Analysis of Tennis Competitions on Different Court Surfaces*

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Abstract

The purpose of this study is to analyze the match statistics of men and women tennis players in the singles category in the 2019 Grand Slam tennis tournaments (Australian Open, French Open, Wimbledon, US Open) according to different court surfaces. Winning matches in 1004 competitions made up of 250 men's singles and 252 women's singles played on hard court (US Open and Australian Open); 127 men's singles and 122 women's singles played on the clay court (French Open); and 127 men's singles and 126 women's singles played on grass court (Wimbledon) were analyzed. SPSS 22.0 statistical package program was used to evaluate the data and find the calculated values. As the data showed normal distribution, One-Way Analysis of Variance (ANOVA) was used for comparisons of more than two sets. Tukey HSD multiple comparison test was used to determine the source of significant differences as a result of ANOVA. The level of significance in the study was taken as 0.05. It was determined that ace in women athletes, winning % on 1st serve, unforced error and the fastest service variables differ significantly based on the court grounds (p <0.05). In male athletes, it was determined that ace, double fault, winning % on 1st serve, break points won, unforced errors, fastest service and match duration variables differ significantly according to court surfaces (p <0.05). As a result, the findings show that the game elements that affect the outcome of the match are affected by the court surface and players tend to change their game patterns, in other words, the tactical structure of the important game elements that will make the match win and to adapt themselves to the playing court surface.

Key words: Grand Slam, Match analysis, Tennis, Court Surface

Farklı Kort Yüzeylerinde Tenis Müsabakalarının Analizi

Özet

Bu çalışmanın amacı 2019 Grand Slam tenis turnuvalarında (Avustralya açık, Fransa açık, Wimbledon, Amerika açık) tekler kategorisinde oynayan erkek ve kadın tenisçilerin farklı kort zeminlerine göre maç istatistiklerinin analizini yapmaktır. Müsabakalar süresince sert zeminde oynanan (Amerika Açık ve Avustralya Açık) 250 tek erkekler, 252 tek kadınlar, toprak zeminde oynanan (Fransa Açık) 127 tek erkekler, 122 tek kadınlar ve çim zeminde oynanan (Wimbledon) 127 tek erkekler, 126 tek kadınlar olmak üzere toplam 1004 müsabaka analiz edilmiştir. Verilerin değerlendirilmesinde ve hesaplanmış değerlerin bulunmasında SPSS 22.0 istatistik paket program kullanılmıştır. Veriler normal dağılım gösterdiğinden dolayı ikiden fazla küme karşılaştırmaları için Tek Yönlü Varyans Analizi (ANOVA) kullanılmıştır. ANOVA sonucu anlamlı farklılıkların kaynağını belirlemek üzere Tukey HSD çoklu karşılaştırma testi kullanılmıştır. Araştırmada anlamlılık düzeyi p<0.05 olarak alınmıştır. Kadın sporcularda doğrudan puan kazandıran servis, 1. servisten kazanılan puan (%), basit hata ve en hızlı servis değişkenlerinin kort zeminlerine göre anlamlı ölçüde farklılaştığı tespit edilmiştir (p<0,05). Erkek sporcularda ise doğrudan puan kazandıran servis, çift hata, 1. servisten kazanılan puan (%), servis kırma puanı, basit hata, en hızlı servis ve maç süresi değişkenlerinin kort zeminlerine göre anlamlı ölçüde farklılaştığı belirlenmiştir (p<0,05). Sonuç olarak, bulgular maçın sonucunu etkileyen oyun unsurlarının kort yüzeyinden etkilendiğini ve oyuncuların oyun kalıplarını, diğer bir deyişle maçı kazandıracak önemli oyun unsurlarının taktik yapısını değiştirme eğiliminde olduklarını ve kendilerini kort yüzeyine göre adapte ettiklerini göstermiştir.

