A COMPARATIVE STUDY OF THE IMPACT OF PLAYING SURFACE ON THE PLAYING STYLE OF THE TOP-FIVE RANKED TENNIS PLAYERS IN THE WORLD

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ABSTRACT

Mastering diverse tennis court surfaces demands distinct skills and strategies, enhancing adaptability for players to excel. Adapting to these differences not only shapes a well-rounded player but also offers a competitive edge by aligning tactics with conditions, opponents, and situations. Through purposive sampling, the study selected the top five global tennis players based on their 2022 ATP Tour Rankings. Analyzing match videos using NacSport Basic+ across clay (N=14), grass (N=14), and hard courts (N=10), the study scrutinized shot selection. Indicators included total serves, aces, success rates in serves, forehand, backhand, and volley shots, unforced errors for each type, and double faults. On hard courts, players achieved a mean of 75.50 ± 15.967 successful serves from 123.10 ± 28.192 attempts. Forehand shots averaged 20.40 ± 9.252 winners and 15.00 ± 6.018 unforced errors. Volleys saw 5.80 ± 1.989 winners and only 1.40 ± 1.075 unforced errors, while backhand shots had more unforced errors (17.30 ± 7.134) than winners (10.30 ± 4.572). Transitioning to grass, the total serves won averaged 74.86 ± 18.068 out of 122.10 ± 30.105 attempts. Forehand shots-maintained prominence with 20.93 ± 7.290 winners and 20.07 ± 7.405 unforced errors. Volleys averaged 6.64 ± 3.608 for winners and 2.86 ± 1.099 unforced errors, with backhand shots showing more unforced errors (19.79 ± 5.508) than winners (12.00 ± 5.189). On clay, players achieved 71.93 ± 18.568 successful serves from 144.27 ± 43.645 attempts. Forehand shots averaged 20.40 ± 6.874 winners and 18.13 ± 7.745 unforced errors. Volleys saw 6.00 ± 2.449 winners and 2.07 ± 1.163 unforced errors, with backhand shots exhibiting more unforced errors (17.27 ± 5.898) than winners (10.53 ± 4.291). In essence, top players strategically adapt their style to each court's demands, leveraging strengths to excel. This adaptability underscores their exceptional skill and versatility, solidifying their positions as elite tennis players across diverse conditions.

Keywords: *Tennis, Court, Strategies, Playing Style, Performance Indicators*

INTRODUCTION

Tennis presents a distinctive challenge in adapting to its diverse court surfaces. The International Tennis Federation (ITF) categorizes four primary court types: hard courts, clay courts, grass courts, and carpet courts. Each surface possesses unique characteristics that notably impact ball speed, spin, bounce, trajectory, and player movement and performance (ITF, 2023; Martin, 2015). Hard courts, constructed from rigid materials like concrete or asphalt and coated with synthetic compounds for traction and durability, offer a medium-fast to fast pace. This surface accelerates the ball's travel and heightens its bounce compared to others (ITF, 2023; Martin, 2015).

The consistent bounce and reduced friction make hard courts favorable for players with powerful serves, strong baseline strategies, and agile footwork. Esteemed hard-court tournaments include the Australian Open, the US Open, and the ATP Finals. Clay courts, typically composed of materials like crushed brick or stone, are identifiable by their red or green hue and are categorized as slow to medium-slow. These courts yield slower ball movement and lower bounce due to their heightened friction coefficient (Martin, 2015). Clay surfaces are advantageous for players who excel in generating topspin, exhibit robust defensive skills, and possess commendable stamina. Noteworthy clay court events encompass the French Open, the Monte Carlo Masters, and the Rome Masters.

