

Acceleration-Speed Profiling of Elite Soccer Players. A Seasonal Analysis

by

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Acceleration-speed (AS) profiling derived from global positioning system (GPS) data has emerged as a practical alternative to traditional force-velocity profiling (FVP) for monitoring sprint performance in applied settings. AS profiles yield key mechanical indicators, including maximal theoretical acceleration (A0) and maximal theoretical speed (S0), which reflect sprint capabilities. This study quantified seasonal variability and determinants of A0 and S0 across a competitive season in 19 professional male English Football League Championship players. Specifically, the influence of individual differences, the seasonal phase, the playing position, and match involvement on AS metrics was examined. Data were collected over nine months of training and match-play. Raw accelerometer data were processed in RStudio to generate individual AS profiles, constructed from non-rolling five-session splits and aggregated into three seasonal blocks (early, mid, late season). Linear mixed-effects models, with a player included as a random effect, assessed the impact of the seasonal block, the playing position, and match exposure on A0 and S0. Significant inter-individual variability was observed for both A0 and S0 ($p < 0.001$). S0 varied across the season, with higher mid-season values compared to early and late periods ($p < 0.001$), whereas A0 remained stable. The playing position influenced A0, with wide players demonstrating higher values than central positions. Greater match involvement was associated with increases in both A0 and S0. These findings indicate distinct seasonal and contextual sensitivities of AS variables, likely reflecting neuromuscular and exposure-related adaptations. AS profiling provides a viable framework for longitudinal monitoring of sprint-related mechanical characteristics in elite soccer players.

Keywords: GPS; force-velocity; running performance; sprint; match-play

Introduction

Soccer is an intermittent field-based invasion sport characterized by high-intensity actions such as jumping, accelerations, decelerations, changes of direction and sprints (Morgans et al., 2026), whose neuromuscular determinants and trainability are also well documented in other racket and intermittent sports (Prończuk et al., 2025). The physical match demands have increased substantially over the last decade (Allen et al., 2025) with the advancement of global positioning system (GPS) technology, facilitating more accurate and consistent

measurement of match-play (Rago et al., 2020). In elite soccer, specifically sprint output, absolute or relativized, is one key metric that has significantly increased and gained attention due to its performance-related impact in deciding key match moments and correlation with injury risk (Morgans et al., 2026). More recently, sprinting above 95% of maximal velocity has also been positively associated with injury risk reduction (Gómez-Piqueras and Alcaraz, 2024), while near-maximal sprints are now routinely included in elite soccer training to enhance performance and reduce injury risk (Buchheit et al., 2021).

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Practitioners aim to enhance understanding of key sprint performance markers using the force-velocity profile (FVP) (Baena-Raya et al., 2022). The FVP is a linear regression drawn from measuring multi-joint actions such as jumping or sprinting, which provides values for theoretical maximal acceleration (F_0) and theoretical maximal velocity (V_0) (Lindberg et al., 2021). Understanding each phase of the sprint during match-play is vital to add the context, as sprints in elite soccer vary in distance with the majority completed under 10 m (Di Salvo et al., 2010).

Understanding and applying the FVP can assist practitioners in improving sprint performance (Lahti et al., 2020), though the gold-standard laboratory-based sprint over force plates is not feasible for repeatedly testing a large squad (van den Tillaar et al., 2022), a constraint familiar across applied sports biomechanics, where accessible field-based methods have been repeatedly validated against laboratory gold standards (Skalski et al., 2025). These methodological challenges prompted research to develop a method for generating FVPs using an over-ground sprint (Samozino et al., 2016), which has been applied with the GPS and Radar (Lacome et al., 2020; Stockdale et al., 2025). The novel approach to creating the acceleration-speed (AS) profile is known as “in-situ” profiling and offers an alternative method not requiring an isolated sprint (Morin et al., 2021). This method utilizes raw training and match-play GPS data and offers performance-related markers conceptually close with those provided by the FVP (Cormier et al., 2023a). The number of training and matches required to establish a robust AS profile has varied (Cardoso et al., 2025; Clavel et al., 2023; Cormier et al., 2023b; Kavanagh et al., 2026; Morin et al., 2021), with five training sessions being proposed (Morin et al., 2021). However, a study comparing AS profiles to an isolated sprint recommended six sessions for robust A_0 values and nine for S_0 values (Cormier et al., 2023b). Subsequent studies have used five and ten training events, respectively, and found reliable and consistent results (Cardoso et al., 2025; Clavel et al., 2023). These findings suggest the method as viable to monitor players’ key markers in-season without isolated testing; however, clarity is needed to establish a robust methodology for the applied environment.

