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Context-Dependent Behaviour in Professional Football: Competitive Constraints and Concurrent Attacking Output

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Abstract

This study examined context-dependent behavioural variation and concurrent attacking output in professional football. Wyscout data covered the 2023/2024 EFL Championship. After a data audit, 546 matches contributed 1092 team-match observations and 2182 team-score-state observations covering at least 5 min. Principal component analysis summarised eight attacking indicators; the defensive-pressure measure combined standardised advanced regains and reversed PPDA. Duration-weighted team fixed-effects models used two-way team/match cluster-robust covariance and t-based inference. Behavioural deviations were calculated relative to leave-one-match-out team-season means. Two attacking components explained 78.7% of variance. Winning was associated with more direct play, deeper loss locations and lower pressure; losing showed the opposite pattern. Deeper loss-location deviation was associated with lower xG/90 (β = −0.139, 95% CI −0.210 to −0.068), lower shot rates and lower penalty-area entry rates. Higher pressure was associated with higher xG/90 (β = 0.133, 95% CI 0.052 to 0.214), higher shot rates and higher entry rates. The pressure–xG association depended on the composite weighting and was mainly attributable to advanced regains. With team fixed effects, deviation models offered negligible explanatory gain over models using original scores. These retrospective associations describe behavioural variation; they do not establish purposeful adaptation, causal benefits or prospective predictive value.

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1. Introduction

Sports performance is the product of interacting physiological, biomechanical, psychological, technical, tactical, and environmental influences, rather than a single isolated capacity. Constraints-based perspectives therefore treat performance behaviour as an adaptive response to the demands of the performer–environment system, with task and environmental conditions shaping the solutions that emerge during competition [1–3]. In professional football, this perspective is especially relevant, because the competitive problem is continuously changing: venue, score state, opponent strength, and opponent behaviour alter the space, time, risk, and action possibilities available to a team. Event-based performance analysis can quantify behavioural variation at scale, although tactical intention and physiological regulation cannot be established from event summaries alone.

The football playing style is intrinsically multidimensional. Previous work has distinguished possession-oriented and direct or counterattacking approaches, as well as higher- and lower-pressure defensive behaviours [4–8]. Possession itself is not a universal marker of superiority: its value depends on what follows, where actions occur, and how opponents constrain progression. Pass direction, progression, pressure, territorial occupation, and the spatial distribution of ball losses and recoveries therefore provide complementary information [9–12]. Team-quality studies likewise indicate that successful performance is expressed through combinations of indicators rather than a single dominant statistic [13,14].

Context modifies these patterns. Match location, opposition quality, and match status have repeatedly been associated with changes in possession, technical actions, attacking behaviour, and ball recovery [15–24]. Teams that are leading may accept less possession or adopt more direct transitions, whereas trailing teams may assume territorial initiative and increase pressure. Home teams can also behave more proactively. These responses are relational: an opponent that presses high, protects a low block, or dominates possession changes the constraints under which the focal team performs.

Much of the literature treats the playing style as a team-level descriptor and uses context as a covariate. Two related questions are how far a team departs from its typical behavioural profile as competitive conditions change and whether those departures coincide with attacking output. Here, behavioural variation denotes an observed difference; tactical adaptation additionally implies a response to a competitive demand, and effective adaptation requires evidence of functional benefit. A team-season reference provides a baseline to assess retrospective within-team variation and does not, by itself, establish either form of adaptation. The deviation transformation is evaluated alongside original scores in models with team fixed effects rather than assumed to provide superior explanatory value.

Accordingly, this study analysed event-derived data from the 2023/2024 English Football League (EFL) Championship. The primary aims were to (i) derive interpretable attacking-performance dimensions from multivariate event indicators; (ii) construct a non-redundant defensive-pressure measure; (iii) quantify how venue, score state, opponent behaviour, and opponent strength were associated with within-team behavioural variation; and (iv) determine whether behavioural deviations from each team's typical profile were concurrently associated with xG, shots, and penalty-area entries. We hypothesised that winning would be associated with more direct and less press-intensive

behaviour, whereas losing would be associated with higher possession orientation and pressure. We further expected more advanced territorial behaviour and higher defensive pressure to be associated with higher attacking output, while making no directional hypothesis for possession directness, because possession can support either control or penetration depending on context. Figure 1 summarises the analytical framework.

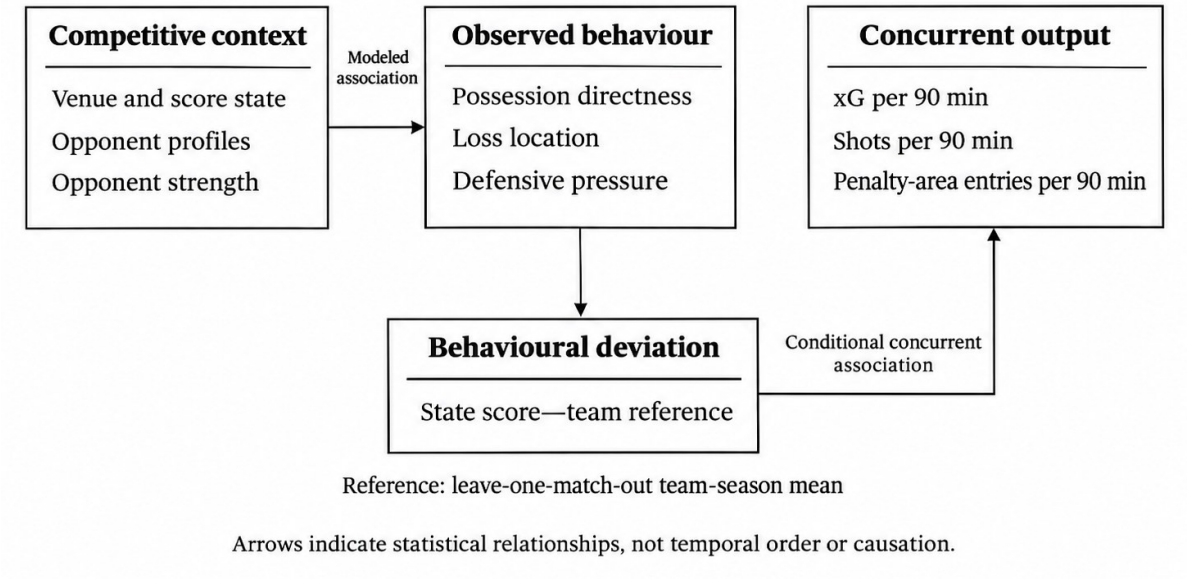


Figure 1. Analytical framework. Competitive context was modelled in relation to three behavioural scores. Score-state values were also expressed relative to leave-one-match-out team-season means and associated with concurrent xG/90, shots/90 and penalty-area entries/90. Arrows identify statistical model relationships, not temporal order or causation. Both teams were retained within each match; team and match dependence were addressed in inference.

