 Hz. The validity and reliability of this device has been analysed for the collection of time-motion variables and is considered a suitable instrument for this purpose in football. [20,21] Total distance covered (DC), distance covered above 21 $km \cdot h^{-1}$ ($DC > 21\ km \cdot h^{-1}$), distance covered above 24 $km \cdot h^{-1}$ ($DC > 24\ km \cdot h^{-1}$), Player Load (calculated by a mathematical formula based on the sum of data obtained by the accelerometer in all planes; arbitrary units), accelerations and decelerations between ±2 and ±3 $m \cdot s^{-2}$ (Acc_{2-3}; Dec_{2-3};) and

higher than ± 3 $m \cdot s^{-2}$ ($Acc_{>3}$; $Dec_{>3}$) were recorded. These variables have been used in the previous literature. [22,23]

Statistical procedures

To confirm the data normality of each of the dataset, the Kolmogorov-Smirnov test, the Q-Q plot of residuals and the random coefficients histogram were used. Data not following a normal distribution were transformed before further analysis analysis (Field, 2017). To compare the external load values of the Team with the Pre10 and Pre5 before scoring a goal and the Team with the Pre10 and Pre5 before to conceding a goal, a one-sample t-tests were used. To analise the impact of the time surrounding the scored goal (Pre10, Pre5, Post5, Post10) and the type of goal (Scored, Conceded) on the dependent parameters, mixed model analyses were employed. Each dependent parameter was modeled with time around the scored goal and the type of goal, as independent fixed factors and random intercepts on the individual scored goal. The goodness of fit for the models was evaluated using a log-likelihood ratio test. Differences in the type of goal at Pre10, Pre5, Post5, and Post10 times around the goal were examined by simple main effects using the type of goal as the simple effects variable and the time surrounding the scored goal as the moderator variable. Statistical significance was set at $\alpha \leq 0.05$. Unless otherwise specified, all values are presented as estimated marginal mean ± SE. Standardized mean difference Cohen's d effect sizes were obtained and were interpreted as: < 0.2 = trivial; 0.2-0.6 = small; 0.6-1.2 = moderate; 1.2-2.0 = large; > 2.0 = very large.[25] The level of significance was set at 0.05 for all tests. All statistical analyses were performed using JAMOVI for Mac (version 2.6. 19; The Jamovi project)[26] and the jamovi module GAMLj: General analyses for linear models.[27]

200 **Results**

201 The external load values for Team, Pre10, Pre5, Post10, and Post5 conditions for scoring
202 a goal are presented in Table 1 and Figure 2. The analyzed data indicate that when a goal
203 was scored, DC > 21 km·h^{-1} was significantly higher in Pre5 than in the Team (Mean
204 Difference (MD) = 1.04 m·min^{-1} 95% confidence interval (CI) (0.42, 1.65), p = 0.001).
205 DC > 24 km·h^{-1} was significantly higher in all periods compared to Team (Pre10: MD =
206 1.02 m·min^{-1} 95% CI (0.68, 1.36), p < 0.001; Pre 5: MD = 2.26 m·min^{-1} 95% CI (1.87,
207 2.65), p < 0.001; Post5: MD = 1.78 m·min^{-1} 95% CI (1.37, 2.19), p <0.001; Post 10: MD
208 = 0.67 m·min^{-1} 95% CI (0.30, 1.05), p < 0.001). In contrast, the Team exhibited higher
209 $Acc_{2\text{-}3}$ than Post5 (MD = -0.10 counts·min^{-1} 95% CI (-0.17, -0.03), p = 0.007) and Post10
210 (MD = -0.10 counts·min^{-1} 95% CI (-0.17, -0.02), p = 0.01). Team also showed higher
211 $Acc_{>3}$ than Pre5 (MD = -0.04 counts·min^{-1} 95% CI (-0.08, 0.00), p = 0.030) and Post 5
212 (MD = -0.08 counts·min^{-1} 95% CI (-0.12, -0.04), p < 0.001). Regarding decelerations,
213 Team showed higher $Dec_{2\text{-}3}$ and $Dec_{>3}$ than Post5 ($Dec_{2\text{-}3}$: MD = -0.09 counts·min^{-1} 95%
214 CI (-0.15, -0.02), p = 0.020; $Dec_{>3}$: MD = -0.16 counts·min^{-1} 95% CI (-0.27, -0.05), p =
215 0.004).
216
217 The comparison of Team values with the studied periods during conceded goals is
218 represented in Table 2 and Figure 3. These data revealed that during Pre10 players scored
219 higher values of DC > 24 km·h^{-1} than Team (MD = 1.25 m·min^{-1} 95% CI (0.73, 1.77), p
220 < 0.001) and lower values of $Acc_{>3}$ than Team (MD = -0.08 counts·min^{-1} 95% CI (-0.14,
221 -0.02), p = 0.007). During Pre5 players scored lower values than Team in DC (MD = -
222 6.23 m·min^{-1} 95% CI (-10.73, -1.72), p =0.007), Player load (MD = -0.14 arbitrary units
223 (AU)·min^{-1} 95% CI (-0.22, -0.06), p = 0.001), $Acc_{>3}$ (MD = -0.13 counts·min^{-1} 95% CI
224 (-0.19, -0.07), p < 0.001), $Dec_{2\text{-}3}$ (MD = -0.18 counts·min^{-1} 95% CI (-0.29, -0.07), p =

