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THE RELATIONSHIP BETWEEN THE MATCH ANALYSIS RESULTS AND RANKING OF SUCCESS IN TURKISH SPOR TOTO FOOTBALL SUPER LEAGUE

RAZMERJE MED REZULTATI ANALIZE TEKEM IN LESTVICO USPEŠNOSTI V TURŠKI TOTO NOGOMETNI SUPER LIGI

ABSTRACT

The purpose of the research was to examine the relationship between ranking of success and match analysis parameters, and to develop a regression formula to understand the effectiveness of these parameters on league score in the season of 2018-2019 Turkish Spor Toto Football Super League. A total of 306 competitions in the league consisting of 18 teams in the season of 2018-2019 were examined. The parameters used in the current research were total, high intensity, and sprint running distances with or without ball, number of successful shots and passes, ball possessions in the first, second and third regions, and points earned at the end of the season. In accordance with the findings, the most related parameters to the league score were total running distance with ball, and the number of successful shots and passes ($p<0.01$) and high intensity running distance with or without ball, sprint running distance, successful passes, and shots were mostly seen in the third region in the season of 2018-2019 Turkish Spor Toto Football Super League. The multivariate linear regression analysis $F(7,10)=6.05$, $p=0.0058$ was found statistically significant, and showed that 68 % of the variance in the dependent variable (R^2 adjusted=0.68) was explained by the ratio of high intensity running distance with ball to high intensity running distance, sprint distance with ball to sprint distance, and the number successful shots and passes. Future studies may also examine the match location, defensive parameters, opposing teams, and other match analysis parameters.

Keywords: match analysis, football, soccer, scouting

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IZVLEČEK

Namen raziskave je bil preučiti razmerje med razvrstitvijo na lestvici uspešnosti in parametri analize tekem ter razviti regresijsko formulo za razumevanje učinkovitosti teh parametrov na rezultat v turški nogometni toto ligi v sezoni 2018/2019. Pregledanih je bilo 306 tekmovanj lige z 18 nogometnimi ekipami v sezoni 2018-2019. Parametri, ki smo jih uporabili v raziskavi so: skupna, visoka intenzivnost in šprinterske tekaške razdalje z ali brez žoge, število uspešnih strelov in podaj, posest žoge v prvi, drugi in tretji regiji, ter točke, zaslužene na koncu sezone. V skladu z ugotovitvami so bili najbolj povezani parametri z ligaškim rezultatom skupna tekaška razdalja z žogo ter število uspešnih strelov in podaj ($p<0,01$). Rezultati multivariatne linearne regresijske analize $F(7,10)=6,05$, $p=0,0058$ so se izkazali za statistično pomembne, kjer odvisna spremenljivka razlaga 68 % skupne variance n podaj. V prihodnjih študijah je potrebno preučiti tudi lokacijo tekme, obrambne parametre, nasprotne ekipe in preostale parametre analize tekem.

Ključne besede: analiza tekem, nogomet, nabor mladih

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INTRODUCTION

Football, which has a complex structure, has many intrinsic and extrinsic factors that affect success as in other team sports (Sarmento et al., 2018). Nevertheless, due to its complex structure and the fact that the direct contribution of all physiological, psychological, cognitive and environmental parameters that affect performance to the score is not always measurable during the game, a game's technical, tactical and sports-specific parameters were started to be monitored. According to Carling et al. (2005), the main reason of using match analysis is to collect objective data that provides feedback about performance. The objectivity of the collected data is considered a substantial factor, which prevents the subjective evaluation of coaches (Hughes and Franks, 2004), and enables them to observe the strengths and weaknesses of each player and the whole team, and to create an effective training program (Carling et al., 2008). Another benefit of performing match analysis is to examine the changes in the teams' and countries' approaches to the game over time. This time-dependent change in the football game will provide information about different football styles and will be used to determine the strategies that the teams will create against their opponents.