2. Materials and Methods

2.1. Data Source and Competition Sample

Event-derived performance data were obtained from the Hudl Wyscout platform (Hudl, Lincoln, NE, USA) for the 2023/2024 EFL Championship season [25,26]. The raw export contained 557 unique match identifiers. Five playoff fixtures played after the 46-match regular season were excluded, leaving 552 scheduled regular-season matches involving 24 teams.

2.2. Data-Integrity Audit and Reconstruction

The raw workbook stored performance data as team-score-state summaries and, for most fixtures, in reciprocal team-oriented views. Before inferential analysis, 62 duplicate metric profiles were identified within affected orientations and collapsed before duration and score validation. One canonical orientation per match was then selected from the orientations with a summed duration compatible with a complete match (85–115 min, allowing for stoppage time), preferring an orientation without duplicate metric profiles and, when more than one complete orientation remained, the orientation retaining the most complete set of distinct score states; remaining ties were resolved alphabetically by focal-team name. Six goalless matches were represented in only one team orientation; opponent fields in those records allowed both team observations to be reconstructed. Five regular-season fixtures lacked a summed duration in the accepted range in either orientation after duplicate resolution. One further fixture, Ipswich Town–Hull City (3:0, 3 October 2023), met the duration criterion, but the retained focal-team goal total was two rather than the three recorded for the fixture. This score-inconsistent fixture was also excluded, without

imputing the missing events. The final match-level sample therefore comprised 546 matches and 1092 team-match observations. The primary score-state analysis retained 2182 team-state observations covering at least 5 min; a sensitivity analysis used a 10 min threshold (2050 observations). Duplicate profiles were defined by the exact equality of all 104 focal-team numeric duration and performance fields, excluding team identifiers, formation and possession-rank labels, within a fixture and orientation. The first occurrence in source order was retained. Score states were drawing, winning and losing; a summary may combine non-contiguous periods, and its duration does not establish when those periods occurred within the match. Reciprocal records were used as alternative source orientations, not counted twice. Opponent fields from the chosen orientation supplied the second team's observation, with winning and losing reversed. The audit retained 2290 team-state observations before the 5 min filter, and 108 were removed by that filter. Table 1 summarises the data audit and analytical sample.

Table 1. Data-integrity audit and analytical sample.

Item	*n*	Decision/Use
Raw unique match identifiers	557	Included five playoff fixtures
Regular-season fixtures	552	Playoffs excluded
Duplicate metric profiles	62	Collapsed before duration/score validation
Fixtures failing duration or score checks	6	Five duration-incomplete; one score-inconsistent
Final retained matches	546	Primary match-level dataset
Team-match observations	1092	Two focal-team observations per match
Score-state observations ≥ 5 min	2182	Primary contextual and attacking-output models
Score-state observations ≥ 10 min	2050	Sensitivity analysis

No missing match summary was reconstructed by statistical imputation. The data-cleaning and reconstruction procedures are described in Supplementary Section S5, and the excluded fixtures are documented in Supplementary Section S2.

2.3. Behavioural Indicators and Match Aggregation

Eight attacking indicators were retained: possession percentage, long-pass percentage, average passes per possession, defensive-third loss percentage, attacking-third loss percentage, lateral-pass percentage, forward-pass percentage, and progressive-pass percentage. Defensive information comprised the distribution of recoveries across defensive, middle, and attacking thirds together with passes per defensive action (PPDA), where a lower PPDA indicates higher pressing intensity. Indicator definitions followed the provider glossary and established performance-analysis terminology [25,26]. Table 2 summarises the indicators and their analytical roles.

For match-level reconstruction, the count variables were summed across score states. Percentages derived from counts were recalculated from summed numerators and denominators rather than averaged. The possession percentage, average passes per possession, and PPDA were aggregated as duration-weighted means. Score-state analyses used team-state values after duration filtering. Expected goals (xG), total shots, and penalty-area entries were retained as attacking-output measures and scaled to a 90 min rate for score-state modelling. For each outcome, rate = 90 × total outcome/duration in minutes. Regression weights equalled duration; so, short observations contributed less. This represents an exposure-weighted linear conditional-mean association, not a guarantee of Poisson variance or a causal rate difference. Loss-location percentages used all possession losses as the denominator, and regain percentages used all recoveries. The ratio of sums was used whenever numerators and denominators were available. The duration-weighted possession, passes per possession and PPDA were approximations because their

exact possession-time, possession-count and PPDA-specific denominators were unavailable; duration weighting is not generally identical to pooling those denominators.

Table 2. Analytical indicators and interpretation.

Indicator	Definition	Analytical Role
Possession %	Proportion of pure playing time in possession	Attacking orientation
Long pass %	Long passes as a percentage of all passes	Attacking orientation
Passes per possession	Mean passes in an open-play possession	Attacking orientation
Defensive-third losses %	Defensive-third losses as a percentage of all losses	Territorial behaviour
Attacking-third losses %	Attacking-third losses as a percentage of all losses	Territorial behaviour
Lateral pass %	Lateral passes as a percentage of all passes	Attacking orientation
Forward pass %	Forward passes as a percentage of all passes	Attacking orientation
Progressive pass %	Progressive passes as a percentage of all passes	Attacking orientation
Attacking-third regain %	Attacking-third recoveries as a percentage of all recoveries	Component of defensive-pressure composite
PPDA	Passes per defensive action; lower values indicate higher pressing intensity	Component of defensive-pressure composite
xG/90	Sum of provider expected-goal values, scaled to 90 min	Attacking output
Shots/90	Shot count scaled to 90 min	Attacking output
Penalty-area entries/90	Penalty-area entry count scaled to 90 min	Attacking output

2.4. Behavioural-Deviation Framework

The analysis distinguished a team's season-level behavioural identity from its score-state expression. After the league-wide style dimensions were derived at team-match level, each score-state observation was projected onto the same measurement scale. For each dimension, a leave-one-match-out season mean was calculated for the focal team so that the current match did not contribute to its own reference value. The behavioural deviation was defined as the score-state value minus this leave-one-match-out team mean. Positive possession-directness deviation indicated a shift toward more possession-oriented circulation; positive loss-location deviation indicated that losses were distributed deeper; and positive defensive-pressure deviation indicated higher attacking-third regaining and lower PPDA. The three behavioural-deviation variables were standardised across the primary score-state sample before the attacking-output modelling. The leave-one-match-out mean used an equal-weight average of the remaining complete team-match scores. It removes the direct contribution of the current match but still includes subsequent matches. PCA, scaling and season baselines therefore constitute a retrospective description, not information available for live decisions. A raw-score comparison tested whether the transformation materially changed the model fit.

The framework quantifies differences in observed behaviour, encompassing ordinary within-team variability as well as possible tactical responses. It does not measure intention, functional appropriateness, adaptation success, energetic cost, internal load, perceived effort or fatigue. A season mean is a transparent descriptive reference rather than an empirically validated tactical optimum.

2.5. Statistical Analysis

Statistical analyses were conducted in Python 3.12.14 (Python Software Foundation, Beaverton, OR, USA) using NumPy 2.3.5, pandas 2.2.3, SciPy 1.17.0 and statsmodels 0.15.0. Continuous variables were standardised where specified. Descriptive values are reported as the mean ± standard deviation or model coefficients with 95% confidence intervals. Random-number generation is described in the Supplementary Material.