0.001) and $Dec_{>3}$ (MD = -0.22 counts·min^{-1} 95% CI (-0.39, -0.05), p = 0.010). However, higher values of DC > 24 km·h^{-1} were registered (MD = 1.79 m·min^{-1} 95% CI (1.14, 2.45), p < 0.001). During Post 5 players scored lower values than Team in DC (MD = -6.12 m·min^{-1} 95% CI (-10.72, -1.53), p = 0.009), Player load (MD = -0.13 AU·min^{-1} 95% CI (-0.21, -0.05), p = 0.002), Acc_{2-3} (MD = -0.14 counts·min^{-1} 95% CI (-0.25, -0.02), p = 0.020), $Acc_{>3}$ (MD = -0.12 counts·min^{-1} 95% CI (-0.18, -0.06), p < 0.001), Dec_{2-3} (MD = -0.17 counts·min^{-1} 95% CI (-0.28, -0.06), p = 0.002) and $Dec_{>3}$ (MD = -0.25 counts·min^{-1} 95% CI (-0.43, -0.08), p = 0.004). However, higher values than Team were reported of DC > 21 km·h^{-1} (MD = 1.09 m·min^{-1} 95% CI (0.08, 2.10), p = 0.030) and DC > 24 km·h^{-1} (MD = 1.98 m·min^{-1} 95% CI (1.33, 2.63), p < 0.001). Finally, during Post10 lower values than Team were reported of DC (MD = -7.63 m·min^{-1} 95% CI (-12.28, -2.99), p = 0.001), Player load (MD = -0.12 AU·min^{-1} 95% CI (-0.21, -0.04), p = 0.005), Acc_{2-3} (MD = -0.12 counts·min^{-1} 95% CI (-0.23, 0.00), p = 0.050) and $Acc_{>3}$ (MD = -0.09 counts·min^{-1} 95% CI (-0.15, -0.02), p = 0.008), except for higher values in DC > 24 km·h^{-1} (MD = 0.66 m·min^{-1} 95% CI (0.11, 1.21), p = 0.020).

The external load data of the Team, comparing the same time period when a goal was scored or conceded are reflected in Table 3 and Figure 4. The analysis revealed that during Pre 5, higher values were registered in Scored than in Conceded goals for DC (MD = -8.45 m·min^{-1} 95% CI (-13.80, -3.10), p = 0.002), Player load (MD = -0.16 AU·min^{-1} 95% CI (-0.25, -0.06), p = 0.002), $Acc_{>3}$ (MD = -0.09 counts·min^{-1} 95% CI (-0.16, -0.02), p = 0.011), Dec_{2-3} (MD = -0.18 counts·min^{-1} 95% CI (-0.30, -0.05), p = 0.007) and $Dec_{>3}$ (MD = -0.25 counts·min^{-1} 95% CI (-0.45, -0.05), p = 0.016) variables. During Post 5, higher values were registered in Scored than in Conceded goals for DC (MD = -5.96 m·min^{-1} 95% CI (-11.39, -0.53), p = 0.032) and Player load (MD = -0.12 AU·min^{-1} 95%

CI (-0.22, -0.02), p = 0.015) variables. Finally, during Post 10, higher values were registered in Scored than in Conceded goals for Player load variable (MD = -0.10 AU·min^{-1} 95% CI (-0.21, -0.00), p = 0.048).

Discussion

The objectives of the study were (1) to compare the demands before and after a goal with the average match demands of the soccer matches and (2) to analyse the differences in response of the soccer players pre and post goal scored and conceded. The main findings show that before and after scoring or conceding a goal, soccer players achieved higher values of DC > 24 km·h^{-1} compared to their average performance during the match. Similarly, in the 5 minutes before a goal scored and 5 minutes after a goal conceded, they also accumulated a greater DC > 21 km·h^{-1}. Moreover, it was found a lower DC and Player Load (except, Pre10) in periods close to goal reception compared to the match average. Accelerations and decelerations were reduced when the goal was conceded (mainly in Pre5 and Post5). In addition, when the goal was scored the accelerations and decelerations were all reduced in Post5, including accelerations between 2-3 m·s^{-2} in Post10 and higher than 3 m·s^{-2} in Pre5. Some small differences were observed in the comparison by periods when a goal was scored or conceded, with higher values when a goal was scored in DC Pre5 and Post5, Player Load in Pre5, Post5 and Post10 and accelerations-decelerations in Pre5, except for accelerations of 2-3 m·s^{-2}.

In football, the scoreboard establishes a crucial contextual element; all behaviors and game dynamics in competition are conditioned by the goal.[17] In this sense, it is essential to examine the context before and after a goal is scored or conceded and how this may affect the locomotor and mechanical responses of the players. However, little previous

275 research has focused on the changes in the average dynamics of the match that could help
276 demonstrate the special context of the goal, as in our study. These changes may be related
277 to players' adaptations to situations during the match[28] and the main technical-tactical
278 actions surrounding the goal, intensified by the intermittent nature of soccer itself. High-
279 intensity and high-speed actions emerge as key elements in the most critical moments of
280 the match.[13,17,29] Thus, it is clear that a team's success is directly connected to goals, and
281 running dynamics appear to be a good indicator for predicting the goal.[7,18]
282
283 Our results have shown that in the moments before scoring a goal, compared to the match
284 average, more distance is achieved at high intensity and sprinting (DC > 24 $km \cdot h^{-1}$ is
285 higher in all periods, in addition to DC > 21 $km \cdot h^{-1}$ in Pre5), possibly associated with
286 transition situations, speed in attacks, counterattacks and pressure.[13,14,16,17] In men's
287 football[13] and in women's football[15] found that most goals were preceded by high-
288 intensity action and situations of fast attacks and counterattacks, which could be the cause
289 of the increase in distance travelled at high-speed and sprint in the moments before a goal.
290 However, the mentioned studies have not analysed the magnitude of the variables but the
291 description of the previous actions. Other studies have focused more specifically on
292 changes in the dynamics of the game at moments close to the goal. Previous authors[17]
293 showed changes in running behaviour and increased activity across distance covered and
294 high-intensity distance, highlighting increased values in direct attackers in previous 1-
295 minute periods when a goal was scored. Our results complement this data, as they show
296 an increase in activity in relation to the match average, and not only in relation to goal vs.
297 non-goal actions. On the other hand, the moments directly following a goal have not been
298 analysed by previous references, however our findings show a slight decrease in
299 acceleration and deceleration actions (mainly in Post5) and continuation of the increase

