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Shots During One-Goal Leads and Match Outcomes in the English Premier League

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Abstract

This observational retrospective study aimed to examine the association between team behaviour during periods of one-goal leads and subsequent match outcomes while accounting for team level and match location. All matches (n = 380) of the English Premier League (EPL) during the season 2023/24 were analyzed. Team behaviour was evaluated by shots every 10 min during a one-goal lead (SP10MDOGL), a time-normalized indicator of offensive activity that reflects a team's strategic orientation while protecting a narrow lead. Mixed effects multinomial logistic regression was used to establish the association between SP10MDOGL and the match outcome. Results indicated that increased SP10MDOGL was strongly associated with a higher likelihood of both drawing (Odds ratio (OR) = 2.37, 95% confidence interval (CI) = 1.29–4.33; Cohen's d (d) = 0.47) and winning (OR = 3.38; 95%CI = 1.93–5.92; d = 0.67) compared to losing. This association remained consistent across high-, intermediate-, and low-level teams regardless of whether they played at home or away. These findings suggest that maintaining an offensive approach through an increased number of shots during a one-goal lead is associated with a higher likelihood of securing positive match outcomes within the elite-level football context, such as the EPL. Soccer coaches should consider implementing proactive offensive strategies when protecting a narrow lead, regardless of their team level and match location.

Keywords: elite soccer; offensive strategy; strategic behaviour; success; contextual factors

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1. Introduction

Football is one of the most popular sports in the world [1,2]. It is a multifactorial, complex team sport where two teams of 11 players produce a high number of interactions [3,4]. Over the past decades, multiple studies aiming to investigate football's successful determinants have been conducted [5–9]. These findings repeatedly demonstrate that success in football has been strongly related to both tactical and technical performance [10,11]. For example, teams that successfully implement an effective offensive strategy tend to

achieve greater ball possession, produce more shots and shots on target, and complete more accurate passes in the final third [12,13].

Essentially, to achieve success in a single match, teams must score at least one goal more than their opponents and successfully maintain the lead until the end of the match [14]. Therefore, managing the game while holding a one-goal advantage represents a fundamental strategic challenge [15]. Traditionally, teams facing this situation tend to adopt one of two primary strategies: a defensive strategy that focuses on lead preservation, potentially reducing scoring opportunities, or a continued offensive strategy aimed at increasing the likelihood of extending the lead, but carrying a greater risk of conceding a goal [16]. Therefore, selecting the most appropriate strategy in such moments requires not only a predefined plan but also the capacity to adapt to the unfolding actions of the opponent, making it a critical element of effective game management.

The choice of in-game strategic approaches when leading may vary depending on the context [17,18]. Previous empirical research established team level and match location as critical determinants of match outcome [19,20], suggesting that it may also influence strategic decisions. Theoretically, high-level teams, which are characterized by superior technical and tactical qualities [21], may be more likely to continue attacking after taking the lead, confident in their ability to manage defensive risks. Conversely, low-level teams, which are characterized by inferior technical and tactical qualities [22], may prefer a more defensive approach aimed at preserving their advantage. Similarly, prior studies have consistently found that home teams generally have an advantage [23,24], suggesting that it may also shape the strategic decisions when holding a lead. For example, factors such as crowd density, travel distance, or altitude difference [25–28] may play a critical role in the team's decision to maintain an offensive strategy after taking the lead, seeking additional goal-scoring opportunities. In contrast, away teams have been shown to be less effective in this context [29], as they are not familiar with the pitch or climate and are aware of their disadvantage [24]. Thus, a defensive strategy aimed at preserving their margin seems to be more appropriate.

However, currently, there is no study to confirm such considerations. As a result, the knowledge about in-game strategic approaches when leading in different contexts is limited, arguably warranting new research. To address this issue, shots per minute during one-goal leads (SPMDOGLs) were selected as the primary indicator of offensive behaviour. Although offensive behaviour is complex and can be represented through typical technical–tactical performance, such as possession, passing in the final third, pressing intensity, or expected goals, shots are still commonly considered the immediate outcome of offensive play [30]. Consequently, SPMDOGL provides a direct and intuitive link between offensive behaviour and the ultimate match outcome. On the other hand, while typical aforementioned technical–tactical performance to evaluate offensive behaviour has been repeatedly investigated [31–33], SPMDOGL has been understudied in the literature. By focusing only on this novel indicator, the specific contribution of SPMDOGL is highlighted, and a foundation is established for future research that may integrate this measure alongside broader technical–tactical indicators. The findings from such (i.e., current and future) research have the potential to determine the most suitable strategic approaches when having a one-goal lead, specifically for high-, intermediate, and low-level teams, when playing at home or away. This could serve as practical guidance for soccer coaches, enabling them to make informed strategic decisions depending on team level and match location.

