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Does running performance relate to the market value of elite male soccer players? A case study from the FIFA world cup

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Abstract

The study main aim was to investigate: the relationship between running performances and market values of soccer players playing in the 2022 FIFA World Cup, by playing position and all players; the comparisons by playing position; to analyse the relationship between running metrics and market values of the highest and lowest players ranked players. The relationship between running metrics and market values of 306 soccer players who participated in the tournament and played full time, as well as the 40 players with the highest ($n=20$) and lowest ($n=20$) market values was analysed. Overall, there was a very weak correlation between market values and total distance ($r=0.149$), zone 3 ($r=0.153$), zone 4 ($r=0.139$), zone 5 ($r=0.160$), high-speed runs ($r=0.132$), sprints ($r=0.147$), and top speed ($r=0.194$) for all players ($p<0.05$). Defenders showed very weak positive correlation between market values and top speed ($r=0.155$, $p<0.05$). Midfielders showed weak positive correlations between market values and zone 4 ($r=0.302$, $p<0.05$) and zone 5 ($r=0.369$, $p<0.001$), sprints ($r=0.367$, $p<0.001$), and top speed ($r=0.304$, $p<0.05$). Forwards showed no correlations ($p>0.05$). While there is no significant correlation between running metrics and market value for players with the lowest market value ($p>0.05$), there was a moderate negative correlation between total distance (r=-0.577) and zone 2 (r=-0.612) for the 20 players with the highest market value ($p<0.05$). Moreover, there was a weak correlation with zone 5 ($r=0.450$) and a moderate correlation with the top speed values ($r=0.596$) ($p<0.05$). Weak correlations between soccer players' running performance and market values suggest that different running thresholds are important metrics, although other factors (e.g., technical skill, age, national and team club) may influence this relationship. In conclusion, since coaches and scouts aim to recruit relatively talented players within the limits of their budgets, selecting athletes with high aerobic and anaerobic performance, particularly those with a strong high-intensity running profile, can contribute to team success and potentially generate high transfer revenues in the future.

Keywords Football, Optical tracking systems, Marketing, Total distance, Sprint, World cup

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Introduction

Soccer is one of the most popular sporting activities in the world, with close to 1.5 billion people watching the final match of the 2022 Qatar World Cup and approximately 6 billion social media interactions and 262 billion cumulative reaches from the end of the tournament to one month later [1]. Based on such a large number of viewers, the revenues of the 'big five' in Europe (English Premier League, Spanish La Liga, French Ligue 1, Italian Serie A and German Bundesliga) [2] for the 2021–2022 season are reported to be approximately €8.9 billion, with total revenues of €17.2 billion [3]. As of June 2024, the list of the world's most valuable clubs on the Transfermarkt website shows that there are 3 soccer clubs with a value of over 1 billion [4] (Real Madrid, Manchester City, Arsenal FC). The values of soccer clubs are expressed by the sum of the market values of the soccer players in the team. Therefore, the market values of the soccer players affect not only their own market value but also the market value of their clubs. In addition to team revenues, the transfer market al.so has an important place in the soccer economy. In 2023, $9.63 billion was spent on transfer fees [5]. When clubs spend so much, they want to reap the rewards from the players. The clearest way to repay this is through the best performance of the players on the pitch.

One of the indirect ways to get information about the market value of soccer players is the Transfermarkt website. Transfermarkt estimates the market value of soccer players with a number of parameters such as age, club and national team performance, development potential, interested club, and others [6]. The researchers, who study the market value of soccer players, often analyze their data through the Transfermarkt website [7]. In addition, some studies have also used sites such as 'who scored' and 'kicker' to examine the relationship between players' performance data in a real soccer competition and their market value [8, 9]. However, the data obtained from these sites consist of data such as playing duration, seasonal running total distance, goals, assists, yellow cards and red cards. These sites provide limited data on the evaluation of performance. Only one study examined the relationship between distance covered, which reflects physical performance, and market values [9]. However, only on the total running distance covered during the whole season was used.