Since the first research on match analysis in 1910, nowadays, with the developed technology, it was said that a computer-video based match analysis program could present numerous descriptive, comparative, contextual, and predictive data to trainers (Sarmento et al., 2014). For instance, De Baranda et al. (2008) reported that goalkeepers use feet to control the ball and to save a goal, and they change their body position before technical movements. Sarmento et al. (2014) showed in their review article that football players from different positions such as defense, midfield, and forward have different physical and technical characteristics. In another study, Dellal et al. (2010) found that forward players sprint four times more than defenders and back players during offense. These analyses was also used to compare the differences among countries. Dellal et al. (2011) indicated that players from Spanish and England Premier Leagues have different approaches to football, and this creates observable technical and physical patterns during a game. Even if 70 % of total exercises are performed at low intensity (Osgnach et al., 2010), the fact that physical intensity during a football match is generally at the level of 80-90% of the maximal heart rate (Hoff, 2005) shows the importance of high intensity activities in winning the game (Güler et al., 2020). For this reason, the total distance, and the distance covered at different speeds are also investigated. Rampinini et al. (2009) found that the players of the top five teams covered more total distance in high-intensity runs than the players of the last five teams in the ranking. They also reported that their technical abilities such as passes,

shots, attacks with the ball etc. were more successful. It was also stated that the quality of opponents is one of the key factors that affects the distance covered low intensities. When the quality of an opponent is high, the low-intensity running distance (<14.1 km/h) covered in the match increases (Lago et al., 2010). A similar study conducted for comparison the physical properties of elite national and international players (Bradley et al., 2010). According to the results of the research there were no statistical differences in high intensity running distance, running speed, and recovery process of the players. These findings suggest that the success of elite players depends not only on physical attributes but also on technical and tactical skills. This was explained by the concept of creativity. In spite of the fact that goal scoring is the most valid indicator of winning (Sarmento et al., 2014), researchers did creativity assessment by using match analysis (Kempe and Memmert, 2018).

The aim of the present study was therefore firstly, to understand the relationship between ranking of success and match analysis parameters in the season of 2018-2019, and secondly to develop a regression formula that help to predict the effect of these parameters on league score in Turkish Spor Toto Football Super league.

METHODS

Turkish Football Super League, one of the most frequently mentioned leagues in the world, ranked sixth in Europe in many ways (Çelik, 2019). In order to evaluate the relationship between match analysis parameters and ranking of success in Turkish Spor Toto Football Super League, a total of 306 competitions in the league consisting of 18 teams in the season of 2018-2019 were examined. Necessary permissions were obtained from the Sentio Sport Analytics Company from which the data was obtained. The inter-operator reliability of the company's observational system (OPTA Client System) is used by Sentio Sport Analytics Company. According to Liu et al. (2013), the reliability of data collected through OPTA Client System is at the appropriate Kappa level. The study was authorized by the Clinical Research Ethics Committee of Akdeniz University Faculty of Medicine (70904504/372).

The data used in the present study are shown in Table 1.

Table 1. The parameters that used in the current study.

Abbreviations	*Explanations*
TRD (km)	Total running distance
TRDwB (km)	Total running distance with the ball
HIRD (km)	High-intensity running distance between 20 km/h and 24 km/h
HIRDwB (km)	High-intensity running distance with the ball between 20 km/h and 24 km/h
SD (km)	Sprint distance above > 24 km/h
SDwB (km)	Sprint distance with the ball above > 24 km/h
SP	Number of successful passes
SS	Number of successful shots
BP1	Ball possession in the first region (%)
BP2	Ball possession in the second region (%)
BP3	Ball possession in the third region in (%)
P	Points earned at the end of the season
R	Ranking at the end of the season

Statistical analysis: Firstly, the normality of the data were analyzed by using Shapiro-Wilk test, and those with ±2 limits for skewness and kurtosis indices calculated by dividing the skewness and kurtosis values by their own standard errors were considered to be normally distributed. The Pearson Correlation coefficient was used to determine whether there was a significant relationship between the evaluated physical and technical parameters and the league score. These analyses were performed using SPSS v.18 software package (SPSS Inc., USA). A multivariate linear regression analysis was performed using the STATA 14 (Data Analysis and Statistical Software) program in order to predict the league score through the determined variables. Variables with multicollinearity problems were proportioned with each other and new variables were created. The BP1 variable was removed. Multivariate linear regression analysis was performed using the following independent variables: the ratio of TRDwB to the TRD, ratio of HIRDwB to HIRD, ratio of SDwB to SD, number of SP, number of SS, BP2, and BP3.

