Is it as simple as run more, win more? Influence of running load on match outcome and final league position across nine consecutive English Premier League football seasons.

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ABSTRACT

Purpose: This study aimed to assess the relationship between running load trends, between teams in a match, match outcomes, and final league positions in the English Premier League (EPL) from 2015/16 to 2023/24 using semi-automated optical tracking systems.

Methods: Data from 3,379 games across nine seasons were analysed for total distance (TD), high-intensity distance (HID), high-speed running (HSR), and sprint distance (SprD). Matches were tracked using TRACAB® and Second Spectrum®. Spearman's rank correlation coefficient identified correlations between running load and league position. Pearson's correlation was used for home and opposition running load correlations. One-way ANOVA and Cohen's effect size (ES) measured differences in running load between won, drawn, and lost matches.

Results: Small-to-moderate, significant correlations were found between HID ($p<0.001$; $r_s=0.28$), HSR ($p=0.007$; $r_s=0.20$), SprD ($p<0.001$; $r_s=0.32$), and final league position. Large to very large correlations between home and away teams were observed for TD, HID, HSR and SprD ($p<0.001$; $r=0.68$-0.75). Teams covered more distance (TD, HID, SprD) when they won compared to when they drew or lost (ES:-0.10 to -0.23). Winning teams significantly ran more than losing teams within the same match (TD, HID and SprD; $p<0.001$; ES=0.12-0.29).

Conclusion: Running load has a small-to-moderate correlation to match outcomes and league standing in the EPL. Winning teams tend to run more (TD, HID and SprD), albeit with trivial to small effect sizes, suggesting running outputs are a determining factor in team success.

Keywords: Competitive performance, team success, high-intensity efforts, Optical tracking systems

Key Findings

Running more is correlated to final league position

Teams running outputs are highly correlated to each other in the same game

Teams run more when they win

Teams that win are more likely to outrun the opposition

Introduction

Success on the pitch, which contributes significantly to the financial stability of professional football clubs,[1] is influenced by a complex interplay of physical, technical, tactical, and psychological factors[2] This has been shown to be associated with success including physical, tactical, technical and psychological.[3] From a physical perspective, running load outputs have been reported to be contributory to match outcome, albeit to various degrees and differential relationships.[4,5,6,7,8] Running loads have continued to increase in the English Premier League (EPL),[9,10] with most recent trends (2015/16 to 2023/24) showing increases in higher speed demands (22% for high-speed running (HSR; 5.5ms^{-1} - 7ms^{-1}) and 32% for sprint distance (SprD; >7ms^{-1}).[9] The most recent season (2023/24) recorded the largest increase, potentially linked to law changes in added time.[11] However, the potential impact of running load and team success (league ranking and match outcome) remains unknown; and whether running more will lead to an increase chance of winning a game for a team.

Practitioners, coaches and players' perception of the importance of running contribution in a game is likely shaped by their experiences and education.[12] The volume of high-intensity distance (HID) and SprD performed by players in a match could be perceived as a marker of 'success' by coaches e.g., "we ran more than the other team, so we must be fitter".[13] Dupont & McCall[14] argued that the physical objective in football is not to run more, but to provide contextual inference about how and why these outputs were achieved. Research has started to look at the contextual inference of running,[15] but research in the EPL has not yet investigated the relationship between running load outputs and team success. In the EPL, there is ongoing debate, often supported by anecdotal evidence, about the impact of running outputs, with managers suggesting running is key to their chances of winning.[16] It is plausible to suggest that teams with capacity to accelerate and achieve higher velocities may allow teams to defy opponent's positional shape, finding high value spaces for the players to attack. This may result in higher running load outputs (more HID and SprD) for teams trying to expose the opposition in quick transitions, which has been linked to team success.[17] However, teams do react to one another, with tactical setups and reactions to the opposing teams changes during the game,[18] suggesting that running load between teams could be strongly linked in the EPL. This may mean any small window of opportunity for a player to outrun his opposite number, could provide their team with an advantage.

Exploratory research in the Bundesliga has shown minimal association between running load and seasonal success.[19] Similarly, studies on European competitions have found no significant differences in running load between successful and unsuccessful teams.[20] Running load in the EPL has been shown to be higher than in other European leagues,[21] suggesting that trends may vary between competitions, and findings from one league may not be directly applicable to another. However, other research suggests that the speed of ball movement may be an important determinant of success.[8] The varying nature of findings are not surprising, considering the many contextual factors that can influence a team's total running load, with both tactical and environmental elements at play.[3] Also of importance is that teams are collectively required to react to the opposition's behaviours i.e., tactical changes and gameplans, finding ways to exploit affordances[22,23] that may raise opportunities for teams.

To the author's knowledge, no study has examined the long-term influence of total distance (TD), HID, HSR, and SprD on EPL match outcomes or overall team success. Consequently, the current study aims to examine influence of team running loads on both short-term (match outcomes) and long-term (league rankings) success and whether it should be deemed as a candidate factor for success. It further explores the relationship between the running load outputs of home and away teams.

Methods

Participants

Player running load outputs (TD, HID, HSR and SprD) across nine consecutive EPL seasons (2015/16-2023/24) were used for analysis. The analysis included 33 teams, with 1764 players used from 3379 games (Table 1). Ethical approval for the use of anonymised match data was obtained from the EPL and University of Central Lancashire, in accordance with the Helsinki Declaration.

Insert Table 1 Here

Table 1. Number of games available for analysis, the number of games that finished 11v11, mean game duration, players included in that season's analysis and mean age of players that season.