300 in sprint distance travelled (DC > 24 km·h^{-1}). The results obtained in our study, in terms
301 of accelerations and decelerations, may be associated with favorable situations on the
302 scoreboard and contexts associated with the post-goal phase. In these periods, teams
303 appear to exhibit a more conservative pacing strategy, emphasizing defensive security,
304 possibly resulting in a slower pace of play, reflected in shorter distances covered and
305 lower intensity, as well as fewer changes of direction, accelerations and decelerations.[30]
306 Nevertheless, other authors observed no change in high intensity activity after scoring a
307 goal.[31] The differences with previous references, in the results of sprint distance after
308 scoring a goal, could be due to the level of the team analyzed with a high number of goals
309 scored and matches won during the season (65%), implying situations in which the team
310 is already ahead on the scoreboard when scoring the goal and no relevant modification in
311 the dynamics of the game is required. Consistent with the maintenance of high values of
312 sprint distance after goal scoring, previous studies observed that higher level players and
313 the most successful teams in competition perform more actions at high intensity and,
314 logically, they score more and concede fewer goals than their opponents,[32,33] which could
315 have consistency with the analyzed context. However, there are some discrepancies, other
316 authors show lower or equal external load in more successful teams compared to less
317 successful teams, highlighting the technical-tactical elements as determinants of sports
318 success.[34–36] When a goal is conceded, our results show that sprint distance is higher in
319 all periods and high-speed distance in Post5. However, DC, Player Load, accelerations
320 and decelerations were lower compared to the match average, with small significant
321 changes in most of the periods analyzed. There are limited references to these findings,
322 but appear to be partly dissenting with our data. Situations prior to conceding a goal may
323 require greater activity with the intention of avoiding a goal. Direct defenders and the rest
324 of the team show superior data in distance covered and high-intensity distance when

conceding a goal in the 1 and 5 minutes prior compared to when the action does not end in a goal.[17] In women's football, the moments before a goal showed more lateral movements and high intensity linear actions and decelerations by defenders.[15] These results could be in line with the results obtained in our study prior to receiving the goal, in terms of sprint distance (> 24 $km \cdot h^{-1}$), but they seem to show controversy to the reported results of DC, Player Load, accelerations and decelerations. This controversy could also be related to the different sample size, country of origin, type of league and context, e.g. in our study the subjects are young professional players, and in the other two studies mentioned are male and female professional football players. The results in the moments after conceding a goal seem to be related to the presence of a series of stressful situations and environmental pressure related to the goal that are intended to react to the negative situation.[37] This response is connected with a greater physical activity, in relation to distance travelled and distance at high speed.[31] Our results after conceding a goal, with a similar tendency to what happened before conceding a goal, could be justified by higher possession percentages than the opponents and tactical situations associated with a possible direct play of the opposing team required by the performance of the analysed team in the competition based on a more combinative game. Previous studies analysing the influence of the scoreboard on external load requirements showed similar results, with the winning teams performing actions at lower intensity.[38] In addition, the success rate of the team analyzed, much higher than the average of the teams in the competition, could mean that conceding a goal, in some cases, did not have a significant influence on the final result of the match, occurring in very favorable scoring situations, which could be a justification for the results obtained.

Finally, the comparison between similar periods when a goal was scored or conceded seems to show some tendency towards higher values when it was scored in a few variables and time periods. These results seem to show that there are no very important differences between the locomotor and mechanical response to scoring and conceding a goal, so the differences may be determined by other elements, such as the technical-tactical ones. However, we must understand these data with caution since they refer to opposite situations in competition. These similarities may be due to the need for defensive responses that, although in different contexts, share similar typology and magnitude to be able to counter offensive actions in both teams, which are in continuous interaction in soccer, being a sport of special complexity. In this sense, we found very limited references on the differences in goal actions between attackers and defenders. A previous study showed results with a similar tendency towards higher values for goals scored than goals conceded, although our results were analyzed on the same team, total distance and low-moderate intensity running performance metrics were higher in teams that scored a goal compared to teams that conceded a goal in previous 5-minute periods, however, no differences were observed at high speeds.[39] In other study[17] it was observed that most physical parameters, mainly in direct participants, were higher when the attempt led to a goal compared to an unsuccessful attempt in attackers and defenders, suggesting the special context of the goal. On the other hand, other study[15] showed, in women's soccer goals, a greater number of actions at high intensity in linear forward movement and decelerations in defenders than in attackers, although the total movements were smaller. Therefore, further studies comparing goals scored and conceded in earlier and later periods are required.

The main limitation of this study was the lack of consideration for the effective time of different periods, which can be influenced by factors such as set pieces, expulsions, fouls, or injuries. Additionally, player demands were assessed without accounting for position, potentially limiting the understanding of how different roles experience varying demands in goal situations. Future studies should examine whether there are position-specific differences in player demands before and after a goal is scored or conceded. Moreover, it would be highly valuable to analyze, in both goals scored and conceded, the potential psychological factors that might explain the patterns observed in competitive demands. Additionally, it would be worth exploring whether the level of the opponent influences the demands related to goal events.