RESULTS

The mean values and standard deviations of the used parameters of the eighteen teams are shown in Table 2.

Table 2. The means and the standard deviations of the collected data.

R	TRD	TRDwB	HIRD	HIRDwB	SD	SDwB	SP	SS	BP1	BP2	BP3	P
1	106.41	41.49	4.20	1.81	2.48	1.22	387.81	10.09	28.28	50.45	21.27	69
2	112.63	46.21	4.72	2.00	2.48	1.14	445.59	9.06	27.39	49.60	23.01	67
3	107.87	40.70	4.59	1.94	2.53	1.22	380.00	9.76	26.94	51.14	21.90	65
4	108.69	40.23	4.45	1.95	2.50	1.16	369.50	10.94	28.73	49.04	22.22	63
5	108.03	34.23	4.28	1.69	2.36	1.04	272.41	7.32	31.79	47.84	20.38	47
6	110.30	40.42	4.58	1.95	2.54	1.19	383.55	8.41	26.85	49.49	22.66	46
7	109.27	36.29	4.30	1.66	2.30	1.09	294.48	6.73	36.48	46.52	17.00	45
8	111.39	36.41	4.61	1.71	2.39	1.01	304.16	6.76	29.19	50.33	20.47	44
9	107.44	34.78	4.49	1.85	2.49	1.12	291.50	7.56	27.59	49.31	23.09	44
10	108.10	36.46	4.17	1.68	2.45	1.17	311.16	8.42	30.45	49.49	20.05	41
11	112.17	40.58	4.44	1.90	2.55	1.30	340.24	8.24	31.89	47.92	20.19	41
12	111.21	37.92	4.88	1.99	2.67	1.27	341.61	9.30	27.97	49.22	22.82	41
13	105.15	34.02	4.08	1.59	2.26	1.03	286.06	7.26	33.03	47.64	19.33	40
14	111.64	38.57	4.95	2.13	2.74	1.33	313.23	9.72	29.19	47.49	23.33	39
15	109.43	37.67	4.45	1.81	2.63	1.23	318.00	7.76	31.33	48.51	20.17	38
16	112.08	38.66	4.70	1.85	2.76	1.25	327.73	7.65	26.44	51.80	21.76	37
17	111.00	37.77	4.29	1.72	2.30	1.01	315.39	8.12	30.43	48.28	21.30	35
18	108.83	36.12	4.14	1.67	2.29	1.07	316.09	7.12	30.48	49.05	20.48	27
Means	**109.54**	**37.40**	**4.46**	**1.83**	**2.48**	**1.16**	**333.25**	**8.35**	**29.69**	**49.06**	**21.19**	**46.17**
	±2.14	±3.03	±0.25	±0.15	±0.15	±0.10	±44.41	±1.22	±2.58	±1.35	±1.61	±12.14

R: Ranking at the end of the season, TRD: Total running distance in km, TRDwB: Total running distance with the ball in km, HIRD: High-intensity running distance between 20 km/h and 24 km/h in km, HIRDwB: High-intensity running distance with the ball between 20 km/h and 24 km/h in km, SD: Sprint distance above > 24 km/h in km, SDwB: Sprint distance with the ball above > 24 km/h in km, SP: Number of successful passes, SS: Number of successful shots, BP1: Ball possession in the first region in %, BP2: Ball possession in the second region in %, BP3: Ball possession in the third region in %, P: Points earned at the end of the season.

According to Pearson Correlation analysis, the relationship among the mean values of the observed parameters is shown in Table 3.

Table 3. The relationship between the league score and match analysis parameters.

