How Serve Tactics Shape Game Dynamics in Professional Men's Padel

Title: How serve tactics shape game dynamics in professional men's padel

Head Title: Serve tactics in padel sport

Abstract

Padel has become extremely popular during the last decade. Investigators debated several physical and technical-tactical parameters, but the influence of serve on match development remains unclear. This study, therefore, aimed to investigate the role of serve strategies on match scores and results. Three thousand five hundred thirty-seven points from 41 men's matches on the Premier Padel circuit during the 2023 season (27.63 ± 3.75 years, 180.24 ± 6.5 cm) were collected by systematic observation and analysed, with a degree of intra and inter-observer reliability equal to 0.97 and 0.96, respectively. The glass was the favourite serve direction, independently of tactic (64.83%, $p<0.001$). Despite this, serving at the T of the line with the conventional formation increases the winning rate by 2.39 (95% CI: 1.40, 4.09; $p=0.045$), whereas it decreases it by 0.45 (95% CI: 0.21, 0.98; $p=0.002$) at the right side. In addition, the probability of winning each point decreased by 3.84% ($p<0.001$) for each additional rally played, and its total length increased at the second serve ($p=0.012$). As in elder racket sports, serve results as a critical moment of the match that affects the match events. Coaches may focus on tactical strategies, carrying the first ball of every point.

Keywords: Padel; match-analysis; serve; performance, tactics.

Introduction

Performance indicators have become the primary area of research in padel (Sánchez-Alcaraz et al., 2022), highlighting four subareas: player movement, temporal structure, score analysis, and game actions (Martín-Miguel et al., 2023), with the serve and return playing a key role within the latter area of investigation.

The serve is one of the most frequently executed strokes in padel (Mellado-Arbelo et al., 2019), as each point begins with this technical-tactical gesture (Sánchez-Alcaraz, Conde-Ripoll, et al., 2022), accounting for 10% of all strokes (Sánchez-Alcaraz et al., 2020). This action is constrained by the International Padel Federation's rules, requiring that the serve be executed below the waist after the ball bounces on the ground (International Padel Federation, 2024). Despite this limitation, it offers a wide range of tactical options due to the two main serve formations: the Australian formation (where the server's partner positions themselves on the same side as the server) and the conventional formation (where the server's partner positions themselves on the opposite side of the serve); additionally, the serve direction can target the side glass, the middle, or the "T", described as the T of serve rectangles (Martín-Miguel, Muñoz, et al., 2024).

Typically, the serve is a stroke with a low error rate, with 88.5% of first serves being successful (Prieto-Lage et al., 2024). It provides a significant advantage to the serving pair by positioning them at the net, leading to a high number of points won by the serving team (Martín-Miguel et al., 2023), with sex differences, as female players obtain more breaks of serve than male players (Escudero-Tena et al., 2021; Sánchez-Alcaraz et al., 2020). However, the effectiveness of the serving pair decreases after the 10^{th} stroke in men's padel (Martín-Miguel, Muñoz, et al., 2024) and after the 12^{th} stroke in women's padel (Bueno-

García et al., 2024). Additionally, the serve causes physical strain, as the server is the player who runs the most during the match (Ramón-Llin et al., 2021). Despite the current research on the serve, the inspection of certain variables is lacking. For example, the direction of the serve relied upon terms of "T," middle, and side glass, but without comparing the serve strategy based on the winning and losing pair (Escudero-Tena, Galatti, et al., 2024), return height (Escudero-Tena, Ibáñez, et al., 2024) and serve side (Sánchez-Alcaraz et al., 2020) in both professional and amateur players (da Silva Morais et al., 2024). However, these studies did not examine strategy or the serve's depth. Whilst point duration typically lasts 13-15 seconds (Almonacid et al., 2023) with approximately nine strokes per point (Ungureanu et al., 2024), these parameters may vary according to the serving strategy. Furthermore, a padel match encompasses up to three sets, with an average of 18.7 games per match (Amieba & Salinero, 2013) and 9.41 games per set (García-Benítez et al., 2016), which led to an emphasis on the role of service on the performance.