Therefore, this study aimed to determine the association between team behaviour during periods of a one-goal lead and subsequent match outcomes while accounting for team level and match location. We hypothesized that higher offensive activity during periods of a one-goal lead, measured by SPMDOGL, would be associated with a greater

likelihood of securing positive match outcomes (win or draw), irrespective of team level and match location.

2. Materials and Methods

2.1. Study Design

This investigation employed an observational retrospective study design, analyzing pre-existing match data from the 2023/2024 English Premier League (EPL) season. The main rationale for this approach was the lack of prior research directly examining how team behaviour during a one-goal lead relates to match outcome. Team behaviour during was evaluated by shots per minute during a one-goal lead (SPMDOGL). Other common indicators of offensive and defensive behaviour, such as passes in the final third, key passes, possession measures, or passes per defensive action, were not included in the present analysis. This decision was made to deliberately focus on a simple metric that directly reflects scoring opportunities, but also to highlight the specific contribution of SPMDOGL and to establish a foundation for future research.

SPMDOGL quantifies the frequency of shooting attempts relative to time spent leading by a single goal, calculated as the total number of shots taken by a team divided by the total number of minutes in which the team held a one-goal advantage. As such, SPMDOGL provides a time-normalized indicator of offensive activity specifically contextualized to periods of minimal score advantage. When increased, this metric reflects the increased offensive activity of a team when leading by one goal, as teams that adopt a more offensive approach are expected to produce a higher amount of shots [16]. Conversely, a lower SPMDOGL indicates a more passive (i.e., defensive) approach. Correlating SPMDOGL with match outcome (win, draw, loss) enables the association between team behaviour while leading and competitive success to be established. This allowed us to elucidate how different strategic decisions when leading may contribute to match success. To contextualize these decisions, team level and match location were included as covariates [22,23,34].

2.2. Sample

The data in this study were obtained from all matches (n = 380) from the 2023/2024 English Premier League (EPL) season. From each match, periods during which one team was leading by one goal were analyzed. Thus, the initial sample included a total of 428 such observations from all 20 EPL teams. However, to ensure that the team had sufficient time to exhibit stable strategic behaviour, only observations in which a team held a one-goal lead for a minimum duration of 10 min were included in the analysis. Among these excluded observations, 51 ended in a win, 16 in a draw, and 15 in a loss. As a result, the final sample included 346 observations from all 20 EPL teams. The average number of observations per team was 17.3, ranging from 10 to 28. In total, the included observations accounted for 12,197 min of one-goal leads and 1663 shots. All data were anonymised in accordance with the principles of the Declaration of Helsinki to ensure confidentiality. The investigation was approved by the local university ethics board. As the data used in this study were publicly available, informed consent was not required.

2.3. Procedures

Match analysis. All data were obtained from the open-sourced soccer data provider SofaScore [35], which uses OPTA (London, UK) real-time data collection to provide their data [36]. A previous study demonstrated that the data gathering method used by OPTA has a high level of inter-operator reliability [36]. Specifically, Liu et al. reported inter-operator agreement exceeding 90% for most technical variables, with Cohen's kappa coefficients ranging from 0.90 to 0.95, indicating high consistency in data coding procedures [36].

All data processing and analysis were conducted using Python (v3.9.7) [37] within the Spyder (v4.2.5) coding language [38], which allowed for structured scripting and visual data inspection.

Variables. The dependent variable was a three-level categorical variable for match outcome: (1) loss, (2) draw, and (3) win. Independent variables included SPMDOGL, team level, and match location. The SPMDOGL was a continuous variable calculated as the ratio between the number of shots performed during a one-goal lead and the total minutes of one-goal lead. To enhance interpretability and reduce numerical instability, SPMDOGL was multiplied by 10 to represent "shots per 10 min during one-goal lead" (SP10MDOGL). Team level was a three-level categorical variable evaluated by teams' position on the table. From 1st to 6th place level was considered as "high", from 7th to 13th as "intermediate", and from 14th to 20th as "low". This approach has been used in previous studies to differentiate team quality based on season-end performance [39]. The match location was a two-level categorical variable coded as "home" or "away" depending on whether the team played home or away.

