Original Article

The effect of contextual variables on match running performance in a category 3, U18 English Academy soccer team

DAVID J. BARRON[1] , CHRIS YIANNAKI[2], JOHN FRY[3], JAKE ATHERTON[4]

[1]*Non-affiliated researcher. Lancashire, United Kingdom.*
[2]*University of Central Lancashire. Lancashire, United Kingdom.*
[3]*University Centre Myerscough. Lancashire, United Kingdom.*
[4]*Preston North End FC, Academy. Lancashire, United Kingdom.*

ABSTRACT

This study aimed to examine the effect of contextual variables on match running performance (MRP) in a category three English Academy U18 soccer team during a competitive season. Total distance (TD), high speed running (HSR) and sprinting (SPT) performance was analysed during the 2020-2021 season. A total of 25 league games were analysed using Catapult Vector GPS (10Hz) and 14 outfield players included for analysis. Players were classified into full back (n = 4), central defender (n = 2), wide midfielder (n = 2), central midfielder (n = 2) and forward (n = 2). Dependent variables were TD, HSR and SPT and independent variables were: match location, match outcome, opposition strength and fixture congestion. Non-significant differences were found for TD and HSR which was higher during all home games compared to all away games, and specifically during home wins compared to away wins. There were no significant differences in MRP against stronger or weaker strength opponents or during period of fixture congestion. Positional comparison showed wide midfielders to complete more SPT than central midfielders during home wins ($p < .05$). All other positional differences were non-significant. Practitioners should examine the influence of contextual variables on a club and positional basis to inform individualised training schedules in support of the player development pathway.

Keywords: Performance analysis of sport, High speed running, Sprinting, GPS, Contextual.

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Corresponding author. *Postal address not available.*
E-mail: djb477@yahoo.co.uk
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INTRODUCTION

A successful talent development programme has the potential to develop more and better homegrown players with meaningful financial and on field performance benefits. English academy player development programmes are shaped by the Elite Player Performance Plan (EPPP) (The Premier League, 2011) a long-term strategy aiming to overhaul talent development. The EPPP features three phases: Foundation (FDP) (U9-U11), Youth (YDP) (U12-U16) and Professional Development (PDP) (U17-U23). The U18 academy team sits within the PDP and is a crucial transitional time for academy players seeking to bridge the gap between youth and senior professional football.

The evaluation of match running performance (MRP) is widespread within the PDP and comparison with professional standards can, firstly, clarify the required physical output of senior match play and, secondly, help identify academy players suitable for promotion to the senior ranks (Smalley et al, 2022: Viera et al., 2019; Waldron & Murphy, 2013). For those individuals who do not yet reach the physical standards of senior competition, analysis can inform individualized training programmes supporting the player development pathway (Viera et al., 2019). However, before MRP can be evaluated the influence of contextual variables must be understood.

At the professional level research has focused on the effect of match location (Aquino et al., 2018; Augusto et al., 2021; Barrera et al., 2021; Lago et al., 2010;), strength of opposition (Castellano et al., 2011; Rampinini et al. 2007; Varley et al., 2017;), match outcome (Augusto et al., 2021; Castellano et al., 2011; Mohr et al., 2003; Rampinini et al., 2009) and fixture congestion (Viera et al., 2019). In contrast, far less focus has been on their impact on U18 match play (Viera et al., 2019), a key phase in the talent development programme marking the transition from academy to full time professional status.

Whether match location impacts MRP in U18 football is presently unclear and information is sparce. At the professional level inconclusive findings may reflect differences in playing standards across the leagues studied. During home games greater MRP has been reported in Portuguese, British (actual nation not stated) and Brazilian leagues (Aquino et al., 2018; Barrera et al., 2021; Lago, 2009), but conflictingly also during away games in separate study in Brazilian football (Augusto et al., 2021). However, in the UEFA Champions League, there were no differences in MRP between home and away games (Modric et al., 2022; 2023), although away games featured a slower match pace (Modric et al., 2023). In summary, the effect of match location appears to be league specific warranting investigation into U18 competition.

Some evidence suggests MRP is influenced by opponent strength. In U14 academy competition, playing against higher tiered opponents led to higher total distance (TD) and high-speed running (HSR) distance than lower tiered opponents (Algoy et al., 2021). Within U17 tournament play the opposition strength exerted a stronger influence when the difference between the two teams was greater (Varley et al, 2017). However, at the professional level stronger opponents have been shown to evoke higher MRP (Castellano et al., 2011; Rampinini et al., 2007) and, elsewhere, lower MRP in the reference team (Lago et al., 2009; 2010). Recent data from the UEFA Champions League showed no differences regardless of opponent strength, suggesting stability in MRP at the highest level shaped by consistency in competitiveness (Modric et al., 2023).

