Quantitative Analysis of Goals Scored from Set Pieces: Turkey Super League Application

Duran Toplardan Atılan Gollerin Niceliksel Analizi: Türkiye Süper Lig Uygulaması

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ABSTRACT Objective: The aim of our study was to investigate the effects of set-piece goals (throw-in, corner, free kick and penalty) on competition results in the Turkey Super League over five seasons (2006-2007, 2007-2008, 2008-2009, 2009-2010 and 2010-2011) based on realization time (0-15, 16-30, 31-45, 46-60, 61-75 and 76-90), the status of being a home or away team, the kick area of the goals (12 penalty areas, 4 out of penalty areas) and striking technique (inside kick, inner side of instep kick, instep kick, outside kick, header and special skill). Additionally, we aim to analyze the association between the kicking area of goals and set-piece goal types, as well as between set-piece goal type and striking techniques. **Material and Methods:** A total of 3614 goals based on 1530 matches have been analyzed in this study. The distribution of set pieces has been investigated according to defined parameters. The frequency and percentage values of the data have been calculated using Microsoft Office Excel and chi-square test was used to calculate relations between variables. **Results:** The number of organized attack goals was 2594 (71.78%) and the number of set-piece goals was 1020 (28.22%) within the five seasons encompassing the 2006-2011 seasons. The highest number of set-piece goals were scored between the 76th and 90th minutes (n=221, 21.67%), from free kicks (n=404, 39.61%), from closest areas (n=606, 88.58%) and from headers (n=377, 37.06%). **Conclusion:** Based on our data, goals scored from set pieces have a remarkable effect on competition results; therefore, the importance of time interval, goal type, areas and kicking type of set-piece goals have been emphasized for coaches.

Key Words: Soccer; goal analysis; set pieces

ÖZET Amaç: Bu çalışmanın amacı, Türkiye Süper ligindeki 5 sezonda (2006-2007, 2007-2008, 2008-2009, 2009-2010 ve 2010-2011) duran toplardan (taç atışı, korner, serbest vuruş ve penaltı) atılan gollerin; gerçekleşme zamanları (0-15, 16-30, 31-45, 46-60, 61-75 ve 76-90), deplasman ve ev sahibi takımı olma durumu, gol vuruş bölgesi (12 ceza sahası bölgesi, 4 ceza sahası dışı bölgesi), ve son vuruş tekniğinin (iç vuruş, üst vuruş, iç üst vuruş, dış vuruş, kafa vuruşu ve özel teknik) müsabaka sonucuna etkilerini araştırmaktır. Ayrıca, duran top golleri ile vuruş bölgeleri ve vuruş tekniği ilişkisinin analiz edilmesi çalışmanın bir diğer amacını ortaya koymaktadır. **Gereç ve Yöntemler:** Bu çalışmada toplamda 1530 maçta atılan 3614 gol incelenmiştir. Duran toplardan atılan gollerin dağılımı belirlenen parametrelere göre değerlendirilmiştir. Elde edilen veriler, Microsoft Office Excel programında frekans ve yüzde değerleri hesaplanarak ve ilişki testleri için ki-kare testi kullanılarak derlenmiştir. **Bulgular:** Çalışma sonucunda organize atak gollerinin sayısı 2594 (%71,78), duran top gollerinin sayısı 1020 (%28,22) olarak belirlendi. En çok gol 76-90. dakikalar arasında (n=221, %21,67), frikik gollerinden (n=404, %39,61), kaleye en yakın bölgelerden (n=606, %88,58) ve kafa vuruşlarından (n=377, %37,06) gerçekleştiği saptandı. **Sonuç:** Bu bilgilerin ışığında; duran toplardan atılan gollerin müsabaka sonucuna önemli bir etkisinin olduğu belirlenmiş ve antrenörlere, duran toplardan atılan gollerin gerçekleşme zamanı, gol türü, bölgeleri ve vuruş tipine yönelik çalışmalara önem vermeleri tavsiye edilmiştir.