Anahtar kelimeler: Grand Slam, Maç analizi, Kort yüzeyi, Tenis

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INTRODUCTION

Tennis is a world class competitive sport attracting millions of players and fans world wide. Competitive tennis is played under the rules of the International Tennis Federation (ITF), and its competitions range from top professional events for example, the Grand Slams and the Olympic Tennis Event to the entry level ITF men's and women's circuits, including tournaments and team events for junior, seniors, and wheelchair players (8).

Tennis is a sports branch in which high performance is determined by qualities such as speed, reaction time, accuracy and efficiency in the movement of the athlete (14). In competitions, professional tennis athletes' performances and match tactics can be affected by various factors (9,21,25). The most common surfaces used for playing professional and recreational tennis are clay and hard courts. Court speed is determined primarily by the friction between the ball and the court surface and the bounce coefficient. The greater the friction, the slower the ball. The higher the bounce, the slower the ball. How well a player performs during professional tournaments is related to the surface on which the matches are played (20). When the total number of strokes between the tournaments is compared, the effect of the tennis court surface is evident. Total number of strokes per game was greater in the French Open than Wimbledon. This result is consistent with the clay court having a slower surface than grass (15). Training on clay courts results in trends for increased heart rate and lactate values, suggesting that sessions on clay courts tend towards higher physiological and perceptual loads than hard courts (26). When playing on clay court surfaces tennis players were required to cover more total and high-intensity running distances and engage in more high-intensity activities than on hard courts. In addition, the body load and the number of accelerations performed were possibly higher when played on a clay court. This shows that the intensity of physical demand required from tennis players is directly influenced by the playing surface (5).

The highest indicator of how effective players are in tennis in terms of competition is their ranking in the national, European or world ranking lists and the statistical data of each individual tennis match. Using the statistical data, it can be better define the successful performance of individual strokes in the match (serve, return), excellent and poor characteristics of an individual's game, the way of playing (aggressive, defensive) and some other factors that contribute to a successful tennis game. With the statistical analysis of game characteristics, it can be establish the reasons for winning or losing a game (10). The purpose of this study is to analyze the match statistics of male and female tennis players in the singles category of the 2019 Grand Slam tennis tournaments (Australian Open, French Open, Wimbledon, US Open) according to different court surfaces.

MATERIAL & METHOD

In this study, the official websites of the 2019 Grand Slam tennis tournaments in the single men and single women category were used as data collection tools (1,2,3,4). Within the scope of the research, a total of 1004 competitions were analyzed including 250 single men and 252 single women played on hard ground (US Open and Australian Open); 127 men's singles, 122 women's singles played on a ground floor (French Open) and 127 men's singles and 126 singles played on a grass floor (Wimbledon). In the competitions won, the variables of aces, double faults, winning % on 1st serve, winning % on 2 nd serve, break points won, unforced errors, winner, total points won, fastest serve and match duration were evaluated. The study was approved by the ethics committee of Selçuk University Faculty of Sports Sciences non-interventional clinical research.

Statistical Analysis

SPSS 22.0 statistical package program was used to evaluate the data and find the calculated values. Data are summarized by giving means and standard deviations. Whether the data showed a normal distribution was checked with the range of Kurtosis and Skewness Coefficients, and it was determined that the data were normally distributed, since the range did not exceed +1.5 and -1.5 (29). As the data showed normal distribution, One-Way Analysis of Variance (ANOVA) was used for comparisons of more than two sets. Tukey HSD multiple comparison test was used to determine the source of significant differences as a result of ANOVA. The level of significance in the study was accepted as $p < 0.05$.