The literature highlights a significant gap in the comprehensive analysis of serve strategies in padel, particularly concerning their tactical implications on match outcomes. Although prior research examined aspects such as serve direction, return height, and serve side, their study may account for key confounders such as winning vs. losing pairs or serve depth. Furthermore, how these strategies affect point duration, number of strokes per rally, and overall match dynamics remains underexplored. Therefore, further analysis is required to gain a deeper understanding of the variables involved in this stroke. This study investigates the role of serve strategies on match scores and results.

Materials and methods

Research design

Understanding the characteristics of the serve from different tactical and temporal perspectives will help coaches improve training planning and preparation. Many studies designed observational research to evaluate performance in padel (Courel-Ibáñez, 2021; Courel-Ibáñez et al., 2019), and such designs fall under the nomothetic, punctual, and multidimensional category (Thomas et al., 2022). This study presents a retrospective crossover design.

Sample

Forty-one matches from 13 randomly selected Premier Padel tournaments played in 2023 were analysed, comprising 3,537 points in the men's category, including both qualifying and final rounds. The sample of professional male padel players consisted of 63 players —11 left-handed (age = 26.89 ± 7.01 years; height = 179.66 ± 7.15 cm) and 52 right-handed (age = 27.79 ± 6.96 years; height = 180.36 ± 6.36 cm) — with a wide experience in professional padel tournaments. All procedures were conducted in accordance with the ethical standards in sport and exercise science research (Harriss et al., 2019) and the local Ethics Commission.

Study variables

The following variables were defined and analysed based on their categorical core and degree of openness (Anguera & Hernández-Mendo, 2015):

- Tactical formation, which includes two choices (Martín-Miguel, Sánchez-Alcaraz, et al., 2024): Australian formation (where the server's partner positions themselves on the same side as the server) or conventional formation (where the server's partner positions themselves on the opposite side of the server)

- Set number states the number of played sets distinguishing between the first, second, and third.

- Serve direction, which includes three areas: Glass, middle, and T, each with a width of 1.66 m, as described by Sánchez-Alcaraz et al. (2020).

- Serve depth, which encompasses two categories: Short (the ball does not reach the wall) and deep (with wall touch).

- Hand dominance, distinguishing between right-handed and left-handed players.

- Serve side, which includes left and right sides.

- Rally length refers to the number of strokes played in one point, from serve up to the end of the point.

- Games per match, which counts the total number of games played in each match.

- Match outcome, a binary variable stating the match's result (pair won or lost).

- Moment of the match, which distinguishes between point, game, set, and match.

Table 1.

Inter-observer and intra-observer reliability

	Intra-Observer	Inter-Observer
Study Variables	*K*	
Tactical formation	1.00	1.00
Set	1.00	1.00
Serve direction	1.00	0.95
Serve depth	0.82	0.79
Hand dominance	1.00	0.98
Serve side	1.00	1.00
Rally length	0.92	0.90
Game per match	1.00	0.98
Match outcome	1.00	1.00
Effectiveness	0.97	0.98
Moment of the match	1.00	0.98
Number of games	0.99	1.00
Total	0.97	0.96

Process

A trained researcher and padel technician observed the matches and recorded the study dataset using a custom-made tool with the specialised software LINCE (Soto-Fernández et al., 2022). We then used open-source Kinovea software (V.0.8.15; www.kinovea.org) to place visual grids over the video image of the court area for our data recording. After the data collection process, an investigator conducted the intra-observer reliability analysis to

verify the accuracy of the data. To ensure sufficient data representation, the observer reanalysed a randomly selected sample of six matches (hosted on the Red Bull website: https://www.redbull.com/), representing 10–20% of the total study sample (Igartua, 2006). The average intra-observer reliability was 0.97, which is considered almost perfect (Landis & Koch, 1977). Furthermore, a further trained observer analysed a random selection of three men's and three women's matches to calculate the inter-observer reliability, which resulted in an average of 0.96 (Landis & Koch, 1977). Table 1 shows reliability results.

