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Areal Distribution of the Number and Intensity of Steps in Won and Lost Badminton Rallies[1]

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Abstract

Badminton is an Olympic sports branch requiring high performance. This study is conducted in order for revealing how the number of steps of badminton athletes is distributed in front, middle and back courts in each rally, and the role that the number of steps plays in terms of winning or losing the competition. The sample group of the study comprises of 8 single-male and 8 single-female matches in European Junior 19 Championship organized in Turkey in 2013. 56,619 steps in total in 1203 rallies were examined within the scope of the study.

Badminton court was divided into three main parts as front, middle, and backcourts, and all steps were classified and counted according to these three parts. Field length and width of each part is 2.23 m x 5.18 m, and the total of each part was determined as 11.91 m^2. Image recording for this study is accomplished by using two Panasonic SDR-H20 cameras. Percentage, arithmetic average, standard deviations were used in the analysis of data, and Mann Whitney U test was used as a non-parametric test for the significance test of the difference between two averages.

It was revealed in the study that there is a significant gender difference in the number of steps taken on the front and middle courts (z=, 034, P<0.05, z=, 029, P< 0.05). There was no significant difference between genders in terms of the number of steps taken in the backcourt and the total number of steps (z =, 217, P>0.05, z =, 153, P>0.05). When the areal distribution of a number of steps in each won and lost rallies is examined, it is revealed that no significant difference exists in terms of the number of steps (z =, 188 P> 0.05).

Consequently, it is determined that the total number of steps taken in each rally by athletes in international organizations is approximate in terms of won and lost rallies, and front and middle court usage were significantly different between male and female athletes.

Keywords: Badminton, number of steps, rally, gender, match analysis

[1] *This study was presented in 6th Racket Sports Symposium as Oral Presentation, in Kocaeli University in December 2013*

Introduction

Badminton is an Olympic sports branch, which has a characteristic of doing successive, short time loadings requiring high performance (Demirci, 2007). For this reason, elite athletes have to accomplish successive running techniques and fundamental stroke techniques frequently, which push to the limits of speed, agility, durability, and strength in the match (Salman and Salman, 1994; Grice, 1996; BAE, 2002). Duration of these rallies is approximately 6-12 seconds for elite athletes. And resting time between rallies is 15 seconds on average. Elite and highly competitive matches are known to take 45 minutes approximately. In this sense, badminton can be defined as a sports branch requiring aerobic and anaerobic durability due to the short time, high-effort rallies and long duration of games. Badminton is also a sports branch requiring a great deal of explosive power, swiftness, and flexibility (Chin etal., 1995; Omesegaard, 1996; Manrique and Badillio, 2003; Salman, 2007). It has been determined in various studies that some differences exist between male and female athletes in terms of rally durations, resting time between rallies and stroke diversity, although the rules of the games are the same (Salman, 2009; Heller, 2010). In another study, a number of strokes of male and female athletes in each badminton rally was examined, and it is determined that male and female athletes have 12.3 +_8.9 and 10.4 +_ 8.0 strokes, respectively. In addition, It was determined that athletes' lowest number of strokes is 2, and the highest number of strokes is 52 (Salman et al., 2013).

Athletes try to score up in each rally by using movement patterns and stroke techniques, which are, or are not similar to each other. A prerequisite for success in Badminton is to use all stroke techniques accurately and effectively as well as having right timing skills in running techniques. For this reason, stroking skill is not enough to be successful in Badminton sport; applying running techniques in a perfect way is at least as important as stroking skills (Cabello and Gnozalez-Badillo, 2013; Faude et al., 2007). In this sense, it is possible to define this Badminton sport as played with feet (running techniques). Given the fact that the single match area is 31.6 m2 in total (6.10x5.18m), the importance of having a perfect running technique in Badminton is obvious.

In this study, the distribution of the number and intensity of steps in front, middle and backcourts is examined for the rallies, which are won and lost by elite badminton athletes representing their countries in the international arena. In addition, the study searched for an answer to the question of whether the number of steps taken in each rally plays a role in winning or losing the match. The purposes of the study are considered as determining whether the number of steps taken in won and lost rallies creates a difference in winning the rally, and if it does, the level of this difference in male and female athletes.

Method

The study was conducted in European Junior 19 Championship held in Ankara ASKİ Sports Hall between the dates of March 22nd and 31st, 2013 by Turkey Badminton Federation. The population of the study comprises of elite badminton athletes who got to the quarterfinal and will play in the last 16 matches. 8 of these matches are single female, 8 are single male matches.