Season	Total Games Tracked	Games that finished 11 v 11	Mean Game Duration	Players Included in Analysis that Season	Mean Age of Players
2015/16	372	317	96.3 ± 1.7	541	27.4
2016/17	378	334	96.4 ± 1.6	521	27.8
2017/18	380	345	96.1 ± 1.8	514	27.3
2018/19	377	332	96.5 ± 1.8	500	27.2
2019/20	375	331	97.4 ± 1.9	513	27.0
2020/21	375	332	96.4 ± 2.1	516	27.0
2021/22	376	332	97.2 ± 2.3	536	27.2
2022/23	372	339	98.4 ± 2.7	547	27.0
2023/24	372	318	101.0 ± 2.9	557	26.7

Protocol and Data Analysis

Activities studied were TD (m), HID (m; speed >5.5ms^{-1}) which combines HSR (5.5ms^{1}–7ms^{-1}) and SprD (speed >7ms^{-1}), HSR and SprD (m; speed >7ms^{-1}). These running load variables were chosen as they are deemed valid and reliable measures using TRACAB®[24,25] and Second Spectrum® (2S; Los Angeles, USA)[26] allowing comparison of teams running load outputs across the EPL. Additionally, they are frequently utilised in the literature and are monitored closely by professional football clubs when analysing match data.[27,28]

Optical tracking data was collected using two 25Hz frequency systems; TRACAB® Gen-4 semi-automated HD cameras (TRACAB®, Chyronhego, New York, USA) at EPL stadiums between 2015/16-2018/19 with a switch in optical tracking provider to 2S covering 2019/20-2023/24. Corrections used for the two systems are the same as used in previous research (Tracab to 2S[11]). The dwell time (minimum effort duration) was set at 0.5s for HID running and 1s to detect SprD efforts for both systems. To allow for comparison, raw tracking data was placed through Python (www.python.org) and R software (www.r-project.org), using *stats* and *Rstatix*, to ensure speed thresholds remained the same on both systems.

Tracking data was missing for 41 games due to technical faults over this period. Games where the match finished with less than 22 players on the pitch (397 games; due to a sending off or injury) were removed from this data set, leaving 2982 games

applicable for full analysis. Team totals were calculated from all players (including subs) for analysis.

Statistical Analysis

Due to increases in running load season to season,[10,11] running load to final league positions, teams were ordered from most running (1st) to lowest running (20th) for each running metric (TD, HID, HSR and SprD), each season, using the teams average running load in all tracked matches that finished 11v11. As data was ordinal, Spearman's rank correlation coefficient was used.

To compare a team's running load (TD, HID, HSR and SprD) when they won, lost or drew, the load variables were converted to Z-scores. Values were normalised separately for each season, using the season's mean and standard deviation, to account for long-term trends.[10,11] As output variance was roughly equal across outcomes (W/L/D), a one-way ANOVA with Tukey's HSD for post-hoc tests, was used to determine differences in team's running load in games with different outcomes.

Pearsons's correlations were used to observe the difference between home and opposition team's TD, HID, HSR and SprD running load in each tracked match. Correlations were determined as trivial (<0.1), small (0.1-0.3), moderate (0.3 – 0.5), large (0.5-0.7), very large (0.7-0.9), perfect (>0.9).[29]

The differences between match outcome and running load were calculated with effect size (ES) using Cohen's *d* to determine differences between the match outcomes evaluated. The ES magnitudes were interpreted as trivial (<0.2), small (0.2–0.6), moderate (0.6–1.2) and large (1.2–2.0).[30] A confidence interval of 95%[30] was used to show the difference in mean outputs between each match outcome.

Comparison between winning and losing teams in the same match used an independent two tailed T-test, to determine statistical significance between the two groups. This was chosen as distribution of difference in outputs is not strictly normal, but the large sample size makes t-test robust to violations of normality due to the Central Limit Theorem. Additionally, the variances of the groups are approximately equal (homoscedasticity). ES was determined by Cohen's *d*. Statistical significance was set at $p<0.05$ throughout.

Results

Team Position and Running Load

No correlation was reported for final league position and TD (r_s =.13, p=0.09). A significant small correlation occurred with HID (r_s =.28, p<0.001), HSR (r_s =.20, p=0.007) and moderate correlation with SprD (r_s =.32, p<0.001) (Figure 1).