Statistical procedures addressed repeated and dyadic observations; model specifications and supplementary results are reported in Supplementary Sections S9–S20. The libraries are community-developed open-source software (NumPy: https://numpy.org; pandas: https://pandas.pydata.org; SciPy: https://scipy.org; statsmodels: https://www.statsmodels.org).

Attacking-performance dimensions. The eight attacking indicators were standardised and entered into principal component analysis (PCA). Sampling adequacy was evaluated using the Kaiser–Meyer–Olkin statistic and Bartlett's test of sphericity. Component retention was supported by observed eigenvalues and parallel analysis. Retained components were orthogonally rotated using Varimax. Component scores were oriented so that higher possession-directness scores denoted higher possession orientation, and higher loss-location scores denoted a deeper distribution of possession losses. Match-level component scores were standardised, and the same scaling solution was applied to score-state observations. Each input used its team-match mean and population SD. The sample covariance of standardised inputs was eigendecomposed; Varimax rotated the retained loading matrix. Scores used the corresponding rotated unwhitened principal-component coefficients (eigenvectors multiplied by the rotation matrix), followed by centring and scaling with the match-score mean and population SD. The fixed input means, SDs, coefficients and score-scaling constants were applied unchanged to every team-state observation. Parallel analysis used 1000 independent column permutations and the 95th percentile of each null eigenvalue. Numerical parameters are reported in the supplementary PCA tables. Only two loss-zone percentages entered PCA, avoiding the exact linear dependence that would arise from including all three; the dependence inherent in compositional percentages nevertheless remains. The label possession-directness summarises this dataset's loading pattern rather than a universal tactical continuum. See Supplementary Section S6.

Defensive pressure. The three regain-zone percentages sum to 100% and are therefore compositional. Entering all three together in a conventional PCA produces a rank-deficient correlation structure. Defensive pressure was therefore defined a priori as a composite of two indicators: attacking-third regain percentage and reversed PPDA. Their standardised values were combined with equal weight, and the resulting score was re-standardised; so, higher values represented more advanced regaining and higher pressing intensity. Specifically, pressure = [z(regain percentage) − z(PPDA)]/(2 × 0.788183088), using the team-match standardisation parameters. Reversal was a sign change of standardised PPDA, not its reciprocal. Equal weighting avoids selecting weights to optimise the outcome association and gives each standardised constituent the same nominal contribution; it is not a validated physiological weighting. Their match-level Pearson correlation was r = 0.242. Separate-constituent models tested whether their associations were similar. See Supplementary Section S14.

Opponent behaviour and strength. For each match, opponent possession-directness and defensive-pressure scores were calculated as leave-one-match-out season averages. This prevented the focal match from contributing to its own opponent-behaviour predictor. Opponent strength was represented by the final league rank, reversed and standardised so that higher values indicated stronger opposition. A sensitivity specification replaced final rank with opponent points per game accumulated strictly before the match date, reconstructed from the final score encoded in each regular-season fixture identifier, including the six fixtures excluded from behavioural analysis. Teams with no preceding match had undefined PPG; their observations were excluded from that specification. This alternative removes future information from the strength predictor, not from the other season-based predictors. See Supplementary Section S15.

Primary contextual models. Team-score-state observations of at least 5 min were analysed using duration-weighted linear regression. Each model included team fixed effects, venue (home vs. away), score state (winning and losing, with drawing as reference), opponent possession directness, opponent defensive pressure, and opponent strength. Covariance was the two-way CR1 sandwich V(team) + V(match) − V(team × match), using weighted design-residual scores and the correction G/(G − 1) × (N − 1)/(N − K) separately for each component. Inference used a Student's t distribution with min(Gteam,Gmatch)−1 degrees of freedom, equal to 23 in the full sample. Outcomes were possession-directness, loss-location, and defensive-pressure scores on the match-level SD scale. Benjamini–Hochberg false-discovery-rate (FDR) correction was applied across the 18 primary contextual tests. Match clustering permits arbitrary dependence between opposing teams and states in the same match; team clustering permits dependence across a focal team's matches. It does not cover all possible network dependence between distinct matches that share an opponent.

Behavioural deviation and concurrent output. Three additional duration-weighted fixed-effects models used xG/90, shots/90, and penalty-area entries/90 as outcomes. The three standardised behavioural-deviation dimensions were entered simultaneously with the same contextual covariates, team fixed effects, and two-way cluster-robust standard errors. FDR correction was applied across the nine behavioural-deviation tests. Because behaviour and output were measured within the same score-state period, these models estimate concurrent associations and are not interpreted as causal or temporally predictive.

Season-level associations and sensitivity analyses. Team-season means for the three behavioural dimensions were correlated with the final league rank using Spearman's rho; 95% confidence intervals were obtained from 5000 bootstrap resamples of the 24 teams. All contextual and attacking-output models were repeated after excluding score-state observations shorter than 10 min. The percentile bootstrap resampled teams, with 5000 draws; these 24-team associations remained exploratory. Additional sensitivity models used one reproducibly selected team per fixture, excluded fixtures with any recorded red card, excluded every fixture involving Leicester City, Ipswich Town or Hull City, and replaced the pressure composite with its constituents. Poisson log-mean models for shot and entry counts used log(duration/90) as an offset and two-way robust covariance; Pearson dispersion was examined. For nonnegative continuous xG, the same log-mean specification was fitted using Poisson pseudo-maximum likelihood, without assuming a count distribution. Duration-weighted xG per shot was analysed only where shots > 0. Raw scores and team-centred scores were compared with leave-one-match-out deviations. A null-imposed wild cluster bootstrap by team supplemented the primary two-way inference; this sensitivity does not preserve cross-team within-match dependence and cannot replace the two-way analysis [27]. Model diagnostics included weighted residual heteroscedasticity, leverage, condition numbers and negative fitted rates. Model specifications and sensitivity-analysis results are reported in the Supplementary Material. The wild bootstrap used 4999 null-imposed Rademacher draws, team-cluster CR1 studentisation and an add-one *p*-value correction. Negative-binomial NB2 models estimated dispersion rather than fixing it. Alternative pressure weights were 25:75 and 75:25 for standardised regains and reversed PPDA, respectively, with each composite rescaled and referenced to its own leave-one-match-out team mean. A five-fold match-grouped cross-fitting analysis fitted PCA, scaling, season profiles and contextual models only to training matches, then formed held-out context-expected residuals. The final outcome models included fold-specific team and contextual nuisance effects. This is a retrospective comparison: training folds include later dates, and it is not prospective validation. Supplementary Sections S10–S19 report these analyses.

3. Results

3.1. Multivariate Structure of Attacking Behaviour

The attacking-indicator matrix showed good sampling adequacy (KMO = 0.836), and Bartlett's test rejected sphericity ($\chi^2 = 6883.3$, df = 28, $p < 0.001$). The first two eigenvalues were 4.776 and 1.522; both exceeded their permutation-based 95th-percentile thresholds. They explained 59.7% and 19.0% of the variance, respectively (78.7% cumulative).