Elevated work rate has been reported during losses (Andrzejewski et al., 2016; Castellano et al., 2011; Mohr et al., 2003; Rampinini et al., 2009), yet the aim of academy systems is to "*develop more and better homegrown players*" (The Premier League, 2011) not to win games, per se. Thus, match outcome might elicit a different influence on MRP in result orientated competition compared to developmental orientated match play.

The effect of fixture congestion on MRP is reported to have no negative impact in professionals (Dellal et al., 2015), but how total distance is accumulated is shown to change (Doncaster et al., 2021) with lower intensity activity reduced to maintain high speed running capability (Julian et al., 2021). The extent to which players are exposed to congested periods is questionable and in professional competition, large squad sizes facilitate player rotation during short term fixture dense periods (Carling et al., 2015a, b). In contrast, in a U18 academy team, TD and HSR was lower in a 2 game week (ES: -0.69, -0.49) (Hattersley et al., 2018) suggesting inferior on field pacing strategies, and lower physical maturity compared to seniors (Hattersley et al., 2018).

Contextual variables contribute to variability in MRP, and the physical rigours of match play are not consistent (Malcata & Hopkins, 2014; Rampinini et al., 2007). In the English Premier League, HSR and SPT varied CV 13.7 to 20.2% and CV 22.6 to 32.3% respectively (Bush et al., 2015; Gregson et al., 2010). In comparison, Italian professionals' variation in HSR and SPT was CV 6.8% and 14.4% (Rampinini et al., 2007) whilst slightly higher in the French league HSR (CV 18.1%) and SPT (CV 37.1%) (Carling et al, 2016). Comparable data about the variability of competition within the PDP is surprisingly absent from literature.

Talent identification is a difficult process and markers of talent include physical fitness, technical ability, and psychosocial factors (Fortin-Guichard et al., 2022), yet often decisions about player promotion to the professional ranks and reward of a professional contract is left to the subjective judgement of coaches and scouts (Meylan et al., 2010; Windt et al. 2022). Greater insight into the effect of contextual variables on physical performance would help to objectify decision making. Additionally, quantifying the variation of MRP would help to individualise training to maintain match fitness and readiness to compete.

Therefore, the aims of this study were to examine the effect of match location, strength of opposition, match outcome and fixture congestion on TD, HSR and SPT MRP in a U18 English academy team during one competitive season. Secondary aims were to analyse the variation in physical performance.

METHOD

Participants and match data

MRP was investigated for a category 3 English Academy U18 team competing in the Northwest Division of the English Football League (EFL) Youth Alliance league, during the 2020-2021 season. 25 of 26 league games were included for analysis (13 home and 12 away) and one game was omitted due to technical issues with the GPS system. Games were 2x45 minutes plus added time and to allow for differences in game duration, MRP data was normalized and is presented $m.min^{-1}$ to facilitate comparison with another research.

Participants had to be named in the starting lineup and complete 90 minutes in their primary position determined by the position allocated with the highest frequency. 14 players were included; age 16.28yrs (±0.88), stature 180.23cm (±8.29) and body mass 72.66kg (±6.91). Players were grouped into full back (FB) (n = 4), central defender (CD) (n = 2), wide midfielder (WMF) (n = 2), central midfielder (CMF) (n = 4) and forwards (FW) (n = 2), but goalkeepers were not included. A total of 121 observations were analysed and individual players contributed 5-15 match observations respectively. During the games a 433/41221 formation was preferred. Informed consent was acquired from the club, individuals and parents/guardian where appropriate and institutional ethical approval was granted before the commencement of the study.

MRP data was recorded using the Catapult Vector S7 GPS system (10Hz) (Catapult, Melbourne, Australia) secured in a custom harness located between the scapula and units were activated at least 10 minutes prior to kick off to ensure satellite connection. Players wore the same unit during each of the fixtures to reduce between unit measurement error (Jennings et al., 2010), although the 10Hz systems has demonstrated acceptable reliability during team sports (Crang et al., 2021; Johnson et al., 2014; Rampinini et al., 2015). MRP measures were TD, HSR (19.8 to 25.2km.hr^{-1} or 5.5m.s^{-1} to 6.94m.s^{-1}) and SPT (≥25.2km.hr^{-1} or >7.0 m.s^{-1}) (Beato et al., 2021; Carling et al., 2016; Gregson et al., 2010; Rampinini et al., 2015). Data was processed using Catapult Openfield software (Catapult, Melbourne, Australia) and synchronized to the start and end of each half to remove non-game data.

