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A notional analysis in badminton sport: How the hit preferences affect the competition performance?*

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Abstract

Introduction: Badminton players make numerous kinds of hits on each point of the court during a game. In order to enhance training programs, it is significant to examine the scoring or failing hits specific to the area of the court and hit diversity of the players. **Objective:** The aim of this study is to determine the diversity and frequency of the hits of international level under-15 players and to analyze scoring or failing hits. Additionally, to evaluate scoring and failing hits specific to the areas of the court, and to define the motive behind the failing hits. **Method:** Through this study, under-15 Men's Singles (MS) (age average; 14,38 ± 0,28) games were examined in the 5th International Rumi Child Sport Games. Six countries (Turkey, Azerbaijan, Bulgaria, Macedonia, Serbia, Georgia) participated in this organization. Eight MS games were examined with the help of two cameras from different perspectives. 3114 hits were analyzed based on the areas of the court. Frequency analysis in SPSS 21.0 program was used for the statistical analysis. **Findings:** It was determined that the players performed most frequently net-drop hits (22,4 %) and lift hits (21,4 %). The players were determined to be mostly scoring with smash hits (42,3 %) and mostly failing in net-drop hits (24,6 %). Moreover, they were detected to be mostly making net faults (58,1 %) in failing hits. **Conclusion:** As a result, it is recommended particularly for the trainers of the younger players that they need to show regard to scoring or failing hits and should try to arrange their training programs so that they lessen the net faults on the areas of the court with the most number of failing hits.

Key Words: *Analysis, Badminton, Hit diversity.*

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Introduction

Badminton is a racket sport that can be played with two or four players on a rectangular court where a net divides it into two equal parts, where jumps, direction changes and rapid arm movements are needed without contact (Cabello Manrique and Gonzalez-Badillo, 2003; Kafkas, Taşkıran, Arslan, and Açak, 2009). It is a racket sport with a very old history in terms of its origins and is now a part of the program of modern Olympics. Being a funny and enjoyable sport that every person can play makes badminton favorable and widespread, while it is increasingly becoming center of interest of the masses as a performance sport with its high struggle power. Today, there are 189 member countries of the International Badminton Federation (Yüksel, 2018).

Badminton is one of the most intense competitive sports and has many factors that affect the performance of the players such as technical, tactical, physiological, and psychological factors (Xie et al., 2001). Considering that badminton is a sport in which mutual hits take place, in order to send the shuttle back to the opponent's half after each hit of the opponent, it is necessary that, during the rally, the shuttle should be met by the racket in the right position and on every point of the court. Indeed, Cabello Manrique, and Gonzalez-Badillo (2003) reported that, in a rally, the shuttle is sent back only 0.93 seconds after a hit. As a natural result of the fact that there are numerous hit types specific to badminton, it is necessary for the athletes to learn different hit types throughout a specific planning (Salman and Salman, 2009). Athletes perform their hits mainly from all parts of the badminton court, which is divided into 3 parts (front-middle-back), and the hit types can vary depending on the part. Tactical understanding is important in order to think quickly during the game and to make necessary moves considering the opponent's position, and technical features are important in order to send the shuttle to the targeted points. However, in order to implement technical and tactical preferences properly and easily, it is necessary to be at the right point at the right time. The technical hits and tactical preferences that the athlete performs during the game are important in winning or losing the rally and the competition.

In line with the strategies to be implemented in the long or short term, competition analyses are important tools, which collect relevant information about the moves performed in the sports competitions and organize these pieces of information for determining the content and management of the training that involves this information, and which are used in realizing the desired impacts on the individual performances of the athletes. In addition, many problems that can be solved through training can be obtained through competition analysis (Işık and

Gencer, 2007; Muniroğlu and Deliceoğlu, 2008). In recent years, there has been an increase in the quest for competition and player analysis in almost every sport (Ferrari, Vaz, Sousa, Couceiro and Dias, 2018; Gürkan, Göral and Saygın, 2017; Paulauskas, Masiulis, Vaquera, Figueira and Sampaio, 2018; Silva, Lacerda and Joao, 2014; Wan and Tan, 2017; Wan, Wilde and Shan 2017; Yüksel, 2018a), and in order to achieve the targeted success, it requires necessary measures to be taken in terms of training contents and competition strategies.