Insert Figure 1 Here

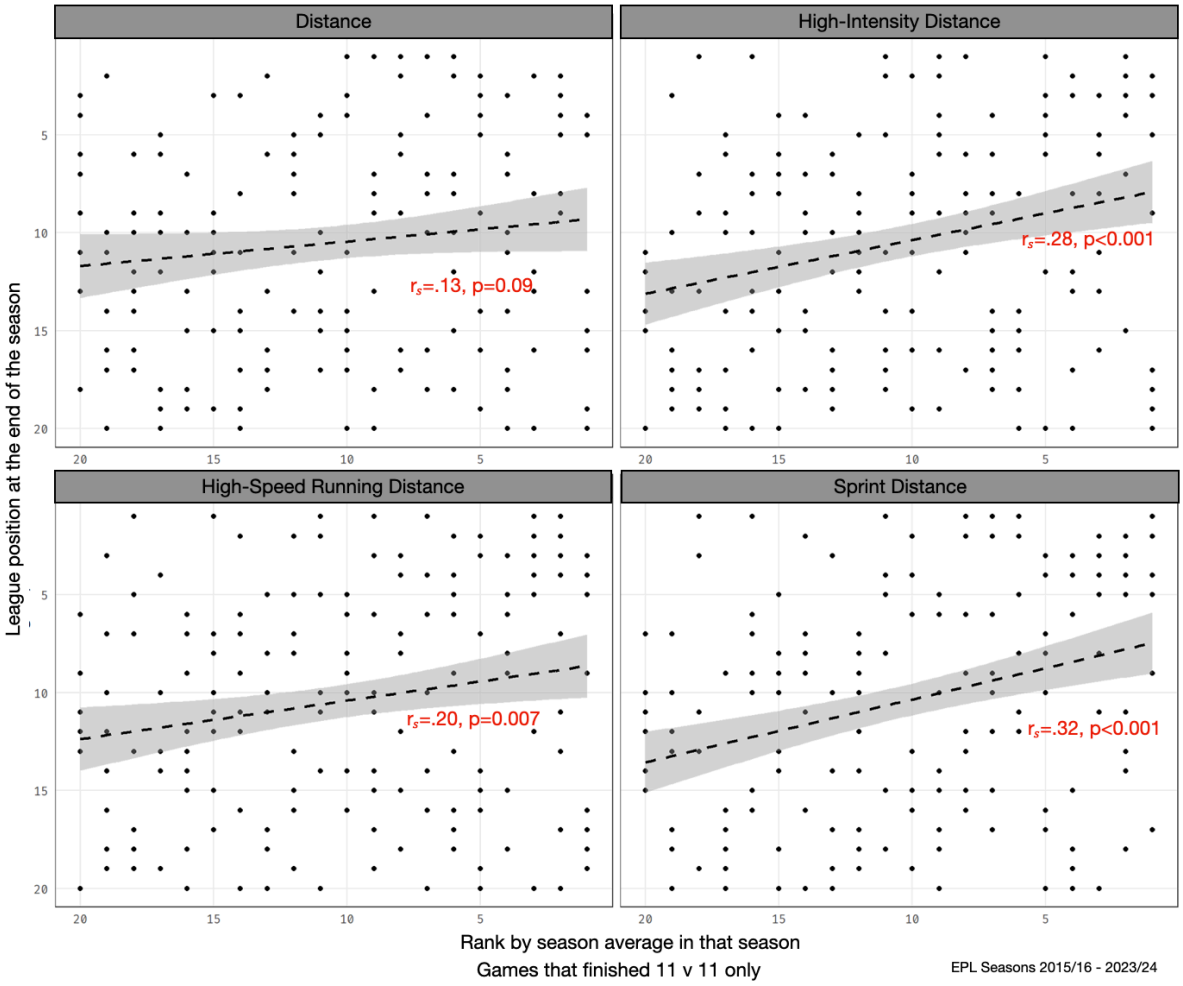

Figure 1. Correlation of final league position of the team in the EPL against their team total running load output for distance (m), high-intensity distance (m), high-speed running distance (m) and sprint (m). Each season, teams are ranked from highest running load that season to lowest. Axis is inverted.

Correlation of Home Team and Opposition Team Running Load Outputs in a Match

Significant large to very large correlations were seen between the home and away teams in TD, HID, HSR and SprD in a match (Figure 2).

Insert Figure 2 Here

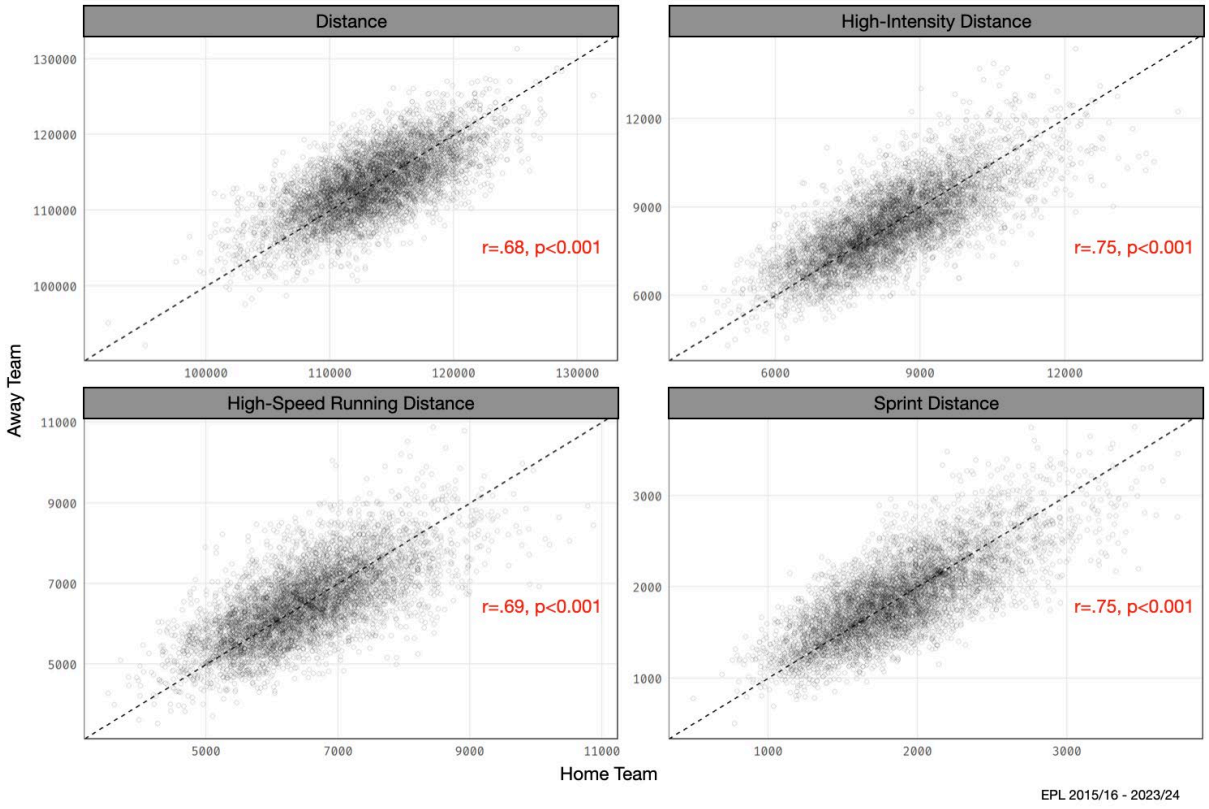

Figure 2. Correlation of running loads between home and away teams in a match for distance (m), high-intensity distance (m), high-speed running distance (m) and sprint (m).

Teams Running Load Differences with Match Outcome

The one-way ANOVA results displayed significant differences in running load variables for wins, draws and losses (Table 2) TD: $F(2,5957) = [20.25]$, $p<0.001$; HID: $F(2,5957) = [10.41]$, $p<0.001$; HSR: $F(2,5957) = [4.26]$, $p=0.01$; SprD: $F(2,5957) = [33.99]$, $p<0.001$, with trivial to small increases in running displayed in wins when compared to draw and loss (see Table 2).

Insert Table 2 Here

Table 2. Multiple comparisons post hoc test showing differences between running load variables and match outcome (win, draw, lose). Negative values show Group 1 had higher outputs than Group 2.

Variable	Group 1	Group 2	Effect Size Differences	Lower	Upper
Distance (m)	Win	Draw	-0.14*	-0.22	-0.06
	Win	Loss	-0.18*	-0.25	-0.11
	Draw	Loss	0.04	-0.12	0.04
High-Intensity Distance (m)	Win	Draw	-0.14*	-0.22	-0.06
	Win	Loss	-0.10*	-0.17	-0.03
	Draw	Loss	0.04	-0.04	0.12
High-Speed Running Distance (m)	Win	Draw	-0.10*	-0.18	-0.02
	Win	Loss	-0.03	-0.10	0.04
	Draw	Loss	0.07	-0.01	0.15
Sprint Distance (m)	Win	Draw	-0.20*	-0.28	-0.12
	Win	Loss	-0.23*	-0.30	-0.16
	Draw	Loss	-0.03	-0.11	0.05

*P<0.05

Winners vs Losers: Running Load Differences in the Same Game

Trivial to small significant differences were seen between the winning team and the losing team over the nine seasons (Table 3).