Statistical analysis

The dependent variables (DV) were TD, HSR and SPT distance and the independent variables (IV) were: match location, opposition strength, match outcome, fixture congestion and playing position. Match location was separated into "*all games*", "*home*" and "*away*". Opposition strength was classified according to the final league position and defined as "*stronger*" (1st to 7th) and "*weaker*" (8th to 14th). Match outcome was recorded as "*win*", "*loss*" or "*draw*" depending on the final score. Fixture congestion was divided into "*1 game*" or "*2 game*" per week.

Data is presented mean ± standard deviation (SD) and 95% confidence intervals (CI), and normality of data was determined using the Shapiro-Wilk test. When data was normally distributed a One-Way Anova was used to assess the effect of the IV on the DV and pairwise comparison performed using Bonferroni correction. The Kruskal-Wallis test assessed differences in non-parametric data. Interaction effects between fixture venue & match result, opponent strength & playing position, fixture congestion & playing position were assessed using Two-Way Anova. IBM SPSS statistical software (version 28, IBM, USA) was used for all analysis. Significance was accepted at $p \leq .05$ and effect sizes were measured using Cohen's d and interpreted as trivial (0.2), small (0.6), large (1.2) and very large >2.0 (Hopkins et al., 2009). Variability in MRP is presented as the coefficient of variation (CV) and calculated by dividing the standard deviation by the mean value of the chosen metric and expressed as a percentage.

RESULTS

Descriptive statistics for MRP according to fixture venue are presented in Table 1. TD, HSR and SPT was not significantly different between home or away games. There was no significant interaction between match outcome &fixture venue in TD (p = .11, d = 0.44), HSR (p = .11, d = 0.45) or SPT (p = .88, d = 0.19) (Table 2). There was a significant main effect of playing position on SPT during a home win (p = .01, d = 3.50). Follow up analysis showed WMF covered significantly more SPT during a home win compared to CMF (p = .03) (Table 3). Overall, the interaction between playing position & result was non-significant (p = .46, d = 0.75). Regarding opposition strength, there was no significant difference between stronger and weaker opponents in TD (p = .18, d = 0.65), HSR (p = .67, d = 0.20) and SPT (p = .84, d = 0.08). Also, there was no significant interaction between opponent strength & playing position on TD (p = .92, d = 0.44), HSR (p = .96, d = 0.36) and SPT (p = 0.92, d = 0.45) (Table 4). Comparison between 1 and 2 games per week found no significant differences in TD (p = .89, d = 0.06), HSR (p = .58, d = 0.26) and SPT (p = .17, d = 0.67). No interaction between games per week & playing position was found for TD (p = .50, d = 0.88), HSR (p = .81, d = 0.59) or SPT (p = .91, d = 0.47) (Table 5).

Table 1. Running performance according to fixture venue.

		All games (n = 25)	**Home only (n = 13)**	**Away only (n = 12)**
TD ($m.min^{-1}$)	Mean ± SD	105.48 ± 7.85	107.79 ± 7.50	103.65 ± 7.50
	CI	100.00. 103.47	104.70. 110.70	101.03. 106.27
	CV (%)	7.44	6.95	7.23
HSR ($m.min^{-1}$)	Mean ± SD	5.21 ± 1.93	5.73 ± 1.44	4.79 ± 2.19
	CI	4.71. 5.72	5.16. 6.30	4.01. 5.57
	CV (%)	37.04	25.13	45.72
SPT ($m.min^{-1}$)	Mean ± SD	1.37 ± 0.72	1.27 ± 0.67	1.45 ± 0.76
	CI	1.17. 1.56	1.00. 1.54	1.16. 1.75
	CV (%)	52.55	52.75	52.41

Table 2. Running performance according to fixture venue and match outcome.