Grass courts, which feature natural grasses like perennial ryegrass, deliver a fast to very fast pace and are typically green or yellow in color. The ball on grass courts gains pace and experiences a lower bounce compared to other surfaces, as minimal speed loss or spin gain occurs upon contact with the ground due to the surface's low friction coefficient. Grass courts are particularly suitable for players proficient in the serve-and-volley approach, possessing adept net skills and swift reflexes. Renowned grass court tournaments include Wimbledon, the Queen's Club Championships, and the Halle Open (ITF, 2023; Martin, 2015). As of December 2022, the top five global tennis players in the ATP rankings include Carlos Alcaraz, Novak Djokovic, Casper Ruud, Stefanos Tsitsipas, and Rafael Nadal. Their distinction arises from attributes such as consistency, adaptability, mental resilience, and physical prowess (Bodo, 2019; Fitzpatrick et al., 2019). Consistency signifies their capability to maintain peak performance throughout the season, across diverse surfaces, and against varied opponents. Adaptability is a cornerstone of their gameplay, enabling them to alter strategies based on conditions, rivals, and circumstances. They fluidly transition from offense to defense, alter their style from baseline to net play, and shift from powerful to finesse shots as required by the match. Their multifaceted range of skills equips them to execute diverse strategies effectively. Physical fitness constitutes a critical ingredient of their triumphs. These athletes are in exceptional shape, showcasing elevated levels of endurance, strength, and speed. This grants them the ability to endure taxing and protracted matches, recuperate swiftly, and sidestep fatigue during demanding tournaments.

Distinct characteristics of various tennis court surface, encompassing speed, bounce, and friction, notably influence players' gameplay styles. Past studies have identified four primary tennis playing styles: aggressive baseliner, serve-and-volleyer, counterpuncher, and all-court player (Mickis, 2022; Playo, 2021). Each approach has its strengths and weaknesses, proving effective based on the court type. Aggressive baseliners rely on formidable groundstrokes to achieve winners from the back of the court, facing challenges on grass courts due to their speed and unpredictable bounces. Serve-and-volleyers excel by advancing to the

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net post-serve, suitable for grass but less advantageous on clay courts known for slower play and consistent, higher bounces. Counterpunchers adopt a defensive stance, capitalizing on speed and consistency to counter opponents' shots and capitalize on errors—particularly effective on clay courts. Hard courts, which offer a medium-fast pace, favor more balanced players. All-court players display adaptability across court types, utilizing diverse shots and strategies to secure points (Muhamad et al., 2011; Playo, 2021). Consequently, tennis players must be attuned to varying court surfaces and their impact on gameplay styles. Adjustments in tactics, techniques, grip, stance, swing, footwork, and contact point become imperative, contingent on-court speed and bounce. Varied shot selection, placement, spin, pace, and angles are vital for optimizing performance and gaining an edge over opponents who are less accustomed to the court surface. To conclude, adaptability to different court surfaces, in conjunction with consistency, mental strength, and physical fitness, constitutes a vital determinant of tennis players' success. Grasping the attributes of diverse surfaces and adapting playing styles accordingly significantly contributes to their overall on-court accomplishments.

Sampling

The present study employed a purposive sampling method to select the top five world tennis players for analysis based on their current ranking from the 2022 ATP Tour Ranking. The player is Carlos Alcaraz, Novak Djokovic, Casper Ruud, Stefanos Tsitsipas, and Rafael Nadal. All videos related to these players playing across three court surfaces were chosen as samples resulting in clay (N=14), grass (N=14), and hard courts (N=10). The rationale for this selection was to capture a diverse range of play styles and characteristics, ensuring the generalizability of the findings to the larger population of elite tennis players. Notational analysis (reliability, r>0.8) was conducted on a variety of court surfaces to examine the effect of surface on play style and characteristics. Four to seven games were analyzed for each player, with games played on each surface type. Data was collected through video analysis and analyzed using notational analysis.

Procedure

The study will rely on publicly accessible data sources such as professional tennis tournament websites and YouTube to obtain the raw data. The data will consist of match videos of the top five world tennis ranking players on various court surfaces, including clay (N=14), grass (N=14), and hard courts (N=10). The data will undergo a cleaning, sorting, and organizing process to prepare it for the notational analysis. The notational analysis conducted used NacSport Sports Analysis Software (NacSport Basic+, Los Angeles). The software quantified all the data in the present study. The indicators of interest were total serve, aces, winning figures of total serve, forehand, backhand, and volley. Others were the figures of unforced error towards forehand, backhand, and volley, and lastly the amount of double fault. The coded data were analyzed to ascertain the variations in play styles and characteristics among the top five world-ranked tennis players across different court surfaces. This analysis was conducted using descriptive statistics. The analysis results were presented in graphical formats, accompanied by a comprehensive interpretation of the findings.