Recently, physical match demands have consistently been reported to vary based on numerous contextual factors (Morgans et al., 2025a), paralleled by evidence that game related performance statistics determine success in other team sports (Mikołajec et al., 2025), such as the playing position (Morgans et al., 2025b), team formation (Morgans et al., 2024) and the stage of the season (Springham et al., 2020). For example, wide midfielders have been observed to cover more distance sprinting than any other position (Sarmiento et al., 2024). Individual differences in FV and AS qualities have also been observed according to the playing position and the stage of the season (Alonso-Callejo et al., 2022; Ben Hassen et al., 2023; Jiménez-Reyes et al., 2022). However, studies in this research area have been limited, and further research will enable practitioners to understand the capabilities and demands imposed on different playing positions over an entire season.

The present article is part of a series of studies conducted by the current authors examining the applied use of AS profiling in elite soccer (Kavanagh et al., 2026). This study aimed to monitor seasonal AS profiles in elite soccer using the methodology originally proposed as a proof-of-concept (Morin et al., 2021). Specifically, the influence of the player, the seasonal block, the playing position and match involvement on AS profile markers was observed, utilizing previous methodological approaches (Cardoso et al., 2025; Clavel et al., 2023; Morin et al., 2021). The study hypothesis was that both maximal theoretical acceleration (A_0) and maximal theoretical speed (S_0) would vary across the competitive season and differ between playing positions, specifically wide forwards and full-backs demonstrating higher values than central positions, while match involvement was expected to cause an increase in A_0 and S_0 values. Given the applied nature of this study and the known inter-individual variability in acceleration-speed characteristics, the present investigation was intended to provide exploratory insights.

Methods

Study Design

A seasonal longitudinal study was conducted analyzing training and match data from 19 male professional soccer players competing in

the EFL Championship during the 2023–2024 season. This work formed part of a broader research project by the current research group examining the applied use of AS profiling in elite soccer (Kavanagh et al., 2026). This study used the same data collection framework as previous research. The season was sub-divided into three blocks: Block One (August, September and October), Block Two (November, December and January) and Block Three (February, March and April), and key values were obtained. Splitting the season into blocks had previously been observed in AS profiling research (Alonso-Callejo et al., 2022; Cardoso et al., 2025). Three blocks were chosen as it allowed the number of matches per block to be standardized. Acceleration-speed profiles for each player were generated using five training/match events. A non-probabilistic sampling protocol was employed to recruit the participants. The emphasis of the study was on examining key AS profile values across a regular EFL season. During the observational 2023–2024 season, consistent player monitoring approaches were implemented without any interference from the researchers.

Participants

Nineteen male professional outfield soccer players (mean $\pm$ SD age of 25.4 ± 2.6 years, body height of 180.68 ± 6.45 cm, body mass of 79.83 ± 11.50 kg) from an EFL Championship first-team squad participated in the present study. The EFL team adopted a 4-3-3 or a 3-5-2 formation and implemented a hybrid model of possession that included a combination of build-up and direct-play strategies. Furthermore, when out-of-possession a mixture of high-press and mid-block (a narrow and compact team shape defending the middle third of the pitch) strategies were employed.

The research inclusion criteria were: (i) named in the first-team squad at the start of the study period, (ii) only official team training completed during the study period. Additionally, the exclusion criteria were: (i) long-term injury (three months or longer), (ii) joining the team late in the study period, (iii) lack of full, complete match data, and (iv) goalkeepers, due to the variations in physical demands.

The sample group consisted of outfield players classified into the following positions: full backs (FBs, $n = 4$), central defenders (CDs, $n = 4$),

central midfielders (CMs, $n = 4$), wide forwards (WFs, $n = 4$) and forwards (FWs, $n = 3$). When a player fulfilled multiple playing positions during match-play, the player was categorized accordingly to each position. This did not affect the sample size or statistical power. Players were required to complete a minimum of 15 training/match events per block to be included. This was based on using a sample of five sessions to generate a reliable profile.

Data were collated from training and matches during the 2023–2024 season (Tuesday, 1st August to Tuesday, 30th April). All data evolved due to employment where players were routinely monitored over the course of the competitive season, nevertheless, written informed consent was provided by all participants. This study was conducted following the principles of the Declaration of Helsinki, and approved by the University of Wolverhampton Ethics Committee, Wolverhampton, UK (protocol code: 09/25/CK/UOW; approval date: 03 September 2025). All data were anonymized prior to inclusion in the study.

Procedures

The initial phase of the season was classified as pre-season (early-July to early-August) which lasted five to six weeks, and the competitive season (early-August to early-May) that fulfilled 36 weeks. Players' external loads were recorded during 168 training sessions and 51 official matches. An average of 153 ± 13 observations per player were recorded. The mean number of events per block was 49.24 ± 3.64 (matches: 9.80 ± 0.3 , training: 39.44 ± 3.34).

Physical training and match data were consistently monitored during the study period during all training and competitive matches using a 10-Hz global positioning system (GPS) (Apex, STATSports, Ireland). STATSports Apex devices have an acceptable level of accuracy and reliability when measuring speed of movement during intermittent exercise and sport-specific actions (Beato et al., 2018). Players wore the same unit each day, though STATSports Apex system has shown excellent inter-unit reliability. Devices were activated 30 minutes prior to data collection to acquire satellite signals (Morgans et al., 2026). GPS signal quality and horizontal dilution of the position were connected to a mean number of $23 \pm$

3 satellites, range 20–26, while HDOP was 0.8.