The first rotated component contrasted the possession circulation with direct progression. Higher scores combined more possession, more passes per possession, and a higher lateral-pass share with lower long-, forward-, and progressive-pass shares. This component was labelled possession directness, with positive values indicating a more possession-oriented profile. The second component was dominated by the spatial distribution of possession losses: defensive-third loss percentage loaded positively, whereas attacking-third loss percentage loaded negatively. Higher values therefore denoted a deeper loss-location profile. The possession percentage cross-loaded on both components, indicating shared circulation and loss-location information. Higher loss-location scores describe where losses were distributed, not territorial control or tactical risk directly. Table 3 presents the rotated component loadings.

Table 3. Rotated loadings for the two-component attacking-performance solution.

Indicator	Possession Directness	Loss Location	Communality
Possession %	0.699	−0.504	0.744
Long pass %	−0.892	0.127	0.812
Passes per possession	0.867	−0.263	0.821
Defensive-third loss %	−0.081	0.920	0.853
Attacking-third loss %	0.166	−0.894	0.827
Lateral pass %	0.754	−0.142	0.589
Forward pass %	−0.924	0.102	0.864
Progressive pass %	−0.886	0.062	0.788

Loadings with an absolute value ≥ 0.50 provide the clearest interpretation of each dimension. Component signs are oriented so that higher possession-directness scores indicate higher possession orientation, and higher loss-location scores indicate a deeper spatial distribution of possession losses.

3.2. League-Wide Season Profiles

Season-average possession directness was associated with the final league position (Spearman $\varrho = -0.743$, 95% percentile-bootstrap CI −0.904 to −0.450, $p = 3.14 \times 10^{-5}$). Because lower rank numbers indicate better finishing positions, more possession-oriented season profiles tended to occur higher in the table. Defensive pressure showed a similar association ($\varrho = -0.568$, 95% CI −0.815 to −0.158, $p = 0.0038$). A deeper loss-location profile was associated with a poorer final position ($\varrho = 0.492$, 95% CI 0.080 to 0.753, $p = 0.0146$). These 24-team correlations are exploratory and descriptive; they neither isolate independent determinants of success nor imply that a style dimension caused final ranking. Team profiles are shown in Figure 2 and reported in Supplementary Section S1.

3.3. Competitive Constraints and Behavioural Variation

The competitive context was associated with substantial within-team shifts in all three behavioural dimensions after controlling for the team identity, opponent behaviour, and opponent strength. The venue and score state produced the largest effects.

Venue. Home teams were more possession-oriented than away teams (β = 0.223, 95% CI 0.146 to 0.301, q = 7.31×10^{-6}). Home performance was associated with a more advanced loss-location profile (β = −0.882, 95% CI −1.010 to −0.754, q = 6.23×10^{-12}) and more defensive pressure (β = 0.530, 95% CI 0.404 to 0.655, q = 2.03×10^{-8}).

Score state. Relative to drawing, winning was associated with lower possession orientation (β = −0.645, 95% CI −0.790 to −0.499, q = 1.01×10^{-8}), deeper loss locations (β = 0.741, 95% CI 0.636 to 0.846, q = 6.23×10^{-12}) and lower defensive pressure (β = −0.481, 95% CI −0.577 to −0.385, q = 1.45×10^{-9}). Losing was associated with higher possession orientation (β = 0.444, 95% CI 0.335 to 0.553, q = 3.38×10^{-8}), more advanced loss locations (β = −0.725, 95% CI −0.835 to −0.614, q = 1.11×10^{-11}) and more defensive pressure (β = 0.591, 95% CI 0.496 to 0.687, q = 2.87×10^{-11}). These are adjusted differences between aggregated team-state observations rather than measured transitions or coordinated responses.

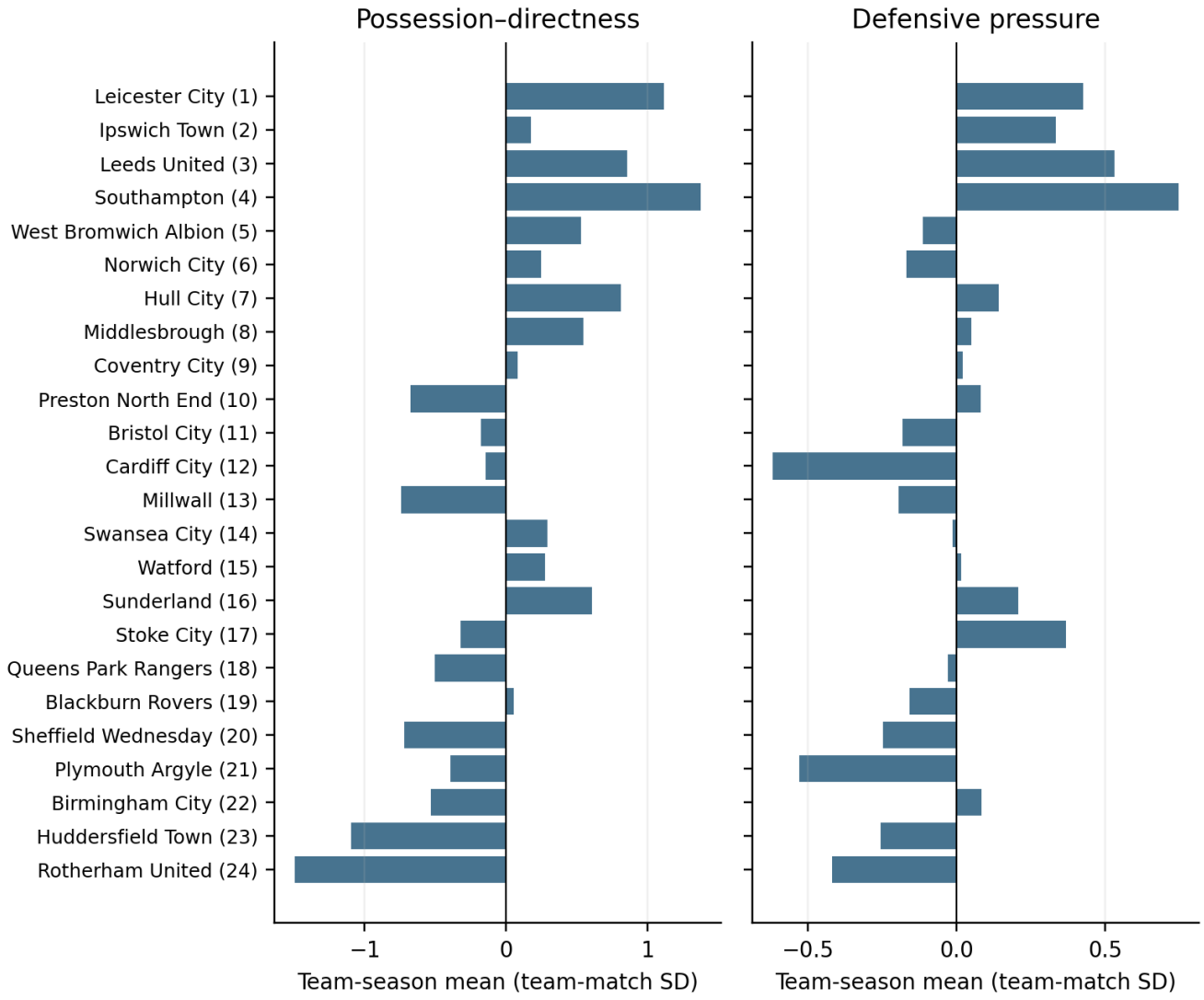


Figure 2. Season-mean possession-directness and defensive-pressure scores for all 24 EFL Championship teams. Numbers in parentheses are final league positions. Scores are standardised at team-match level. Bars show each team's mean on the two dimensions separately; full values are in Supplementary Section S1.