A soccer player's total distance during a competition is covered by running at different paces, such as walking, jogging, jogging, high-intensity running, and sprinting. The main methods used as a tool to obtain data such as running distance that including different intensity is the use of Global Position System (GPS) and Optical Tracking (OT) [10, 11]. Today, it is a material available in almost every soccer club and its use in soccer is quite common [12, 13]. The movement speed of the players in the competition is defined as an important variable reflecting the player's performance [14]. As a matter of fact, in the evolutionary process of changing and evolving soccer, the movement speed of the game and therefore the movement speed of the players is also gradually increasing [15]. In a recent study on this subject, although the total distance covered by the players in the 2022 World Cup increased by 3,2% compared to the 2018 World Cup, the total distance traveled at high intensity increased by 19,2% [16]. In addition, considering the activities performed before the goals scored in a competition, the importance of high-intensity activities is seen [17].

Additionally, another relevant aspect when analysing different running measures is the playing position of players. As an example, the distances above 20 and 25 km/h were 16 to 92% and 36 to 138% higher for wide midfielders and wide forwards compared to centre forwards, defensive/central midfielders and central defenders [18] which highlight distinct patterns that potentially influence market values of the players.

As abovementioned, it may be more guiding to evaluate the relationship between the market value of soccer players and the performance of the distance covered in different running zones in addition to the total running distance. Therefore, the performances of soccer players in the competition can be interpreted comprehensively and their relationship with market values can be analyzed in more detail. This study aims to examine: the relationship between running performances and market values of soccer players playing in the 2022 FIFA World Cup, by playing position and all players; the comparisons by playing position; to analyse the relationship between running metrics and market values of the highest and lowest players ranked players. Consequently, it was hypothesized that soccer players with high market value will have a positive relationship with running metrics based on a previous study [9].

Materials and methods

Participants

The participants were selected from players who competed in the Men's Senior Soccer FIFA World Cup 2022 in Qatar. The study included 306 players from 32 teams. A total of 743 players participated in the tournament. However, to minimize differences in match running performance due to playing time and position, and to ensure comparability, we analyzed the OT data of 306 players, excluding those who did not play the full 90 min (excluding matches with extra time) [18] and goalkeepers due to the different variations in the physical demands with outfield players [18]. The tournament consisted of 8 groups of 4 teams each, with 56 matches including knockouts. The data considered in our study consists of matches

played both in the group stage and in knockout stage. However, we only included matches ending in 90 min with no extra time in the analysis. For players who only played in one match, OT data was obtained from the single match they played. However, it was taken into consideration average OT data for players who played more than one match. Although the data used in this study are publicly available, we obtained ethics committee approval as authors. This study was approved in accordance with the Declaration of Helsinki with decision number 68 at the meeting of Cukurova University Faculty of Medicine Research Ethics Committee dated 06.09.2024 and numbered 147.

Procedures

The participants' OT data were obtained directly from the FIFA website (FIFA Training Centre) (www.fifatrainingcentre.com) [19]. The FIFA website provides the data such as the player's name, birth date, country, playing position, running data, competition category, tournament information, and the match results. Players' match performances were recorded by FIFA using the multi-camera-computerized optical tracking system TRACAB (Chyronhego, New York, NY). Previous studies have reported that TRACAB OT is a valid and reliable tracking system, with an average measurement error of approximately 2% for distances covered [20]. Moreover, it has been recognized as a valid technology for soccer-specific performance analyses in tested environments, provided that players are tracked accurately [11]. OT reports that were used to obtain data stated following variables: total distance covered (m), as well as distance in the speed categories of walking (zone 1 / 0–7.0 km/h) (m), jogging (zone 2 / 7–15 km/h) (m), running (zone 3 / 15–20 km/h) (m), and high-intensity running (zone 4 / 20–25 km/h) (m), sprint running (zone 5 / > 25 km/h) (m), attempted high-speed runs (counts), attempted sprint (counts), and top speed (km/h). On the other hand, the Transfermarkt website (transfermarkt.com.tr) [21] provided information on the market value of the players, for which data was taken just one day before the start of the tournament (October 19th, 2022). Market values of the players are evaluated in euro (€) currency. We also examined the relationship between the market values of the 20 athletes with the highest market values (n = Defender (DF):1, Midfielder (MF):13, Forward (FW):6) and the 20 players with the lowest market values (n = DF:14, MF:6, FW:0) and the running metrics. A total of 20 players were selected for this analysis based on the results of the power analysis, which indicated a strong effect size. Additionally, the disparity in market values among the players was not substantial, supporting the decision to limit the sample to this number. FIFA Training Centre and Transfermarkt databases are professionally managed, and we consider that the merging of both datasets allows us to create a comprehensive database containing consistent evaluations of a large number of soccer players.