		Home fixtures		**Away fixtures**		
		Win (n = 6)	Loss (n = 7)	Win (n = 6)	Loss (n = 3)	Draw (n = 3)
TD ($m.min^{-1}$)	Mean ± SD	108.90 ± 8.86	106.76 ± 6.84	100.98 ± 9.47	105.93 ± 5.86	104.72 ± 5.60
	CI	104.67. 113.14	102.81. 110.71	96.75. 105.22	101.10. 110.76	100.12. 109.33
	CV (%)	8.13	6.4	9.37	5.53	5.34
HSR ($m.min^{-1}$)	Mean ± SD	5.76 ± 1.53	5.70 ± 1.40	3.78 ± 2.60	5.43 ± 1.99	5.32 ± 1.53
	CI	4.73. 6.79	4.71. 6.69	2.71. 4.85	4.26. 6.61	4.20. 6.44
	CV (%)	26.56	24.56	68.78	36.64	28.76
SPT ($m.min^{-1}$)	Mean ± SD	1.18 ± 0.71	1.36 ± 0.64	1.37 ± 0.87	1.48 ± 0.86	1.51 ± 0.65
	CI	0.77. 1.59	0.96. 1.75	0.88. 1.86	0.98. 1.97	1.06. 1.95
	CV (%)	60.16	40	63.5	58.1	43.05

Note. NB: No drawn home fixtures.

Table 3. MRP presented in positional groups according to match outcome ($m.min^{-1}$).

			FB (n = 4)	**CD (n = 2)**	**WMF (n = 2)**	**CMF (n = 4)**	**FW (n = 2)**
Home win (n = 6)	TD	Mean ± SD	110.24 ± 2.95	98.13 ± 4.06	107.25 ± 13.79	115.71 ± 8.62	
		CI	98.35.104.13	92.50.103.76	88.14.126.36	107.26.124.16	101.33 ± 0.00Δ
		CV%	2.68	4.14	12.86	7.45	
	HSR	Mean ± SD	6.50 ± 1.83	3.99 ± 0.33	7.52 ± 0.88	5.10 ± 0.56	
		CI	4.71.8.29	3.53.4.45	6.30.8.74	4.55.5.65	5.53 ± 0.00 Δ
		CV%	28.29	8.22	11.81	10.98	
	SPT	Mean ± SD	1.21 ± 0.24	0.88 ± 0.17	2.46 ± 0.90*	0.62 ± 0.83	
		CI	0.98.1.45	0.64.1.12	1.21.3.71	-0.19.1.43	1.37 ± 0.00 Δ
		CV%	19.82	19.7	36.88	61.44	
Home Loss (n = 7)	TD	Mean ± SD	106.79 ± 3.21	100.12 ± 3.60	104.50 ± 2.12	113.42 ± 6.24	102.29 ± 11.25
		CI	103.64.109.94	95.13.105.11	101.56.107.44	107.31.119.54	86.70.117.88
		CV%	3	3.6	2.03	5.5	11
	HSR	Mean ± SD	6.56 ± 0.74	4.40 ± 0.16	5.76 ± 1.60	5.37 ± 1.68	5.90 ± 2.47
		CI	5.84.7.39	4.18.4.62	3.54.7.98	3.72.7.02	2.48.9.32
		CV%	11.28	3.66	27.75	31.35	41.84
	SPT	Mean ± SD	1.45 ± 0.64	1.00 ± 0.19	1.77 ± 0.27	1.22 ± 0.95	1.38 ± 0.75
		CI	0.84.2.09	0.74.1.26	1.40.2.14	0.29.2.15	0.34.2.42
		CV%	43.71	19.33	15.32	77.55	54.02
Away Win (n = 6)	TD	Mean ± SD	102.25 ± 7.67		101.75 ± 19.45	99.73 ± 11.86	102.17 ± 8.24
		CI	94.73.109.77	97.00 ± 0.00 Δ	74.79.128.71	88.11.111.35	90.75.113.59
		CV%	7.5		19.11	11.89	8.07
	HSR	Mean ± SD	3.01 ± 2.08		3.96 ± 4.98	3.63 ± 3.20	5.78 ± 2.36
		CI	0.97.5.05	2.95 ± 0.00 Δ	-2.94.10.86	-4.32. 11.59	2.51.9.05
		CV%	68.96		125.54	88.15	40.77
	SPT	Mean ± SD	0.78 ± 0.19			1.38 ± 0.55	2.05 ± 1.63
		CI	0.31. 1.24	0.87 ± 0.00 Δ	2.27 ± 0.00	-3.57. 6.33	-0.21.4.31
		CV%	24.35			39.85	79.57