Opponent behaviour. Higher opponent possession orientation was associated with more direct focal-team attack, deeper loss locations and lower pressure. Higher opponent defensive pressure was also associated with more direct attack, deeper losses and lower

focal-team pressure. The adjusted coefficients and uncertainty are reported in Table 4. These conditional relationships do not establish opponent behaviour as an exogenous constraint. Figure 3 displays the adjusted contextual coefficients and their confidence intervals.

Table 4. Duration-weighted contextual models for behavioural outcomes.

Outcome	Predictor	β	SE	95% CI	*p*	q (FDR)
Possession directness	Home	0.223	0.037	0.146 to 0.301	4.06×10^{-6}	7.31×10^{-6}
Possession directness	Winning vs. drawing	−0.645	0.070	−0.790 to −0.499	3.91×10^{-9}	1.01×10^{-8}
Possession directness	Losing vs. drawing	0.444	0.053	0.335 to 0.553	1.69×10^{-8}	3.38×10^{-8}
Possession directness	Opponent possession directness	−0.124	0.037	−0.200 to −0.048	0.00259	0.00333
Possession directness	Opponent defensive pressure	−0.187	0.020	−0.227 to −0.146	1.97×10^{-9}	5.92×10^{-9}
Possession directness	Opponent strength	0.078	0.028	0.020 to 0.136	0.0105	0.0118
Loss location	Home	−0.882	0.062	−1.010 to −0.754	6.92×10^{-13}	6.23×10^{-12}
Loss location	Winning vs. drawing	0.741	0.051	0.636 to 0.846	4.07×10^{-13}	6.23×10^{-12}
Loss location	Losing vs. drawing	−0.725	0.053	−0.835 to −0.614	1.84×10^{-12}	1.11×10^{-11}
Loss location	Opponent possession directness	0.125	0.046	0.031 to 0.220	0.0117	0.0124
Loss location	Opponent defensive pressure	0.158	0.032	0.093 to 0.224	4.52×10^{-5}	7.39×10^{-5}
Loss location	Opponent strength	0.116	0.030	0.054 to 0.178	0.000794	0.00119
Defensive pressure	Home	0.530	0.061	0.404 to 0.655	9.01×10^{-9}	2.03×10^{-8}
Defensive pressure	Winning vs. drawing	−0.481	0.047	−0.577 to −0.385	4.04×10^{-10}	1.45×10^{-9}
Defensive pressure	Losing vs. drawing	0.591	0.046	0.496 to 0.687	6.38×10^{-12}	2.87×10^{-11}
Defensive pressure	Opponent possession directness	−0.112	0.044	−0.203 to −0.020	0.0186	0.0186
Defensive pressure	Opponent defensive pressure	−0.131	0.035	−0.203 to −0.058	0.00116	0.0016
Defensive pressure	Opponent strength	−0.097	0.031	−0.162 to −0.032	0.0053	0.00636

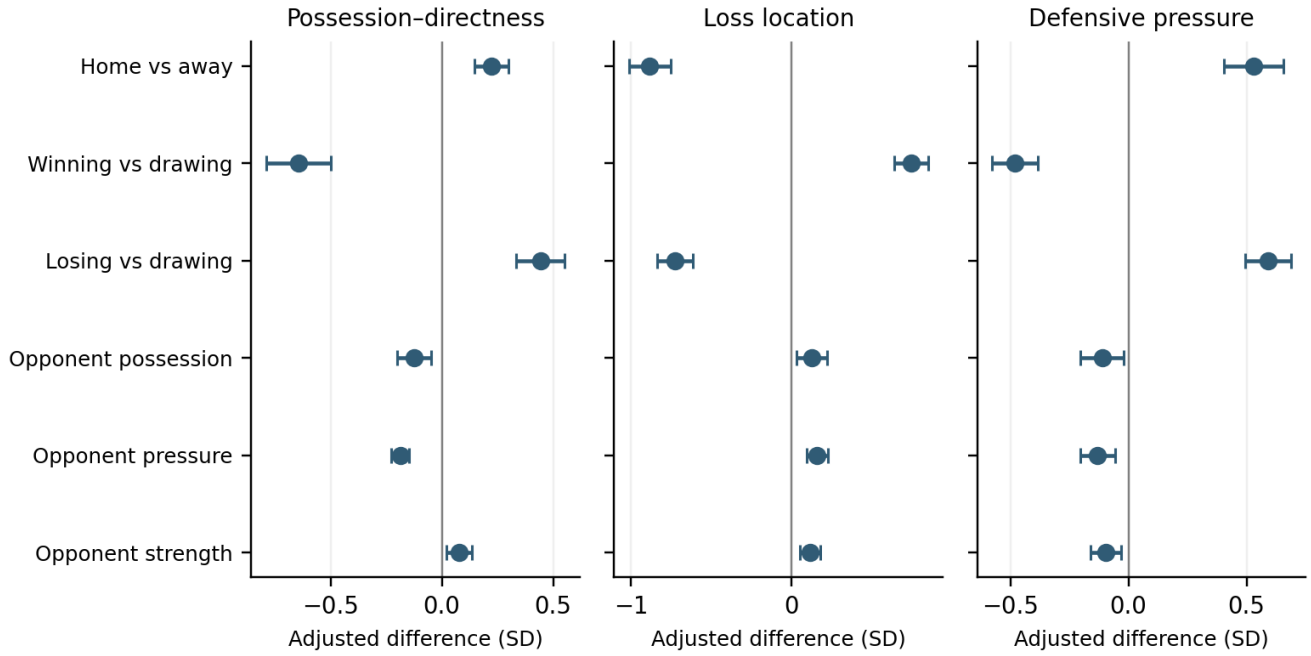


Figure 3. Adjusted contextual coefficients with 95% t23 confidence intervals for three behavioural dimensions. Outcomes are in team-match SD units. Home is compared with away; winning and losing are compared with drawing; coefficients for continuous opponent variables represent differences per 1 SD. Positive possession directness denotes higher possession orientation; positive loss location denotes deeper losses; positive defensive pressure denotes more advanced regaining and lower PPDA. Models include team fixed effects and two-way team/match cluster-robust covariance.