Insert Table 3 Here

Table 3. The difference in average outputs between winning and losing teams in the same match.

Metric	Winning Team	Losing Team	Difference	95% Confidence Intervals	p value	Effect Size
Distance (m)	113895 ± 4378	113115 ± 4515	780*	(636 – 924)	p<0.001	0.22
High-Intensity Distance (m)	8478 ± 1280	8368 ± 1338	110*	(72 - 148)	p<0.001	0.12
High-Speed Running (m)	6543 ± 922	6524 ± 991	19	(-12 - 50)	0.226	0.22
Sprint Distance (m)	1935 ± 447	1844 ± 437	91*	(78 - 103)	p<0.001	0.29

*P<0.05

Discussion

The study aimed to examine the relationships between TD, HID, HSR and SprD with match outcomes and final league rankings in the EPL. It also investigated how the home team's running load is influenced by the opponents. Key findings were: 1) HID, HSR (small) and SprD (moderate) had positive correlations with final EPL league position; 2) Teams showed trivial to small increases in TD, HID, and SprD when they won compared to draws or losses; 3) Home and away team running loads were strongly correlated; and 4) Trivial to small differences were found between winning and losing teams in the same match. As running load has trivial to small differences with match outcomes, it should be considered alongside other factors like technical and tactical aspects in future research.

Teams that finish in higher league positions ran more at higher speeds

This study highlights that teams who were ranked higher in the EPL (2015/16-2023/24), average more HID, HSR and SprD in matches than those who finish in lower

positions. Again, small correlations for HID, HSR and SprD with final league ranking would suggest, in addition to being able to run more distance at higher speeds, other factors likely contribute to team success (e.g. player technical abilities, team injury record, style of play). Despite this, our findings may imply covering greater distance and at faster speeds could bare an influence on a team's chances of success. While speculative and acknowledging that association does not equal causation,[31] this may be linked to moments of transitions (switching between defence to attack, or vice-versa) and high-pressure activities, where teams exploit space by moving up the pitch quicker, increasing high velocity variables such as HID and SprD.[32] Higher speed variables have been linked to higher value goal probability,[33] possibly due to opposition disorganisation (run faster to exploit the opportunity) or to create opposition disorganisation (run faster to create space in the opposition). Counterattacking football has become more prevalent,[34] as more frequent and faster running speeds may increase the chances of pulling opposition players out of position, allowing a team to capitalise to move the ball in more dangerous areas. This suggests that understanding when and how effectively to run could impact the match outcome most. Performance practitioners and analysts can become more valuable by supporting coaching teams, identifying the most optimal opportunities (where and when to run) to be most impactful on the game. This paper shows running may be a contributor to success, however, it is highly likely it is part of a more complex interaction and future research should attempt to unpack these complex interactions and establish causality. In this way, research can guide practitioners as to when running can become more impactful (linked to technical and tactical factors), and provide a richer source of information for coaches, instead of highlighting just how far they have run in certain actions.

Although higher-ranked teams tended to cover more distance at higher speeds, the small correlations with league position suggest that running load outputs may be more related to playing style. Specific styles of play may require teams to have squads containing athletes with certain physiological profiles; hence the players they recruit are more expensive (i.e., better teams have more expensive squads[35] as they are typically, technically[36] and physically superior). However, again it is important to remember that correlation does not imply causation,[31] and factors like physiological profile or playing style could also affect running load. While top teams do cover more distance, some lower-ranked teams cover more distance at higher intensity (e.g chasing the ball). It may be that better teams do run more but also run more in areas

that can exploit the opposition. Future research should explore game management and running efficiency to better understand their impact.

Further research would likely also be useful focusing on the spatial context of high-speed running, exploring how it disrupts opposition and creates attacking opportunities. Integrating spatial data with running metrics could provide deeper insights into the impact of running on match outcomes. This may be especially pertinent during moments where there are spaces to capitalise on due to disorganisation in the opposition. Ultimately, such research will help practitioners and coaches come closer together in designing training plans.

Team Running Load Output is associated to how the Opposition Runs

This study shows one factor that may contribute to a player's running load output is the opposing team. Figure 2 shows running load in a match is largely to very largely correlated with the TD, HID, HSR and SprD of the opposition's outputs ($r=.68$-$.75$, $p<0.001$). This indicates that outputs completed by a team may somewhat be defined by the opposition's tactical setup, as well as responding to opposition tactical adaptations during gameplay. Teams have been shown to mirror the opposition with centroid analysis (one team moves forward, the other team moves backwards[37]). This may allow practitioners to forecast bandwidths of how much their team may run prior to the game by observing the opposing team's running load outputs in previous games in relation to tactical setup. This could assist with tailoring team and individual training prescription, enabling practitioners to put in place processes to account appropriately for the match demands. Additionally, highlighting the correlation between teams, suggests that out-running the opposition may provide advantages if used at the right times, by getting into space before the opposition player.

Teams typically run more when they win

Observing the information at the match level, the present study identified that running more is significantly higher when teams win when compared to draws and losses (Table 2). No significant difference was identified between team's running load when they lost or drew. Whilst significant, trivial to small effect sizes were seen between winning and drawing/losing, highlighting that running more may have a small role on match outcome but is likely too simplistic to suggest that running more alone will increase chances of winning. For this reason, it is important for researchers to

understand what coaches perceive as important to win a game of football so that findings are relatable and transferable to real-world practices. Currently, research in this field has looked at interpretation of running load from a sports performance and medical perspective but has not considered the context of running from the head coach, the most important decision maker. This understanding may allow further contextual factors to be considered, while tactical elements determined by the coach may cause an increase in running load outputs in certain areas. This will be essential to assisting the direction of future research in this field, to develop more meaningful interpretation that may assist management to determine the effectiveness of their team's running outputs.

Tactical factors may be the reason winning teams run more. Inferior teams often play in their final third, adopting a low-block defensive strategy.[38] This may result in reduced high intensity outputs but increasing mechanical consequences/demands (acceleration/decelerations). Hence, should the inferior team lose, they may be running less than their average, whereas they may deploy other tactics against weaker opposition, with more chances to break (run more). These differences could be linked to changes in a team's style of play or opportunities to progress up the pitch. If a potential reason for running more is linked to the capitalising of opportunity (i.e., a team sees the opportunity to run into space at speed to capitalise on disorganisation), it would be expected that a stronger team would have more opportunities to do so against weaker teams.