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RESULTS

Table 1. ANOVA and Tukey test results for variables of women athletes participating in the study according to court surfaces

Variables	Court surfaces		n	X	Ss	Sd	F	P	Tukey
Aces	A	Hard	252	4,273	3,169	2			
	B	Clay	122	2,762	2,805	497	9,808	**0,000***	A>B
	C	Grass	126	3,595	3,306	499			
Double faults	A	Hard	252	2,853	2,535	2			
	B	Clay	122	2,754	2,117	497	0,290	0,749	
	C	Grass	126	2,658	2,298	499			
Winning % on 1st serve	A	Hard	252	72,555	8,294	2			B<A
	B	Clay	122	67,819	9,379	497	12,007	**0,000***	B<C
	C	Grass	126	70,611	9,188	499			
Winning % on 2 nd serve	A	Hard	252	52,333	11,397	2			
	B	Clay	122	50,409	12,136	497	1,835	0,161	
	C	Grass	126	53,023	10,167	499			
Break points won	A	Hard	252	52,067	17,559	2			
	B	Clay	122	55,147	17,392	497	1,209	0,299	
	C	Grass	126	53,182	19,305	499			
Unforced errors	A	Hard	252	24,785	11,295	2			
	B	Clay	122	24,221	10,939	497	4,860	**0,008***	A>C
	C	Grass	126	21,119	10,307	499			
Winner	A	Hard	252	25,734	9,615	2			
	B	Clay	122	25,426	9,573	497	0,867	0,421	
	C	Grass	126	24,325	10,643	499			
Total points won	A	Hard	252	77,353	17,593	2			
	B	Clay	122	78,688	20,989	497	0,233	0,792	
	C	Grass	126	77,349	18,910	499			
Fastest serve (km/h)	A	Hard	252	178,187	6,851	2			A>B
	B	Clay	122	173,682	5,723	497	18,785	**0,000***	A>C
	C	Grass	126	176,246	7,268	499			B<C
Match duration (min)	A	Hard	252	95,313	30,211	2			
	B	Clay	122	94,311	32,823	497	0,250	0,779	
	C	Grass	126	92,944	29,983	499			

*p<0,05

It was determined that the variables ace, winning on % on 1st serve, unforced errors and fastest serve differ significantly in women athletes compared to court surfaces (p<0.05). A statistically significant difference was observed between the hard and clay court in the ace variable. Ace averages were significantly greater in hard court than clay court (p<0.05). A statistically significant difference was observed between the clay court and both the hard and grass court in winning on % on 1st serve (p<0.05). A statistically significant difference was observed between the hard and grass court in unforced errors variable. Unforced errors averages were significa tly greater in hard court than grass court (p<0.05). In the fastest service variable, a statistically significant difference was observed between all courts (p<0.05).

Table 2. ANOVA and Tukey test results for variables of men athletes participating in the study according to court surfaces

Variables	Court surfaces		n	X	Ss	Sd	F	P	Tukey
Aces	A	Hard	250	12,196	7,460	2	21,199	**0,000***	A>B C>B
	B	Clay	127	7,283	5,974	501			
	C	Grass	127	10,464	6,705	503			
Double faults	A	Hard	250	4,432	3,512	2	5,351	**0,005***	A>B
	B	Clay	127	3,370	2,905	501			
	C	Grass	127	3,724	2,605	503			
Winning % on 1st serve	A	Hard	250	77,880	6,666	2	13,252	**0,000***	B<A B<C
	B	Clay	127	74,661	7,033	501			
	C	Grass	127	78,653	6,540	503			
Winning % on 2 nd serve	A	Hard	250	55,652	9,142	2	2,850	0,059	
	B	Clay	127	56,480	9,016	501			
	C	Grass	127	57,984	8,556	503			
Break points won	A	Hard	250	45,880	17,414	2	3,717	**0,025***	B>C
	B	Clay	127	49,259	15,680	501			
	C	Grass	127	43,629	15,900	503			
Unforced errors	A	Hard	250	35,652	16,094	2	13,042	**0,000***	C<A C<B
	B	Clay	127	33,417	15,569	501			
	C	Grass	127	27,196	12,996	503			
Winner	A	Hard	250	42,712	15,066	2	1,660	0,191	
	B	Clay	127	39,850	14,546	501			
	C	Grass	127	41,834	12,899	503			
Total points won	A	Hard	250	125,376	31,474	2	1,139	0,321	
	B	Clay	127	120,724	32,083	501			
	C	Grass	127	122,078	26,297	503			
Fastest serve (km/h)	A	Hard	250	205,705	8,325	2	11,637	**0,000***	B<A B<C
	B	Clay	127	201,618	7,513	501			
	C	Grass	127	205,165	7,630	503			
Match duration (min)	A	Hard	250	159,956	49,169	2	3,858	**0,022***	A>C
	B	Clay	127	154,488	50,654	501			
	C	Grass	127	145,401	43,192	503			