Acceleration-speed profiles were generated from raw data capturing five consecutive training events, with a varying composition of training and matches in each block. Using a consecutive number of training events was preferred to using time-based periods which might contain varying session numbers and decrease consistency of data. A sample size of five training/match events had been used in previous AS profile studies (Clavel et al., 2023; Morin et al., 2021). Reportedly this represented a minimal threshold to allow participants to reach all speeds from 3 m/s to maximal running speed (Morin et al., 2021). The mean number of training/match events per block was 47 ± 4.32 .

The mean number of matches per block was 10.09 ± 0.64 . On completion of each session, GPS data were extracted using proprietary software (Apex version 4.3.8, STATSports; Northern Ireland, UK) before being exported in a raw form to RStudio statistical software for further analysis. The values from each cluster of five events were then split into season blocks based on the month of completion. An average was produced for A0 and S0 using these multiple clusters.

Statistical Analysis

Acceleration-speed profiles were generated in RStudio (version 3.6.0., 2009–2021, RStudio, PBC). Linear interpolation was completed for missing speed data points based on the 10-Hz data from the GPS. The speed data were smoothed using the Savitzky-Golay signal filtering algorithm (Gallagher, 2020). Acceleration values were determined at every speed recorded. The values for the regression line in the AS profile were derived based on the maximal acceleration for speed values in the range 3 m/s to the individual maximal velocity at 0.2 m/s intervals. The maximal two values from each grouping were used for the fitting of the regression line following the removal of outlier points. Maximal values for acceleration and speed were derived from this regression line.

In addition to descriptive analysis, a linear mixed-effects model was fitted to examine the effects of the season block, the number of matches per grouping, the player and the playing position on A0 and S0. The player was treated as a random effect in the model with the other predictor

variables treated as fixed effects. This data analysis was conducted in Jamovi Statistical software (2.7.14, 2025). The level of statistical significance was set at $p < 0.05$.

Results

Individual and Position Values

Positional data for each player are outlined in Table 1. Group mean averages for A0 were 6.93 ± 0.37 m/s² (Block One), 6.82 ± 0.41 m/s² (Block Two), 6.96 ± 0.40 m/s² (Block Three). Group mean averages for S0 were 9.45 ± 0.42 m/s (Block One), 9.74 ± 0.27 m/s (Block Two), and 9.39 ± 0.38 m/s (Block Three) (Table 2).

Peak A0 and S0 values by playing position in each seasonal block varied (A0 6.44 – 7.33 m/s²; S0 9.01 – 9.86 m/s). Wide-forwards showed the highest A0 values in Block One and Three with a decrease in Block Two (Block One: 7.19 m/s², Block Two: 7.02 m/s², Block Three: 7.33 m/s²). Values for A0 appeared most consistent for FWs (Block One: 7.10 m/s², Block Two: 7.10 m/s², Block Three: 6.99 m/s²). Centre-backs showed most variation across all seasonal blocks (Block One: 6.86 m/s², Block Two: 6.44 m/s², Block Three: 6.61 m/s²). Full-backs displayed the highest S0 values in Block One and Three (Block One: 9.86 m/s, Block Two: 9.79 m/s, Block Three: 9.72 m/s). Positional S0 values were least stable in CBs (Block One: 9.01 m/s, Block Two: 9.80 m/s, Block Three: 9.24 m/s). Individually, for A0, WFs recorded the highest value across each block (Block One: 7.78 m/s², Block Two: 7.63 m/s², Block Three: 7.7 m/s²). The highest S0 values for individuals were recorded by FBs (Block One: 10.09 m/s and Block Two: 10.00 m/s) and WFs (Block Three: 10.07 m/s).

The spread of A0 and S0 values by individual player are displayed in Figures 1 and 2, respectively. The figures indicate the high A0 and S0 individual variation. The difference in mean values across blocks is displayed in Figure 3. Values for A0 were highest in Block Three. Values for S0 were highest in Block Two.

Linear Mixed Models

Mixed effects models were fitted to explore the impact of key variables on A0 and S0 measures. In fitting the model to the A0 values the best model included the player, the playing position, the number of matches and the block as significant variables (Table 3).

The model revealed that the player and the number of matches were highly significant ($p < 0.001$). The overall effect of the block trended towards significance ($p = 0.060$). However, the block variable interacted significantly with the position variable ($p = 0.017$), indicating that block effects differed across playing positions. Specifically, the model variables indicated that the addition of a match to the five-session grouping in place of a training session resulted, on average, in the estimated increase of 0.11 units in A0. The model explained 30% of the total variance (conditional $R^2 = 0.30$), with 25% attributable to between-player differences (ICC = 0.25). Positional analysis reported WFs to have the highest A0 values, though no statistically significant difference was observed between positions. The largest difference was observed between WFs and CBs, although outside statistical significance (mean difference = 0.3019, $p = 0.142$) (Table 4).