Away Draw (n = 3)	TD	Mean ± SD	79.13 ± 52.76	98.00 ± 2.82	50.00 ± 70.71	83.13 ± 55.51	103.50 ± 6.63
		CI	27.43.130.83	94.09.101.91	-47.03.147.03	28.73.137.53	94.26.112.74
		CV%	66.68	2.88	141.41	66.78	6.15
	HSR	Mean ± SD	4.54 ± 3.28	4.57 ± 0.65	2.91 ± 4.12	3.64 ± 2.99	5.44 ± 2.36
		CI	1.33.7.75	3.67.5.47	-2.80.8.62	0.71.6.57	2.17.8.71
		CV%	72.16	14.2	141.42	82.21	4.35
	SPT	Mean ± SD	1.00 ± 0.70	1.46 ± 0.45	1.04 ± 1.47	0.82 ± 1.47	1.99 ± 1.18
		CI	0.32.1.69	0.84.2.08	0.99.3.08	-0.62.2.26	0.36.3.63
		CV%	69.79	30.81	141.42	96.79	59.41
Away Loss (n = 3)	TD	Mean ± SD	103.50 ± 4.94	105.50 ± 7.78	104.25 ± 2.48	110.61 ± 7.43	
		CI	59.02. 147.97	94.72.116.28	100.81.107.69	92.14. 129.08	101 ± 0.00 Δ
		CV%	4.77	7.37	2.37		
	HSR	Mean ± SD	5.82 ± 3.54	4.25 ± 0.84	5.94 ± 0.55	5.21 ± 2.91	
		CI	-26.07. 37.72	3.09.5.42	5.18.6.70	-2.04. 12.46	6.68 ± 0.00 Δ
		CV%	60.82	19.69	9.24	55.85	
	SPT	Mean ± SD	1.10 ± 0.65	0.54 ± 0.61	1.51 ± 0.18	1.51 ± 0.17	
		CI	-4.74. 6.94	-0.31.1.39	1.26.1.76	-0.07. 3.1	3.11 ± 0.00 Δ
		CV%	59.09	113.14	11.79	11.25	

*Note. *SPT Home win WMF > CMF, p ≤ .05. Δ insufficient players to produce statistics due to insufficient data sets. NB: No drawn home fixtures.*

Table 4. MRP presented in positional groups according to opponent strength (m.min^{-1}).

		Stronger opponents (n = 6)			**Weaker opponents (n = 7)**		
		TD	**HSR**	**SPT**	**TD**	**HSR**	**SPT**
FB (n = 4)	Mean ± SD	105.20 ± 4.08	5.60 ± 1.67	1.33 ± 0.75	108.96 ± 2.43	6.28 ± 1.20	1.25 ± 0.22
	CI	101.20. 109.19	3.96. 7.24	0.59. 2.07	106.58. 111.34	5.10. 7.46	1.03. 1.47
	CV%	3.88	29.81	56.06	2.23	19.07	17.75
CD (n = 2)	Mean ± SD	95.56 ± 2.04	3.67 ± 0.32	0.99 ± 0.11	102.80 ± 4.81	4.48 ± 0.57	0.97 ± 0.31
	CI	92.73. 98.39	92.73. 98.39	0.84. 1.15	96.13. 109.47	3.69. 5.27	0.54. 1.40
	CV%	2.14	8.66	10.91	4.68	12.85	31.46
WMF (n = 2)	Mean ± SD	104.23 ± 7.04	6.12 ± 1.43	1.78 ± 0.74	107.25 ± 11.67	6.55 ± 1.30	2.05 ± 0.30
	CI	94.47. 113.99	4.19. 8.10	0.75. 2.81	91.18. 123.42	4.75. 8.35	1.63. 2.47
	CV%	6.75	23.31	41.22	10.88	19.87	14.8
CMF (n = 4)	Mean ± SD	109.20 ± 6.02	4.26 ± 1.82	0.88 ± 0.61	113.64 ± 8.54	5.23 ± 1.72	0.98 ± 0.83
	CI	103.30. 115.10	2.78. 6.04	0.28. 1.48	105.27. 122.00	3.54. 6.92	0.17. 1.79
	CV%	5.52	42.75	69.29	7.51	32.82	84.8
FW (n = 2)	Mean ± SD	102.71 ± 8.43	6.00 ± 2.25	1.88 ± 1.34	101.88 ± 5.48	5.73 ± 1.62	1.69 ± 0.79
	CI	91.03. 114.39	2.88. 9.11	0.02. 3.73	94.29. 109.48	3.48. 7.97	0.59. 2.78
	CV%	8.2	37.42	71.05	5.38	28.23	46.71
Group (n = 14)	Mean ± SD	104.51 ± 6.44	5.45 ± 1.56	1.42 ± 0.76	108.16 ± 7.26	5.66 ± 1.39	1.31 ± 0.63
	CI	101.18. 107.92	4.63. 6.27	10.2. 1.82	104.36. 111.96	4.93. 6.39	0.98. 1.64
	CV%	6.2	28.6	53.5	6.7	24.56	48.09

Table 5. MRP of positional groups during 1 and 2 game weeks according (m.min^{-1}).