All steps taken by athletes during the match were counted in and these steps were classified and counted according to three parts. These are front, middle and back main parts. Length and

width of each part are 2.23m x 5.18m, respectively, and the total area is determined as 11.91 m^2.

Necessary permissions for the video recording in European Junior 19 Championship were obtained from Turkey Badminton Federation. Video recordings were carried out from a distance of 27 m to courts and a height of 12 m. Remote recording was made to obtain a clearer view to count the steps of athletes as well as not to disturb athletes' concentration. Two Panasonic SDR-H20 cameras were used to get all the video-recordings for this study, and these cameras were fixed by tripods during the match to obtain a clear view. Data were collected through the records taken by two video cameras. A total of 1203 rallies were analyzed, 581 of which belonged to female and 622 belonged to male athletes. Video-recordings related to each match were transferred to a widescreen through a projection device to analyze the obtained data and the badminton court was divided into 3 equal parts and fixed by establishing a mathematical ratio on the wide screen. Study data were collected through these videos recorded by two cameras. The study searched for an answer to four hypotheses:

There is no difference between

H0= There is no difference between the number and intensity of steps taken by male and female elite athletes in terms of areal distribution.

H1= There is a difference between the number and intensity of steps taken by male and female elite athletes in terms of areal distribution.

H0= There is no difference between the number and intensity of steps taken by male and female elite athletes in won-lost rallies in terms of areal distribution.

H1= There is a difference between the number and intensity of steps taken by male and female elite athletes in won-lost rallies in terms of areal distribution.

Percentage, arithmetic average, standard deviations were used in the analysis of data, and Mann Whitney U test was used as a non-parametric test for the significance test of the difference between two averages.

Findings

Table 1. Areal distribution of the number and intensity of steps in badminton according to the gender variable (16 matches in total, 8 of which are male and 8 are female matches).

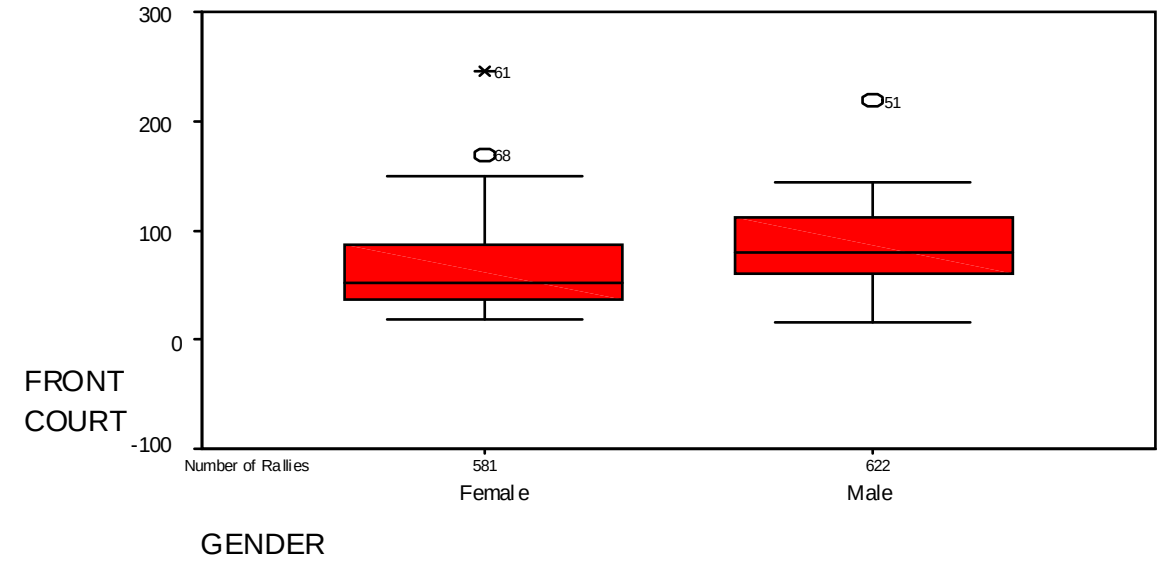
Gender	**Badminton Court Areas**							
	Front Court		Middle Court		Back Court		Total Number of Steps	
	n	%	n	%	n	%	n	%
Female	2378	8,9	15799	59,1	8568	32,0	26745	47,2
Male	3067	10,3	19239	64,4	7568	25,3	29874	52,8
General Total (n: number of steps)							56619	100,0

It can be seen in the Table 1 that 55,619 steps in total were analyzed. Female athletes took 47.2% of total steps and 52.8% were taken by male athletes. Percentages of the front, middle, and backcourt steps in a total number of steps taken by female athletes are 8.9%, 59.1%, and 32.0%, respectively. And the percentage of the number of frontcourt steps in a total number of steps taken by male athletes is 10.3%. Male athletes use middle and backcourts at the percentage of 64.4% and 25.3%.