Post-hoc Tukey-adjusted (Table 5) comparisons indicated that the largest difference in values were reported between Block Three and Block Two without reaching statistical significance (mean difference = 0.12 ± 0.05 , $p = 0.050$).

In fitting the linear mixed model to S0 values, the best model included the player, the number of matches, and the block as significant variables (Table 6). The position was not significant when random effect of the player was included. The number of matches and the block were highly significant ($p < 0.001$).

The model demonstrated a significant main effect of the season block and a strong positive effect of the number of matches (Table 6). Each additional match was associated with an estimated increase of 0.29 in S0. The model explained 24% of total variance (conditional $R^2 = 0.239$), with 11% attributable to inter-player differences (ICC = 0.113).

Post-hoc Tukey-adjusted comparisons indicated that mean values were significantly higher in Block Two compared with Block Three (mean difference = 0.29 ± 0.06 , $p < 0.001$) (Table 7). Values in Block One were significantly lower than in Block Two (mean difference = 0.22 ± 0.07 , $p = 0.004$).

Table 1. Values of A0 (Maximal Theoretical Acceleration) and S0 (Maximal Theoretical velocity) by player across all seasonal blocks.

Player ID/Pos	A0 (m/s ²)			S0 (m/s)		
	Block One	Block Two	Block Three	Block One	Block Two	Block Three
1/FB	7.17	7.13	6.91	10.09	10.00	9.65
2/CB	6.61	6.14	6.09	9.45	9.69	9.51
3/CB	6.73	6.66	6.71	9.16	9.64	9.26
4/FB	6.48	7.02	7.47	9.58	9.53	9.82
5/CM	6.66	6.35	6.8	8.79	9.27	8.7
6/WF	6.72	6.71	6.89	9.58	9.77	10.07
7/CM	6.35	6.46	6.66	9.68	9.69	8.98
8/CM	7.15	6.97	7.11	9.88	9.80	9.54
9/CM	6.60	6.71	6.77	9.12	9.67	9.51
10/FW	7.35	7.56	7.43	9.69	9.85	9.88
11/WF	7.12	6.48	7.38	9.61	9.85	9.06
12/CB	7.46	6.77	7.09	8.59	9.87	9.01
13/WF	7.14	7.26	7.35	9.44	9.63	9.32
14/FB	7.11	7.02	7.16	9.76	9.63	9.32
15/FW	7.35	7.26	6.87	8.92	8.96	8.98
16/FB	6.73	6.76	6.58	9.99	10.0	9.78
17/CB	6.63	6.19	6.54	8.85	9.98	9.17
18/WF	7.78	7.63	7.7	9.64	9.98	9.27
19/FW	7.05	6.82	6.84	9.62	9.63	9.33

A0 = Maximal Theoretical Acceleration; S0 = Maximal Theoretical Velocity; FB = Full-Back; CB = Centre-Back; CM = Central Midfielder; FW = Forward; WF = Wide Forward

Table 2. Values of A0 (Maximal Theoretical Acceleration) and S0 (Maximal Theoretical velocity) by player across all seasonal blocks.

Position	A0 (m/s ²)			S0 (m/s)		
	Block One	Block Two	Block Three	Block One	Block Two	Block Three
FB	6.87	6.98	7.03	9.86	9.79	9.72
CB	6.86	6.44	6.61	9.01	9.80	9.24
CM	6.69	6.62	6.84	9.37	9.61	9.18
WF	7.19	7.02	7.33	9.57	9.81	9.43
FW	7.10	7.10	6.99	9.42	9.52	9.34

A0 = Maximal Theoretical Acceleration; S0 = Maximal Theoretical Velocity; FB = Full-Back; CB = Centre-Back; CM = Central Midfielder; WF = Wide Forward; FW = Forward

Table 3. Fixed effects from the linear model examining seasonal effect and the number of matches on maximal theoretical acceleration (A0).

Effect	Estimate	Std. Error	95% CI	p-value
Intercept	6.91	0.070	(6.77, 7.05)	< 0.001
Block (Two vs. One)	-0.08	0.054	(-0.19, 0.02)	0.133
Block (Three vs. One)	0.04	0.053	(-0.06, 0.15)	0.426
Number of Matches	0.11	0.031	(0.05, 0.17)	< 0.001

Table 4. Tukey-adjusted pairwise comparisons between positions for maximal theoretical acceleration (A0).