Table 1 Players' running metrics

Running Metrics	Mean ± SD
Total Distance (m)	10479.99 ± 917.23
Zone 1 (m)	3801.92 ± 331.78
Zone 2 (m)	4499.25 ± 741.23
Zone 3 (m)	1361.19 ± 358.90
Zone 4 (m)	602.69 ± 177.46
Zone 5 (m)	214.97 ± 124.83
High Speed Running (counts)	121.32 ± 26.31
Sprints (counts)	64.96 ± 12.98
Top Speed (km/h)	31.35 ± 1.68
Market Value (€)	21698611.11 ± 26234101.35

Statistical analysis

Categorical variables were expressed as numbers and percentages, whereas continuous variables were summarized as mean and standard deviation. For comparison of more than two groups, One-way ANOVA or Kruskal Wallis test was used depending on whether the statistical hypotheses were fulfilled or not. For each position, to assess the correlations between the running metrics, and the market values Pearson Correlation Coefficient was used for normally distributed variables and Spearman Rank Correlation Coefficient for non-normally distributed variables. Correlation coefficient values were evaluated as 0.00-0.25 very weak, 0.26–0.49 weak, 0.50–0.69 moderate, 0.70–0.89 high, 0.90-1.00 very high correlation. The R package "ggplot2" was used to create the 95% CI graphs.

All analyses were performed using IBM SPSS Statistics Version 20.0 statistical software package (IBM Corp, Armonk, NY, USA). The statistical level of significance for all tests was considered to be $p < 0.05$.

Results

Descriptive statistics of the analysed metrics

There was a total of 306 players in the study. The average age of these players was 27.35 ± 4.00. Their average playing time is 97.97 ± 2.14. The average of their market value is 21.698.611,11 ± 26.234.101,35 Euro. Among the players playing in different positions, 89 (29.1%) players played in the MF position, 167 (54.6%) in the DF position and 50 (16.3%) in the FW position. Running metrics and market values for all players are presented in Table 1.

Analysis by playing position

The means and standard deviations of running metrics and market values of soccer players according to the

Table 2 Players' running metrics according to position

Running Metrics	DF Position Mean ± SD	MF Position Mean ± SD	FW Position Mean ± SD	DF vs. MF *p* value	DF vs. MF ES	DF vs. FW *p* value	DF vs. FW ES	MF vs. FW *p* value	MF vs. FW ES
Total Distance (m)	10094.73 ± 687.69	11205.51 ± 799.18*^	10475.35 ± 1012.70*	< 0.001	1.49	0.008	0.44	< 0.001	0.80
Zone 1 (m)	3833.95 ± 267.61#	3663.63 ± 363.60	3941.08 ± 383.61#	< 0.001	0.53	0.094	0.32	< 0.001	0.74
Zone 2 (m)	4313.52 ± 538.83	5009.55 ± 759.27*^	4211.26 ± 854.61	< 0.001	1.06	0.608	0.14	< 0.001	0.99
Zone 3 (m)	1194.18 ± 246.43	1669.67 ± 341.04*^	1369.90 ± 345.18*	< 0.001	1.60	0.001	0.59	0.001	0.87
Zone 4 (m)	547.16 ± 168.54	668.46 ± 164.42*	671.05 ± 167.61*	< 0.001	0.73	< 0.001	0.74	0.996	0.02
Zone 5 (m)	205.96 ± 122.25	194.18 ± 116.55	282.11 ± 127.70*#	0.741	0.10	< 0.001	0.61	< 0.001	0.72
HSR (counts)	109.65 ± 20.53	142.31 ± 23.24*^	122.94 ± 25.40*	< 0.001	1.45	0.001	0.58	< 0.001	0.80
Sprints (counts)	43.39 ± 12.80	50.04 ± 11.47*	53.43 ± 12.45*	< 0.001	0.58	< 0.001	0.80	0.268	0.28
Top Speed (km/h)	31.34 ± 1.57	30.89 ± 1.75	32.23 ± 1.63*#	0.088	0.27	0.002	0.56	< 0.001	0.79
Market Value (€)	14,822,455 ± 17,901,175	29,291,292 ± 30,696,957*	31,150,000 ± 33,896,194*	< 0.001	0.58	< 0.001	0.60	0.909	0.06

DF: Defenders, **MF**: Midfielders, **FW**: Forward, **HSR**: High-Speed Running, *: Significance from DF, #: Significance from MF, ^: Significance from FW. All results were considered significant at $p < 0.05$.