	P	TRD	TRDwB	HIRD	HIRDwB	SD	SDwB	SP	SS	BP1	BP2	BP3
P	1											
TRD	-.186	1										
TRDwB	,650**	,454	1									
HIRD	,110	,691**	,417	1								
HIRDwB	,362	,503*	,658**	,838**	1							
SD	,055	,466	,372	,776**	,775**	1						
SDwB	,118	,328	,455	,569*	,755**	,879**	1					
SP	,710**	,275	,955**	,335	,597**	,285	,363	1				
SS	,647**	,013	,636**	,348	,712**	,454	,563*	,660**	1			
BP1	-,341	-,242	-,493*	-,562*	-,619**	-,573*	-,368	-,578*	-,509*	1		
BP2	,336	,082	,366	,253	,206	,378	,188	,463	,257	-,811**	1	
BP3	,263	,308	,457	,670**	,788**	,588*	,419	,497*	,597**	-,881**	,450	1

* p<0.01; ** p<0.05

The multivariate linear regression analysis F $(7,10)=6.05$, p=0.0058<0.01 was found statistically significant, and showed that 68 % of the variance in the dependent variable (R^2 adjusted= .68) was explained by the independent variables (table 4). According to the variance inflation factors (VIF) obtained, there is no multicollinearity problem in the model (Max. VIF=6.87) (Gujarati, 1995). In accordance with the results of the Shapiro-Wilk W normality test, the residues are normally distributed (p=0.8808>0.10). According to White's test, no problem of varying variance was encountered in the model (p=0.3888>0.10) (White, 1980). The Link test results showed that there is no specification error in the model (p=0.787>0.10), and the Ramsey test indicated that a necessary variable was not left out in the model (p=0.0745>0.05) (Ramsey, 1969).

According to the regression analysis, as the ratio of HIRDwB to the total HIRD increases by 1 km, the league score decreases by 3.45, and this decrease is significant at the error level of 0.10 (the ratio of HIRDwB to HIRD= -3.455449, p=0.050). When the ratio of SDwB to SD increases by 1 km, the league score also increases by 2.38 points, and this increase is significant at the error level of 0.05 (the ratio of SDwB to SD=2.383946, p=0.021). Additionally, it was found that a rise of one successful pass contributes 0.12 points to the league score, and this increase is significant at the error level of 0.05 (SP=0.1241754, p=0.045) and one successful shot increases the league score 5.70, and this increase is significant at the error level of 0.05 (5.705136, p=0.019). Unlike other parameters mentioned above, the ratio of TRDwB to TRD, and BP2 and BP3 were not significantly effective on league score (3.775533, p=0.118; 2.732382, p=0.111; and -2.860537, p=0.133 respectively).

Table 4. The multivariate linear regression analysis results.

Dependent variable: Point	Coefficient	Robust Std. error	t	P
The ratio of TRDwB to the TRD	3.775533	2.206342	1.71	0.118
The ratio of HIRDwB to HIRD	-3.455449*	1.554445	-2.22	0.050
The ratio of SDwB to SD	2.383946**	0.8733459	2.73	0.021
The number of SP	0.1241754**	0.0541737	2.29	0.045
The number of SS	5.705136**	2.045363	2.79	0.019
The percentage of the BP2	2.732382	1.564067	1.75	0.111
The percentage of the BP3	-2.860537	1.750511	-1.63	0.133
Stable	-233.1375	107.4349	-2.17	0.055
N= 18, F(7,10)= 6.05 (p= 0.0058 <0.01)				
Shapiro Wilk W test	p value 0.8808 >0.10			
White test	p value 0.3888 >0.10			
Link test	p value 0.787 >0.10			
Ramsey RESET test	p value 0.0745 >0.05			
Max. VIF= 6.87				
R^2= .8089				
R^2 adjusted= .6752				
*: 0.10; **: 0.05				

DISCUSSION

The purpose of the current study was to investigate the relationship between the ranking of success and match analysis parameters of all teams attended the 2018-2019 Turkish Spor-Toto Super League, and to develop a regression formula that allows predicting the effectiveness of the match analysis parameters on league score. Therefore, in order to explain the key parameters effecting the football performance in Turkey, the TRD, HIRD, and SD or SDwB, SP, SS, BP1, BP2, BP3, league score and ranking of success parameters were evaluated.