Outrunning the opposition could help

A team's running load seems to involve opposition factors, however, on average, outrunning the opposition does have a trivial to small effect size increase in their chances of winning (table 3). Over the nine seasons observed, winning teams outran the opposition in TD and SprD (small effect). A significant trivial effect size was seen in teams who run more HID (although this looks to be due to the SprD as HSR was not significant). This suggests that covering more distance than the opposition may have some effect on increasing a team's chances of winning. This might be because, by outrunning a team, you are able to run into spaces before the opposition (capitalising on space available) or conversely, close spaces down quicker (reducing open space for the opposition). Teams who reduce space make it more difficult for the

opposition to score[39] and so could be important for teams to exploit any spaces available, whilst reducing space around their box in transitions.

Better teams tend to run more (Figure 1), with higher-ranked teams more likely to win games. Naturally, we would expect the teams that are winning the matches to produce higher running load outputs (Table 3). This higher running load may be determined by style of play, understanding of transitional moments in the game (running faster than the opposition to capitalise on space) or athletic characteristics (ability to express athletic capabilities) of players within their squad. For example, lower-ranked teams often have less possession and defend deep against stronger opponents, potentially reducing running opportunities.[39,40] This defensive strategy keeps their formation compact, limiting space near their goal,[38] while stronger teams may use faster movements to create and exploit space for goal opportunities.

Future research could explore how efficient movement, rather than simply running more, affects gameplay. Successful teams might disrupt opponents by creating space faster, leading to scoring chances. Researchers and coaches could develop methods for "efficient tactical movement"; focusing on where and how players should run to impact the game. Quicker play, especially through counterattacks and shorter passing patterns, increases a team's chances of winning,[17,42] would support the idea of capitalising on open spaces quicker than the opponent.

To our knowledge, no research has investigated the correlation of outrunning the opposition and performance in the EPL. It is suggested this is explored further to observe any potential relationships between tactical and technical information, such as possession and pitch location. This may provide further insight for practitioners to determine where players should run and its effects within the team performance.

Limitations

This research investigates running and performance in isolation and in one league. Many factors can determine a team's running performance (location,[43] possession,[44] playing style,[45] match status i.e., scoreline[46]), with this study looking to determine whether there were relationships with running more and success. It is suggested that further studies need to link it with technical and tactical elements of the game, building on the findings from other leagues.[44] Running load relationships with possession, ball in play times, player technical level or tactical changes within games needs to be explored further in relation to the EPL. This study however does provide evidence of

running as a suitable candidate factor associated with success that can inform future models that include multiple factors.

Practical Implications

Running more in EPL games has a small correlation to final league position and match success. For this reason, it would be reasonable to suggest that practitioners prepare their players to thrive in matches where high running demands may be required. Running load in training has been linked to match running load,[47] with higher HID in training being moderately correlated to match HID. Increasing training intensity may see increases in running load in matches, however it is likely to be linked to the tactical elements required in games. With training drills producing different running loads for different positions,[48] practitioners may want to create training conditioning drills within their football game model (drills specific to the way the team plays in matches) to increase specificity and aid knowledge transfer.

In matches, it may be important for players to focus on duels through comparison against their immediate one v one (i.e., I need to move and react faster than the player marking me). Moderate correlations were noted between opposition teams (Figure 2), whilst small to moderate effect sizes reported between winning and losing teams (Table 3). Consequently, outrunning your immediate opponent could be an important contributing factor to winning. It is possible that successful teams can react to space quicker than the opposition, capitalising on any disorganisation in the opposition. It may be important for players to implement fast transitions and keep moving to try and move the opponent to create space for more opportunities. By moving at higher speeds, this may cause teams to be disoriented in transitions, with players out of position and, potentially, key areas of the pitch exposed to attack.

Conclusion

This study provides novel data on match running loads in the EPL across nine seasons (2015/16-2023/24). Our findings illustrate that running more and at higher speeds does have some correlation to success. That said, by informing coaches and players that running more and faster will increase success is far too simplistic and may be reductionist. Nevertheless, we highlight that it is likely to be pertinent for teams to recruit and develop players with high athletic capabilities as players with a high

technical quality and high running load capacity may be able to have a better influence on final league ranking and match outcome.

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Disclosure Statement

There are no competing interests to declare.

Additional

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References

1. Annual review of football finance 2024 | Deloitte UK [Internet]. [cited 2025 May 31]. Available from: https://www.deloitte.com/uk/en/services/consulting-financial/research/annual-review-of-football-finance-europe.html
2. Lepschy H, Wäsche H, Woll A. How to be successful in football: A systematic review. *Open Sports Sci J*. 2018 Jun 29;11:3–23.
3. Carling C, Le Gall F, McCall A, et al. Squad management, injury and match performance in a professional soccer team over a championship-winning season. *Eur J Sport Sci*. 2015;15(7):573–82.
4. Andrzejewski M, Chmura P, Konefał M, et al. Match outcome and sprinting activities in match play by elite German soccer players. *J Sports Med Phys Fitness*. 2018 Jun;58(6):785–92.
5. Rhodes D, Valassakis S, Bortnik L, et al. The effect of high-intensity accelerations and decelerations on match outcome of an elite English League Two football team. *Int J Environ Res Public Health*. 2021 Jan;18(18):9913.
6. Chmura P, Konefał M, Chmura J, et al. Match outcome and running performance in different intensity ranges among elite soccer players. *Biol Sport*. 2018 Jun 1;35:197–203.
7. Longo UG, Sofi F, Candela V, et al. The influence of athletic performance on the highest positions of the final ranking during 2017/2018 Serie A season. *BMC Sports Sci Med Rehabil*. 2021 Mar 25;13(1):32.
8. Wilson RS, Smith NMA, Melo de Souza N, et al. Dribbling speed predicts goal-scoring success in a soccer training game. *Scand J Med Sci Sports*. 2020;30(11):2070–7.
9. Barnes C, Archer DT, Hogg B, et al. The evolution of physical and technical performance parameters in the English Premier League. *Int J Sports Med*. 2014 Dec;35(13):1095–100.
10. Allen T, Taberner M, Zhilkin M, et al. Running more than before? The evolution of running load demands in the English Premier League. *Int J Sports Sci Coach*. 2023 Apr 1;19(2):779–87.
11. Allen T, Taberner M, Zhilkin M, et al. Evolving running load demands and fixture congestion in the English Premier League: A decade of insights from 2015/16 to 2024/25. Manuscript in review. 2025 Jan 1.
12. Ponce-Bordón JC, García-Calvo T, Candela-Guardiola JM, et al. The relationship between running distance and coaches' perception of team performance in professional soccer player during multiple seasons. *Sci Rep*. 2022 Jan 27;12(1):1454.
13. Taberner M, Allen T, O'Keefe J, et al. Interchangeability of optical tracking technologies: Potential overestimation of the sprint running load demands in the English Premier League. *Sci Med Football*. 2022 Jul 27;Epub ahead of print. doi:10.1080/24733938.2022
14. Dupont G, McCall A. Soccer science [Internet]. Champaign (IL): Human Kinetics; 2016 [cited 2022 Aug 13]. Available from: https://us.humankinetics.com/products/soccer-science
15. Bradley PS, Ade JD. Are current physical match performance metrics in elite soccer fit for purpose or is the adoption of an integrated approach needed? *Int J Sports Physiol Perform*. 2018 May 1;13(5):656–64.
16. Amorim: My players will have to run like mad dogs for me [Internet]. [cited 2024 Dec 12]. Available from: https://www.premierleague.com/news/4188974