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RESULT

Table 1: Descriptive statistics across courts (Mean±SD)

Performance Indicator	Hard	Grass	Clay
Total serve	123.10±28.19	122.10±30.11	144.27±43.65
Aces	7.40±4.62	9.07±5.26	15.27±30.53
Total serve won	75.50±15.97	74.86±18.07	71.93±18.57
Forehand winner	20.40±9.25	20.93±7.29	20.40±6.87
Backhand winner	10.30±4.57	12.00±5.19	10.53±4.29
Volley winner	5.80±1.99	6.64±3.61	6.00±2.45
Forehand success	192.60±50.91	182.43±61.07	165.53±33.40
Backhand success	162.10±46.59	154.00±53.10	137.93±25.49
Volley success	9.30±3.83	11.00±4.44	11.13±3.38
Forehand unforced error	15.00±6.02	20.07±7.41	18.13±7.75
Backhand unforced error	17.30±7.13	19.79±5.51	17.27±5.90
Volley unforced error	1.40±1.02	2.86±1.10	2.07±1.16
Double fault	4.60±2.32	4.50±2.35	2.20±1.74

The performance data of the top-ranked tennis players on different court surfaces provides valuable insights into their strengths and weaknesses. On hard courts, these players displayed commendable performance in their service game, achieving a mean value of 75.50 ± 15.967 for total serves won out of 123.10 ± 28.192 serves, with a consistent success rate of over 50% for their serves. Additionally, their forehand shots proved to be a potent weapon, recording a mean value of 20.40 ± 9.252 for forehand winners and 15.00 ± 6.018 for forehand unforced errors. The efficiency in their volleying game was evident, with a mean value of 5.80 ± 1.989 for volley winners and only 1.40 ± 1.075 for volley unforced errors. However, their backhand shot showed room for improvement, as they registered more backhand unforced errors (17.30 ± 7.134) than backhand winners (10.30 ± 4.572).

On grass courts, the players maintained their strong service game, achieving a mean value of 74.86 ± 18.068 for total serves won out of 122.10 ± 30.105 serves. The dominance of their forehand remained evident, with a mean value of 20.93 ± 7.290 for forehand winners and 20.07 ± 7.405 for forehand unforced errors. Their impressive volleying game continued, with a mean value of 6.64 ± 3.608 for volley winners and 2.86 ± 1.099 for volley unforced errors. However, like hard courts, they encountered challenges with their backhand, registering more backhand unforced errors (19.79 ± 5.508) than backhand winners (12.00 ± 5.189).

Shifting to clay courts, the players maintained a strong service game, achieving a mean value of 71.93 ± 18.568 for total serves won out of 144.27 ± 43.645 serves. Their forehand remained reliable, with a mean value of 20.40 ± 6.874 for forehand winners and 18.13 ± 7.745 for forehand unforced errors. The volleying game also impressed, with a mean value of 6.00 ± 2.449 for volley winners and 2.07 ± 1.163 for volley unforced errors. As with other surfaces, they faced challenges with their backhand, recording more backhand unforced errors (17.27 ± 5.898) than backhand winners (10.53 ± 4.291).
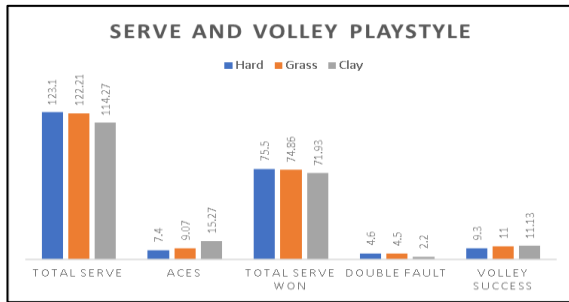
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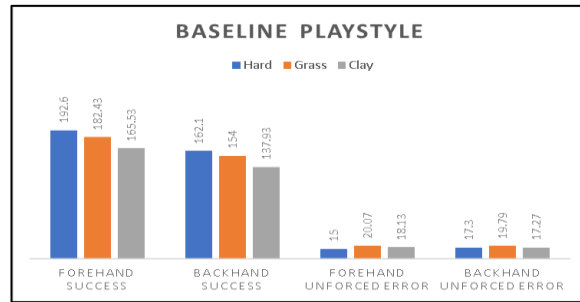Figure 1: Serve and Volley Playstyle