In the current study, SS were related to the TRDwB, HIRDwB, SP (p.0.01) and SDwB (p<0.05). Besides, the league score was highly affected by SS (p<0.01). Similar results were found by Souza et al. (2019). Authors indicated that the most crucial attacking parameters that affecting the league score were firstly number of shots and secondly the number of corners. Although the number of corners was not examined in the current study, a highly significant correlation was found between the SS and the league score. Similar results showing the importance of the

number of shots were also found by Szwarc in Champions League matches (2007) and Broich et al. (2014) in the Bundesliga. Besides, SS or shooting accuracy was one of the decisive distinction between the best and worst ranked teams in La-Liga in 2008-2009 (Lago et al., 2010), and 2012-2013 (Souza et al., 2019). In line with the mentioned research, Castellano et al. (2012) reported that total shots and SS were the most significant parameters in three World Cups played in 2002, 2006, and 2010. Rumpf et al. (2016) suggested that the winning teams had more successful shots than the losing teams in 2014 World Cup, and Rampinini et al. (2009) stated that players from the top five teams had more shots that are successful in Italian Serie A League. These findings show that teams with more ball possession closer to winning.

Another substantial parameter found related to league score at the end of the season was the SP ($p<0.01$). In the current study the SP was highly correlated to the SS, TRDwB, HIRDwB ($p<0.01$), but not with SDwB. However the SDwB was related to SS ($p<005$). These results show that players prefer to shoot at running speeds over 24 km/h. In addition, the SP decreases as ball possession increases in the first zone ($p<0.05$). In contrast, a positive correlation was found between the BP3 and the SP. Some previous studies has also reached similar conclusions. Rampinini et al. (2009) and Luhtanen et al. (2001) stated that SP are one of the related parameters to football performance with ball possession. Similarly, a research indicated that winning English professional football teams had less but SP, dribbling, and crossing (Taylor et al., 2008). Another study, performed by Harrop and Nevill (2014) showed that performing fewer but SP, SS and high intensity running was the key parameter to be on the top of the English League One. Detailed research could give more information about the relationship between pass and goal scoring in football. Hughes and Frank (2005) stated that 84 % of the goals were performed after only four or less passes. Unfortunately, this data was not accessible in the current study. Hence, the current study indicated that SP was highly correlated with total/high intensity running distance with the ball, and mostly occurred in the third region. Besides, the number of SP tends to decrease when the teams have the ball in the first region.

The HIRD ($p<0.05$), HIRDwB ($p<0.01$), and SD ($p<0.05$) were negatively correlated with the BP1. Both SP and SS were also negatively related to BP1 ($p<0.05$), and positively correlated with the BP3 ($p<0.05$ and $p<0.01$ respectively). There was found a negative correlation between BP1 and BP2, BP3 ($p<0.01$). These results suggest that teams in possession of the ball are more likely to pass and shoot successfully. Lago and Martin stated ball possession as a key factor of football performance (2007). Castellano et al. (2012) investigated 177 matches played in three World Cups in 2002, 2006, and 2010, and found that ball possession was a discriminating

variable in 2006 and 2010. Lago and Dellal (2010) reported that the top teams in the Spanish League rankings have more possession of the ball. In the present study, ball possession was not correlated with the P; however, the TRDwB, HIRD, HIRDwB, SD, and SP were negatively correlated with the BP1. Unlike the BP1, the BP3 was found related to HIRD, HIRDwB, SD, and SP positively. In line with the current study, Barreira et al. (2016) suggested that ball possession was not an effective factor on winning the match. They stated that losing teams had less shots and successful shots when compared with winning and drawing teams.