Anahtar Kelimeler: Futbol; gol analizi; duran toplar

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Nowadays soccer is a sport that is followed by large crowds. The increase in studies in technology and science, and the reach of the sport extending to the masses have worked together to make this game well known. Fans and coaches can share their ideas about soccer by making distinctive observations and comments on TV and on the internet.[1] Trainers have difficulty remembering all the details of the games, partly because of the complex game analysis.[2] In the past few years, numerous studies and research projects have been carried out in an attempt to summarize the technical and tactical skills as well as to develop reliable, valid and consistent methods. The information gained from these studies could be utilized as an application tool in sport sciences, and they also could provide fast and objective support to all trainers from different sport branches.[3,4] In this sense, all measurements should be identified as practicable and objective.[5] Game analysis is divided into qualitative (application number) and quantitative (percentage of successful applications) approaches.[4] They are important tools that, could gather information about the actions of the players during the match, organize this information in accordance with aims, and increase the performance of individuals or the whole team.[2] The purpose of game analysis and observation in soccer is to record the information during training and competition objectively and to acquire correct statistical and numerical results in order to specify the optimum performance parameters.[6] In general, trainers have a chance to examine the indicators concerning the performance of either their own team or the opponent team by means of game analysis. In soccer, as in the case of other types of sports, game analysis has been utilized to evaluate predetermined performance and success norms.[4] Another highly important point of game analysis is to share all the results with players as feedback. When all the information that has been collected after the game analysis and observation results is shared with the players, the analysis process will be pleasant and appropriate. There are many various factors in soccer for success, and game analysis and observation are just a few aspects of these factors.[6]

The analysis of soccer games and sport video data has received great attention in the last decade.[7,8] While some studies focused on a specific type of set pieces, such as corner kicks in mega sport organizations, other studies compared goal scoring strategies in different leagues.[5,9-12] Moreover, comparison or deep investigation of World Cups stands as another approach of game analysis research.[7,13,14]

Regarding goal analysis, some studies have emphasized the importance of set pieces and showed that 25% to 40% of all goals were scored from set pieces.[13,15,16] De-Baranda and Lopez-Riquelme analyzed all goals scored from corner kicks in the 2006 World Cup according to match status and different performance indicators. Cerrah and Gürol emphasized the importance of set-piece goals by analyzing all free kick, corner, throw in and penalty goals for the Turkey Super League, but they did not investigate the goal areas and kicking techniques.

It has been observed in the literature that previous studies have focused on the analysis of scored goals by dividing them into time periods, and by analyzing the winning percentage of the first team to score, the winning percentage of games played at home, and all goals during a season.[3,10,17] All these studies have evaluated either more than one season or different leagues or organizations by means of the requisite consistent results but none of them analyzed different types of set pieces and final kicking types.

In this regard, the first aim of our study is to investigate the effect of goals scored from set pieces on competition results in Turkey's Super League over five seasons, based on the realization time of scored goals and the status of being either the home or the away team.[17,18] The second aim of our study is to analyze the association between the kicking area of goals and the set-piece goal types as well as the association between set-piece goal types and striking techniques. This study will be an important source for goal analysis studies for Turkey's Super League in the future, and it will also contribute to the awareness of the importance of set-piece goals among trainers.

MATERIAL AND METHODS

STUDY DESIGN

In the study, five seasons (2006-2007, 2007-2008, 2008-2009, 2009-2010 and 2010-2011) have been investigated and the effects of goals scored from set pieces (throw-in, corner, free kick and penalty) have been examined based on the realization time (0-15, 16-30, 31-45, 46-60, 61-75 and 76-90) of the scored goals, the status of being the home or away team, the kick area of goals (12 penalty areas, 4 out of penalty areas) and the striking technique (inside kick, inner side of instep kick, instep kick, outside kick, header and special skill). Numbering schemes in Figure 1 have been determined according to the position of the goalposts.

A total of 3614 goals based on 1530 matches have been investigated to reveal the total distribution of set piece, realization time within seasons, relation between kicking areas and set-piece goal types and association between kicking technique and set-piece goal types within 5 seasons encompassing the 2006-2011 seasons. Because penalty kicks occur on an exact point, they have not been assessed for kicking areas, whereas the striking technique of the penalty kicks have been evaluated according to set-piece goal types. All the goals have been evaluated according to the last strike before goal by two different soccer trainers who have either UEFA B License or TTF C License.

DATA COLLECTION

Match summaries have been elicited from the website of the broadcaster (Lig TV) during data collection. In this study, pass and goal positions up to four passes were considered as set pieces. In soccer, goals scored even from counter attacks are generally actualized after a long pass period both in Europe and in Turkey's Super League competitions. Pass and goal positions up to four passes were the limitation of our study in this sense. If the position lasts more than four passes it has been assess as an organized attack. For penalty and free-kick goals, pass and goal options as well as direct goal options have been included in our evaluation. The goals scored from free kicks have been evaluated in the same manner regardless of being indirect or direct. In this study, five seasons from 2006 through 2011 were studied.