17. Tenga A, Sigmundstad E. Characteristics of goal-scoring possessions in open play: Comparing the top, in-between and bottom teams from professional soccer league. *Int J Perform Anal Sport*. 2011 Dec 1;11(3):545–52.
18. Marcelino R, Sampaio J, Amichay G, et al. Collective movement analysis reveals coordination tactics of team players in football matches. *Chaos Solitons Fractals*. 2020 Sep 1;138:109831.
19. Hoppe MW, Slomka M, Baumgart C, et al. Match running performance and success across a season in German Bundesliga soccer teams. *Int J Sports Med*. 2015 Jun;36(7):563–6.
20. Clemente JA, Requena B, Jukic I, et al. Is physical performance a differentiating element between more or less successful football teams? *Sports (Basel)*. 2019 Oct;7(10):216.
21. Morgans R, Ju W, Radnor J, et al. The positional demands of explosive actions in elite soccer: Comparison of English Premier League and French Ligue 1. *Biol Sport*. 2024;42(1):81–7.
22. Chong I, Proctor RW. On the evolution of a radical concept: Affordances according to Gibson and their subsequent use and development. *Perspect Psychol Sci*. 2020 Jan 1;15(1):117–32.
23. Myszka S, Yearby T, Davids K. (Re)conceptualizing movement behavior in sport as a problem-solving activity. *Front Sports Act Living* [Internet]. 2023 May 26 [cited 2024 Dec 14];5. Available from: https://www.frontiersin.org/articles/10.3389/fspor.2023.1130131/full
24. Linke D, Link D, Lames M. Football-specific validity of TRACAB's optical video tracking systems. *PLoS One*. 2020 Mar 10;15(3):e0230179.
25. FIFA quality performance reports for EPTS [Internet]. 2019 [cited 2022 Aug 15]. Available from: https://www.fifa.com/technical/football-technology/standards/epts/fifa-quality-performance-reports-for-epts
26. Resource hub template > Resource hub [Internet]. [cited 2024 Dec 14]. Available from: https://inside.fifa.com/technical/football-technology/resource-hub
27. Taberner M, O'Keefe J, Flower D, et al. Interchangeability of position tracking technologies; Can we merge the data? *Sci Med Football*. 2020 Jan 2;4(1):76–81.
28. Akenhead R, Nassis GP. Training load and player monitoring in high-level football: Current practice and perceptions. *Int J Sports Physiol Perform*. 2016 Jul;11(5):587–93.
29. Hopkins W. A new view of statistics [Internet]. 2000 [cited 2024 Dec 14]. *Sportscience*. Available from: https://sportscience.sportsci.org/resource/stats/index.html
30. Hopkins W, Marshall S, Batterham A, et al. Progressive statistics for studies in sports medicine and exercise science. *Med Sci Sports Exerc*. 2009 Jan 1;41:3–13.
31. Rohrer JM. Thinking clearly about correlations and causation: Graphical causal models for observational data. *Adv Methods Pract Psychol Sci*. 2018;1(1):27–42.
32. Bortnik L, Burger J, Rhodes D. The mean and peak physical demands during transitional play and high pressure activities in elite football. *Biol Sport*. 2022;40(1):1055–64.
33. Gregory S, Robertson S, Aughey R, et al. Assigning goal-probability value to high intensity runs in football. *PLoS One*. 2024 Sep 12;19(9):e0308749.