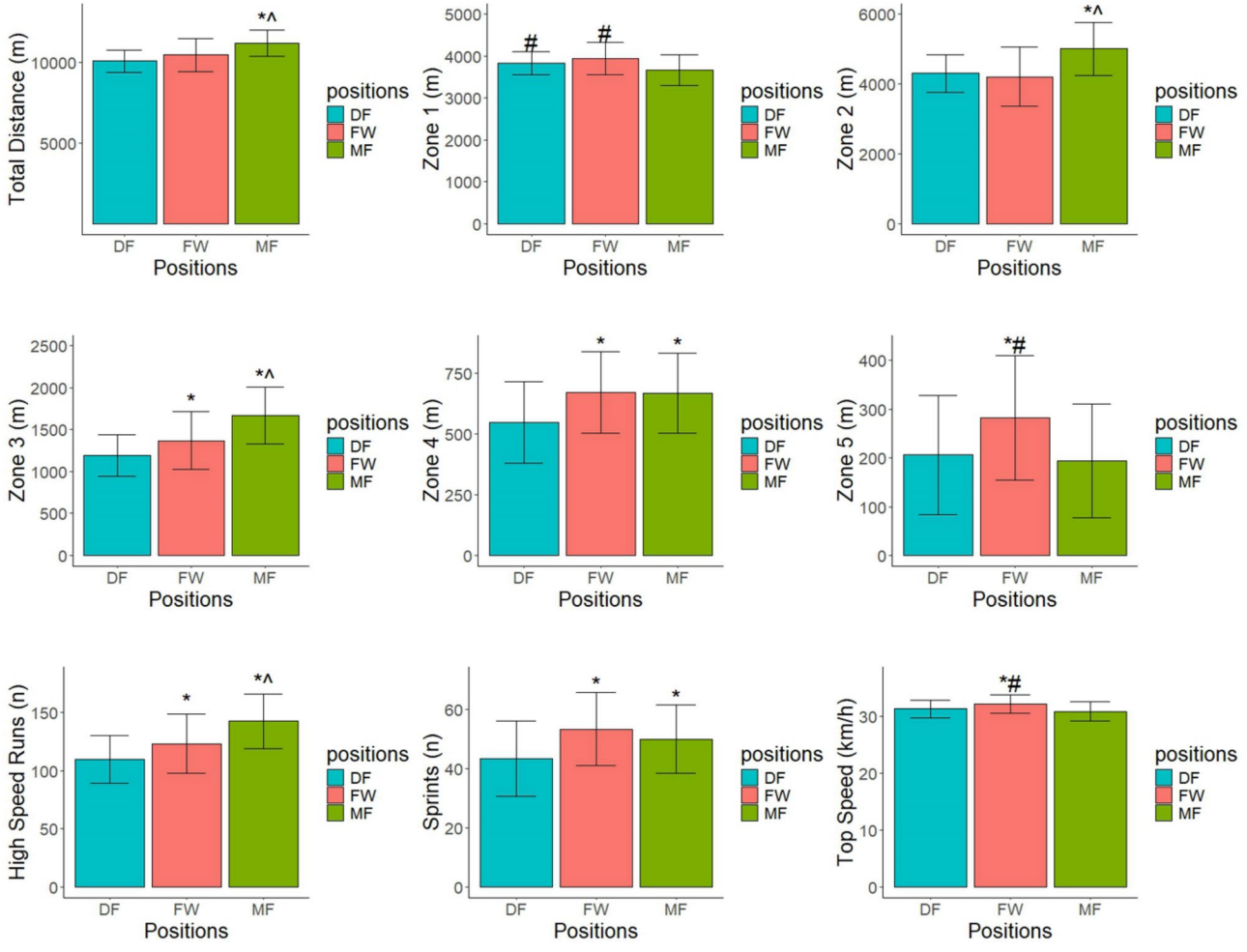

Fig. 1 Players' running running metrics according to position are presented Mean ± SD with 95% confidence interval. *: Significance from DF, #: Significance from MF, ^: Significance from FW; All results were considered significant at $p < 0.05$.