The manuscript was prepared in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines, and a completed STROBE checklist is provided as Supplementary Material.

2.4. Statistical Analysis

Mixed effects multinomial logistic regression was used to establish the association between team behaviour during periods of one-goal leads and subsequent match outcome while accounting for team level and match location. For this purpose, the match outcome was included as the dependent variable, with loss as the reference category. The SP10MDOGL, team level, and match location were the independent variables included as fixed effects. Teams' identities were modelled as a random effect. A "step up" approach was applied, retaining variables only if they significantly improved model fit based on information criteria and reached statistical significance ($p \leq 0.05$) when compared to the previous model. This procedure involved the use of the Akaike Information Criterion (AIC), with lower values indicating a better-fitting model, as well as the chi-square likelihood ratio test. Specifically, the models were compared by subtracting the log-likelihood of the new model from the value of the old one and considering the degrees of freedom equal to the difference in the number of parameters between the two models.

In addition, absolute model adequacy was evaluated by examining predicted versus observed outcome plots, showing that the model adequately captured outcome distributions (Figure 1). To examine whether the assumed linear association between SP10MDOGL and the log-odds of outcomes was appropriate, additional models including a quadratic term were estimated [40]. Model fit was compared using AIC. The model, including a quadratic term for SP10MDOGL, yielded a slightly lower AIC compared to the linear specification (454 vs. 457), indicating a marginal improvement in fit. This suggests that the linear specification was generally adequate, with no strong evidence of non-linear effects. As a simple sensitivity check of the independence of irrelevant alternatives (IIA) assumption, the final model was re-estimated with each outcome (win, draw, and loss) set as the reference category. The results were consistent across all specifications, suggesting that the conclusions were not sensitive to the choice of baseline outcome.