DATA ANALYSIS

The frequency and percentage values of the data have been calculated using Microsoft Office Excel and the chi-square test was used to calculate associations between variables via the SPSS 21.0 packet program.

RESULTS

Table 1 shows the general distribution of set pieces and organized attacks according to all seasons. The frequency of set-piece goals were 1020 (28.22%) and it was 2594 (71.78%) over all seasons, respectively.

Table 2 shows that of set-piece goals, 54.04% in 2006-2007, 61.32% in 2007-2008, 60.29% in 2008-2009, 59.66% in 2009-2010 and 57.39% in 2010-2011 seasons were scored by home teams.

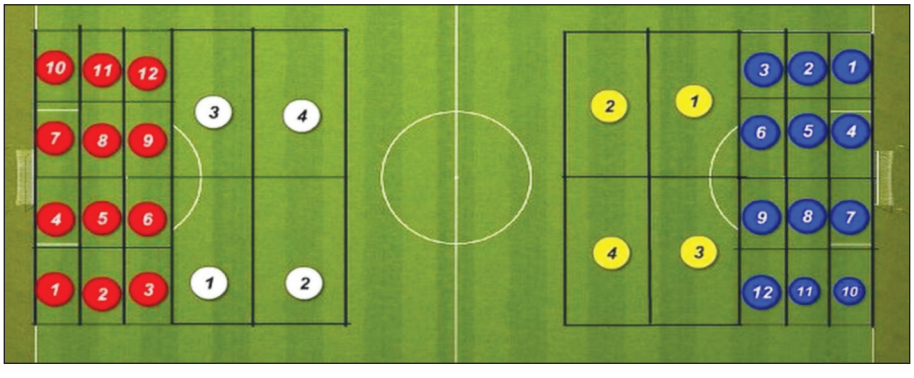

FIGURE 1: Kick areas of goals.

TABLE 1: Distribution of goals scored from set pieces and organized attacks according to seasons in Turkey's Super League

	2006-2007		2007-2008		2008-2009		2009-2010		2010-2011	
	F	%	F	%	F	%	F	%	F	%
Set Pieces	198	28.25	212	28.23	204	28.57	176	28.89	230	29.08
Org. Attack	503	72.75	539	72.77	536	72.43	455	72.11	561	71.92
Total	701	100	751	100	740	100	631	100	791	100

TABLE 2: The status of being a home or away team for set-piece goals in Turkey's Super League.

	2006-2007		2007-2008		2008-2009		2009-2010		2010-2011	
	F	%	F	%	F	%	F	%	F	%
Home Team	107	54.04	130	61.32	123	60.29	105	59.66	132	57.39
Away Team	91	46.96	82	39.68	81	39.71	71	40.34	98	42.61
Total	198	100	212	100	204	100	176	100	230	100

Table 3 shows that of the teams that scored from set pieces, 54.70% in 2006-2007, 61.58% in 2007-2008, 58.86% in 2008-2009, 55.19% in 2009-2010 and 59.47% in 2010-2011 won the competition. The reason for the different total number of set-piece goals was the tie games which cause missing values.

Figure 2 shows that the highest number of set-piece goals were scored between the 76th and 90th minutes (*n*=221) with added time inclusive at 21.67%. For subsequent ranges, 169 (16.57%) set-piece goals were scored between the 60th and 75th minutes, 131 (12.84%) set-piece goals were scored between the 16th and 30th minutes while 173 (16.96%) set-piece goals were scored between the between 31st and 45th minutes. Interestingly, the number of set-piece goals was the same for the first 15 minutes of the first and second half (*n*=163, 15.98%).

Figure 3 shows the distribution of all set-piece goals (*n*=1020) based on goal type within all five seasons. The highest number of set-piece goals were scored from free kicks (*n*=404, 39.61%). Subsequent frequencies and percentages were 65 and 6.37% for throw-in, 334 and 32.75% for corners, and 217 and 21.27% for penalties.

Table 4 shows the association between kicking areas and set-piece goal types. Penalty goals were not been included to table since the exact point of strike. Our data showed that the 4th, 5th, 7th and 8th areas are the most important areas for goals scored from set pieces (*n*=606, 88.58%). Especially the 8th and 5th areas have the highest number of goals (*n*=167, 24.41% and *n*=156, 22.8%) respectively. Moreover, 115 set-piece goals were scored outside of the penalty area, and their distribution in order of frequency was as follows:

TABLE 3: The effects of set-piece goals on competition results in Turkey's Super League.