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Drawing was the reference score state. Continuous opponent predictors were standardised. Outcomes were expressed on the match-level SD scale. Models included team fixed effects and two-way cluster-robust standard errors by team and match, with N = 2182 observations from 546 matches and 24 teams. Confidence intervals and *p*-values use t23; q-values use the 18-test Benjamini–Hochberg family. Coefficients for home, winning and losing are adjusted category contrasts; coefficients for continuous opponent predictors represent differences per 1 SD.

3.4. Behavioural Deviations and Concurrent Attacking Output

Behavioural deviations from the team's typical season profile were conditionally associated with the attacking output after adjustment for the venue, score state, opponent behaviour, opponent strength, and team fixed effects. The strongest and most consistent associations concerned territorial loss location and defensive pressure.

A 1-SD deeper loss-location deviation was associated with lower xG/90 (β = −0.139, 95% CI −0.210 to −0.068, q = 0.000762), fewer shots/90 (β = −1.508, 95% CI −1.875 to −1.142, q = 4.40×10^{-8}) and fewer penalty-area entries/90 (β = −4.525, 95% CI −5.008 to −4.042, q = 8.63×10^{-15}). These conditional concurrent associations do not identify a benefit of deliberately changing the loss location.

A larger defensive-pressure deviation was associated with higher xG/90 (β = 0.133, 95% CI 0.052 to 0.214, q = 0.00323), more shots/90 (β = 1.188, 95% CI 0.834 to 1.543, q = 1.02×10^{-6}) and more penalty-area entries/90 (β = 2.244, 95% CI 1.781 to 2.707, q = 3.28×10^{-9}). Possession-directness deviation was not detectably associated with xG/90 (β = 0.001, 95% CI −0.051 to 0.052, q = 0.972) or shots/90 after multiplicity correction (β = 0.304, 95% CI −0.061 to 0.669, q = 0.111) but was associated with more entries/90 (β = 1.220, 95% CI 0.660 to 1.780, q = 0.000285). Table 5 reports the associations between behavioural deviations and attacking output.

Table 5. Associations between behavioural deviations and concurrent attacking output.

Outcome	Behavioural Deviation	β	SE	95% CI	*p*	q (FDR)
xG/90	Possession-directness deviation	0.001	0.025	−0.051 to 0.052	0.972	0.972
xG/90	Loss-location deviation	−0.139	0.034	−0.210 to −0.068	0.000508	0.000762
xG/90	Defensive-pressure deviation	0.133	0.039	0.052 to 0.214	0.00251	0.00323
Shots/90	Possession-directness deviation	0.304	0.176	−0.061 to 0.669	0.0983	0.111
Shots/90	Loss-location deviation	−1.508	0.177	−1.875 to −1.142	1.47×10^{-8}	4.40×10^{-8}
Shots/90	Defensive-pressure deviation	1.188	0.171	0.834 to 1.543	4.53×10^{-7}	1.02×10^{-6}
Penalty-area entries/90	Possession-directness deviation	1.220	0.271	0.660 to 1.780	0.000158	0.000285
Penalty-area entries/90	Loss-location deviation	−4.525	0.233	−5.008 to −4.042	9.59×10^{-16}	8.63×10^{-15}
Penalty-area entries/90	Defensive-pressure deviation	2.244	0.224	1.781 to 2.707	7.28×10^{-10}	3.28×10^{-9}

Behavioural deviations were standardised; coefficients therefore represent the change in the outcome rate associated with a 1-SD change in the behavioural deviation. All three deviations were entered simultaneously. The models also included the venue, score state, opponent possession directness, opponent defensive pressure, opponent strength, team fixed effects, and two-way cluster-robust standard errors, with N = 2182 observations, 546 matches and 24 teams in every model. Confidence intervals and *p*-values use t23; q-values use the nine-test Benjamini–Hochberg family.

3.5. Sensitivity Analyses

Raising the duration threshold from 5 to 10 min reduced the sample from 2182 to 2050 observations without changing the principal direction of associations (Sections S3 and S4). Excluding red-card fixtures retained 1962 observations from 491 matches and 24

teams. Excluding all fixtures involving Leicester City, Ipswich Town or Hull City retained 1664 observations from 420 matches and 21 teams. Selecting one team per fixture retained 1091 observations from 546 matches and 24 teams. Using the pre-match PPG retained 2136 observations from 534 matches and 24 teams. Loss location and pressure associations with the three attacking rates retained their directions across these specifications (Sections S15–S18). Inferential stability was not universal: possession directness and shot rate were associated after the three-team exclusion ($q = 0.0354$). Poisson shot and entry models gave dispersion ratios 1.180 and 1.217; log-mean xG estimates were consistent in direction (Section S12). The xG-per-shot analysis included 2029 observations; none of the three deviation coefficients survived its three-test FDR correction (minimum $q = 0.060$; Section S13). In separate-constituent models, attacking-third regains were associated with all three output rates, whereas reversed PPDA was not (all $q > 0.20$). The composite therefore should not be interpreted as an isolated measure of pressing intensity (Section S14). Raw-score and leave-one-match-out models produced fitted-value correlations above 0.99996, with R^2 differences of −0.000351, −0.000352, +0.000287 for xG, shots and entries, respectively. Team-mean centring was numerically equivalent to raw scores with team fixed effects. Cross-fitted context-expected residuals and their corresponding fold-scaled raw scores were also equivalent after matched nuisance adjustment (maximum fitted-value difference $< 3 \times 10^{-13}$; Section S11). With the 25% regain/75% reversed-PPDA weighting, the pressure–xG estimate was $\beta = 0.058$ ($q = 0.0873$). With the 75% regain/25% reversed-PPDA weighting, the pressure–xG estimate was $\beta = 0.181$ ($q = 0.000113$). Thus, the xG association depended on how the defensive composite was defined. Complete negative-binomial results, alternative weights and inferential sensitivities are in Supplementary sections S10–S14. Descriptive statistics, correlations, primary covariates, diagnostics and software details are in Supplementary sections S7–S9, S19 and S20.

4. Discussion

This full-season analysis describes the context-dependent variation in professional football behaviour. Across 546 complete EFL Championship matches, possession directness, territorial loss location and defensive pressure differed with the venue, score state, opponent behaviour and opponent strength. These associations are compatible with a constraints-based perspective [1,2], but event summaries cannot establish purposeful regulation. Relating team-referenced deviations to concurrent output provides a descriptive characterisation; it does not itself establish effective adaptation or superiority over conventional fixed-effects models.

The score-state associations showed a consistent directional pattern. Leading states were associated with more direct play, deeper losses and lower defensive pressure. Trailing states were associated with higher possession orientation, more advanced loss locations and higher pressure. Similar scoreline-dependent shifts have been reported for possession and attacking behaviour in elite football [18–20,22,24]. These parallel associations do not demonstrate temporal coordination between behaviours.