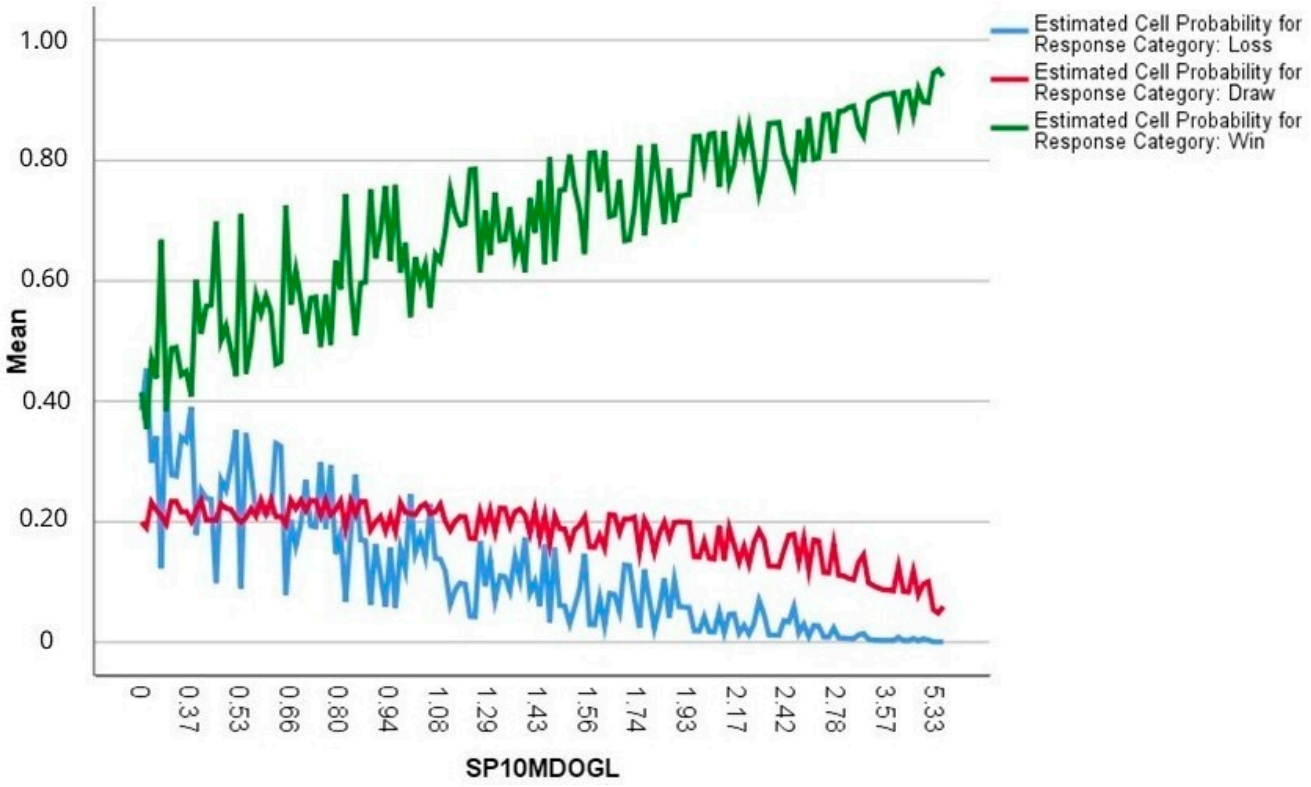


Figure 1. Predicted probabilities of win, draw, and loss outcomes across the observed range of SPMDOGL.

To estimate the post hoc power of observed effects, odds ratios were converted to Cohen's d (d) effect sizes (ES) using the approximation d = ln(OR)/1.81 as proposed previously [41], and interpreted as follows: <0.2 as trivial, 0.2–0.5 as small, 0.5–0.8 as medium, and >0.8 as large. An a priori power analysis (test family: z tests) was performed in G*Power (v3.1.9.7) to evaluate sample adequacy. Assuming $\alpha = 0.05$ and power = 0.95, the analysis indicated that a minimum of 180 cases would be required to detect an odds ratio of 2. Given that the present study included 346 cases, the available sample exceeded the required size, suggesting that the study was adequately powered to detect effects of practical relevance.

3. Results

Figure 1 presents the predicted probabilities of win, draw, and loss across the observed range of SP10MDOGL, based on the final multinomial logistic regression model. For example, when SP10MDOGL was around 0.3, the predicted probability of winning was approximately 40%, while the probability of losing was about 35%. In contrast, at values around 2.5, the probability of winning increased to nearly 80%, whereas the probability of losing dropped below 10%.

Table 1 presents descriptive statistics of SP10MDOGL in the context of match outcome, team level, and match location. Mean SP10MDOGL was 1.57 in matches that ended in a win, 1.22 in draws, and 0.74 in losses. High-, intermediate-, and low-level teams demonstrated mean SP10MDOGL of 1.74, 1.27, and 1.06, respectively. Home and away teams exhibited mean SP10MDOGL of 1.53 and 1.22, respectively.

Table 1. Descriptive statistics of SP10MDOGL in the context of match outcome, team level, and match location.

Match Outcome	Mean	SD	*n*
Loss	0.74	0.82	47
Draw	1.22	0.73	65
Win	1.57	1.01	234
Team level	Mean	SD	*n*
High	1.74	1.02	131
Intermediate	1.27	0.86	125
Low	1.06	0.92	90
Match location	Mean	SD	*n*
Home	1.53	1.06	188
Away	1.22	0.85	155

Table 2 presents the final model used to examine the association between SP10MDOGL and match outcome while accounting for contextual factors. A random effect (team identity) was initially specified to address clustering. However, the model output produced convergence warnings indicating that the covariance matrix of the random effects was not positive definite. This reflected the fact that the estimated variance component was 0.000. Given this redundancy, incorporation of team identity as a random effect did not enhance the model fit, and it was therefore excluded, indicating that the associations between the predictors and match outcome were consistent across teams.

Table 2. Association between SP10MDOGL and match outcome while taking into account the effect of contextual factors.

	B (SE)	*p*	OR	95%CI	d
Draw					
Intercept	−0.99 (0.4)	0.01			
SP10MDOGL	0.86 (0.31)	0.01	2.37	1.29–4.33	0.47
Team level: High	1.33 (0.6)	0.03	3.79	1.16–12.38	0.73
Team level: Intermediate	0.56 (0.44)	0.2	1.76	0.74–4.19	0.31
SPMDOGL × Team level	NS				
Match location	NS				
SPMDOGL × Match location	NS				
Win					
Intercept	−0.41 (0.35)	0.24			
SP10MDOGL	1.22 (0.29)	<0.01	3.38	1.93–5.92	0.67
Team level: High	1.84 (0.54)	<0.01	6.27	2.17–18.07	1.01
Team level: Intermediate	0.62 (0.38)	0.1	1.85	0.88–3.89	0.34
SPMDOGL × Team level	NS				
Match location	NS				
SPMDOGL × Match location	NS				

B = standardized regression coefficient, SE = standard error, *p* = level of significance, OR = odds ratio, CI = confidence interval, NS = nonsignificant. Reference category for match outcome was loss; for team level, the reference category was low-level team; and for match locations, the reference category was home.