		1 game week (n = 19)			**2 game week (n = 6)**		
		TD	**HSR**	**SPT**	**TD**	**HSR**	**SPT**
FB (n = 4)	Mean ± SD	107.55 ± 0.62	5.69 ± 0.63	1.12 ± 0.26	103.42 ± 4.57	5.48 ± 2.02	1.42 ± 0.71
	CI	106.94. 108.16	5.07. 6.30	0.87. 1.38	98.94. 107.89	3.50. 7.46	0.72. 2.11
	CV%	0.57	11.01	22.9	4.42	36.87	49.79
CD (n = 2)	Mean ± SD	100.47 ± 5.00	4.25 ± 0.74	0.94 ± 0.33	95.38 ± 1.94	3.30 ± 0.89	1.13 ± 0.24
	CI	93.54. 107.4	3.22. 5.28	0.48. 1.40	92.69. 98.06	2.07. 4.53	0.79. 1.46
	CV%	4.97	17.34	34.79	2.04	27.02	20.98
WMF (n = 2)	Mean ± SD	103.92 ± 8.60	6.13 ± 1.71	1.82 ± 0.47	109.67 ± 3.77	7.44 ± 0.53	2.07 ± 0.58
	CI	92.00. 115.84	3.76. 8.50	1.17. 2.48	104.44. 114.89	6.70. 8.18	1.27. 2.87
	CV%	8.28	27.94	25.94	3.44	7.12	27.83

CMF (n = 4)	Mean ± SD	111.28 ± 6.03	4.56 ± 1.47	0.87 ± 0.63	112.63 ± 8.46	4.99 ± 2.27	1.06 ± 0.93
	CI	105.37. 117.19	3.11. 6.00	0.25. 1.48	104.33. 120.92	2.76. 7.22	0.15. 1.97
	CV%	5.54	32.35	72.13	7.51	45.55	87.47
FW (n = 2)	Mean ± SD	102.33 ± 8.01	5.75 ± 2.04	1.51 ± 0.76	106.00 ± 1.41	6.93 ± 0.69	2.44 ± 0.98
	CI	94.48. 110.18	3.75. 7.75	0.46. 2.56	104.62. 107.38	6.54. 7.61	1.48. 3.4
	CV%	7.83	35.54	50.27	1.33	9.89	40.13
Group (n = 14)	Mean ± SD	106.33 ± 6.13	5.23 ± 1.30	1.18 ± 0.55	106.16 ± 7.60	5.51 ± 1.99	1.51 ± 0.83
	CI	103.11. 109.54	4.55. 5.91	0.89. 1.47	102.18. 110.41	4.47. 6.55	1.08. 1.95
	CV%	5.76	24.85	46.66	7.15	36.11	54.96

DISCUSSION

This study aimed to investigate the effect of contextual variables on MRP (TD, HSR and SPT) within an English U18 academy team during one competitive season. We found that MRP was not significantly affected by match location, match outcome, strength of opposition or fixture congestion. TD and HSR are slightly lower than data reported in category 2 English academies: TD 112.22m.min^{-1} ± 11.81, HSR 7.24m.min^{-1} ± 1.83 (Smalley et al., 2022), TD ~ 125.0m.min-1, HSR ~8.67m.min^{-1} (Hattersley et al., 2018) and by Reynolds et al. (2021) (academy category not stated) TD ~107.98m.min^{-1}, HSR ~ 6.59 m.min^{-1}. However, SPT was higher: 1.29m.min^{-1} ± 0.81 (Smalley et al., 2022) and ~1.15m.min^{-1} (Reynolds et al., 2021). Differences were also apparent with overseas U18's: Qatar TD 99.00m.min^{-1} (Buchheit et al., 2011) and Japan TD ~127.43m.min^{-1} (Goto & Saward, 2019). These differences emphasise the difficultly in generalizing findings from single club case studies, and reflect differences in physical fitness (Castagna et al., 2009) playing formations (Paraskevas et al., 2020) and tactical philosophy.