Findings show that a high level of TRD was related to increased HIRD and HIRDwB ($p<0.01$ and $p<0.05$, respectively). Similarly, an increased TRDwB was related to HIRDwB positively ($p<0.01$), and indicates performing more SP and SS ($p<0.01$) during the game. There was a positive relationship between HIRD and HIRDwB, SD ($p<0.01$), and SDwB ($p<0.05$). In addition, the HIRD, HIRDwB ($p<0.01$), and SD ($p<0.05$) was mostly occurred in the third region. The HIRDwB was highly correlated with the SD and SDwB ($p<0.01$), and affected more SP and SS ($p<0.01$). When the running distances at different intensities with or without ball examined, different results are reached in the literature. It was found that players in the first five teams in Premier League ranking had less HIRD than other players (Di Salvo et al., 2009). Hoppe et al. (2015) suggested that there was no relationship between points earned and TRD in Bundesliga. However, they also indicated that TRDwB had positive effects on league score. Similarly, Rampinini et al. (2009) showed the effect of the total and high intensity distances covered with ball on league score in Italy. Previous studies performed in Turkey did also examine same parameters. Kahraman (2019) found the distance covered with ball by teams was the main reason of being at the top level in Turkish Super League, while total distance covered without ball had no effect on being successful. Another study investigating the Turkish Spor Toto Super League in the season of 2017-2018 suggested that most correlated parameters to the league ranking were ball possession and SP. When these findings are compared with the current research, it could be seen that the effect of the percentage of ball possession on the ranking in a year in the Turkish Spor Toto Super League has decreased. However, the SP still has a significant effect on the league score.

The multivariate linear regression analysis was used to test the effectiveness of the ratio of TRDwB to TRD, the ratio of HIRDwB to HIRD, the ratio of SDwB to SD, the SP, SS, BP2 and BP3 on the league score. According to the analysis it was found that only the ratio of the TRDwB to TRD, the percentages of BP2, and BP3 were not effective on the ranking of success significantly. However, increased level of SDwB to SD, and the SP and SS caused positive

changes on the league score. A rise of 1 kilometer in the ratio of SDWB to SD increased the league score 2.38 points ($p<0.05$). Because of the fact that previous studies have shown successful teams cover more distance at higher intensities than lower intensities (Mohr et al., 2003, Rampinini et al., 2009), this result obtained in the current study could be considered in line with the literature. The effect of one SP or SS was 0.12, and 5.70 points respectively ($p<0.05$). Unlike the other parameters, the increase in the ratio of HIRDwB to HIRD, negatively affected the league score. The league score tended to decrease by 3.45 points for each kilometer increased in HIRDwB's ratio to HIRD ($p<0.05$). This regression analysis used in the current study could explain the 68 % of the total variance ($p<0.05$). Such regression analyses are used in soccer-related match analyses studies to estimate the value of the dependent variable or to examine the effect of the independent variables. Souza et al. (2019) developed two regression formulas to predict the end-season number of points by using offensive and defensive parameters. The formula based on offensive parameters included shots, successful shots and passes, penalty kicks, free kicks, corners, offsides, total crosses, turnovers and fouls received, and was able to explain 84.1 % of the total variance of the league score. Although the percentage of total variance in the current study is statistically sufficient, the reason why it is lower than Souza et al.'s study may be the small number of parameters used.

CONCLUSION

In accordance with the regression analysis, it could be stated that the ratio of HIRDwB to HIRD, the ratio of SDwB to SD, SP and SS are the indicators that are most associated parameters with the league score in Turkish Spor Toto Football Super League. Furthermore, these were other main conclusions: a) P was highly related to the TRDwB and SP and SS; b) HIRD or HIRDwB, SD, SP and SS were mostly seen in the third region. These correlations show that the game is played the fastest in the third region. Although an entire season's matches have been examined in the current research, the present study has some limitations. In the literature, it is said that football performance depends on many internal factors including anaerobic power and endurance, sprint ability, and external factors such as weather conditions, referee, opposing team, match location. However, the number of parameters examined in the current study was limited. Further research may also examine match location, defensive parameters, opposing teams, and other match analysis parameters such as the number of corners, free kicks, assists, number of passes before goal, fouls, and offsides etc.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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