In conclusion, these results suggest a distinct context in the moments before and after a goal, especially when compared to average match responses. The study indicates that moments close to scoring lead to a significant increase in high-intensity activities, as evidenced by greater distances covered at speeds exceeding 24 $km \cdot h^{-1}$ compared to overall match averages. Additionally, there is a notable reduction in accelerations and decelerations immediately after scoring. Conversely, when a goal is conceded, while the distance at speeds over 24 $km \cdot h^{-1}$ also increases, there is a marked decline in performance metrics, including DC, Player Load, accelerations, and decelerations. The data show small significant differences when comparing similar periods before and after scoring or conceding a goal, with higher values when scoring, which requires future research.

Practical applications

This study offers valuable insights for soccer coaches, helping them to better understand the demands of the game in relation to its context. The results suggest that an event such

as scoring a goal can significantly alter players' running demands. Therefore, coaches should avoid making in-game decisions, such as substitutions, based solely on physical performance data. Instead, they should consider player demands from a broader, more contextualized perspective. Additionally, this study highlights that coaches can design training exercises with varying physical demands to simulate different contexts or moments that may occur during a match. The tactical implications of these findings should be addressed by football coaches during training, implementing appropriate interventions aimed at preparing teams for these crucial moments of competition, which are typically associated with high physical demands.

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Legend of figures

Figure 1. Graphical representation of the data analysis according to the time of the goal.

Figure 2. Differences in the team's external load mean and the moments before and after scoring a goal.

Notes: Team: mean values of the whole team; Pre10: mean values of the previous 10 min before scoring a goal; Pre5: mean values of the previous 5 min before scoring a goal; Post5: mean values of the posterior 5 min after scoring a goal; Post10: mean values of the posterior 10 min after scoring a goal. The grey dashed vertical lines delimits the lower (-0.20) and the upper limit (0.20) of a trivial effect size. DC: total distance covered; DC >21 $km \cdot h^{-1}$: distance covered above 21 $km \cdot h^{-1}$; DC >24 $km \cdot h^{-1}$: distance covered above 24 $km \cdot h^{-1}$; AU: arbitrary units; Acc_{2-3}: accelerations between +2 and +3 $m \cdot s^{-2}$; $Acc_{>3}$; accelerations higher than +3 $m \cdot s^{-2}$; Dec_{2-3}: decelerations between -2 and -3 $m \cdot s^{-2}$; $Dec_{>3:}$ decelerations higher than -3 $m \cdot s^{-2}$.

Figure 3. Differences in the team's external load mean and the moments before and after conceding a goal.

Notes: Team: mean values of the whole team; Pre10: mean values of the previous 10 min before receiving a goal; Pre5: mean values of the previous 5 min before receiving a goal; Post5: mean values of the posterior 5 min after receiving a goal; Post10: mean values of the posterior 10 min after receiving a goal. The grey area delimits the lower (-0.20) and the upper limit (0.20) of a trivial effect size. DC: total distance covered; DC >21 $km \cdot h^{-1}$: distance covered above 21 $km \cdot h^{-1}$; DC >24 $km \cdot h^{-1}$: distance covered above 24 $km \cdot h^{-1}$; AU: arbitrary units; Acc_{2-3}: accelerations between +2 and +3 $m \cdot s^{-2}$; $Acc_{>3}$; accelerations higher than +3 $m \cdot s^{-2}$; Dec_{2-3}: decelerations between -2 and -3 $m \cdot s^{-2}$; $Dec_{>3:}$ decelerations higher than -3 $m \cdot s^{-2}$.

Figure 4. Comparative analysis between goals for (black line) and goals against (grey line) at different times around the goal in A) Total distance covered, B) Distance covered above 21 $km \cdot h^{-1}$, C) Distance covered above 24 $km \cdot h^{-1}$, D) Player load, E) Accelerations between +2 and +3 $m \cdot s^{-2}$, F) Accelerations higher than +3 $m \cdot s^{-2}$, G) Decelerations between -2 and -3 $m \cdot s^{-2}$ and H) Decelerations higher than -3 $m \cdot s^{-2}$.

Notes: Data are presented as estimated marginal means with 95% confidence interval. Pre 10: ten previous minutes before a received goal; Pre 5: five previous minutes before a received goal; Post 5: five posterior minutes after a received goal; Post 10: ten posterior minutes after a received goal. *: $p \leq 0.05$ statistically significant differences between type of goal. AU: arbitrary units. Read text to further explanation.

Legend of tables

Table 1. The team's external load average and the moments before and after goal scoring. **Notes:** values are presented as mean ± standard deviation. Team: mean external load of the team for the whole match; Pre10: mean external load of the team for the 10 previous minutes of the goal; Pre5: mean external load of the team for the 5 previous minutes of the goal; Post10: mean external load of the team for the 10 after minutes of the goal; Post5: mean external load of the team for the 5 after minutes of the goal; *$p \leq 0.05$ statistically significant from Team values; ^{T}: trivial effect size; ^{S}: small effect size.

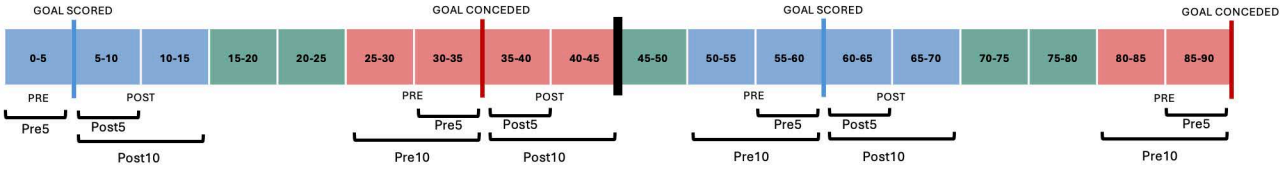
Table 2. The team's external load average and the moments before and after conceding a goal.