Position	vs.	Position	Difference	Std. Error	t	df	p-value
FB	-	WF	-0.0758	0.133	-0.5676	124.4	0.979
FB	-	FW	0.0554	0.140	0.3958	142.24	0.995
FB	-	CB	0.2261	0.138	1.6361	102.8	0.478
FB	-	CM	0.0647	0.146	0.4426	79.1	0.992
WF	-	FW	0.1313	0.136	0.9652	158.3	0.870
WF	-	CB	0.3019	0.129	2.3316	125.8	0.142
WF	-	CM	0.1405	0.137	1.0251	97.9	0.843
FW	-	CB	0.1705	0.156	1.0941	89.2	0.809
FW	-	CM	0.0092	0.151	0.0608	101.0	1.000
CB	-	CM	-0.1614	0.156	-1.0367	66.1	0.837

FB = Full-Back; WF = Wide Forward; FW = Forward; CB = Centre-Back

Table 5. Tukey-adjusted pairwise comparisons between blocks for maximal theoretical acceleration (A0).

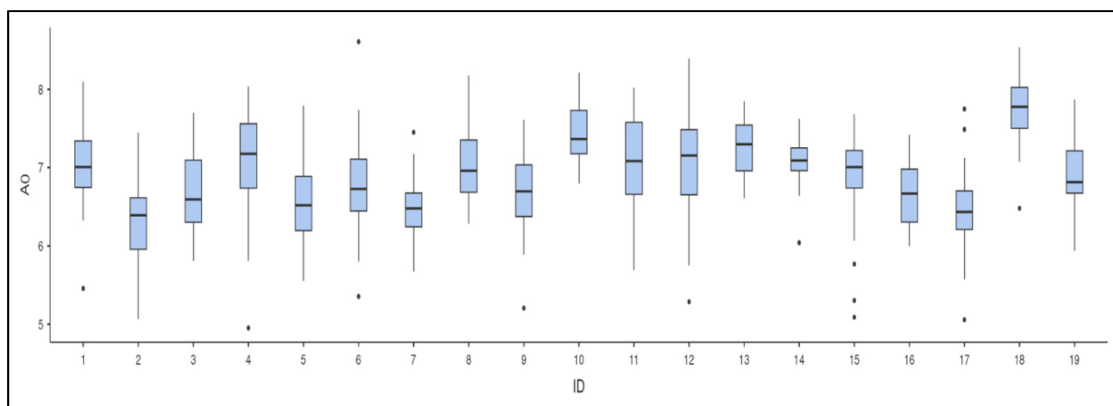
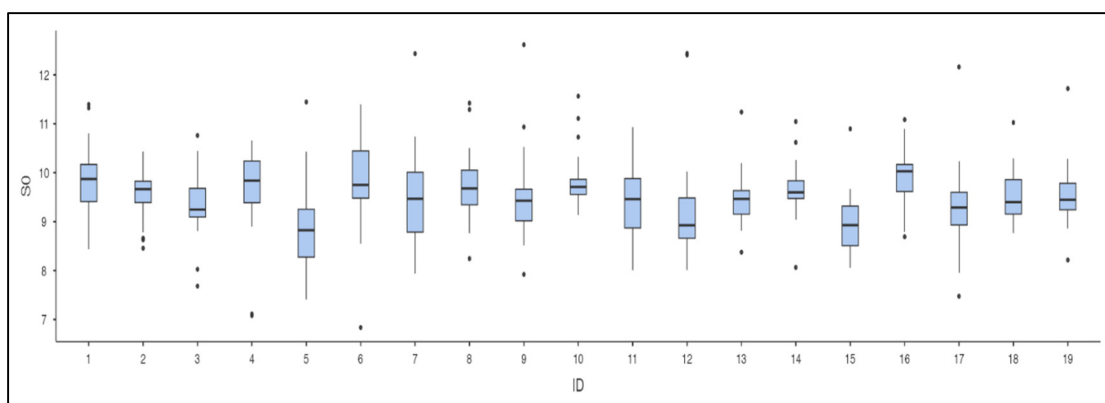
Block	vs.	Block	Difference	Std. Error	t	df	p Tukey
One	-	Two	0.0815	0.0541	1.506	535	0.289
One	-	Three	-0.0422	0.0529	-0.798	535	0.705
Two	-	Three	-0.1237	0.0525	-2.354	534	0.050

Table 6. Fixed effects from linear model examining seasonal effects and the number of matches on maximal theoretical velocity (S_0).

Effect	Estimate	Std. Error	95% CI	p-value
Intercept	9.52	0.068	(9.38, 9.65)	< 0.001
Block (Two vs. One)	0.22	0.070	(0.09, 0.36)	0.001
Block (Three vs. One)	-0.07	0.068	(-0.21, 0.06)	0.279
Number of Matches	0.29	0.040	(0.21, 0.37)	< 0.001

Table 7. Tukey-adjusted pairwise comparisons between season blocks for maximal theoretical velocity (S_0).

Block	vs.	Block	Difference	Std. Error	t	df	p-value
One	-	Two	-0.2241	0.0702	-3.19	547	0.004
One	-	Three	0.0741	0.0684	1.08	548	0.524
Two	-	Three	0.2982	0.0683	4.37	547	< 0.001

**Figure 1.** Boxplot displaying maximal theoretical acceleration (A_0) values for individual players across the season. The box represents the interquartile range, the central line indicating the median, and whiskers extending to the non-outlier values.**Figure 2.** Boxplot displaying maximal theoretical velocity (S_0) values for individual players across the season. The box represents the interquartile range, the central line indicating the median, and whiskers extending to the non-outlier values.