*p<0,05

It was determined that the variables of the aces, double faults, winning % on 1st serve, break points won, unforced errors, fastest serve, match duration differ significantly in male athletes compared to the court floors (p<0.05). Averages of ace were highest on the hard court and lowest on the clay court (p<0.05). Double faults differed significantly on the hard and clay court. It was determined that the players made the most double faults on the hard court (p<0.05). Winning% on 1st serve was least observed on clay court (p<0.05). The break points won differed significantly on the clay and grass court. Break points won were higher on the clay court than on the grass court (p<0.05). Unforced errors values were significantly lower on the grass court compared to both court surfaces (p<0.05). Fastest serve averages had the lowest values on the clay court (p<0.05). The match duration varied significantly on the hard and grass court. Match duration was highest on the hard court and lowest on the grass court (p<0.05).

DISCUSSION AND CONCLUSION

A number of important findings have been obtained as a result of this study, which aims to analyze the single men's and women's tennis competitions played on different court surfaces. First one; In women athletes, it was determined that aces, winning % on 1st serve, unforced errors and fastest service variables differed significantly from court surfaces. Secondly, it was determined that the variables of aces, double faults, winning % on 1st serve, break points won, unforced errors, fastest service and match duration differ significantly in men athletes compared to court surfaces.

Even on clay, the slowest court surface, serves and serve-returns remain the strokes that most influence the match results in modern tennis games (13). However, it has been stated that the service is not enough to earn points only, the success of serve-returns, the technical level and condition of the athlete and the strategy in the game are very important (24). The results did not reveal a direct

correlation between the serve and the match result; nevertheless, a successful serve helps players to win games during their own serve (11). Surface also had a significant influence on the proportion of points won when serving, with a significantly greater proportion of points won when serving by both winning and losing players at Wimbledon than at the Australian and French Opens (22). In our current study, the ace, winning % on 1st serve and fastest serve averages of both men and women were the lowest on the clay court. Break points won reached the highest values on clay court in men. In 2011 Grand Slam, while there were significant differences between tournaments in the 1st percentage of service, aces, the average 1st serve speed and the average 2nd serve speed in champion men tennis players, there was no significant difference in the other data. Service values are generally high in fast courts (Wimbledon), while low service speeds and percentages of service increase in slow (France Open) courts (17). O'Donoghue and Ingram (21) investigated the influence of the sex of the player and court surface on elite tennis strategy at all four Grand Slam tournaments between 1997 and 1999. The serve was least dominant at the French Open and male players could not rely on aces and serve winners to provide points as they did at other tournaments. The shortest rallies and highest shot rates in Grand Slam tennis occurred in the men's singles at Wimbledon, where almost half of the points were 'service points'. Unlike women's singles, there were differences between the Australian and US Opens for men's singles. The serve was more important at the US Open, with more serve winners but similar numbers of aces. As a result of the analysis of the 2014 Grand Slam tournament (US Open, Australian Open, French Open), there was no significant difference between the tournaments in the variables of double faults, break points won and points won on first serve for both men and women. Significant differences were observed between tournaments for both genders in the service variable that ace. Aces reached their highest values at the Australian Open for both men and women (27).