In the findings of the accessible literature, there are a lot of research studies conducted on physical, physiological, and psychological properties of badminton players. Besides, in order to analyze the general characteristics of badminton, Salman and Salman (2009) examined the regional distribution of scoring hits in terms of gender factor, while Ming, Keong, and Ghosh (2008) identified the differences between 21 and 15-point game systems. Chu and Situmeang (2017), and Liu, Han, and Xiao (2017) conducted a research study aiming at developing hit and training strategies supported by video and computer programs. In addition, useful studies draw attention that conducted a general analysis of badminton competitions at international and Olympic Games (Abdullahi and Coetzee, 2017; Abian-Vicen, Sanchez and Abian, 2018; Arslanoğlu, Arslan and Şenel, 2009; Chiminazzo, Barreira, Luz, Saraiva, and Cayres, 2018; Şenel and Eroğlu, 2005). In addition to the current literature findings, it is considered important for contributing to the training programs that analysis of the numerical distribution of the hits performed by the athletes should be done and the examination of the failing hits and scoring hits should be employed by taking into account the areas of the hits.

The main objective of this study is to determine the diversity and frequency of hits of under-15 international level male athletes, and to analyze the failing hits and scoring hits, and additionally, to evaluate the scoring and failing hits by their areas, thus determining the causes of failing hits.

Methods

Participants

The participants of this research were selected from the volunteer athletes. The research study was conducted on 8 men's singles competitions, in which under-15 national male badminton athletes (age; 14,38 ± 0,28) participated from 6 countries (Turkey, Azerbaijan, Bulgaria, Macedonia, Serbia, and Georgia) within the 5th International Rumi Children Sports Games.

Official Permits

Necessary permissions were gained from the organization committee and the country representatives concerning that there is no problem in conducting the research. The volunteer participants of the research filled out personal information forms and written consent forms.

Data Collection Tools

The competitions were recorded with the help of two cameras. The cameras were positioned diagonally at the back of the court. Among the hits performed by the athletes, 7 basic hit types (Clear, smash, drive, drop, clear drop, lift, and net-kill) and block hits, in total, 8 hit types were taken into consideration. It is necessary to explain two important aspects of the method of research. First, some hits, which were performed in an attempt to deceive or cannot be classified accurately and which were particular to the athlete, were evaluated in terms of the hit technique and purpose, and thus, included in its own category. Second, the last scoring hit in the rally, which was effectively carried out for both technical and tactical purposes and which subsequently won the game, or the failing hit, which resulted in losing the game, were taken into account considering the technique and areas of the hits. The type of service that athletes used for starting the game (short-long) were not taken into consideration since, in line with the subject of the research, they were not among the numerical distribution of the hit types within the game, regardless of whether they were scoring or failing hits. Certain analyses were conducted in competitions concerning the total numbers of hits of the athletes, their types and areas, the numerical distributions of scoring hit types with failing hit types, as well as area analysis of faults resulting from incorrect hits.

The court is divided into three main areas: the front, middle, and back court (Figure 1). The area between the service line and the net is classified as the front court area, the area between the service line and the doubles service line as the middle court area, and the area between the doubles service line and the back boundary line was classified as the back court.

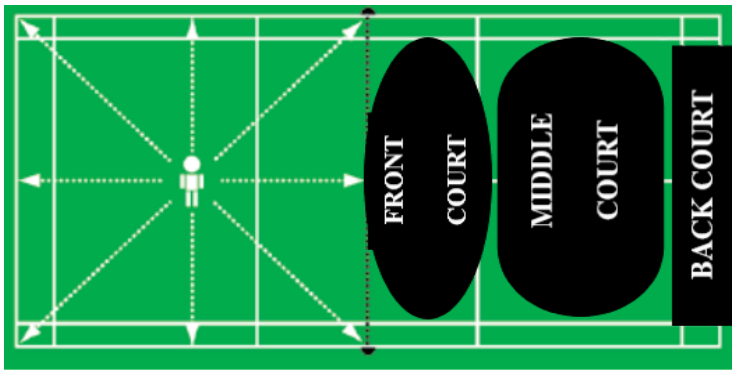

Figure 1. Parts of the court in badminton.

During the data collection process, considering the athlete characteristics (technique, experience etc.) 5 group matches together with semi-final and final matches, in total, 8 matches were analyzed. According to the camera recordings obtained from the competitions, considering the hit types and areas, totally 3114 hits were analyzed.

Statistical Analysis

In the evaluation of the data obtained from the research, SPSS 21.0 package program (IBM Corp., Armonk, NY, USA) was used and frequency analysis was conducted.

Results

Table 1. Numerical distribution of total hits and hit types of the athletes.

Hit Type	Number	Percentage (%)
Drive	244	7,8
Clear	333	10,7
Smash	503	16,2
Drop	316	10,1
Net-drop	698	22,4
Lift	667	21,4
Net-kill	68	2,2
Block	285	9,2
TOTAL	3114	100,00

Examining the Table 1, it was determined that the hit type with the highest number among 3114 hits of the men single athletes was net-drop with 22,4 % (698 hits), and subsequently lift with 21,4% (667 hits).