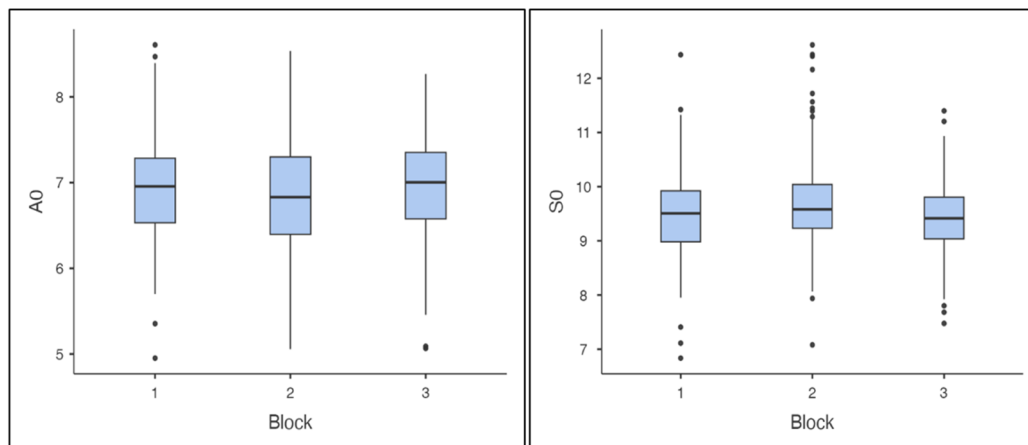


Figure 3. Boxplots showing range of values for maximal theoretical acceleration (A0) and maximal theoretical velocity (S0) across season blocks. The box represents the interquartile range, the central line indicating the median, and whiskers extending to the non-outlier values.

Discussion

This study aimed to contribute to the research on in-situ AS profiling in professional soccer by evaluating profile metrics with reference to the player, seasonal change, the playing position and match involvement. This study was part of a broader project by the present research group evaluating the applicability of AS profiling in elite soccer (Kavanagh et al., 2026). The main findings of this study were that each player had a unique acceleration and speed profile which varied across the season; S0 varied more than A0 throughout the season, peaking in Block Two and declining in Block Three; the playing position significantly influenced A0, with WFs recording the highest values; and the greater number of matches analyzed significantly increased A0 and S0 values. It is important to note that the present findings were derived from a single professional team and a relatively small sample size, which limits external validity. Therefore, these results should be interpreted as context-specific and exploratory rather than representative of elite soccer players broadly.

Baseline values for key metrics across the season were obtained for an entire squad. Mean

scores for A0 (6.90 ± 0.39 m/s²) and S0 ($9.51 \pm$

0.38m/s) fell within ranges (A0: 5.14–8.62 m/s²; S0 6.23–12.09 m/s) found in previous research (Clavel et al., 2023; Kavanagh et al., 2026; Morin et al., 2021). These findings suggest that at a squad level, values do not vary significantly across playing levels, countries and age-groups, despite differences observed across levels in high-intensity activities (Castagna et al., 2025). A possible explanation for this is that the chronic practice of a sport can induce specific changes in the force-velocity profile (Haugen et al., 2019). This may be further explained by the relative similarity in training and match demands for soccer players during the season, specifically, that match-play has previously been observed to have the highest AS profiles across a training micro-cycle in elite soccer players (Alonso-Callejo et al., 2022). However, in the context of professional soccer, a small difference in AS can be significant in real-world practical applications such as goalscoring opportunities as well as attacking and defending transitions (Cardoso et al., 2025).

A significant difference was observed between players for A0 and S0 ($p < 0.001$) (Figures 1 and 2, the individual range of values across the