Table 2. Areal distribution of the number and intensity of steps in won and lost rallies according to the gender variable (16 matches in total, 8 of which are male and 8 are female matches).

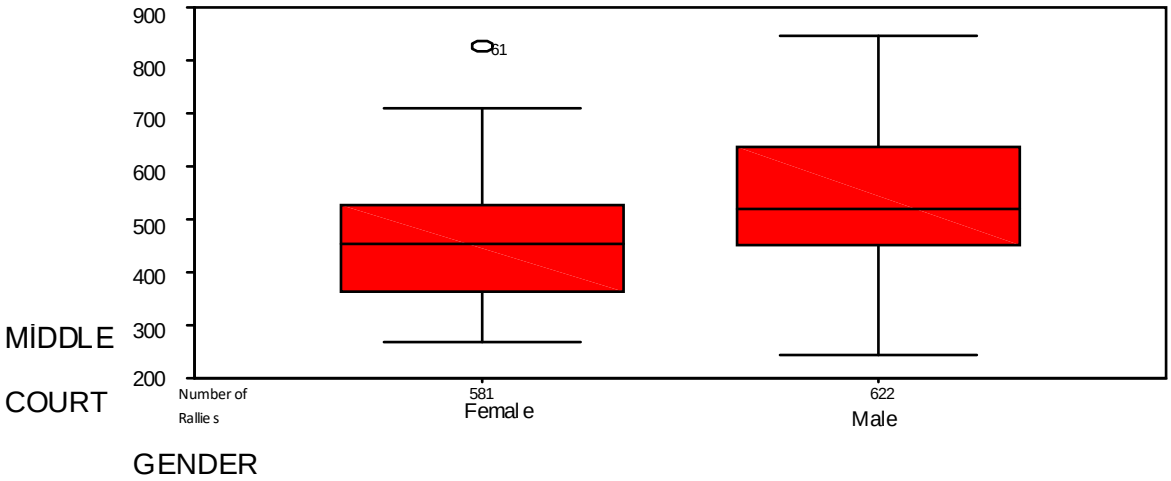
	Gender	**Badminton Court Areas**			
		FRONT	**MIDDLE**	**BACK**	**TOTAL NUMBER OF STEPS**
Number of Steps in Each Rally as $\overline{X}$ and S.S.	**Female**	77,8 ± 45,5	500,5 ± 139,2	230,5 ± 128,5	814,1 ± 207,5
	Male	85,1 ± 39,9	534,4 ± 148,3	210,2 ± 110,8	837,2 ± 221,2
Min.	**Female**	16,0	244,0	11,0	354,0
	Male	17,0	234,0	32,0	374,0
Max.	**Female**	246,0	847,0	762,0	1303,0
	Male	219,0	847,0	441,0	1227,0
Mann-Whitney U		431,500	426,500	507,000	490,500
Z		-2,122	-2,180	-1,234	-1,428
Sig.		,034*	,029*	,217	,153

When we compare female and male athletes on the basis of gender variable in terms of the number and intensity of steps in won and lost rallies, it is revealed that female athletes' number of steps reached $\overline{X}$= 814.1± 207.5 and male athletes took $\overline{X}$= 814.1± 207.5 steps. According to the study findings, it is determined that there is a significant gender difference in the number of steps taken in front and middle courts in won and lost rallies (z=, 034, P<0.05, z=, 029, P< 0.05). No significant difference was found between genders in terms of the number of backcourt steps and totaa l number of steps (z =, 217, P>0.05, z =, 153, P>0.05).