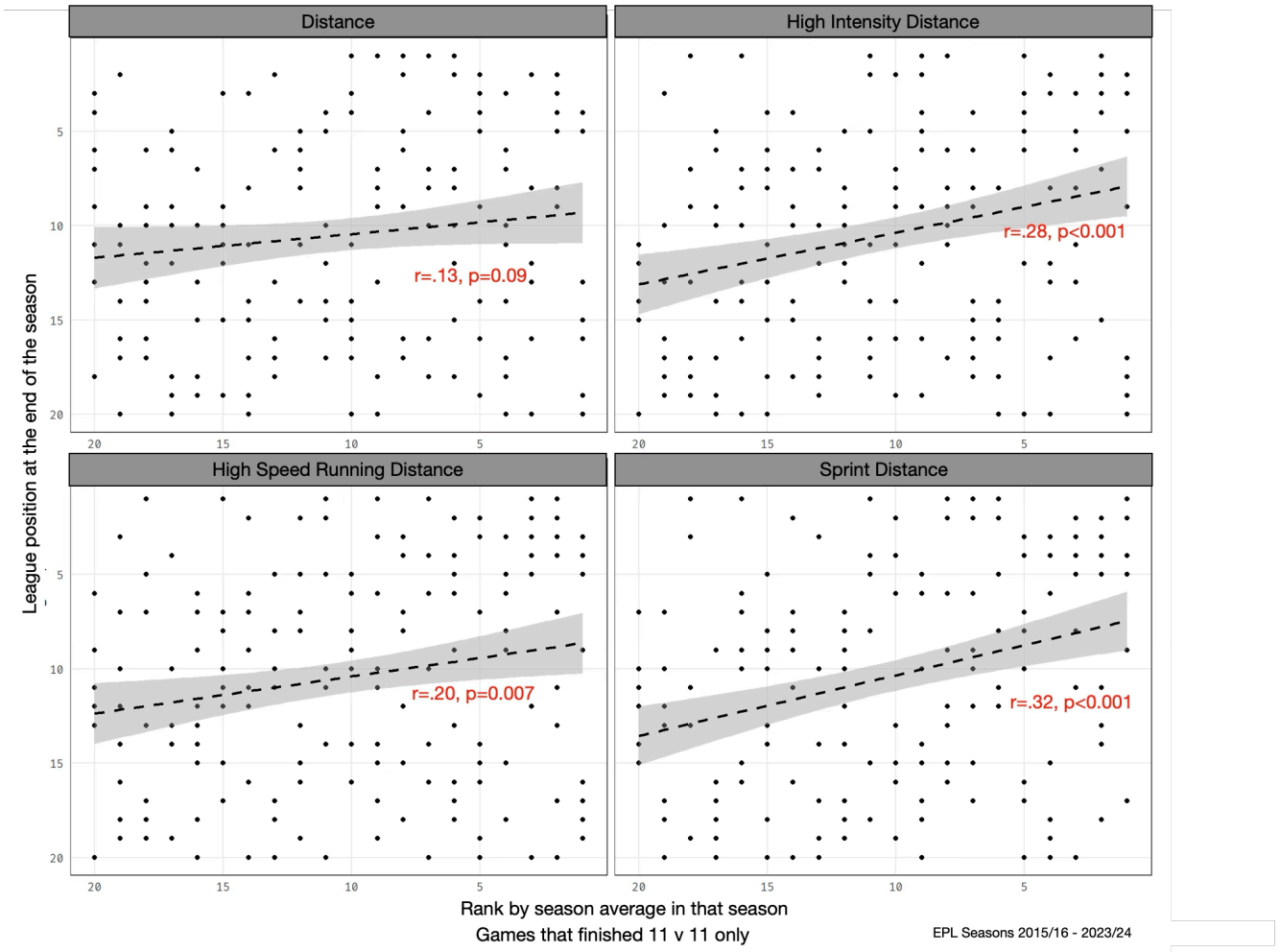
34. Maneiro R, Casal CA, Álvarez I, et al. Offensive transitions in high-performance football: Differences between UEFA Euro 2008 and UEFA Euro 2016. *Front Psychol*. 2019;10:1230.
35. Felipe JL, Fernandez-Luna A, Burillo P, et al. Money talks: Team variables and player positions that most influence the market value of professional male footballers in Europe. *Sustainability*. 2020 Jan;12(9):3709.
36. Oliva-Lozano JM, Martínez-Puertas H, Fortes V, et al. Is there any relationship between match running, technical-tactical performance, and team success in professional soccer? A longitudinal study in the first and second divisions of LaLiga. *Biol Sport*. 2023 Apr;40(2):587–94.
37. Frencken W, Lemmink K, Delleman N, et al. Oscillations of centroid position and surface area of soccer teams in small-sided games. *Eur J Sport Sci*. 2011 Jul 1;11(4):215–23.
38. Gollan S, Bellenger C, Norton K. Contextual factors impact styles of play in the English Premier League. *J Sports Sci Med*. 2020 Feb 24;19(1):78.
39. Link D, Lang S, Seidenschwarz P. Real time quantification of dangerousity in football using spatiotemporal tracking data. *PLoS One*. 2016 Dec 30;11(12):e0168768.
40. Casal CA, Anguera MT, Maneiro R, et al. Possession in football: More than a quantitative aspect—A mixed method study. *Front Psychol*. 2019;10
41. Brîndescu S, Datcu FR, Buda IA. Study on the efficiency of advanced pressing in the Premier League. *Balt J Health Phys Act*. 2021 Nov 30;115–22.
42. Rathke A. An examination of expected goals and shot efficiency in soccer. *J Hum Sport Exerc* [Internet]. 2017 [cited 2024 Dec 14];12(Proc2). Available from: http://hdl.handle.net/10045/68771
43. Lago-Peñas C, Lago-Ballesteros J. Game location and team quality effects on performance profiles in professional soccer. *J Sports Sci Med*. 2011;10(3):465–71.
44. Jerome BWC, Stoeckl M, Mackriell B, et al. Evidence for a new model of the complex interrelationship of ball possession, physical intensity and performance in elite soccer. *Scand J Med Sci Sports*. 2023 Dec 7;Epub ahead of print. doi: 10.1111/sms.14546
45. Navarro F. Analysis of styles of play in soccer and their effectiveness [Internet]. 2018 [cited 2023 Mar 1]. Available from: https://www.semanticscholar.org/paper/Analysis-of-styles-of-play-in-soccer-and-their-Navarro/8871fac23f962d33a8b73ba2a4066fdebf47f157
46. Konefał M, Radzimiński Ł, Chmura J, et al. The seven phases of match status differentiate the running performance of soccer players in UEFA Champions League. *Sci Rep*. 2023 Apr 24;13(1):6675.
47. Silva R, Camões M, Barbosa A, et al. Relationship between training load and match running performance in men's soccer. *J Mens Health*. 2021 Sep 30;17(4):92–8.
48. Chena M, Morcillo-Losa JA, Rodríguez-Hernández ML, et al. Workloads of different soccer-specific drills in professional players. *J Hum Kinet*. 2022 Oct;84:135–47.

Tables and Figures

Table 1. Number of games available for analysis, the number of games that finished 11v11, mean game duration, players included in that season's analysis and mean age of players that season.

Season	Total Games Tracked	Games that finished 11 v 11	Mean Game Duration	Players Included in Analysis that Season	Mean Age of Players
2015/16	372	317	96.3 ± 1.7	541	27.4
2016/17	378	334	96.4 ± 1.6	521	27.8
2017/18	380	345	96.1 ± 1.8	514	27.3
2018/19	377	332	96.5 ± 1.8	500	27.2
2019/20	375	331	97.4 ± 1.9	513	27.0
2020/21	375	332	96.4 ± 2.1	516	27.0
2021/22	376	332	97.2 ± 2.3	536	27.2
2022/23	372	339	98.4 ± 2.7	547	27.0
2023/24	372	318	101.0 ± 2.9	557	26.7

Figure 1. Correlation of final league position of the team in the EPL against their team total running load output for distance (m), high intensity distance (m), high speed running distance (m) and sprint (m). Each season, teams are ranked from highest running load that season to lowest. Axis is inverted.