Notes: values are presented as mean ± standard deviation. Team: mean external load of the team for the whole match; Pre10: mean external load of the team for the 10 previous minutes of the goal; Pre5: mean external load of the team for the 5 previous minutes of the goal; Post10: mean external load of the team for the 10 after minutes of the goal; Post5: mean external load of the team for the 5 after minutes of the goal; *$p \leq 0.05$ statistically significant from Team values; ^{T}: trivial effect size; ^{S}: small effect size.

Table 3. External load of the team when according when the goal is scoring or conceding before and after the goal.

Notes: values are presented as mean ± standard deviation. Pre10: ten previous minutes before a scored goal; Pre5: five previous minutes before a scored goal; Post5: five posterior minutes after a scored goal; Post10: ten posterior minutes after a scored goal. Scored: scored goal; Conceded: received goal; DC: total distance covered; DC > 21 $km \cdot h^{-1}$; distance covered above 21 $km \cdot h^{-1}$, DC > 24 $km \cdot h^{-1}$: distance covered above 24 $km \cdot h^{-1}$; Acc_{2-3}:

598 Accelerations between 2 to 3 $m \cdot s^{-2}$; $Acc_{>3}$: Accelerations above 3 $m \cdot s^{-2}$, $Dec_{2\text{-}3}$:
599 Decelerations between -2 to -3 $m \cdot s^{-2}$; $Dec_{>3}$: Decelerations above -3 $m \cdot s^{-2}$; *: $p \leq 0.05$
600 statistically significant different from scored goal at the same time around the goal. ^{T}: Trivial
601 effect size; ^{S}: Small effect size.


GOAL SCORED
GOAL CONCEDED
GOAL SCORED
GOAL CONCEDED
0-5
5-10
10-15
15-20
20-25
25-30
30-35
35-40
40-45
45-50
50-55
55-60
60-65
65-70
70-75
75-80
80-85
85-90
PRE
POST
Pre5
Post5
Post10
PRE
POST
Pre5
Post5
Pre10
Post10
PRE
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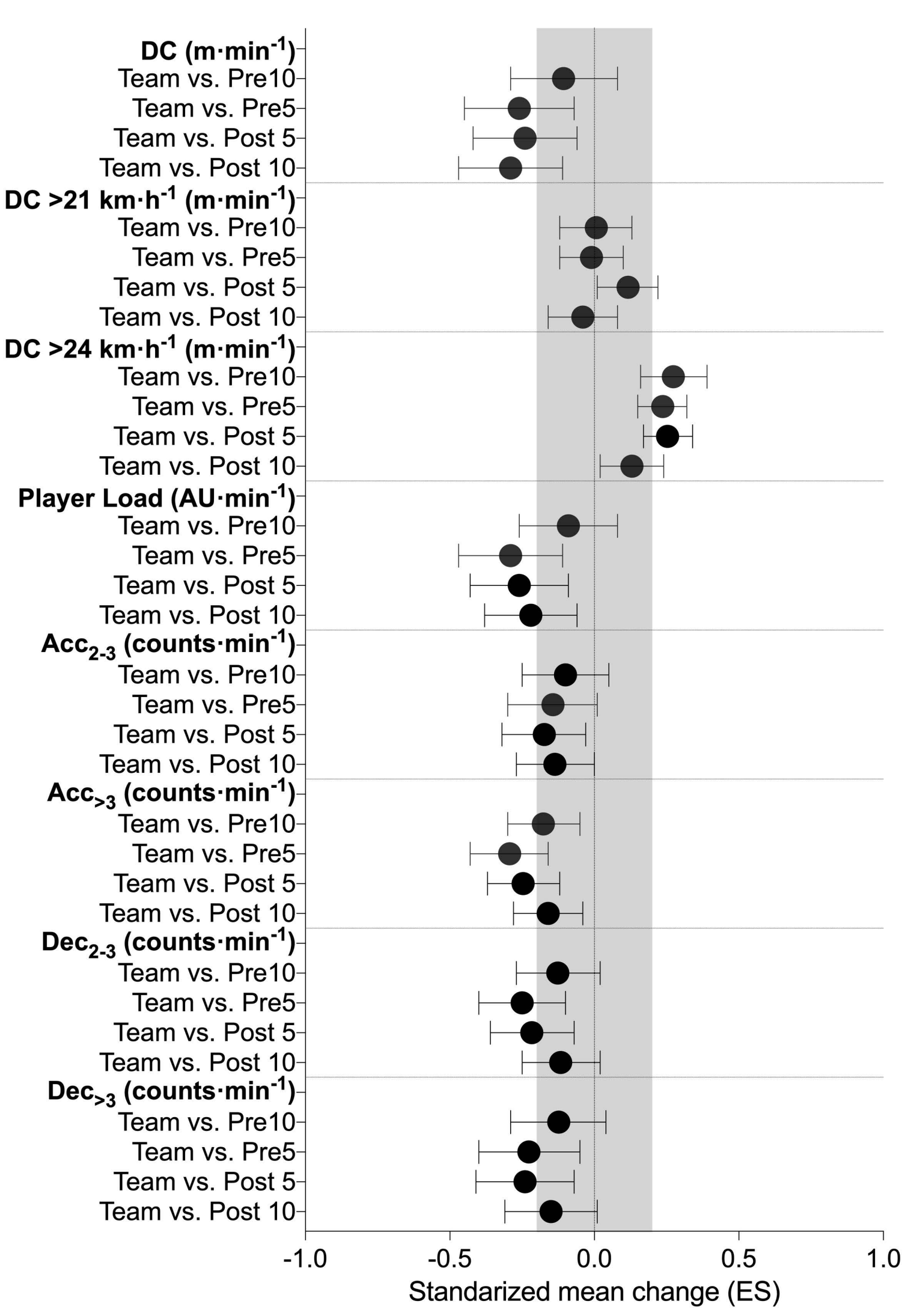
Post10
PRE
Pre5
Pre10