Table 3 Correlation coefficient between the market values of players according to all players and positions and running data

Running Metrics		Defenders	Midfielders	Forwards	All players
Total Distance (m)	**r**	-0.032	0.110	-0.167	**0.149***
	p	0.683	0.305	0.245	**0.009**
Zone 1 (m)	**r**	0.028	0.074	0.089	-0.049
	p	0.723	0.491	0.541	0.395
Zone 2 (m)	**r**	-0.002	-0.028	-0.023	0.077
	p	0.975	0.793	0.121	0.179
Zone 3 (m)	**r**	-0.007	-0.022	-0.011	**0.153***
	p	0.931	0.839	0.478	**0.007**
Zone 4 (m)	**r**	-0.115	**0.302***	0.043	**0.139***
	p	0.137	**0.004**	0.768	**0.015**
Zone 5 (m)	**r**	-0,056	**0.369***	0.274	**0.160***
	p	0.471	**< 0.001**	0.054	**0.005**
HSR (counts)	**r**	-0.044	-0.020	-0.039	**0.132***
	p	0.570	0.854	0.786	**0.021**
Sprints (counts)	**r**	-0.119	**0.367***	0.022	**0.147***
	p	0.124	**< 0.001**	0.879	**0.010**
Top Speed (km/h)	**r**	**0.155***	**0.304***	0.270	**0.194***
	p	**0.045**	**0.004**	0.058	**0.001**

HSR: High Speed Running. Bold denotes significant results.

Table 4 The relationship between market value and running metrics of the 20 lowest and highest players

Running Metrics		Market values of lowest players	Market values of highest players
Total Distance (m)	**r**	-0.004	**-0.577***
	p	0.987	**0.004**
Zone 1 (m)	**r**	0.008	0.333
	p	0.972	0.173
Zone 2 (m)	**r**	-0.107	**-0.612***
	p	0.652	**0.004**
Zone 3 (m)	**r**	0.044	-0.317
	p	0.854	0.132
Zone 4 (m)	**r**	-0.107	-0.072
	p	0.652	0.620
Zone 5 (m)	**r**	0.117	**0.450***
	p	0.623	**0.004**
High Speed Running (counts)	**r**	0.056	-0.280
	p	0.816	0.192
Sprints (counts)	**r**	-0.022	0.175
	p	0.928	0.626
Top Speed (km/h)	**r**	-0.049	**0.596***
	p	0.837	**0.040**

Bold denotes significant results.

position they play are given in Tables 2 and 95% confidence interval are presented in Fig. 1.

Relationship between running metrics and market values by playing position all players

There is a positive and very weak correlation between market values and top speed players in DF position ($p = 0.045$). There is no correlation between total distance, zone 1, zone 2, zone 3, zone 4, zone 5, high-speed runs and sprints with market values. There is a positive and low correlation between market values and zone 4 ($p = 0.004$), zone 5 ($p < 0.001$), sprints ($p < 0.001$) and top speed ($p = 004$) players in MF position. There is no relationship between market values and Total distance, zone 1, zone 2, zone 3 and high-speed runs. On the other hand, for players in FW position there is no correlation between any running metrics with market values. For all players, there is a very weak correlation between total distance ($p = 0.009$), zone 3 ($p = 0.007$), zone 4 ($p = 0.015$), zone 5 ($p = 0.005$), high speed runs ($p = 0.021$), sprints ($p = 0.010$) and top speed ($p = 0.001$) with market values. There is no relationship between market values and zone 1 and zone 2 (Table 3).

Relationship between running metrics and market values of the highest and lowest players

The correlation tables between the running metrics of the 20 players with the lowest and the 20 players with the market value are given in Table 4. There is no correlation between the lowest market value and running metrics. However, a negative and strong correlation was found between total distance and zone 2 values and the highest market value ($p = 0.004$). A positive and weak and moderate relationship was found between zone 5 ($p = 0.004$) and top speed ($p = 0.040$) values, respectively (Table 4).