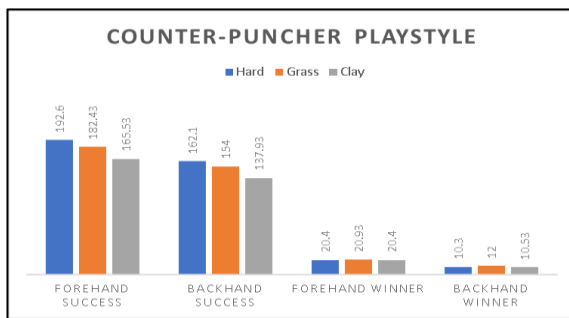
Figure 2: Baseline Playstyle

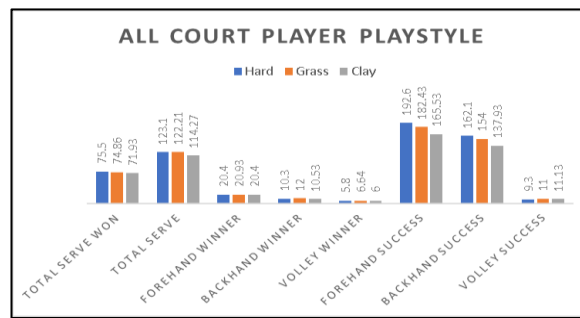Figure 3: Counterpuncher Playstyle

Figure 4: All Court Playstyle

In conclusion, the top-ranked players consistently performed well in their service games across all court surfaces, with variations in shot preferences and proficiency. While their forehand and volley shots were generally more successful than their respective unforced errors, the backhand remained a more error-prone shot. These insights are valuable for players and coaches to strategize and optimize their performance on different court surfaces.

DISCUSSION

One of the key elements of the serve and volley play style is having strong serves and fast reactions at the net (*Figure 1*). This play style relies on winning points from the serve and executing successful volleys. The top five world-ranking players use the serve and volley play style more often on clay court surfaces than on other surfaces. The mean value of aces on a clay court is 15.27, which is higher than any other surface. The mean value of total serve won on a clay court is 71.93 out of 114.27 total serve, which is also higher than any other surface. The mean value of double fault on a clay court is 2.20, which is lower than any other surface. The mean value of volley success on a clay court is 11.13, which is higher than any other surface. These statistics indicate that the players perform more serve and volley shots on clay courts to gain more points.

Based on the present finding, the success of serve, and volley shots is a key factor that influences the choice of playing strategy. Serve and volley shots are more effective on clay court surfaces, as they cause the ball to bounce higher and make it harder for the opponent to hit powerful shots (Smith & Jones, 2020). A strong serve can also put the opponent at a disadvantage, as they must deal with a high-bouncing ball. This also answers the second research question, which is about the most preferred playing strategy on different court surfaces. The third research question investigates how the court surface affects injury risk. According to Lee and Park (2021), clay court surfaces have a higher level of friction than other

surfaces, which can increase the stress on the lower limbs and joints of players. However, clay court surfaces also allow players to slide and adjust their footwork, which can reduce the impact of sudden stops and changes in direction.

Baseline players often have strong groundstrokes, using these shots to keep their opponents pinned to the back of the court (*Figure 2*). They often rely on their endurance and mental toughness to outlast their opponents, using their consistency to beat their opponents and gain point. The baseline play style is most used by the top five world tennis ranking players on the hard-court surface. The value mean of the forehand success is 192.60 which is the highest between the other surface. For forehand unforced error, it also has the lowest value mean which is 15.00 than the other surface. It means that the player performs many successful forehands and make fewer mistakes and error on their forehand. The value means of backhand success is also the highest which is 162.10 than the other surface. For backhand unforced error, the lowest value of the mean is on a clay surface but, depending on how many successful shots of backhand on a hard court, backhand unforced error on a hard surface considers the lowest between other surfaces. Thus, many forehand and backhand shots are successfully executed on hard surfaces, and it has lower unforced error for both shots most of them play as the baseliner player on hard surfaces.