In our study, the fastest service averages reached the highest values on the hard court and the lowest values on the clay court in women. The fastest service averages reached the highest on the hard and grass court and the lowest on the clay court in men. In a different study, the fastest service was highest at the French Open (clay) in 2008 for both men and women. The fastest service was lowest for men at the French Open (clay) in 2016, while the fastest service was the lowest for women at the Australian Open (hard) in 2012 (31). Analysis of data from the men's singles event at the four Grand Slam events shows that the nature of the game of tennis is continuing to change from 1991 to 2009. Serve speeds are now higher than they have ever been and the number of aces continues to rise (6). However, the highest and lowest service speed values may vary depending on weather conditions such as sun, wind and temperature or the use of different systems to measure or calibrate the service speed (31). In addition, O'Donoghue (23) reveals that service speed influences a number of factors that in turn influence the proportion of points won on first and second service in his study. In ladies' singles, the success of points emanating from first serve depends on aces, ability at the net and the number of winners played per unforced error. Effectiveness in points emanating from second service, however, depends largely on the number of winners played per unforced error. In men's singles, the success of points emanating from first serve depends on aces, number of net points, ability at the net and the number of winners played per unforced error. Ability at the net and number of winners played per unforced error are the main determinants of second service points in men's singles.

Tennis performance varies according to game-specific variables such as different court surfaces and balls, as well as gender and player levels (18). In our current study, it has been determined that the unforced errors values of women tennis players are higher on the hard court than on the grass court. It was determined that the double faults variable were not significantly affected by the court surfaces. In men tennis players, unforced error averages were highest on the hard court and lowest on the grass court. Double fault values were found higher on the hard court than on the clay court. At Roland-Garros the number of unforced errors increased in 2011, whereas on the fast surfaces of Wimbledon (grass court) and US Open (hard court) the number of unforced errors, as well as winners, decreased. Researchers indicate that the players tend to manifest a safer playing style when playing on the fast courts with a lower risks in the starting and middle stages of points, whereas when playing on slow courts, they tend to play more aggressively in the middle stages of points (30). In different Grand Slams (2014-2017) women players had more service

winners, double faults, return winners and return unforced errors in the Australian Open and US Open, implying a "fast-fast" serve strategy, and higher dominance ratio and better serving performance in Wimbledon. While receiving players had better chances to break opponents' service game in Roland Garros (7). For the same training session on hard and clay courts, there were no differences in total distance or stroke volume. However, clay courts resulted in fewer errors compared with the increased (forced) error rate noted on hard courts (26).

In our current study between match durations and court surfaces; there was a significant difference in men, but no significant difference in women. It was determined that the match durations of the men tennis players were higher on the hard court than on the grass court. Smith and Holmes (28) indicated that men have continued to have a greater length of rally than women on clay and hard courts, however women saw a longer rally duration when playing on the grass courts of Wimbledon, but fewer shots were played. Significant results were found when comparing both rally duration and number of shots across the three playing surfaces, with clay showing the longest rally duration and grass the shortest. In a study evaluating the correlation between certain tennis game elements and match results in Wimbledon and Roland Garros tournaments (2009), it was found that Wimbledon winners are characterized by the variables related to service which the players rely on, while Roland Garros winners are characterized by baseline play predominated by basic strokes (16). These data reflect the different demands and strategies used by the players on different court surfaces. For example, a more aggressive game is associated with a faster surface such as grass. In addition, the data suggest that various factors such as gender and surface have a significant effect on match activity. These observations mean that the training components must be specific to the court surface and gender, so that players do more aerobic training as they prepare for competitions on slower surfaces (8). Martin et al. (19) stated that the court surface influences tennis match characteristics. On clay courts, effective playing time and mean duration of rallies are increased, whereas effective resting time is decreased. On hard courts, effective playing time, and mean duration of rallies are reduced, whereas effective resting time is increased. Gale-Ansodi et al.(12) reported that there were differences in the

physical demands, in both velocity and acceleration dimensions, on tennis players depending on the kind of surface they played on. Tennis players who played matches on hard court developed more amount and higher intensity of acceleration/deceleration motion and high velocities than on clay court. Therefore, all our results indicate that tennis players develop high neuromuscular activities on hard court.

As a result, the findings show that the game elements that affect the outcome of the match are affected by the court surface and players tend to change their game patterns, in other words, the tactical structure of the important game elements that will make the match win and to adapt themselves to the playing court surface.

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