	2006-2007		2007-2008		2008-2009		2009-2010		2010-2011	
	F	%	F	%	F	%	F	%	F	%
Winner	99	54.70	109	61.58	103	58.86	85	55.19	113	59.47
Tie	48	26.52	37	20.90	27	15.43	41	26.62	36	18.95
Defeated	34	18.78	31	17.51	45	25.71	28	18.18	41	21.58
Total	181	100	177	100	175	100	154	100	190	100

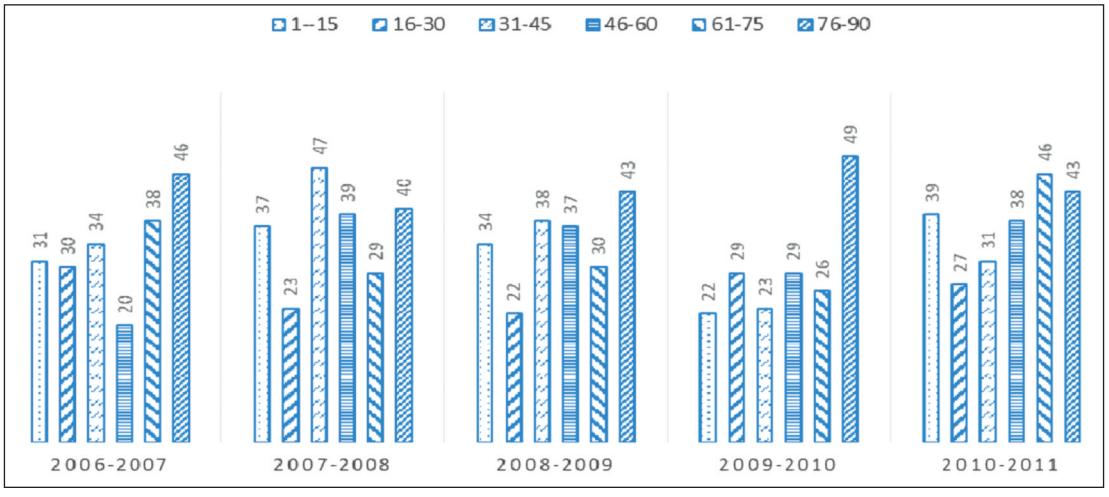

FIGURE 2: Distribution of set-piece goals based on realization time in Turkey's Super League.

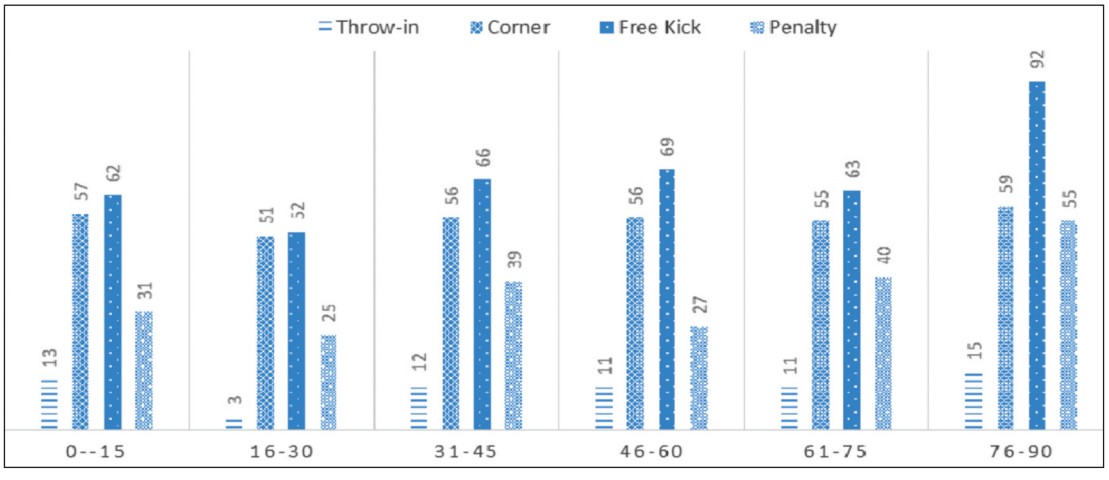

FIGURE 3: Distribution of set-piece goals based on goal type in Turkey's Super League.

from free-kicks (*n*=102), from corners (*n*=8) and from throw-in (*n*=5). The number of all goals based on Table 4 and with the addition of 115 out-of-penalty area goals and 217 penalty goals was 1016, but we investigated a total of 1020. This means four goals were scored from the out of defined areas (e.g., around center line), which is quite rare in soccer games.