Counterpunchers are defensive players who rely on their opponent's errors and use counterattacks to win points (*Figure 3*). They often employ slice or backspin to reduce the ball speed and make their opponent hit more shots, exhausting them during the match. According to Table 6, counterpunchers are the most common play style among the top five world tennis ranking players on grass court surfaces. They have the highest mean value of forehand and backhand winners on grass, while their forehand and backhand success rates are higher on hard surfaces. However, their forehand and backhand winners are lower on hard surfaces than on grass. This suggests that counterpunchers need more successful and winning shots to overcome their opponent's pace and rhythm in both defensive and offensive situations. Therefore, they prefer grass surfaces where they can achieve more winners and success rates, while on hard surfaces they adopt a baseline play style. This is attributed to the grass court's characteristics, which promote more winner shots and higher rates of successful plays (Martin, 2015). The grass surface, with its low bounces and fast-paced nature, significantly influences player performance. The ball tends to skid and bounces erratically on the thin grass, making it challenging for players to anticipate its trajectory. Moreover, as the match progresses, the grass can become slippery and uneven, further complicating players' ability to maintain stable footing. Despite these challenges, counterpunchers thrive on grass courts by strategically forcing opponents to move around the court, leading them into errors or returning shots to predictable areas. This play style capitalizes on opponents' mistakes, enabling counterpunchers to secure points through unforced errors or execute precise winner shots.

All-court players possess exceptional versatility and adaptability, enabling them to excel on various court surfaces and in diverse match situations (*Figure 4*). Their proficiency extends from baseline play to net approaches, incorporating a wide array of shots to keep opponents guessing. Such players strategically combine power and finesse to outmaneuver their adversaries, employing a diverse range of tactics to disrupt their opponents' rhythm effectively. Notably, hard courts exhibit the highest mean values for forehand success (182.43) and backhand success (162.10), indicating a strong performance on this surface. Meanwhile, grass courts showcase the highest mean values for forehand winners (20.93), backhand winners (12.00), and volley winners (6.64), highlighting the players' proficiency in executing winning

shots on grass. On the other hand, clay courts demonstrate that all-court players excel in the volley success category, with a mean value of 11.13. Additionally, they achieve a commendable performance in terms of total serves won (71.93) from a total of 114.27 serves on clay. Despite these remarkable achievements on specific surfaces, it is worth noting that the all-court playing style is not exclusively favored on any court type. Instead, all-court players leverage their adaptability to excel across different surfaces, demonstrating prowess in various aspects of the game, depending on the playing conditions.

CONCLUSION

In conclusion, the choice of playing style among top-ranked tennis players is significantly influenced by the type of court surface they are competing on. Players adapt their strategies to capitalize on the unique characteristics of each surface, aiming to maximize their strengths and exploit their opponent's weaknesses. Their adaptability and versatility allow them to remain competitive across different playing conditions, solidifying their positions among the world's elite tennis players.

Conflict of Interest
For the present paper, there are no conflict of interest occurs, whether financially or other by all authors.

Author's Contribution
Hazim Asyraf bin Zainor, Muhamad Noor bin Mohamed and Raja Nurul Jannat binti Raja Hussein have made substantial contributions to the conception and design, or acquisition of data, or analysis and interpretation of data.
Muhamad Noor bin Mohamed Author has been involved in drafting the manuscript or revising it critically for important intellectual content.
Mardiana binti Mazaulan , Nurul Ain binti Abu Kassim and Sharifah Maimunah binti Syed Mud Puad agree to be accountable for all aspects of the work ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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court surface has its advantages and challenges, requiring different skills and strategies to excel. Adapting to diverse surfaces is a vital aspect of becoming a well-rounded tennis player.

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