Table 2. Numerical distribution of the total hits and types of the athletes according to the areas.

Hit Types	FRONT COURT	MIDDLE COURT	BACK COURT	Total
Drive	9	235	-	244
Clear	-	8	325	333
Smash	5	213	285	503
Drop	-	27	289	316
Net-drop	698	-	-	698
Lift	616	51	-	667
Net-kill	68	-	-	68
Block	-	114	171	285
TOTAL	1396	648	1070	3114
Its Proportion to the Total Number of Hits	**%44,83**	**%20,81**	**%34,36**	**%100**

Examining the Table 2, it was determined that the area with the highest number of hits by the men's single athletes was the front court with 1396 hits (44,83 %) and the area with the lowest number of hits was the middle court with 648 hits (20,81 %).

Table 3. Numerical distribution of the scoring hits of the athletes.

Types of the Scoring Hits	Number	Percentage (%)
Drive	49	9,8
Clear	6	1,2
Smash	211	42,3
Drop	37	7,4
Net-drop	86	17,3
Lift	41	8,2
Net-kill	62	12,4
Block	7	1,4
TOTAL	499	100,00

Examining the Table 3, among the 499 scoring hits, it was determined that the athletes mostly used the smash hit technique in scoring with 211 hits (42,3 %).

Table 4. Numerical distribution of the failing hits of athletes.

Types of the Failing Hits	Number	Percentage (%)
Drive	36	7,5
Clear	29	6,0
Smash	80	16,5
Drop	44	9,1
Net-drop	119	24,6
Lift	91	18,8
Net-kill	3	0,6
Block	82	16,9
TOTAL	484	100,00

Examining the Table 4, it was determined that, among the 484 failing hits, the highest number of hit type was the net drop for 119 times (24,6%), and the lowest number of hit type was the net-kill with 3 hits (0,6 %).

Table 5. Proportion of number of scoring hits of the athletes to the total number of hits.

Type Hits	Number of Scoring hits (a)	Total number of hits (b)	Proportion of a/b in %
Drive	49	244	20,08
Clear	6	333	1,8
Smash	211	503	41,94
Drop	37	316	11,7
Net-drop	86	698	12,32
Lift	41	667	6,14
Net-kill	62	68	91,17
Block	7	285	2,45
TOTAL	499	3114	16,02

Examining the Table 5, it was determined that, among the 499 scoring hits (16,02 %) out of 3114 total hits, the athletes mostly used the net-kill hit type for 62 times (91,17 %) and smash hit type for 211 times (41,94 %) based on the proportion of each type of scoring hit to the total number of its type.

Table 6. Proportion of number of failing hits of the athletes to the total number of hits.

Type Hits	Number of failing hits (a)	Total number of hits (b)	Proportion of a/b in %
Drive	36	244	14,75
Clear	29	333	8,7
Smash	80	503	15,9
Drop	44	316	13,92
Net-drop	119	698	17,04
Lift	91	667	13,64
Net-kill	3	68	4,41
Block	82	285	28,77
TOTAL	484	3114	15,54

Examining the Table 6, it was determined that, among the 484 failing hits (15,54 %) out of 3114 total hits, the athletes mostly used the block hit type for 82 times (28,77 %) and smash hit type for 119 times (17,04 %) based on the proportion of each type of failing hit to the total number of its type.

Table 7. The numerical distribution of number and types of scoring hits of the athletes according to the areas.

	FRONT COURT			MIDDLE COURT			BACK COURT		
Hit Types	NHA	NSH	%	NHA	NSH	%	NHA	NSH	%
Drive	9	4	44,44	235	45	19,14	-	-	-
Clear	-	-	-	8	-	-	325	6	1,84
Smash	5	5	100	213	148	69,48	285	58	20,35
Drop	-	-	-	27	3	11,11	289	34	11,76
Net-drop	698	86	12,32	-	-	-	-	-	-
Lift	616	39	6,33	51	2	3,92	-	-	-
Net-kill	68	62	91,17	-	-	-	-	-	-
Block	-	-	-	114	6	5,26	171	1	0,58

NHZ: Number of hits on the area,
NSH: Number of scoring hits

Examining the Table 7, it was determined that, among the scoring hits of the athletes, regardless of the proportion of scoring hit technique to the number of hits on the area, the hit type with highest number on the front court was net-drop (86 hits), smash hit type on the middle (148 hits) and back court (58 hits) areas.

Table 8. The numerical distribution of number and types of failing hits of the athletes according to the areas.