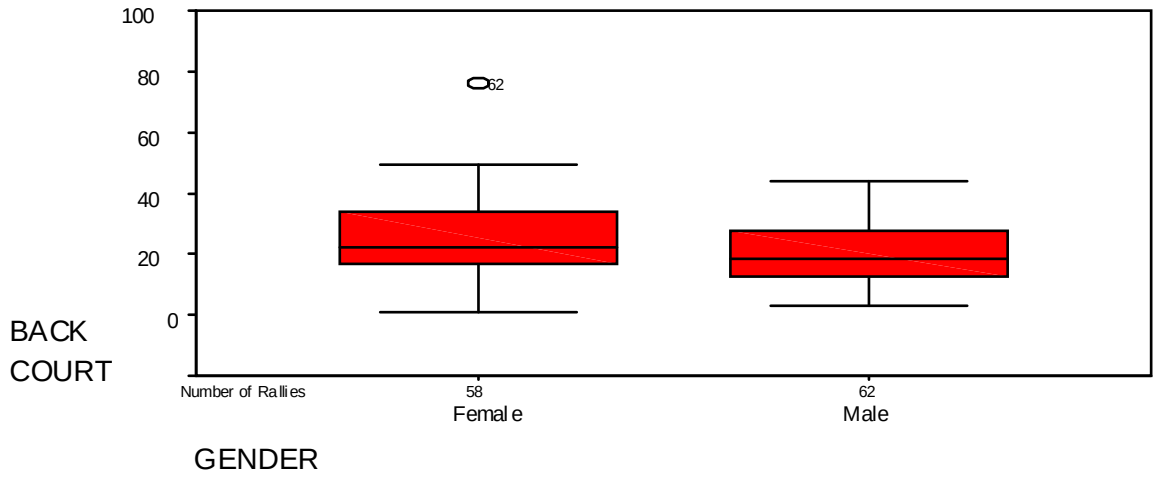
Graphic 1. Front Court Box Plot Regarding the Areal Distribution of the Number and Intensity of Steps in Won and Lost Rallies by Genders

Female athletes took 2,378 steps on the frontcourt in total. This number accounts for 8.9% of the total number of steps taken by female athletes (Table 1). The number of steps taken in the front area of Badminton court was determined as at least 16 and at most 256. The number of steps taken by female athletes on the frontcourt is $\overline{X}$=77.8 ± 45.5. Male athletes took totally 3.067 steps in frthe ontcourt in eight matches. The number of steps taken by male athletes on the frontcourt is 10.4% of the total number of steps. The number of steps taken by male athletes on the frontcourt in each rally is $\overline{X}$= 85,1 ± 39,9. Accordingly, it is concluded that there is a significant difference in the number of steps taken on the middle court between won and lost rallies based on gender (z =, 034, P<0.05).



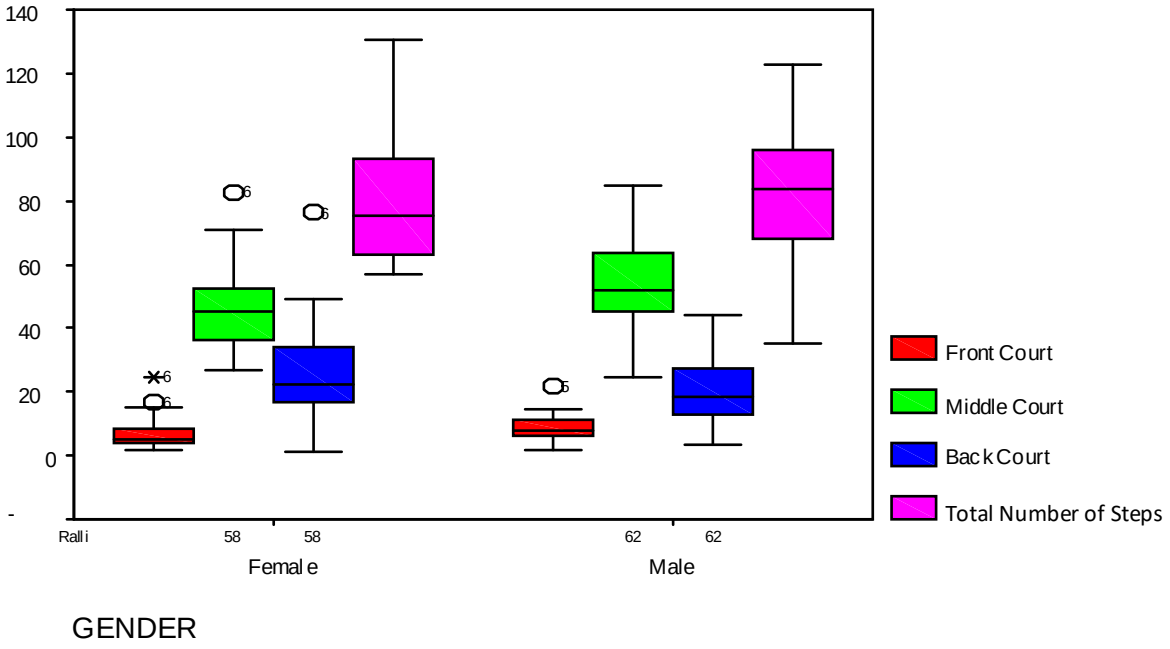
Graphic 2. Middle Court Box Plot Regarding the Areal Distribution of the Number and Intensity of Steps in Won and Lost Rallies by Genders