study season). This finding was expected and supports previous findings (Haugen et al., 2019; Morin et al., 2021) from both AS and FVP research that capacities are more individual than sport specific. Within players, fluctuation across the season was highly dependent on the individual, with broad standard deviations (*SD*) ranges ($A0$ 0.18 ± 0.13 m/s²; $S0$ 0.26 ± 0.16 m/s), although the smallest individual *SD* for $A0$ across all blocks was 0.04 m/s², while the largest was 0.50 m/s². Furthermore, for $S0$, the smallest individual *SD* was 0.07 m/s, and the largest was 0.65 m/s. Such variation may be influenced by multiple factors, such as match involvement, positional demands or changes of the tactical role (Altmann et al., 2021; Arjol-Serrano et al., 2021). For example, it has been reported that a match day results in the highest $A0$ and $S0$ values (Alonso-Callejo et al., 2022), and players that transition from playing regularly to less match involvement may show a greater deviation than a player who consistently plays matches. Similarly, physical output for the same position may vary in a different formation, as observed for FWs and CMs in research (Arjol-Serrano et al., 2021), meaning that players who employ different tactical roles may show more deviation than those who do not. Thus, the present values further emphasize the individual nature of the AS profile and support the importance of regular individual monitoring. Additionally, a significant $S0$ difference for the squad was observed between seasonal blocks, while $A0$ was more stable across the season. The highest values for $A0$ (7.78 m/s²) and $S0$ (10.09 m/s) were observed in Block One. For $S0$, the mean values in Blocks One and Three were by 0.22 m/s and 0.30 m/s lower, respectively, than the value observed in Block Two. Previous studies with senior players in this area have reported mixed findings, with $S0$ being largely stable (9.56 – 10.09 m/s, *SD* 0.51 – 0.40 m/s), and $A0$ peak values showing greater variation (6.85 – 7.40 m/s², *SD* 0.70 – 0.36 m/s²) (Cardoso et al., 2025; Jiménez-Reyes et al., 2022). The observed seasonal variation in AS metrics may be influenced by multiple interacting factors, including accumulated fatigue, fixture congestion, and potential changes in training content (Cardoso et al., 2025; Haugen, 2018). While coaching and tactical modifications during the season may have contributed to these fluctuations (Ekstrand et al., 2023), this interpretation remains speculative due

to the absence of contextual performance indicators (e.g., possession time, sprint exposure). Future studies integrating technical-tactical variables are warranted to further explain these relationships.

Furthermore, previous studies examining AS profiling across a competitive season have reported divergent patterns of change in $A0$ and $S0$ (Cardoso et al., 2025; López-Sagarra et al., 2022). In a Portuguese youth team, both $A0$ and $S0$ increased during later-season blocks (Cardoso et al., 2025). In contrast, among players from the Russian Premier League, $A0$ peaked during the early-to-mid season before declining, whereas $S0$ remained relatively stable throughout the season (López-Sagarra et al., 2022). Notably, changes in $A0$ and $S0$ were more pronounced at the individual level than at the squad level (López-Sagarra et al., 2022). Collectively, these findings emphasize the practical value of longitudinal AS profile monitoring and support the need to consider individual responses when interpreting changes in $A0$ and $S0$ across a season.

Considering positional differences, clear trends in AS profile metrics were observed, in agreement with previous research (Alonso-Callejo et al., 2022; Garrosa et al., 2025). Specifically, FBs produced consistently higher $S0$ values compared with all other positions (9.79 ± 0.07 m/s), while WFs recorded the highest mean $A0$ (7.18 m/s² ± 0.16 m/s²), as previously reported (Alonso-Callejo et al., 2022). However, it is unclear whether this finding simply reflects the tactical positional role of the examined wide players (FBs, WFs), where more sprinting opportunities and, inherently, a greater physical capacity are evident. Thus, it may be suggested that pre-determined individual characteristics increase positional suitability. In contrast, one of the roles of central players (CBs, CMs) is to retain team structure and fulfil tactical positions attempting to break-up opposition attacks (Morgans et al., 2025a), which may partly explain the lower $A0$ and $S0$ values (6.64 – 6.72 m/s² and 9.35 – 9.39 m/s, respectively) when compared with FBs and WFs in the present study and in previous research (Garrosa et al., 2025). Furthermore, CDs have been found to complete less intense accelerations than all other positions, while CMs complete high-intensity accelerations with higher start speeds, likely to result in lower $A0$ values (González-Rodenas et al., 2025), which

further agrees with the findings of the present study. Forwards recorded the third-highest mean S0 values behind FBs and WFs (9.45 ± 0.09 m/s), with a low SD value indicating stable values reported across blocks.

The number of matches per block was found to significantly affect A0 and S0 values. Both A0 and S0 data reported increased as the number of matches per block accumulated. For every additional match, A0 increased by an average of 0.11 m/s², with S0 rising by an average of 0.29 m/s. This result is in line with previous findings highlighting match-play to be the most demanding load of the micro-cycle, for high-speed running, sprinting and accelerations (Oliva-Lozano et al., 2022). Furthermore, previous research has highlighted match-play to record the highest AS values during the micro-cycle when compared with all other training days in the same period (Alonso-Callejo et al., 2022). The importance of session content and an appropriate spread of speeds for a reliable AS profile has been noted (Clavel et al., 2023), and as the match is typically the most physically demanding component of a micro-cycle (Oliva-Lozano et al., 2022), the inclusion of match data is deemed appropriate to produce a robust, holistic AS profile. However, this finding also suggests that match data must be considered when attempting to generate longitudinal AS profiles, as the number of matches per sample may vary. Several potentially important confounding variables were not controlled in the present study. Factors such as player fatigue, recovery status, minor injuries, environmental conditions (e.g., temperature, pitch quality), and contextual match difficulty are known to influence sprint performance and may have contributed to the observed variability in A0 and S0. The absence of these variables should be considered when interpreting the findings.