	FRONT COURT			MIDDLE COURT			BACK COURT		
Hit Types	NHA	NFH	%	NHA	NFH	%	NHA	NFH	%
Drive	9	3	33,33	235	33	14,04	-	-	-
Clear	-	-	-	8	1	12,50	325	28	8,61
Smash	5	-	-	213	17	7,98	285	63	22,10
Drop	-	-	-	27	4	14,81	289	40	13,84
Net-drop	698	119	17,04	-	-	-	-	-	-
Lift	616	86	13,96	51	5	9,80	-	-	-
Net-kill	68	3	4,41	-	-	-	-	-	-

Block	-	-	-	114	51	44,73	171	31	18,12

NHA: Number of hits on the area,
NFH: Number of failing hits

Examining the Table 7, it was determined that, among the failing hits of the athletes, regardless of the proportion of failing hit technique to the number of hits on the area, the highest number of hit type on the front court was net drop (119 hits), block hit type on the middle court (51 hits), and smash hit type on the back court (63 hits) areas.

Table 9. The proportion of the area-based failing hits to the total number of failing hits.

Area of the failing hits	Area-based number of failing hits (a)	Total number of failing hits (b)	Proportion of a/b in %
Net Fault	281	484	58,1
Side Line Fault	99		20,4
Back Boundary Line Fault	104		21,5
Total	**484**	**484**	**% 100**

Examining the Table 9, it was determined that the highest number of area-based failing hits was the net fault with 281 (58,1 %).

Table 10. Numerical distribution of the failing hits of the athletes concerning the areas.

Number, type, and % of the hits	FRONT COURT						MIDDLE COURT						BACK COURT					
	NF		SLF		BBLF		NF		SLF		BBLF		NF		SLF		BBLF	
	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%	N	%
Drive	1	33,3	1	33,3	1	33,3	22	66,7	8	24,2	3	9,1	-	-	-	-	-	-
Clear	-	-	-	-	-	-	-	-	-	-	1	100	-	-	6	21,4	22	78,5
Smash	-	-	-	-	-	-	9	52,9	5	29,4	3	17,6	47	74,6	11	17,5	5	7,9
Drop	-	-	-	-	-	-	3	75	1	25	-	-	30	75	10	25	-	-
Net-drop	100	84	19	16	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Lift	6	7	13	15,1	67	77,9	-	-	3	60	2	40	-	-	-	-	-	-
Net-kill	2	66,6	1	33,3	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Block	-	-	-	-	-	-	38	74,5	13	25,5	-	-	23	74,2	8	25,8	-	-

NF: Net Fault, SLF: Side Line Fault, BBLF: Back Boundary Line Fault

In Table 10, examining the failing hit types of the athletes together with the total number of failing hits on the areas, and the areas(net, side line, back boundary line faults) with the failing hits, it was determined that the athletes employed the highest number of failing hits (119

hits) in net drop type and 84 % of these were net faults; it was also determined that they employed 86 failing hits in lift hit type 77,9% of which were back boundary line faults. It was determined that the athletes employed the highest number of failing hits on the middle court with 51 in the block hit type, 74,5 % of which were net faults; as per the drive hit type, they made 33 failing hits in this type and 66,7 % of these were net faults. In the back court area, they employed the highest number of failing hits in the smash type 74,6% of which were net faults, and they performed 40 failing hits in the drop hit type, 75 % of which were net faults.

Discussion

In this study, the men's competitions of the 5th International Rumi Children Sports Games were examined, in which 6 countries participated (Turkey, Azerbaijan, Bulgaria, Macedonia, Serbia, and Georgia). The hit diversity and frequency of under-15 international level athletes were determined, and it was aimed to analyze the scoring hits or failing hits. Additionally, it was aimed at evaluating the scoring and failing hits according to the areas of the hits.

Among the 3114 hits performed by the athletes, the most preferred hit type was determined as the net-drop (22.4%). Salman and Salman (2009) conducted a study on young badminton players and found that the most preferred hit type for male badminton players was net drop (28.1%), which supports the findings of this research, as well. On the contrary, in another study conducted by Ming et al., (2008), it was determined that the most preferred hit type was clear. However, it is observed that this study evaluated the findings through a single training match, and it is thought that this was due to differences in regional terms and concerning player levels as well as lack of official competitions.