Female athletes took 15,799 steps on the middle court in total. This number accounts for 59.1% of the total number of steps taken by female athletes (Table 1). The number of steps taken in the middle area of Badminton court was determined as at least 244 and at most 847. The number of steps taken by female athletes on the middle court is $\overline{X}$= 505.5 ± 139.2. Male athletes took totally 19.239 steps in middle court in eight matches. The number of steps taken by male athletes on the middle court is 64.4% of the total number of steps. The number of steps taken by male athletes on the middle court in each rally is $\overline{X}$= 534.4 ± 148.3. Accordingly, it is concluded that there is a significant difference in the number of steps taken on the middle court between won and lost rallies based on gender (z =, 029, P<0.05).



Graphic 3. Back Court Box Plot Regarding the Areal Distribution of the Number and Intensity of Steps in Won and Lost Rallies by Genders

Female athletes took 8,568 steps on the backcourt in total. This number accounts for 32.0% of the total number of steps taken by female athletes (Table 1). The number of steps taken in the back area of Badminton court was determined as at least 11 and at most 762. The number of steps taken by female athletes on the backcourt is $\overline{X}$= 230,5 ± 128.5. Male athletes took totally 7,568 steps in bathe ckcourt in eight matches. The number of steps taken by male athletes on the backcourt is 25.3% of the total number of steps. The number of steps taken by male athletes on the backcourt in each rally is $\overline{X}$= 210,2 ± 110,8. Accordingly, it is concluded that there is no significant difference in the number of steps taken on the back court between won and lost rallies based on gender (z =, 217, P>0.05).



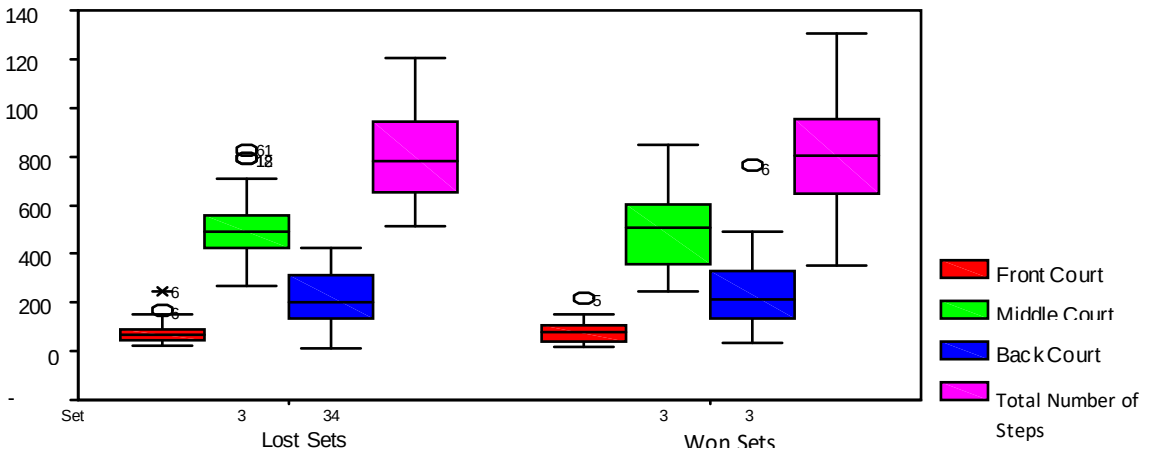
Graphic 4. Overall Box Plot Regarding the Areal Distribution of the Number and Intensity of Steps in Won and Lost Rallies by Genders

Female athletes took 26,745 steps totally in all parts of badminton court in eight matches. The number of steps taken by female athletes in each match was determined as $\overline{X}$= 814.1 ± 207. And male athletes took 29,874 steps totally in the end of eight matches. The number of steps taken by male athletes in all three parts of the court in each rally is $\overline{X}$= 837.2 ± 221.2. Accordingly, it is determined that there is no significant gender difference between won and lost rallies in terms of the number of steps taken in entire badminton court (z =, 153, P>0.05).