Table 5 shows the association between kicking technique and all investigated set-piece goal types. Our data showed that the header is the most important kicking technique for goals scored from set pieces (*n*=377, 37.06%), especially those scored from free kicks and corners.

DISCUSSION

The timing of set-piece goals (Figure 2) shows that the highest proportion of set-piece goals were scored between the 76th and 90th minutes with added time included. The decrease of condition properties at the last phase of the competition, as well as attention and concentration deficit could be a reason for this. Table 2 shows that the status of being the home team is a significant advantage and home teams have higher set-piece goals proportionally over all seasons. The pressure on the players made by the home team audience could be a reason for this situation. Of late, the significance of

TABLE 4: The kicking area of goals scored from set pieces in Turkey's Super League (penalty area).

	Throw-in		Corner		Free Kick		Total	
Areas	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
1st	0	0	1	0.31	1	0.33	2	0.29
2nd	2	3.38	1	0.31	2	0.66	5	0.73
3rd	0	0	0	0	4	1.32	4	0.58
4th	7	11.86	73	22.67	69	22.77	149	21.78
5th	11	18.64	73	22.67	72	23.76	156	22.8
6th	3	5.08	12	3.72	14	4.62	29	4.23
7th	11	18.64	75	23.29	48	15.84	134	19.59
8th	16	27.11	75	23.29	76	25.08	167	24.41
9th	4	6.77	11	3.41	15	4.95	30	4.38
10th	2	3.38	1	0.31	0	0	3	0.43
11th	3	5.08	0	0	1	0.33	4	0.58
12th	0	0	0	0	1	0.33	1	0.14
Total	59		322		303		684	

TABLE 5: The kicking technique of goals scored from set pieces in Turkey's Super League.

	Throw-in		Corner		Free Kick		Penalty		Total	
Kicking Technique	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**	**N**	**%**
Inside	15	22.08	43	12.91	49	12.1	107	50	214	21.04
Inner side of instep	8	12.31	9	2.70	75	18.52	73	32.71	162	15.92
Instep	22	33.85	36	10.81	81	20	37	17.29	176	17.30
Outside	3	4.62	8	2.40	7	1.73	0	0	18	1.76
Header	11	16.92	201	60.36	164	40.74	0	0	377	37.06
Special	6	9.23	36	10.81	28	6.91	0	0	70	6.88
Total	65		334		404		217		1020	

set-piece goals in soccer as well as tactical strategies has increased remarkably. According to these strategies, the majority of balls especially coming from corner kicks and free kicks have been sent to behind and between the six-yard box and penalty spot. Given these circumstances, the position of goalkeepers is important so that the percentage distribution of set-piece goals is considerably high at the 4th, 5th, 7th and 8th areas (Table 4).

Most of the broadcasters and national federations have recently released a lot of statistical results of the competitions to the public. Moreover, coaches and soccer clubs have an analysis staff in addition to technical staff. Because of these positive developments, coaches have taken this statistical information into consideration during the competition preparation period. This investigation of the effects of set-piece goals on competition results in this study has proven that the majority of teams scoring from set pieces could finish the competition with a point or points. It has been observed that there were a lot of studies that have been carried out related to game analysis for World Cups, European Cups, Super Leagues and Champions Leagues in the past years. Yet, we have not discovered another study that shows parallelism with our study.

Cerrah and Gürol have indicated that there were a total of 6726 goals in eight seasons between 2001 and 2009 in Turkey's Super League.[4] In addition, 69.68% (4687 goals) of goals were from organized attacks and 30.32% (2028 goals) were from set pieces. Further, 38% (765 goals) of set-piece goals were from free kicks, while 29% (579 goals)

were from corner kicks, 24% (486 goals) were from penalty kicks, and 10% (198 goals) were from throw-ins with relative and absolute frequency. However, they did not analyze the association between the kicking area of goals and the set-piece goal types or between set-piece goal types and striking techniques.

In another study done by Turkey's Super League, a total of 910 goals for the 2001-2002 season have been investigated.[3] They showed that the average goals scored per match were 2.97, and 83.40% (759 goals) of these were kicks and 16.37% (149 goals) were from headers. Concerning the goal distribution over the 90-minute period, the 76th to 90th minutes had the highest proportion of goals with 192 goals scored, and this result paralleled our study.