Discussion

This study evaluated: the relationship between running performances and market values of soccer players playing in the 2022 FIFA World Cup, by playing position and all players; the comparisons by playing position; to analyse the relationship between running metrics and market values of the highest and lowest players ranked players. Considering all players, it was concluded that the relationship levels differed in different running zones. No correlation was observed in relatively low running speed zones, whereas low levels of correlation were found in higher running speeds, total distance covered and top speed. On the other hand, another important finding of our study was the results of the analyses in which players were categorised according to their market values. A moderate correlation was observed with high running speeds of the 20 players with the highest market value. However, no statistically significant correlation was found in players with low market value. These findings suggest that high intensity running performance is an important factor not only for the game but also for the market value.

Studies on the market values of soccer players have generally calculated a performance score with the combination of many parameters associated with performance (goal, assist, pass, strength, speed, agility, etc.) and the relationship between this score and market

values has been examined [9, 22, 23]. In addition to the fact that running distance is not considered as a standalone parameter representing athletes' performance, the relationship between distance covered at different running speeds and market values has never been examined before [9, 22, 23]. Moreover, the distance covered at different running speeds may be influenced by the position demands of the players playing at different positions, and total running distance alone may not be an accurate indicator of performance [18].

As a matter of fact, considering the relationship between straight sprints and goal scoring [17], it can be suggested that soccer players who perform more high-speed runs may have the potential to engage in more decisive moments and contributing to goals. A similar scenario may also apply in defense situations. Nonetheless, only defenders and midfielders showed correlations between running measures and market values while forwards did not follow the same pattern. Such results can be justified by other variables not considered for the present study, such as, the club of the player, goals, assists, passes and playing time [9]. One possible justification for these results could be associated with the playing time [23]. For instance, the present study included players who competed for at least 90 min but did not consider those who participated in more matches which could be determinant for the present findings [9, 23]. Another justification could be the club of the players since this variable was considered as a predictor of 50.9% of market values [9] and nationality was not considered as such [23].

Furthermore, running data from the 2018 and 2022 World Cups showed an increase in both total running distance and high-speed running activities, indicating that game performance has increased and accelerated [16]. Although the match performance has increased, when the running performances of the players with high market value were analysed, it can be concluded that the superiority of high intensity running, sprinting and top speed performances have a more important effect on the determination of their market value by the authorities. While high correlations between running metrics and market values of players at different positions were not observed, the 20 players with the highest market values show high correlations, suggesting that the combination of all players at a certain position may lead to an underestimation of relationships. Furthermore, Argentina and France, the two teams that played in the final of the World Cup, had below average total running distance, zone 4 and zone 5 running distances when compared to the performances of other teams [16]. Considering the high market values of the players of these two teams, it is suggested that technical skills (e.g., goals, assists, passing, dribbling, dueling) [24] also have an important effect on the determination of the market values of the players. Although the transfer industry, which has continuously grown in economic volume, faced a decline due to the Covid-19 pandemic in the period between these two World Cups, it increased by 48.1% in 2023 compared to 2022, from $6.50 billion to $9.63 billion [5]. Although factors such as increased revenues from social media platforms (e.g., Facebook, Twitter, Instagram, YouTube, TikTok) [25], enhanced brand value of clubs, large-scale sponsorship agreements, and the rise in private investments [26] have significantly contributed to the growth in player salaries and transfer fees, the increasing physical demands of modern soccer may also be playing a role in this upward trend. Therefore, considering that contemporary soccer players exert greater physical effort compared to their predecessors, it is plausible that this increase in performance may have contributed significantly to the rise in market value.

Different sub-factors representing the performance component in the literature have led to conflicting findings on the relationship between soccer player performance and market value. Indeed, there is a study that reports that the relationship between soccer player performance and market value is much less dependent on the field than assumed [9], whereas there is a study that reports the opposite [23]. It has also been reported that club reputation has a significant relationship with the market value of soccer players and that soccer players who are considered star players are over-evaluated by approximately 70%, thus containing a commercial dimension [22]. A team's financial soundness and team performance are important reputational indicators [27]. League level of a team and its success in major organizations lead to a higher perception of the value of team players [28]. Consequently, while the individual performance of the player is an important factor for market value, the reputation of the team has significant effects on the perceived value of the player [22]. External factors such as the player's age, position, quality of the league, nationality, injury history, reputation and brand value and transfer history are other external factors that affect the market value of the player [29, 30].