Table 2. Areal distribution of the Number and Intensity of the Steps in Rallies According to the Won and Lost Sets Mann Whitney U Table

Badminton Court Parts	Won/Lost Sets	Set Scores	$\overline{X}$	Std. Dev.	Benches Average	Sum of Bench Values	Mann-Whitney U	Z	Sig.
Front Court	Lost Sets	34	77,8	45,5	34,9	1187,0	592,0	, 235	,814
	Won Sets	36			36,1	1298,0			
Middle Court	Lost Sets	34	500,5	139,1	35,3	1198,5	603,5	-,100	,920
	Won Sets	36			35,7	1286,5			
Back Court	Lost Sets	34	230,5	128,5	34,3	1167,5	572,5	-,464	,643
	Won Sets	36			36,6	1317,5			
Total Number of Steps	Lost Sets	34	814,1	207,5	35,0	1191,0	**596,0**	-,188	,851
	Won Sets	36			35,9	1294,0			

When the areal distribution of the number and intensity of steps in rallies according to won and lost rallies, it can be seen that there are no significant difference in the total number of steps in none of the front, middle and back parts of the court based on winning and losing the match (z =, 188 P> 0.05).



Graphic 5. Overall Box Plot Regarding the Areal Distribution of the Number and Intensity of Steps in Won and Lost Sets by Genders

It can be seen in Graphic-5 that the number of steps in each set and in all rallies of the step shows no significant difference between front, middle and backcourts (Front Court z = 0,814, P>0.05, Middle Court z = =, 920, P>0.05 and Back Court z = 0,643, P>0.05).

Discussion and Conclusion

Contrary to what is believed, Badminton can be defined as a sports branch not played with a racket, but with feet, because changing direction fast and quickly and having a swiftness to catch the shuttlecock above the net level is required to play Badminton at an elite level. Hence, badminton athletes should move fast and quickly on the court. Therefore, bringing running techniques to perfection is an obligation for the racket and the shuttlecock to meet at optimum height and to be sent to the desired point with an accurate technique. Çümşütoğlu and Kale (1994) and Şenel et al. (1998) emphasized that one of the most important techniques during the Badminton match is stepping technique an stressed the importance of quick start principle, right floor and contact principle, integrative returning, center position, step changes, and the importance of swiftness and quickness in stepping.

According to the study results, female and male athletes take 8.9% and 10.3% of their steps on the frontcourt. Female athletes use 59.1%, and male athletes use 64.4%, of their total number of steps on the middle court. Accordingly, it is determined that there is a significant difference in the number of steps taken on the front and middle courts in terms of won and lost rallies based on gender variable (z =, 034, P<0.05, z =, 029, P<0.05). According to these data, male athletes stay longer than female athletes on the front and middle parts of the court during the match and take more steps. This situation can be explained as male athletes want to make a stroke in front and more offensive tactically (particularly net drop and smash).

The number of steps taken on the backcourt in a match is determined as $\overline{X}$= 230,5 ± 128,5 for female athletes and $\overline{X}$= 210,2 ± 110,8 for male athletes. The proportion of the number of steps on the backcourt to the total number of steps is 32.0% for female athletes and 25.3% for male athletes. According to these findings, it is determined that there is no significant difference in the number of steps taken on the back court based on genders between won and lost rallies (z =, 217, P>0.05, z =, 153, P>0.05). It is concluded that the winner and the loser reach close scores based on the number of total and back court steps and there is no significant difference between groups in terms of the intensity of steps on the backcourt. Salman et al. (2013) analyzed rally stroke diversities, loading and resting relationship for the Olympic Badminton athletes and determined that female badminton athletes use high service stroke 17.3 times, and clear stroke 3.8 times more than male badminton athletes. Given the both types of stroke are the ones which require making strokes on the back court, it is surprising that even though female athletes have to make strokes from the back court to return these kinds of strokes; there is no significant difference between groups.

When examined the areal distribution of the number of steps in rallies by won and lost rallies, it is concluded that there is no difference in the total number of steps depending on winning or losing rallies in front, middle and back parts of the Badminton court. The most important conclusion to reach here is that all athletes in the study group have high-level running and stepping techniques to the degree that has no effect on winning or losing rallies. Therefore, giving due importance to make the athletes gain less than stellar stepping and running techniques is an obligation for coaches.

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Conflict of Interest

The authors have not declared any conflicts of interest.

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