The model displayed Nagelkerke pseudo R2, showing variance explained by fixed effects, of 0.18. The SP10MDOGL was found to be strongly associated with both

draw (OR = 2.37, 95%CI = 1.29–4.33; p = 0.01; ES = medium) and win (OR = 3.38; 95%CI = 1.93–5.92; $p < 0.01$; ES = large).

High-level teams had higher odds for draws than loss (OR = 3.79; 95%CI = 1.16–12.38; p = 0.03; ES = large) and wins than loss (OR = 6.27, 95%CI = 2.17–18.07; $p < 0.01$; ES = large) compared to the low-level teams. Similar trend was observed for intermediate-level teams who had higher odds also for both draw vs. loss (OR = 1.76; 95% CI = 0.74–4.19; p = 0.20, ES = small) and win than loss (OR = 1.85; 95% CI = 0.88–3.89; p = 0.10; ES = small) compared to low-level teams but the effects were smaller in magnitude and less statistically robust. Incorporating interaction SP10MDOGL × team level did not improve model fit and was therefore not included in the final model, indicating that the association between SP10MDOGL and match outcome was consistent across high-, intermediate, and low-level teams.

Adding match location and interaction SP10MDOGL × match location failed to enhance the model fit and were therefore not retained. This suggests that the association between SP10MDOGL and match outcome was consistent regardless of whether the team was playing at home or away.

4. Discussion

This study was the first to determine the association between team behaviour during periods of one-goal leads evaluated by SP10MDOGL and subsequent match outcome while controlling for contextual factors. The results revealed a positive association between SP10MDOGL and both a draw and a win. Additionally, this association was shown to be consistent across high-, intermediate, and low-level teams, and regardless of whether playing at home or away. Such findings suggest that maintaining or increasing offensive activity while holding a one-goal lead may be related to enhancing the likelihood of securing positive outcomes, regardless of team level and match location.

It is well-known that teams employing offensive strategies typically achieve higher ball possession, more shots, and shots on target [5,12,20,42,43], which enables them to control the game rhythm and increase the likelihood of achieving positive outcomes. In line with this, our results showed that increased SP10MDOGL, indicating increased offensive activity when holding a one-goal lead, was strongly associated with an increased likelihood of both drawing (medium ES) and winning (large ES) compared to losing. Although causal conclusions cannot be drawn due to the observational nature of the study, this finding suggests that maintaining an offensive approach during a one-goal lead is associated with more favourable match outcomes and may reflect more effective match control. The possible reason could be that continuous maintenance of offensive actions while leading may prevent the opposing team from gaining momentum or settling into their own offensive rhythm [44]. Also, by continuing to generate chances and maintain territorial advantage [45,46], the leading team may keep defensive pressure high and reduce the frequency and quality of opposition attacks. All of this could help protect the lead and raise the chances of securing a positive result for the leading team, suggesting that adopting a conservative (i.e., defensive) approach during one-goal lead periods may not be advantageous. The practical relevance of these conclusions is confirmed by the medium to large effect sizes observed [47].

This should be particularly considered by lower-level teams. Given their inferior technical–tactical qualities in such contexts compared to their opponents [48], it would be more logical for these teams to adopt a defensive approach after taking a one-goal lead in order to preserve their advantage. However, our results revealed that the association between SP10MDOGL and match outcome was observed consistently across high-, intermediate, and low-level teams. This clearly suggests that, regardless of team level,

a proactive approach (i.e., more shooting) after taking a one-goal lead appears to be a more beneficial strategy than keeping defensive organization (i.e., for the same reasons as previously discussed). Such findings most likely reflect specificities of the sample used in the current study, which consisted exclusively of matches from the EPL. In such an elite-level context, the gap in quality between the strongest and weakest teams is relatively small [49]. Even teams classified as lower-quality relative to their opponents often possess sufficient technical–tactical, physical, and psychological capabilities, enabling them to apply offensive strategies consistently irrespective of their team level.