The practical implication of our findings is that even if scouts select players according to their team's needs, it is an important choice for team performance to select athletes with better running performance (i.e., running speeds higher than 15 km/h, ability of higher number of sprints and top speeds). Moreover, it should be noted that this is the same for all positions. Although, for all cases, only very weak correlations were denoted. Much more relevant were the moderate associations found between the market values of the highest players with zone 5 (> 25 km/h) and top speed, which means that higher relevancy should be given to those metrics when analysing match data and when preparing specific training drills.

This were followed by a negative association between the market values of the highest players with total distance which means that those players tend to cover a lower distances, being more intelligent in conserving energy, managing pacing and their fatigue which consequently allows higher levels at high intensity [31]. Our results provide useful insights, especially for clubs whose policy is to catch young and talented players early, discover their potential, and then transfer them to other clubs with high transfer fees. On the other hand, our findings also provide insights for another stakeholder of the transfer process, the soccer players. Although performance declines with age, minimizing the decline in high-intensity running performance (e.g., > 15 km/h) through specific training interventions may allow them to play longer and for relatively higher salaries.

Limitations and recommendations for future studies

Limitations of the present study included the data collection procedure, as it was performed from an open, online database. Transfermarkt is a platform that operates based on the 'wisdom of crowds' approach [32]. The subjective evaluations of its members are analyzed according to specific criteria and are then processed by the platform to estimate players' market values [33]. Although this method is effectively reflects general market trends [34], provides a reliable estimate of players' market value [35] and frequently used in academic research [36], it may involve certain biases. In addition, only distance-based running metrics were used while other accelerometry-based measures (e.g., acceleration and deceleration) would provide further insights. Moreover, the positional, tactical roles and systems and were defined by coaches of the different teams which limited the findings. Furthermore, only three positions were considered for analysis which may influence the results. For instance, when comparing full-backs and centre-backs, higher values are usually found for fullbacks [37] and such analysis was not included in the present study. Finally, the analysis derived from FIFA World Cup Qatar 2022 may differ from other scenarios [16, 18].

In future studies, examining the relationship between a performance score calculated by a combination of technical parameters, running and accelerating metrics obtained from running and the market values of soccer players may provide a better understanding of the subject. Moreover, more playing positions should be considered for better context of the results (e.g., centre-backs, full-backs, centre midfielders, defensive midfielders, attacking midfielders, wingers, and centre forwards. In addition, identical studies can be replicated with goalkeepers which present a different positional, tactical and technical role when compared with other positions. Finally, a replication of the present study in female players would be very interesting to provide transparency and equality for all players.

Conclusion

Overall, there were very weak correlations between market value and running performance metrics. When analyzed by position, only midfielders showed weak positive correlations between market value and high-intensity zones, sprint count, and top speed. Among the top 20 highest-valued players, moderate negative correlations were found with total distance and low-intensity running, while top speed showed a moderate positive correlation with market value. These findings suggest that running capacity at different thresholds may play a more critical role in determining player value, particularly among elite players.

In conclusion, selecting players with a strong high running profile may be beneficial for teams, and training programs aiming to improve running abilities could support both athletic development and the maintenance of players' market value over time. Moreover, clubs may identify talented players with the potential for a strong high-intensity running profile and, by nurturing their development, generate high revenue from their future transfers.

Abbreviations

GPS	Global Position System
OT	Optical Tracking
DF	Defender
MF	Midfielder
FW	Forward
HSR	High Speed Running

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Not applicable.

Author contributions

Conceived and designed research, A.K., M.E.K and A.E.; Data collection, M.E.K; Analyzed data, H.B.; Interpreted results of statistics, H.B. and A.E.; Prepared figures, H.B., M.E.K.; drafted manuscript, A.K., M.E.K., O.K. and R.O.; Edited and revised manuscript, A.K., M.E.K., O.K. and R.O. All authors have approved the final version of the manuscript.

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Data availability

Data are available for research purposes upon reasonable request to the corresponding author.

Declarations

Ethics approval and consent to participate

The data of our study were published publicly by FIFA. Therefore, informed consent was not requested. We still applied to the local ethics committee of Çukurova University (Adana, Turkey) and received ethics committee approval (Decision No: 147/68, Approval Date: 6 August 2024).

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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