The concurrent-output analysis adds a descriptive association. Periods in which losses occurred relatively farther from a team's own goal were associated with a higher xG, shot rate, and penalty-area entry rate, while periods characterised by more defensive pressure showed the same direction of association. These findings are consistent with the practical logic that advanced territorial occupation and aggressive regaining can sustain access to dangerous attacking zones. They should not, however, be interpreted as evidence that pressing or losing the ball high causes chance creation. The measures were concurrent, score state is endogenous to match events, and teams may both press more and generate more attacks because of a third factor such as territorial dominance. Shared measurement is a further concern: a higher attacking volume creates more opportunities

both to enter the penalty area and to lose possession high up the field. Loss location depends on possession distribution, opposition pressure and the denominator of all losses. The analysis therefore cannot isolate an independent territorial mechanism from common event opportunities. Goals also terminate or change score states, creating simultaneity and possible reverse causality. Standard field tilt was unavailable; passes to the final third were not substituted as if they measured the share of final-third possession.

The associations for possession directness were more nuanced. Higher possession orientation was associated with more penalty-area entries but not detectably with xG/90 or, after multiplicity correction, the shot rate in the primary models. The absence of an association with the total xG does not establish anything about shot quality. The separate xG-per-shot analysis identified no association that survived FDR correction and excluded zero-shot states, limiting the population to which it applies. The performance meaning of possession remains context-dependent [9,11,12].

The venue was associated with the behavioural profile. Home teams were modestly more possession-oriented but showed larger shifts toward advanced territorial loss locations and higher pressure. Opponent behaviour showed additional associations conditional on opponent strength: more press-intensive opponents were associated with a shift in the focal team toward direct attack and a deeper loss profile, while more possession-oriented opponents were associated with reduced focal-team pressure. Final rank and pre-match PPG capture different aspects of opposition quality, and neither measures all contextual influences. Two opponents of comparable quality can create different temporal, spatial, and decision-making constraints.

Methodologically, continuous dimensions describe overlapping characteristics rather than exclusive playing-style categories. No comparative classification analysis established their superiority. The PCA label summarises correlated indicators in this competition; possession-oriented circulation and progressive passing need not be mutually exclusive tactical choices. Although using only two loss-zone shares avoided exact singularity, their compositional dependence constrains interpretation. Defensive pressure was an equally weighted composite of standardised advanced regaining and reversed PPDA, with modest correlation between its constituents. Its associations with attacking output were largely attributable to regaining, indicating a broader territorial-defensive construct rather than uniform evidence for pressing intensity. The near-equivalence of raw-score and deviation models means that team-referenced centring is primarily an interpretive device, not an independent explanatory innovation. Context-expected residualisation also added no information after equivalent covariate adjustment. The pressure–xG association was sensitive to alternative weighting, further limiting generalised claims about pressing.

Event data identify observable behaviour but not its physiological cost. Future work could synchronise event and tracking data with physical-load, physiological and perceptual measures to test tactical intention, temporal mechanisms and functional benefit [1,3].

4.1. Strengths and Limitations

The study has several strengths. It used a near-complete full-season competition dataset, reconstructed both teams within each match, explicitly audited duplicated and incomplete source records, represented opponent behaviour without current-match leakage, controlled for stable between-team differences through team fixed effects, and accounted for dependence at both team and match levels. The behavioural-deviation analysis used a leave-one-match-out team baseline, reducing circularity when defining what constituted a deviation from the season mean. The principal associations were directionally consistent under a stricter score-state duration threshold.

Several limitations remain. First, event data do not directly capture the team shape, inter-player spacing, physical load, physiological strain, perceived effort, or tactical

intention; the dimensions analysed here are behavioural proxies. Second, six regular-season matches were excluded, because five lacked sufficient summed duration and one had inconsistent goal totals, leaving Hull City, Leicester City, and Ipswich Town with fewer than 46 complete matches. Third, the score state is endogenous to match events, and the attacking output was assessed concurrently with behaviour; causal and temporal interpretations are therefore inappropriate. Fourth, final league rank is an end-of-season strength measure and cannot represent short-term form or squad availability. Fifth, provider xG values depend on the provider's underlying model, which was not re-estimated here. Finally, the study covers one season of one professional league, and effect sizes should be replicated across seasons, competitions, and data providers before being treated as generalisable. Aggregated states may span non-contiguous intervals, preventing reliable adjustment for match minute, substitution timing or exact numerical disadvantage; excluding fixtures with red cards cannot recover those effects. Duration-weighted PPDA and possession-based means approximate unavailable denominator-weighted aggregates. Final rank and season reference profiles include future information; replacing rank with prior PPG does not make the entire pipeline prospective. Two-way clustering with 24 teams remains an approximation, and the one-way team wild bootstrap is complementary rather than a full two-way small-cluster solution. Cross-match opponent-network dependence may remain. Linear models can produce negative fitted rates and showed residual heteroscedasticity; robust covariance and nonnegative log-mean sensitivities address some, not all, specification concerns. Tactical intention, substitutions, fatigue, formation changes and possession opportunity were not comprehensively controlled. No operational threshold for a meaningful deviation was validated.

4.2. Practical Applications

Applied analysts can use these dimensions to describe how a team's observed behaviour differs across competitive contexts. Season means and leave-one-match-out deviations are retrospective summaries. Monitoring applications require reference models fitted only to information available before the observation and independent validation of calibration and usefulness. The present results do not justify prescribing increased pressure, losses farther up the pitch, or numerical deviation thresholds as ways to improve attacking output.

For integrated performance departments, the event-based outputs provide one descriptive layer alongside tracking, physical-load and perceptual information. Prospective or intervention-based studies are needed to determine whether changing a behavioural feature improves performance under specified constraints.

5. Conclusions

Professional football behaviour in the 2023/2024 EFL Championship varied with the venue, score state and opponent characteristics. Relatively more advanced loss locations and higher defensive-pressure scores were concurrently associated with higher xG, shot rate and penalty-area entry rate. Separate-constituent results linked the pressure association mainly to advanced regains. The association between defensive pressure and xG was sensitive to the relative weighting of advanced regains and reversed PPDA within the composite. Possession-oriented deviation was associated with entries but not detectably with xG/90 in the primary model. These retrospective associations describe behavioural variation and attacking output; they do not establish purposeful regulation, successful adaptation, causal benefits or real-time predictive value.

Supplementary Materials: The following supporting information can be downloaded at https://www.mdpi.com/article/10.3390/sports14110519/s1, Supplementary Material: Methods and

supplementary results (Sections S1–S20; Tables S1–S36); Supplementary Code: Executable analysis scripts, README and pinned software requirements (Reproducibility_Code.zip).

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Data Availability Statement: The match-performance data were obtained from the Hudl Wyscout platform. Access may be subject to provider licensing and subscription conditions. The executable analysis scripts and software requirements are provided in the Supplementary Code (Reproducibility_Code.zip).