Taking into account previous research demonstrating the influence of home advantage on team behaviour [23,34], it was expected that the association between SP10MDOGL and match outcome might be dependent on match location. Specifically, home teams, benefitting from crowd support [25], familiarity with pitch/weather conditions [34], and psychological momentum [50], might adopt a more offensive approach when leading, while away teams could be more inclined to protect the lead through defensive strategies. However, our findings revealed that the association between SP10MDOGL and match outcome was consistent regardless of whether the team was playing at home or away. This suggests that maintaining or increasing offensive activity while holding a one-goal lead may be more beneficial for securing positive outcomes than a conservative (i.e., defensive) approach, even when playing away from home. This is also most likely a reflection of the previously mentioned elite-level context of the present study. Namely, in the highest-level soccer league, such as the EPL, teams are typically tactically, physically, and psychologically well-prepared regardless of whether they are playing at home or away, which enables them to apply offensive strategies consistently across different match locations.

From a practical perspective, this study has important implications for soccer coaches when developing in-game strategic approaches for protecting a narrow lead. In brief, maintaining or increasing offensive activity (i.e., shooting) during one-goal leads has been demonstrated to be a more beneficial strategic approach than keeping defensive strategies regardless of various contexts (i.e., team level and match location). Notably, this advantage was not limited only to specific teams. Namely, incorporating team identity as a random effect in the current study did not enhance the model fit, indicating that the association between SP10MDOGL and match outcome was consistent across all teams. Such consistent effect across all EPL teams suggests that proactive behaviour (i.e., maintaining or increasing offensive activities) during the one-goal represents a generalizable advantage for securing a positive match outcome within the elite-level football context, rather than being a recommended strategy only for top-level or home teams.

This study has several limitations that should be acknowledged to provide a transparent interpretation of the results. The main limitation of this study is the exclusive use of shots as a parameter of offensiveness. While shots are a clear indicator of offensive activities, they occur less frequently than, for example, passes in the final third [51], which limits the ability to capture the full spectrum of teams' offensive behaviour (i.e., build-up play, possession strategies, off-the-ball movement, or pressing intensity). As such, the measure provides a partial view of overall offensive behaviour, and its interpretation should be viewed in this context. In future studies, additional factors to evaluate offensive activities, such as passes in the final third or the expected number of shots, should be used. Second, due to the observational design, the results reflect associations rather than causal relationships. Additionally, the possibility of reverse causality must be considered. For example, teams that already feel dominant may both engage in higher offensive activity and achieve better results, challenging the interpretation that increased SP10MDOGL drives better outcomes. A further limitation involves selection bias. Only observations with more than 10 min of a one-goal lead were included, which excluded more transient

lead scenarios. This criterion, while designed to ensure behavioural stability, may have unintentionally biased the sample toward teams with inherently better match control or structural superiority, limiting the generalizability of findings to all one-goal lead situations. Lastly, despite adjusting for team level and match location, many unmeasured confounding variables could have influenced both a team's behaviour while leading and the match outcome. Therefore, future studies should control for additional confounding variables such as opponent quality, tactical formations, playing styles, red cards, and similar factors.

5. Conclusions

This study demonstrates that, within the context of the EPL, higher offensive activity during one-goal leads, measured by SP10MDOGL, is associated with a greater likelihood of securing positive match outcomes (i.e., win and draw). Such results suggest that maintaining or increasing offensive activity (i.e., shooting) during narrow leads may be a beneficial approach across different teams and contexts. These findings challenge the conventional tendency to adopt defensive strategies to control the match and preserve a one-goal lead, which is a common approach among lower-ranked teams and when playing away.

Beyond its practical implications, the present study also highlights the role of technology in sports science. The use of large-scale, open-source datasets combined with advanced statistical modelling represents a technological approach to analyzing strategic behaviour in elite football. Such data-driven methodologies enable the capture, processing, and interpretation of complex tactical dynamics on a scale that was previously not feasible, thereby strengthening the integration of technology with applied sports performance research.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/app152010868/s1, Table S1: STROBE Statement—checklist of items that should be included in reports of observational studies.

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Informed Consent Statement: As the data used in this study were publicly available, informed consent was not required.

Data Availability Statement: The datasets generated and/or analyzed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

SPMDOGL	Shots per minute during one-goal lead
SP10MDOGL	Shots per 10 min during one-goal lead
EPL	English Premier League

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