DC (m·min^{-1})
Team vs. Pre10
Team vs. Pre5
Team vs. Post 5
Team vs. Post 10
DC >21 km·h^{-1} (m·min^{-1})
Team vs. Pre10
Team vs. Pre5
Team vs. Post 5
Team vs. Post 10
DC >24 km·h^{-1} (m·min^{-1})
Team vs. Pre10
Team vs. Pre5
Team vs. Post 5
Team vs. Post 10
Player Load (AU·min^{-1})
Team vs. Pre10
Team vs. Pre5
Team vs. Post 5
Team vs. Post 10
$Acc_{2\text{-}3}$ (counts·min^{-1})
Team vs. Pre10
Team vs. Pre5
Team vs. Post 5
Team vs. Post 10
$Acc_{>3}$ (counts·min^{-1})
Team vs. Pre10
Team vs. Pre5
Team vs. Post 5
Team vs. Post 10
$Dec_{2\text{-}3}$ (counts·min^{-1})
Team vs. Pre10
Team vs. Pre5
Team vs. Post 5
Team vs. Post 10
$Dec_{>3}$ (counts·min^{-1})
Team vs. Pre10
Team vs. Pre5
Team vs. Post 5
Team vs. Post 10

-1.0 -0.5 0.0 0.5 1.0

Standarized mean change (ES)


DC (m·min-1)
Team vs. Pre10
Team vs. Pre5
Team vs. Post 5
Team vs. Post 10
DC >21 km·h-1 (m·min-1)
Team vs. Pre10
Team vs. Pre5
Team vs. Post 5
Team vs. Post 10
DC >24 km·h-1 (m·min-1)
Team vs. Pre10
Team vs. Pre5
Team vs. Post 5
Team vs. Post 10
Player Load (AU·min-1)
Team vs. Pre10
Team vs. Pre5
Team vs. Post 5
Team vs. Post 10
Acc2-3 (counts·min-1)
Team vs. Pre10
Team vs. Pre5
Team vs. Post 5
Team vs. Post 10
Acc>3 (counts·min-1)
Team vs. Pre10
Team vs. Pre5
Team vs. Post 5
Team vs. Post 10
Dec2-3 (counts·min-1)
Team vs. Pre10
Team vs. Pre5
Team vs. Post 5
Team vs. Post 10
Dec>3 (counts·min-1)
Team vs. Pre10
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Team vs. Post 5
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Standarized mean change (ES)