Armatas et al. have investigated 558 goals scored in 240 matches in Greece's Super League over the 2006-2007 season.[10] In addition, 41.04% of the goals were scored in the first half while 58.96% of the goals were scored in the second half. In terms of goal distribution over the 90-minute period, the 76th to 90th minutes had the highest proportion of goals scored (23.3%). Moreover, 71.43% of first scoring teams won the match and 16.19% of them had a tied game, while 12.38% were defeated. These results are similar to our findings.

Imamoglu et al. have analyzed all goals that were scored in the tournaments held by FIFA (Fédération Internationale de Football Association) and UEFA (The Union of European Football Associations) in 2006.[19] They have indicated that 21.7% (31 goals) were headers, 42% (60 goals) were inside kicks, 32.2% (46 goals) were instep kicks and 4.2% (6 goals) were outside kicks. Based on the time intervals of scored goals, in the 76th to 90th minutes with added time included, the highest proportion of goals were scored 29.25% relative frequency and 43 goals for the absolute frequency.

Zhao and Li have analyzed all goals that were scored in the FIFA World Cup in 2006 based on timing periods, kick areas, shooting type of organized attack and set-piece goals.[20] They have showed that 63% (92 goals) were scored from organized attacks, 16% (24 goals) were scored from free kicks, 9% (13 goals) were scored from penalty kicks, 8% (12 goals) were scored from corner kicks and, 4% (6 goals) were scored from throw-ins of all 147 scored goals.

Yiannakos and Armatas have analyzed 32 matches of the UEFA Euro 2004, which was held in Portugal.[21] Based on their findings, there were a higher proportion of goals in the second half (57.4%). The proportion of relative frequencies of organized attack goals was 44.1%, set piece goals (corner kick, free kick, penalty, and throw-in) was 35.6% and contra attack goals was 20.3%. Furthermore, the distribution of set-piece goals was 40% from corner kicks, 30% from free kicks (direct or indirect), 25% from penalty kicks, and 5% from throw-ins.

Armatas et al. have analyzed 192 matches of FIFA World Cup 1998, 2002 and 2006.[17] The proportion of goals scored in the second half was 52.5% in 1998, 59% in 2002 and 60.8% in 2006. Goals scored between the 76th and 90th minutes, with added time included, had the highest proportion based on time intervals in all three World Cups.

Lago-Peñas et al. have analyzed 288 matches played at the group stage in the 2007-2008, 2008-2009, and 2009-2010 seasons in UEFA Champions League.[22] The evaluation parameters they used were: total shots, shots on goal, effectiveness, passes, successful passes, crosses, off sides committed and received, corners, ball possession, crosses against, fouls committed and received, corners against, yellow and red cards, venue, and the quality of opposition.

Bangsbo and Peitersen have emphasized the importance of set-piece goals in modern soccer and indicated that each team has, on average, 20 set pieces in a match.[9] Similarly, this study will attempt to change the point of view of coaches regarding set-piece goals. It has been emphasized that 29% of all scored goals for the 2010-2011 season and 28% for all other seasons were from set pieces. The percentage of set-piece goals range from 70% for organized attacks and from 30% for

set pieces.[4,20,21] Based on this information, goals scored from set pieces have a remarkable effect on competition results so that the importance of set-piece goals has been emphasized for coaches.

Additionally, the 4th, 5th, 7th and 8th areas are the most important areas for goals scored from set pieces according to data because of these four areas are the closest areas to the goalpost. The majority of balls, especially coming from corner kicks and free kicks have been sent to these areas. With respect to the kicking technique, the highest number of set-piece goals was 377 (37.06%). Considering these two variables, if teams have considerably tall players, set-piece goal strategies will be so crucial and the position of goalkeepers and strikers will also be important.

CONCLUSION

This study assessed the distribution of set-piece goals according to defined parameters over five seasons. Based on our data, trainers can modify the intensity and shape of set-piece tactics. Moreover, different studies show a consistency across seasons regarding the realization time of scored goals. The majority of scored goals were between the 75th and 90th minutes, with added time included, across many seasons and competitions.[3,10,17,19] Coaches should be made aware of potential offensive and defensive strategies during the last quarter of the game, due to the high percentage of goals scored between the 75th and 90th minutes.

On the other hand, the percentage of organized attack goals is still high at around 70%. Therefore, other studies should analyze the distribution of organized attack goals according to kicking areas and striking techniques. These kinds of studies could provide important data, which could allow new training strategies according to striking type and area, especially in the youth age groups.

In conclusion, it has been recommended that goal analysis studies should have been done for more than one season, for organized attacks, and for other leagues besides Turkey's Super League for future studies.

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