Across all positions, variability for TD ranged CV 6.95 to 7.44% which is higher than professionals: CV 2.4 to 5.0% (Bush et al., 2015; Mohr et al., 2003; Rampinini et al., 2007). In contrast, higher values for HSR (CV 25.13 to 37.04%) and SPT (CV 52.41 to 52.75%) reflect the trend for higher variability during high speed running. Data found here was also higher than professionals (HSR CV 6.8 to 37.1%, SPT CV 14.4 to 30.8%) (Carling et al., 2016; Gregson et al., 2010; Rampinini et al., 2007), highlighting a need for age group and team specific analysis of variability.

Match location

We found greater TD and HSR was performed during home fixtures compared to away games, and SPT showed the opposite trend, although these differences were not significant. Similar data from the professional level (Aquino et al., 2018; Barrera et al., 2021; Lago et al., 2010) is suggested to reflect a cautious mindset during away fixtures translating into a defensive approach (Algoy et al., 2021; Gollan et al., 2020; Staufenbiel et al., 2015). Research about the home advantage effect proposes home crowd support, travel fatigue for the opposition and familiarity of facilities favour the home team (Aquino et al., 2018; Pollard & Gomez, 2014). However, the team in this study compete in a regionalised league meaning relatively short travel to away games and fixtures are not typically played in stadia with large crowds, which may reduce the home advantage effect. This season was also immediately after the COVID pandemic and rule changes limited spectators to essential staff only. Interestingly, research reports that amongst several professional leagues (Premier League, La Liga and Primeria Liga (Almeida & Leite, 2021; Jiminez Sanchez & Lavin, 2021) the COVID-19 restrictions did not reduce the home advantage effect.

Match outcome

Separating the outcome of fixtures according to venue showed non-significant differences in MRP. During home wins TD and HSR was higher than away wins, but the reverse was found for SPT. Comparison between

TD, HSR and SPT during home and away losses showed small differences. No interaction effect was found between venue and match outcome, but this might be explained by the small sample size.

WMF completed significantly more SPT distance than CMF during a home win which may suggest the use of a counterattacking strategy. Winning teams are shown to defend in deeper positions (Redwood-Brown et al., 2008) and exploit counterattacks decreasing TD and increasing HSR/SPT (Aquino et al., 2020; Fernandez-Navarro et al., 2020; Garcia-Rubio et al., 2015). The trend for lower MRP during a win may also reflect a possession style of play slowing the game to exert control over the opposition (Aquino et al., 2020; Lago et al., 2010) and could explain the higher variability found during games won (Table 2). Previous work into the effect of match outcome used group rather than positional comparison (Aquino et al., 2018; Augusto et al.,2021; Castellano et al.,2011) which would mask positional differences, and, therefore, it seems important to base future analysis on a positional/individual basis. It is noteworthy that our analysis was complicated by the tendency for FW to be substituted more frequently which reduced the number of players in this positional data set.

A limitation of this study is that we did not consider changes in score line during games. Ponce-Bordon et al. (2021) reported that, when winning, TD and SPT was increased in CMF, WMF and FW ($p < .05$) when exerting sustained attacking pressure. Yet, when losing it was increased in CD and FB in response to the opposition attacking play ($p < .05$). Elsewhere when losing, ball possession was prioritised in order to sustain attacking pressure (Bradley et al, 2014; Lago, 2009; Lago & Martin, 2007) which facilitated an increase in MRP (Castellano et al., 2011; Aquino et al., 2020). In addition, winning teams were reported to defend in deeper positions (Redwood-Brown et al., 2008) and exploit counterattacks thus decreasing TD but increasing HSR/SPT (Aquino et al., 2020; Fernandez-Navarro et al., 2018; Garcia-Rubio et al., 2015). In summary, the proportion of time spent winning, losing, or drawing would influence MRP and should be considered in future analysis along with the format of competition.

Strength of opposition

MRP is often found to increase as the strength of opponent increases (Castellano et al., 2020), but we found no differences against stronger or weaker opponents, and this is unlike several studies in professional players (Aquino et al., 2018; Castellano et al., 2011, 2020; Mohr et al., 2003; Paraskevas et al., 2020; Rampinini et al., 2009). When playing against lower ranked teams, stronger teams are shown to impose their style of play forcing their opponents to change their game plan by positioning players closer to their own goal (Gollan et al., 2020; Fernandez-Navarro et al., 2018). However, amongst Brazilian professionals no differences in MRP were observed (Augusto et al., 2021) and the authors speculated this was because of greater competitiveness in this league. However, greater competitiveness seems to be unlikely in this study because the average points difference between the top half and bottom half teams was 23.50.