Practical Implications

The findings of this study offer several practical implications for physical performance practitioners in elite soccer. Firstly, this study can inform practitioners wishing to establish a methodology for applied AS profiling. An AS profile created using a single micro-cycle will significantly alter depending on the number of matches completed during the given week. To address this issue, it may be necessary to improve

standardization of the profiling methodology to account for varying match numbers in a sample. There are potentially several practical applications available to achieve this. Firstly, rather than considering five time-based training events in this study, four training sessions and one match per micro-cycle would eliminate the imbalance created by varying matches per sample. Secondly, employing match data alone to derive profiles may also be appropriate, as stated earlier, match-play represents the most demanding load of the micro-cycle (Oliva-Lozano et al., 2022).

Furthermore, this approach would remove the need to account for a varying number of matches per sample. The unique individual nature of each AS profile, reflecting the demands imposed from training and matches on the player (Morin et al., 2021), offers further application for practitioners, both in performance and developmental environments. By observing the AS profile, coaches can determine players' acceleration capacity at different speeds (Morin et al., 2021), and subsequently tailor pitch or gym-based training to target weaknesses and enhance strengths (Cardoso et al., 2025). Interpreting individual AS values and implementing specific interventions to target key physical aspects derived from the profile may support coaches to optimally prepare and improve players (Lahti et al., 2020). Finally, the observed fluctuations in AS qualities across the seasonal blocks suggest that coaches should consistently monitor these qualities in real-time, attempting to highlight any decrements to maximize readiness to perform and subsequently reduce the risk of injury (Edouard et al., 2021; Jiménez-Reyes et al., 2022). From a practical perspective, individualized interpretation of speed demands may better inform training prescription than reliance on fixed absolute sprint thresholds (Pimenta et al., 2026). While AS profiling may provide useful insights for monitoring neuromuscular readiness, the present study did not include injury incidence data. Therefore, any inference regarding injury prevention should be considered theoretical and warrants confirmation in future longitudinal studies integrating performance and medical datasets.

Limitations and Future Research Directions

This research is not without limitations. Though the research is amongst the first to present A0 and S0 values from an EFL Championship first-team squad, considering all examined data was from a single team with a similar training regime and periodized model may limit the generalizability of the results. Furthermore, this study did not consider players with more match involvement than others where physical qualities such as A0 and S0 would be significantly affected (Alonso-Callejo et al., 2022). Given the limited number of players per positional group, positional comparisons should be interpreted with caution and considered descriptive rather than inferential. This also suggests that a sample without a match exposure may not deliver a comprehensive profile, as the player may not achieve maximal acceleration values at all speeds (Clavel et al., 2023). The inverse relationship of the profile means that an abundance of points at one end of the curve may skew the regression line, delivering results not in line with the athletes' actual capabilities. Research is required to examine this potential flaw in the method. This is one potential explanation for the values of A0 and S0 peaking during different blocks. A limitation of the present study is also the lack of direct control for anthropometric and body-composition variables, which have previously been shown to influence match running performance. The absence of these covariates limits the ability to determine whether observed seasonal changes in AS metrics were driven by neuromuscular adaptations or by changes in physical characteristics (Radaković et al., 2026). Multiple changes to coaching staff and subsequent playing style alterations during the period studied may also impact findings (Arjol-Serrano et al., 2021). Style changes could influence player roles and demands in training and match situations. The applied aspect of this study is a notable strength, however, standardizing factors such as the playing surface, temperature and testing time were not possible to control.

Future research may consider fluctuations to individual profiles over the season. Research has shown these to be much larger than those seen when metrics are considered at a squad level (López-Sagarra et al., 2022). Establishing trends

and understanding factors causing A0 and S0 to fluctuate would provide performance staff with a greater insight to tailor pitch and gym-based programming to maximize performance at key stages. Presenting values attained more regularly across the season for individuals is a worthwhile consideration for future research. This research may also have implications for injury management and return-to-play processes. Research has shown F0 at low velocities to be a risk factor for hamstring injury (Edouard et al., 2021). An altered F0 value both prior to and following return to sport from injury has also been observed (Mendiguchia et al., 2016). The advent of A0 and more straightforward testing of this metric provides directions for future research. Coaches must consider the factors that impact these values at different times of the season and optimize performance at key stages. Future studies could also explore the integration of acceleration-speed profiling with change-of-direction performance assessments and targeted training interventions. Evidence from training-based systematic reviews indicates that specific strength- and velocity-oriented programs can meaningfully improve COD performance, warranting investigation into how such interventions modulate A0 and S0 across the competitive season (Forster et al., 2023).

Conclusions

This research is the first to the authors' knowledge to provide baseline data for A0 and S0 in an English senior professional soccer team. It provides benchmarks for all levels of soccer seeking to use acceleration-speed profiling as a monitoring and athletic development tool. The study highlights the influence of matches per sample, the individual and the playing position on A0 and S0. It also highlights considerations for practitioners who wish to conduct AS profiling in the applied environment. Coaches should consider individual findings when programming gym and field-based sessions to facilitate a tailored training response and align programming with positional demands.

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