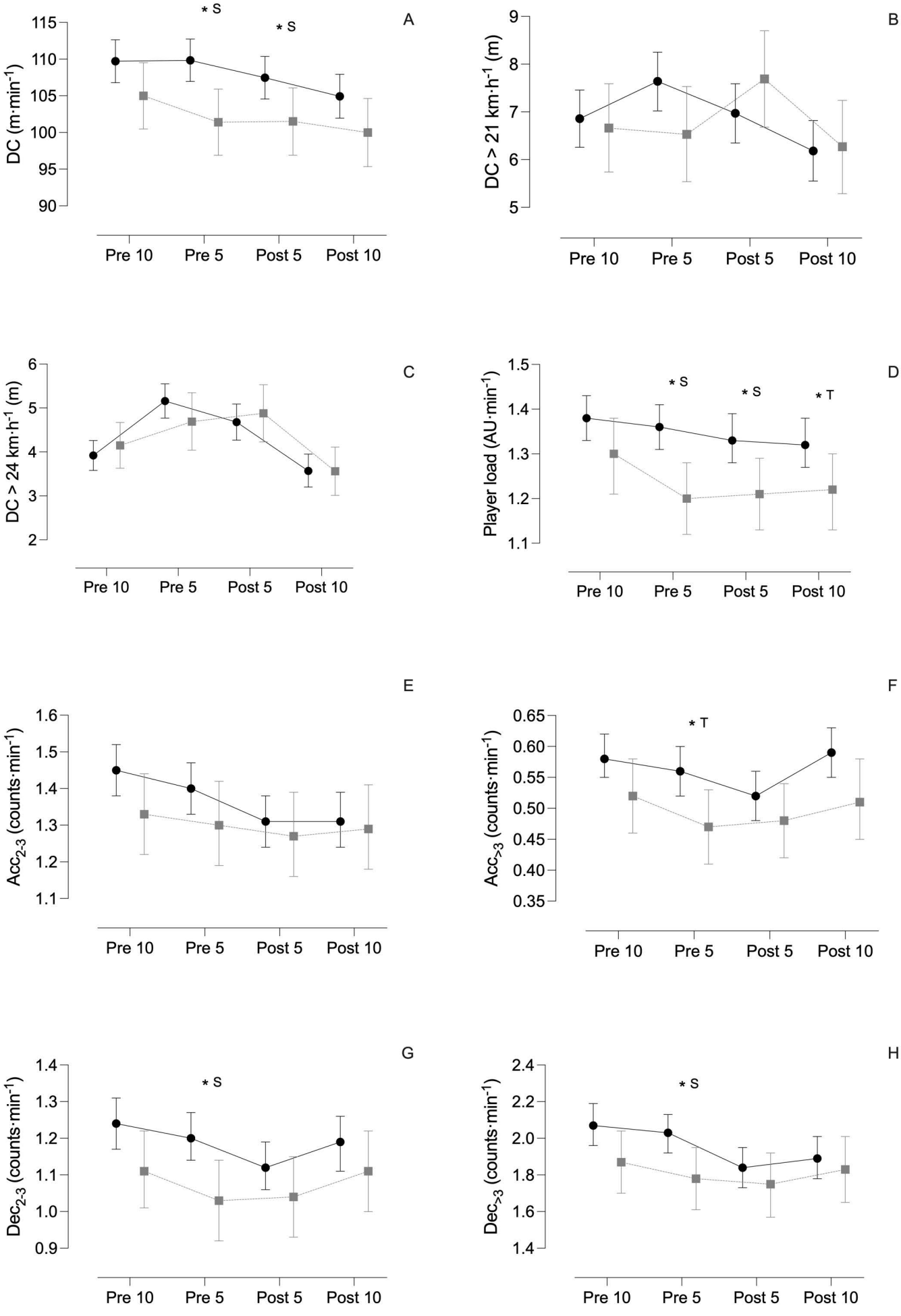
A
* S
* S
DC (m·min-1)
115
110
105
100
95
90
Pre 10
Pre 5
Post 5
Post 10
B
DC > 21 km·h-1 (m)
9
8
7
6
5
Pre 10
Pre 5
Post 5
Post 10
C
DC > 24 km·h-1 (m)
6
5
4
3
2
Pre 10
Pre 5
Post 5
Post 10
D
Player load (AU·min-1)
* S
* S
* T
1.5
1.4
1.3
1.2
1.1
Pre 10
Pre 5
Post 5
Post 10
E
Acc2-3 (counts·min-1)
1.6
1.5
1.4
1.3
1.2
1.1
Pre 10
Pre 5
Post 5
Post 10
F
Acc>3 (counts·min-1)
* T
0.65
0.60
0.55
0.50
0.45
0.40
0.35
Pre 10
Pre 5
Post 5
Post 10
G
Dec2-3 (counts·min-1)
* S
1.4
1.3
1.2
1.1
1.0
0.9
Pre 10
Pre 5
Post 5
Post 10
H
Dec>3 (counts·min-1)
* S
2.4
2.2
2.0
1.8
1.6
1.4
Pre 10
Pre 5
Post 5
Post 10

Table 1. The team's external load average and the moments before and after goal scoring.

Variable	Pre 10	Pre 5	Team	Post 5	Post 10
DC ($m \cdot min^{-1}$)	109.72 ± 1.47	109.85 ± 1.46	107.63 ± 0.57	107.47 ± 1.46	104.94 ± 1.51
DC > 21 $km \cdot h^{-1}$ ($m \cdot min^{-1}$)	6.86 ± 0.30	7.64 ± 0.31*^{T}	6.60 ± 0.17	6.97 ± 0.31	6.18 ± 0.32
DC > 24 $km \cdot h^{-1}$ ($m \cdot min^{-1}$)	3.92 ± 0.17*^{S}	5.16 ± 0.20*^{S}	2.90 ± 0.10	4.68 ± 0.21*^{S}	3.57 ± 0.19*^{T}
Player Load ($AU \cdot min^{-1}$)	1.38 ± 0.03	1.36 ± 0.03	1.34 ± 0.01	1.33 ± 0.03	1.32 ± 0.03
Acc_{2-3} ($counts \cdot min^{-1}$)	1.45 ± 0.04	1.40 ± 0.04	1.41 ± 0.01	1.31 ± 0.04*^{S}	1.31 ± 0.04*^{T}
$Acc_{>3}$ ($counts \cdot min^{-1}$)	0.58 ± 0.02	0.56 ± 0.02*^{T}	0.60 ± 0.01	0.52 ± 0.02*^{S}	0.59 ± 0.02
Dec_{2-3} ($counts \cdot min^{-1}$)	1.24 ± 0.04	1.20 ± 0.03	1.21 ± 0.01	1.12 ± 0.03*^{T}	1.19 ± 0.04
$Dec_{>3}$ ($counts \cdot min^{-1}$)	2.07 ± 0.06	2.03 ± 0.05	2.00 ± 0.02	1.84 ± 0.06*^{S}	1.89 ± 0.06

Notes: values are presented as mean ± standard deviation. Team: mean external load of the team for the whole match; Pre10: mean external load of the team for the 10 previous minutes of the goal; Pre5: mean external load of the team for the 5 previous minutes of the goal; Post10: mean external load of the team for the 10 after minutes of the goal; Post5: mean external load of the team for the 5 after minutes of the goal; *$p \leq 0.05$ statistically significant from Team values; ^{T}: trivial effect size; ^{S}: small effect size.

Table 2. The team's external load average and the moments before and after conceding a goal.