Distance
High Intensity Distance
High Speed Running Distance
Sprint Distance
r=.13, p=0.09
r=.28, p<0.001
r=.20, p=0.007
r=.32, p<0.001
League position at the end of the season
Rank by season average in that season
Games that finished 11 v 11 only
EPL Seasons 2015/16 - 2023/24

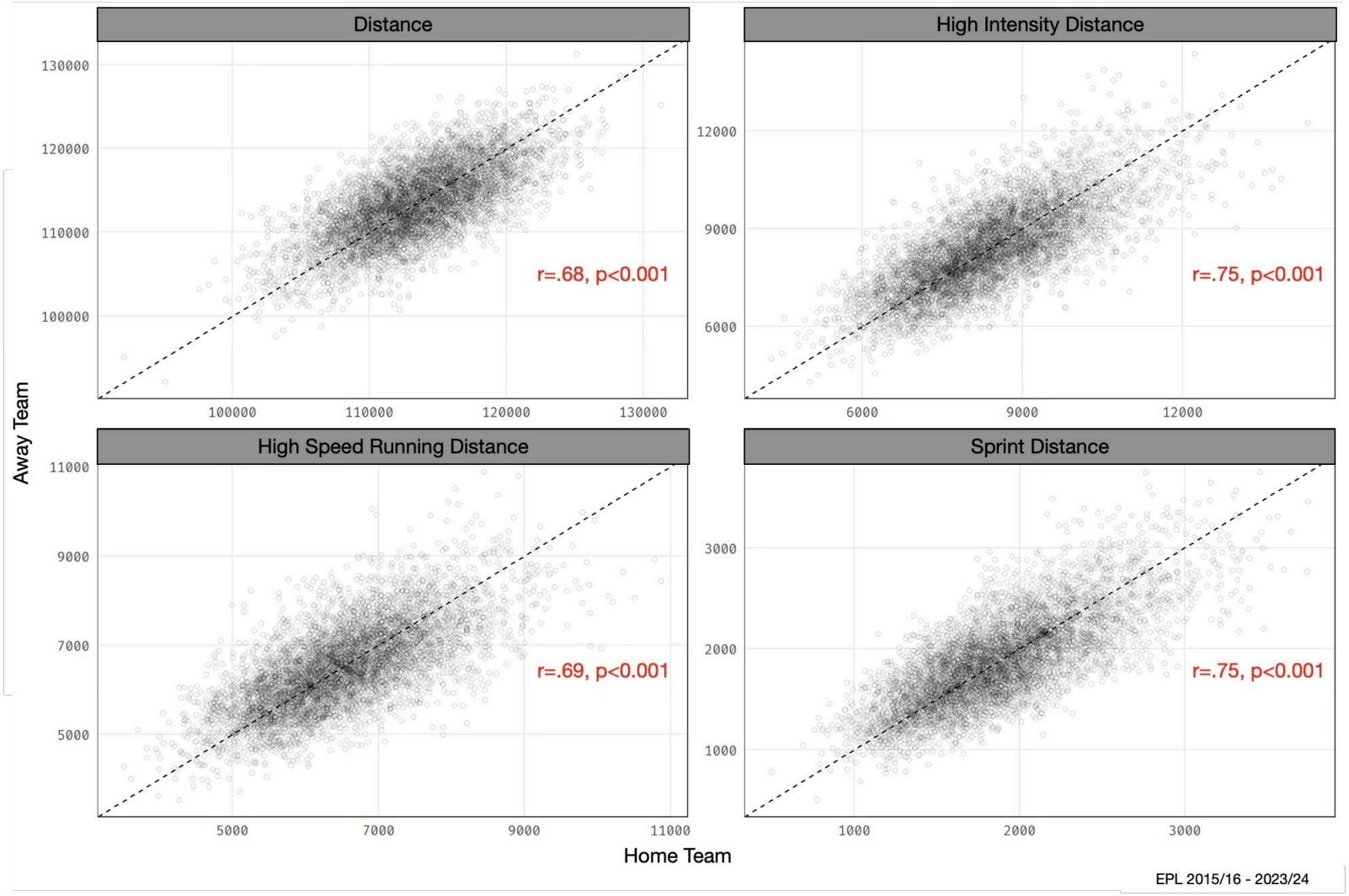


Figure 2. Correlation of running loads between home and away teams in a match for distance (m), high intensity distance (m), high speed running distance (m) and sprint (m).

Table 2. Multiple comparisons post hoc test showing differences between running load variables and match outcome (win, draw, lose). Negative values show Group 1 had higher outputs than Group 2.

Variable	Group 1	Group 2	Effect Size Differences	Lower	Upper
Distance (m)	Win	Draw	-0.14*	-0.22	-0.06
	Win	Loss	-0.18*	-0.25	-0.11
	Draw	Loss	0.04	-0.12	0.04
High-Intensity Distance (m)	Win	Draw	-0.14*	-0.22	-0.06
	Win	Loss	-0.10*	-0.17	-0.03
	Draw	Loss	0.04	-0.04	0.12
High-Speed Running Distance (m)	Win	Draw	-0.10*	-0.18	-0.02
	Win	Loss	-0.03	-0.10	0.04
	Draw	Loss	0.07	-0.01	0.15
Sprint Distance (m)	Win	Draw	-0.20*	-0.28	-0.12
	Win	Loss	-0.23*	-0.30	-0.16
	Draw	Loss	-0.03	-0.11	0.05

*P<0.05

Table 3. The difference in average outputs between winning and losing teams in the same match.

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Metric	Winning Team	Losing Team	Difference	95% Confidence Intervals	p value	Effect Size
Distance (m)	113895 ± 4378	113115 ± 4515	780*	(636 – 924)	p<0.001	0.22
High-Intensity Distance (m)	8478 ± 1280	8368 ± 1338	110*	(72 - 148)	p<0.001	0.12
High-Speed Running (m)	6543 ± 922	6524 ± 991	19	(-12 - 50)	0.226	0.22
Sprint Distance (m)	1935 ± 447	1844 ± 437	91*	(78 - 103)	p<0.001	0.29

636 *P<0.05

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