In the study, when the hits performed by the athletes were examined in terms of areas, it was determined that the hits were mostly performed from the front court (44.83%), and from the back and middle courts, respectively. Similarly, in another study examining under-15 women's competitions, it was reported that the hits were mostly performed from the front court and from the back and middle courts, respectively (Yüksel, 2018). It is understood that the athletes are constantly moving to the front and back of the court during the rally. Considering the research studies reporting that shuttle is the world's fastest ball (Bankosz et al., 2013; Hayashi, Kakuta and Sekine, 2008; Huynh, 2011) and in a rally, the shuttle is sent back in around 1 second after a hit (Cabello-Manrique and Gonzalez-Badillo, 2003; Ming et al., 2008), the speed of the game is clear together with the necessity that the motoric and physiological characteristics of athletes must be improved. Indeed, the results of research studies conducted by Ramos-Alvarez, Del Castillo, Polo, Ramon and Bosch (2013), Alcock and Cable (2009),

Campos, Daros, Mastrascusa, Dourado and Stanganelli (2009), Yüksel and Aydos (2017) and Singh, Raza and Mohammad (2011) confirm the findings of this study.

When the scoring hits of the athletes were examined (Table 5), it was determined that among the 499 scoring hits, the highest number of hit type was smash with 211 hits (41.94%). In line with the subject of the research, when the proportion of the scoring hits to the total number of hits was examined, it was observed that the net-kill hit type has a 91.17 % scoring ratio. The net-kill hit type is used in front court and over-net positions, and it was used 68 times in 3114 hits with a ratio of 2.2 %. Therefore, this finding can be misleading when considering the total number of hits. However, the current findings reveal that, during the rally, the athletes need to prefer the net-kill hit technique in front-court over-net positions, or to develop a game strategy to prevent the opponent's net-kill hit in front-court. Players can create the opportunity to score with a smash hit during the rally, or keep the opponent staying at the defensive position and prevent the opponent from shifting from defensive position to the offensive position. When the findings were evaluated, it was determined that, in the badminton game, the smash hit type played a decisive role in winning the rally and was the most effective offensive option. This determination is supported by the findings of Li, Zhang, Wan, Wilde, and Shan (2017), Zhang et al. (2016), Al-Gizawy and Akl (2014), Salman and Salman (2009), Rambely, Abas and Yusof, (2008). However, when the Table 7 was examined as an important finding, it is observed that scoring rate was 20.3% for the smash hits performed from around the back boundary line, while the scoring rate of the smash hit type was 69.4% from the middle court area. Preferring the right technique at the right time at the right place during the rally plays an important role for the athlete to improve her/his competition performance. Similarly, Hong and Tong (2000) state that the majority of the hits performed from the back court are ineffective. In addition, the athlete spends a high level of energy for the smash hit, and the possibility should not be underestimated concerning increased fatigue symptoms and exhaustion as a result of ineffective smash attempts from around the back boundary line of the court. Therefore, it can be said that hits using smash technique should be rather performed from the middle court area in order to end the rally and score.

When the failing hits were examined, it was determined that, among the 484 total hits, the highest number of failing hits was the net-drop technique with 119 hits (24.6%). Furthermore, when the proportion of the area-based failing hits to the total number of failing hits was examined (Table 9), it was determined that the area with the highest number of failing hits was net faults with 281 hits (58.1%). In another study conducted on similar age groups, it was determined that the hits with simple faults were mostly performed on the net area (Ming et

al., 2008), which supports the findings of this research. In addition, considering the areas for the failing hits (Table 10), it is observed that an important finding of this research is about the smash hit type. It was determined that the athletes made the highest number of failing hits (63) during the smash hit in the back court area. This is thought to be emerging from uncontrolled hits to end the rally and win the game, particularly for the athletes in the lower age category. This determination also confirms the findings of the research conducted by Yüksel (2018b). In addition, it can be suggested that the athletes should perform the smash hit from around the back boundary line in a more controlled manner in order to put the opponent in a tactically difficult position rather than scoring.

Conclusion

It can be said that the findings of this research study were separated from other studies since the failing hits were examined by considering the areas. However, the fact that the data presented in the study were obtained from the men's singles category and over 8 competitions, and lack of an analysis concerning the serving and deceiving hits can be considered as the limitations of the research. It is thought to be useful to evaluate this study together with further studies to be conducted with higher numbers of participants and over different age groups. A well-planned game strategy can result in a victory for both badminton and other sports. For this reason, conducting further research studies on determining strategic differences in technical-tactical analysis in badminton and other sports will be important for all sports stakeholders.

Consequently, findings of this study concerning the diversity and effects of hits may be useful in providing useful data to sports scientists, coaches, and other stakeholders. Taking into account individual differences, it is suggested that coaches, especially those working in lower age groups, should consider the areas for the scoring and failing hits, and should plan trainings for reducing the net faults, where the highest number of faults were recorded.

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