Variable	Pre 10	Pre 5	Team	Post 5	Post 10
DC ($m \cdot min^{-1}$)	105.01 ± 2.28	101.40 ± 2.27*^{S}	107.63 ± 0.57	101.51 ± 2.32*^{S}	100.00 ± 2.34*^{S}
DC > 21 $km \cdot h^{-1}$ ($m \cdot min^{-1}$)	6.66 ± 0.47	6.53 ± 0.51	6.60 ± 0.17	7.69 ± 0.51*^{T}	6.27 ± 0.49
DC > 24 $km \cdot h^{-1}$ ($m \cdot min^{-1}$)	4.15 ± 0.26*^{S}	4.69 ± 0.33*^{S}	2.90 ± 0.10	4.88 ± 0.33*^{S}	3.56 ± 0.28*^{T}
Player Load ($AU \cdot min^{-1}$)	1.30 ± 0.04	1.20 ± 0.04*^{S}	1.34 ± 0.01	1.21 ± 0.04*^{S}	1.22 ± 0.04*^{S}
Acc_{2-3} ($counts \cdot min^{-1}$)	1.33 ± 0.06	1.30 ± 0.06	1.41 ± 0.01	1.27 ± 0.06*^{T}	1.29 ± 0.06*^{T}
$Acc_{>3}$ ($counts \cdot min^{-1}$)	0.52 ± 0.03*^{T}	0.47 ± 0.03*^{S}	0.60 ± 0.01	0.48 ± 0.03*^{S}	0.51 ± 0.03*^{T}
Dec_{2-3} ($counts \cdot min^{-1}$)	1.11 ± 0.06	1.03 ± 0.05*^{S}	1.21 ± 0.01	1.04 ± 0.06*^{S}	1.11 ± 0.06
$Dec_{>3}$ ($counts \cdot min^{-1}$)	1.87 ± 0.09	1.78 ± 0.09*^{S}	2.00 ± 0.02	1.75 ± 0.09*^{S}	1.83 ± 0.09

Notes: values are presented as mean ± standard deviation. Team: mean external load of the team for the whole match; Pre10: mean external load of the team for the 10 previous minutes of the goal; Pre5: mean external load of the team for the 5 previous minutes of the goal; Post10: mean external load of the team for the 10 after minutes of the goal; Post5: mean external load of the team for the 5 after minutes of the goal; *$p \leq 0.05$ statistically significant from Team values; ^{T}: trivial effect size; ^{S}: small effect size.

Table 3. External load of the team when according when the goal is scoring or conceding before and after the goal.

Variable	Type of goal	Pre 10	Pre 5	Post 5	Post 10
DC ($m \cdot min^{-1}$)	Scored	109.72 ± 1.47	109.85 ± 1.46	107.47 ± 1.46	104.94 ± 1.51
	Conceded	105.01 ± 2.28	101.40 ± 2.27*^{S}	101.51 ± 2.32*^{S}	100.00 ± 2.34
DC > 21 $km \cdot h^{-1}$ ($m \cdot min^{-1}$)	Scored	6.86 ± 0.30	7.64 ± 0.31	6.97 ± 0.31	6.18 ± 0.32
	Conceded	6.66 ± 0.47	6.53 ± 0.51	7.69 ± 0.51	6.27 ± 0.49
DC > 24 $km \cdot h^{-1}$ ($m \cdot min^{-1}$)	Scored	3.92 ± 0.17	5.16 ± 0.20	4.68 ± 0.21	3.57 ± 0.19
	Conceded	4.15 ± 0.26	4.69 ± 0.33	4.88 ± 0.33	3.56 ± 0.28
Player Load ($AU \cdot min^{-1}$)	Scored	1.38 ± 0.03	1.36 ± 0.03	1.33 ± 0.03	1.32 ± 0.03
	Conceded	1.30 ± 0.04	1.20 ± 0.04*^{S}	1.21 ± 0.04*^{S}	1.22 ± 0.04*^{T}
Acc_{2-3} ($counts \cdot min^{-1}$)	Scored	1.45 ± 0.04	1.40 ± 0.04	1.31 ± 0.04	1.31 ± 0.04
	Conceded	1.33 ± 0.06	1.30 ± 0.06	1.27 ± 0.06	1.29 ± 0.06
$Acc_{>3}$ ($counts \cdot min^{-1}$)	Scored	0.58 ± 0.02	0.56 ± 0.02	0.52 ± 0.02	0.59 ± 0.02
	Conceded	0.52 ± 0.03	0.47 ± 0.03*^{T}	0.48 ± 0.03	0.51 ± 0.03
Dec_{2-3} ($counts \cdot min^{-1}$)	Scored	1.24 ± 0.04	1.20 ± 0.03	1.12 ± 0.03	1.19 ± 0.04
	Conceded	1.11 ± 0.06	1.03 ± 0.05*^{S}	1.04 ± 0.06	1.11 ± 0.06
$Dec_{>3}$ ($counts \cdot min^{-1}$)	Scored	2.07 ± 0.06	2.03 ± 0.05	1.84 ± 0.06	1.89 ± 0.06
	Conceded	1.87 ± 0.09	1.78 ± 0.09*^{S}	1.75 ± 0.09	1.83 ± 0.09

Notes: Values are presented as mean ± standard deviation. Pre10: ten previous minutes before a scored goal; Pre5: five previous minutes before a scored goal; Post5: five posterior minutes after a scored goal; Post10: ten posterior minutes after a scored goal. Scored: scored goal; Conceded: received goal; DC: total distance covered; DC > 21 $km \cdot h^{-1}$; distance covered above 21 $km \cdot h^{-1}$, DC > 24 $km \cdot h^{-1}$: distance covered above 24 $km \cdot h^{-1}$; Acc_{2-3}: Accelerations between 2 to 3 $m \cdot s^{-2}$; $Acc_{>3}$: Accelerations above 3 $m \cdot s^{-2}$, Dec_{2-3}: Decelerations between -2 to -3 $m \cdot s^{-2}$; $Dec_{>3}$: Decelerations above -3 $m \cdot s^{-2}$; *: $p \leq 0.05$ statistically significant different from scored goal at the same time around the goal. ^{T}: Trivial effect size; ^{S}: Small effect size.