It is important to acknowledge that differences in physical performance may have occurred outside the variables examined in this study. Accelerations and decelerations are reported to contribute 5-10% of total player workload (Dalen et al., 2016) and high magnitude activities occur at low movement speed which would be overlooked by the GPS metrics used in this study (Osgnach et al., 2010). Finally, this study considered final league position rather than ranking when the teams met and overlooked team form and comparative strength at the time of meeting.

In relation to variability, findings between stronger and weaker opponents were not dissimilar: HSR (CV 28.60 vs. 24.56%) and SPT (CV 53.50 vs. 48.09%). Against stronger opponents, HSR and SPT variability ranged from CV 8.66% in CD to 42.75% in CMF and, CV 10.91% in CD to 69.29% in CMF. In contrast, against weaker opponents HSR and SPT ranged CV 12.85% in CD to 32.82% in CMF and, CV 17.75% in FB to 84.80% in CMF. Higher variability amongst central players suggests greater sensitivity to tactical changes within games and may reflect higher player density in central areas (Bush et al., 2015; Di Salvo et al., 2013). The data reported here is higher than in professionals HSR CV 13.10 to ~25.00% and SPT CV 26.80 to 52.80% (Bush et al., 2015; Carling et al., 2016; Gregson et al., 2010) meaning that in this group MRP was more volatile and, therefore, individual, positional and age group analysis of variability is necessary to monitor MRP.

Fixture congestion

That fixture congestion did not affect MRP is in line with studies in professional soccer (Julian et al., 2021; Viera et al., 2019), but contrasts another U18 academy team (Hattersley et al (2018) yet comparison is complicated because they examined a team from a higher tier (PDP Northern League 2), featured only two, 2 game weeks and did not distinguish according to playing position.

Within this study there were six separate occasions where two games were completed in a week, which is considerably less than professional football where 50-80 games over ~40 weeks is not uncommon (Julian et al., 2021). Nevertheless, recovery from match play is player dependent and may be prolonged up to 72 hours (Julian et al., 2021; Nedelec et al., 2012), therefore MRP should be examined on an individual basis rather than as a group. We found no positional differences in MRP between 1 and 2 games per week, however in U23's a trend for reduced TD and HSR was identified, although SPT was maintained (Varley et al., 2017). The lack of significant differences suggests physical performance was maintained during congested periods, however the tendency for FW to be substituted more frequently highlights the use of player management strategies to mitigate any decline in MRP (Carling et al., 2015b). Interestingly, reduced acceleration and deceleration capacities have been identified during congested fixture periods meaning these metrics may be more sensitive to fatigue related changes rather than locomotor activity (Rhodes et al., 2021).

Player rotation policies and individual pacing strategies that help to manage fatigue (Bradley & Noakes, 2013) contribute to the higher variability found during 2 game weeks (Table 5). Overall, variability in TD, HSR and SPT increased CV 1.39%, 11.26 and 8.30% respectively during a 2-game week, yet positional differences existed. Reductions in variability were found in TD for CD, WMF and FW (-2.93 to -6.50%): HSR for WMF and FW (-20.82% to -25.65) and SPT for CD and FW (-9.97% to -13.81), suggesting adjustments made to these tactically flexible positions during congested periods (Carling et al., 2008; Gregson et al., 2010).

CONCLUSIONS

Contextual variables contribute to the complex nature of soccer competition and the MRP of players. Yet, within this study we reported no significant effect of match location, match outcome, strength of opposition or fixture congestion on the MRP of a category 3 U18 academy team during one season. However, because this is a single club case study these findings cannot be generalized to other teams, but differences in MRP between playing positions support the use of individualized analysis. Practitioners should, therefore, examine the influence of contextual variables on club and positional basis to inform individualised training schedules in support of the player development pathway. Further work should investigate whether there are tier specific differences in MRP across the categories of academy football within the PDP.

AUTHOR CONTRIBUTIONS

Barron, Yiannaki and Fry wrote the paper and Atherton collected the data. All authors approved the final submission.

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No potential conflict of interest were reported by the authors.

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