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References

1. Glazier, P.S. Towards a Grand Unified Theory of sports performance. *Hum. Mov. Sci.* **2017**, *56*, 139–156. https://doi.org/10.1016/j.humov.2015.08.001.
2. Woods, C.T.; McKeown, I.; Shuttleworth, R.J.; Davids, K.; Robertson, S. Training programme designs in professional team sport: An ecological dynamics exemplar. *Hum. Mov. Sci.* **2019**, *66*, 318–326. https://doi.org/10.1016/j.humov.2019.05.015.
3. Woods, C.T.; McKeown, I.; O'Sullivan, M.; Robertson, S.; Davids, K. Theory to Practice: Performance Preparation Models in Contemporary High-Level Sport Guided by an Ecological Dynamics Framework. *Sports Med. Open* **2020**, *6*, 36. https://doi.org/10.1186/s40798-020-00268-5.
4. Fernandez-Navarro, J.; Fradua, L.; Zubillaga, A.; Ford, P.R.; McRobert, A.P. Attacking and defensive styles of play in soccer: Analysis of Spanish and English elite teams. *J. Sports Sci.* **2016**, *34*, 2195–2204. https://doi.org/10.1080/02640414.2016.1169309.
5. Fernandez-Navarro, J.; Fradua, L.; Zubillaga, A.; McRobert, A.P. Influence of contextual variables on styles of play in soccer. *Int. J. Perform. Anal. Sport* **2018**, *18*, 423–436. https://doi.org/10.1080/24748668.2018.1479925.
6. Fernandez-Navarro, J.; Fradua, L.; Zubillaga, A.; McRobert, A.P. Evaluating the effectiveness of styles of play in elite soccer. *Int. J. Sports Sci. Coach.* **2019**, *14*, 514–527. https://doi.org/10.1177/1747954119855361.
7. Kong, L.; Zhang, T.; Zhou, C.; Gomez, M.A.; Hu, Y.; Zhang, S. The evaluation of playing styles integrating with contextual variables in professional soccer. *Front. Psychol.* **2022**, *13*, 1002566. https://doi.org/10.3389/fpsyg.2022.1002566.
8. Plakias, S.; Tsatalas, T.; Armatas, V.; Tsaopoulos, D.; Giakas, G. Tactical Situations and Playing Styles as Key Performance Indicators in Soccer. *J. Funct. Morphol. Kinesiol.* **2024**, *9*, 88. https://doi.org/10.3390/jfmk9020088.
9. Castellano, J.; Pic, M. Identification and Preference of Game Styles in LaLiga Associated with Match Outcomes. *Int. J. Environ. Res. Public Health* **2019**, *16*, 5090. https://doi.org/10.3390/ijerph16245090.
10. Harrop, K.; Nevill, A. Performance indicators that predict success in an English professional League One soccer team. *Int. J. Perform. Anal. Sport* **2014**, *14*, 907–920. https://doi.org/10.1080/24748668.2014.11868767.
11. Kapsalis, M.; Plakias, S.; Kyranoudis, A.; Zarkadoula, A.; Lathoura, A.; Tsatalas, T. Exploring the impact of possession-based performance indicators on goal scoring in elite football leagues. *J. Phys. Educ. Sport* **2023**, *23*, 2004–2015. https://doi.org/10.7752/jpes.2023.08231.

12. Wang, S.H.; Qin, Y.; Jia, Y.; Igor, K.E. A systematic review about the performance indicators related to ball possession. *PLoS ONE* **2022**, *17*, e0265540. https://doi.org/10.1371/journal.pone.0265540.
13. Kite, C.S.; Nevill, A. The Predictors and Determinants of Inter-Seasonal Success in a Professional Soccer Team. *J. Hum. Kinet.* **2017**, *58*, 157–167. https://doi.org/10.1515/hukin-2017-0084.
14. Yang, G.; Leicht, A.S.; Lago, C.; Gómez, M.Á. Key team physical and technical performance indicators indicative of team quality in the soccer Chinese super league. *Res. Sports Med.* **2018**, *26*, 158–167. https://doi.org/10.1080/15438627.2018.1431539.
15. Almeida, C.H.; Ferreira, A.P.; Volossovitch, A. Effects of Match Location, Match Status and Quality of Opposition on Regaining Possession in UEFA Champions League. *J. Hum. Kinet.* **2014**, *41*, 203–214. https://doi.org/10.2478/hukin-2014-0048.
16. Gollan, S.; Bellenger, C.; Norton, K. Contextual factors impact styles of play in the English Premier League. *J. Sports Sci. Med.* **2020**, *19*, 78–83.
17. Gómez, M.A.; Gómez-Lopez, M.; Lago, C.; Sampaio, J. Effects of game location and final outcome on game-related statistics in each zone of the pitch in professional football. *Eur. J. Sport Sci.* **2012**, *12*, 393–398. https://doi.org/10.1080/17461391.2011.566373.
18. González-Rodenas, J.; Aranda-Malavés, R.; Tudela-Desantes, A.; Calabuig Moreno, F.; Casal, C.A.; Aranda, R. Effect of Match Location, Team Ranking, Match Status and Tactical Dimensions on the Offensive Performance in Spanish 'La Liga' Soccer Matches. *Front. Psychol.* **2019**, *10*, 2089. https://doi.org/10.3389/fpsyg.2019.02089.
19. González-Ródenas, J.; Aranda, R.; Aranda-Malaves, R. The effect of contextual variables on the attacking style of play in professional soccer. *J. Hum. Sport Exerc.* **2021**, *16*, 399–410. https://doi.org/10.14198/jhse.2021.162.14.
20. Lago, C. The influence of match location, quality of opposition, and match status on possession strategies in professional association football. *J. Sports Sci.* **2009**, *27*, 1463–1469. https://doi.org/10.1080/02640410903131681.
21. Lago-Peñas, C.; Lago-Ballesteros, J. Game location and team quality effects on performance profiles in professional soccer. *J. Sports Sci. Med.* **2011**, *10*, 465–471.
22. Lago-Peñas, C.; Lago-Ballesteros, J.; Dellal, A.; Gómez, M. Game-related statistics that discriminated winning, drawing and losing teams from the Spanish soccer league. *J. Sports Sci. Med.* **2010**, *9*, 288–293.
23. Lago-Peñas, C.; Gomez, M.Á.; Pollard, R. Home advantage in elite soccer matches. A transient effect? *Int. J. Perform. Anal. Sport* **2017**, *17*, 86–95. https://doi.org/10.1080/24748668.2017.1304024.
24. Taylor, J.B.; Mellalieu, S.D.; James, N.; Shearer, D.A. The influence of match location, quality of opposition, and match status on technical performance in professional association football. *J. Sports Sci.* **2008**, *26*, 885–895. https://doi.org/10.1080/02640410701836887.
25. Hudl. Wyscout Data. Available online: https://www.hudl.com/products/wyscout/football-api (accessed on 27 October 2026).
26. Wyscout. Wyscout Glossary. Available online: https://dataglossary.wyscout.com/ (accessed on 27 October 2026).
27. Cameron, A.C.; Miller, D.L. A practitioner's guide to cluster-robust inference. *J. Hum. Resour.* **2015**, *50*, 317–372. https://doi.org/10.3368/jhr.50.2.317.

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