Statistical Analysis

Descriptive statistics includes measures of central tendency such as mean and median, measures of dispersion such as standard deviation or standard error and interquartile range, and frequency of observations and appearance percentage. The chi-squared test ($\chi 2$) statistic with g-1 degrees of freedom inferred differences between categorical variables. Rally length was a continuous variable for the regression model with categorial covariances. The Kolmogorov-Smirnov test accounted for the residual distribution curve assumed to be bell-shaped. The variance inflation factor checked homogeneity to meet sphericity; if necessary, the robust standard deviation adjusted for variance heteroskedasticity. Two logistic models estimated the probability of winning (or losing) the points and games. Results reported regression coefficients (β), odds ratio (OR), confidence intervals (95% CI) and p-value (type I error probability settled at 5%).

Excel 2024 Windows edition (Microsoft, Washington, USA) gathered data in digital spreadsheets, then analysed with STATA 18.5 Windows edition (StataCorp., Texas, USA).

Results

Table 2 shows descriptive statistics by serve tactics. Generally, 88.5% of matches ended in two sets, with an average of 17.3 games per match. Two thousand one hundred ninety-six services were won (62.09%), with conventional formation by 52.5% ($\chi 2=0.07$, $p=0.793$). The glass was the favourited serve direction (64.8%), while only 15.9% was direct to the middle. Only 393 serves bounced deeper, 87.18% in the first two sets and 97.2% at first serve ($\chi 2=41.61$, $p<0.001$).

Table 2.

Descriptive statistics

	Australian	Conventional	Total	Inference	
Factorial variables	1686 (47.7%)	1851 (52.3%)	3537 (100.0%)	χ^2	p
Set number				$\chi^2_{(2)}$	0.559
1	739 (43.8%)	836 (45.2%)	1575 (44.5%)		
2	745 (44.2%)	812 (43.9%)	1557 (44.0%)		
3	202 (12.0%)	203 (11.0%)	405 (11.5%)		
Serve direction				$\chi^2_{(5)}$	<0.001*
right glass	487 (28.9%)	664 (35.9%)	1151 (32.5%)		
right middle	65 (3.9%)	81 (4.4%)	146 (4.1%)		

right T	224 (13.3%)	188 (10.2%)	412 (11.6%)		
left glass	541 (32.1%)	601 (32.5%)	1142 (32.3%)		
left middle	225 (13.3%)	191 (10.3%)	416 (11.8%)		
left T	144 (8.5%)	126 (6.8%)	270 (7.6%)		
Serve depth				$\chi^2_{(1)}$	0.224
short	1510 (89.6%)	1634 (88.3%)	3144 (88.9%)		
deep	176 (10.4%)	217 (11.7%)	393 (11.1%)		
Hand dominance				$\chi^2_{(1)}$	0.102
right	1295 (76.8%)	1464 (79.1%)	2759 (78.0%)		
left	391 (23.2%)	387 (20.9%)	778 (22.0%)		
Serve side				$\chi^2_{(1)}$	<0.01*
right	776 (46.0%)	933 (50.4%)	2769 (78.0%)		
left	910 (54.0%)	918 (49.6%)	778 (22%)		
Continuous variables				$F_{(1, 3535)}$	p
Rally length	9.20 (7.17)	9.47 (7.89)	9.34 (7.56)	0.03	0.866
Game per match	16.65 (12.83)	17.90 (13.72)	17.30 (13.32)	7.73	0.005*

Data expressed as frequency (n) and percentage (%).

Table 3 shows the rally length characteristics, and the cumulative shots needed to win (or lose) the point, game, set and match. No significant difference appeared in rally length needed for point, set and match between winners and losers, but the number of shots played to get the game was significantly lower in winners (53.26 vs 70.64, p<0.01). When players were at serve, the odds ratio of winning the point was 2.57 higher than losing (95% CI: 2.08, 3.17; p<0.001).

Table 3.

Rally length stratified for different relevant moments of the matches and compared with winning or losing results

	Match							
	Losers			Winners				
	rally length			rally length				
	n	Mean	SD	n	Mean	SD	$F_{(18, 3262)}$	p
lose	657.00	10.72	7.65	461.00	10.39	7.90	0.75	0.46

point	813.00	8.77	7.27	821.00	8.55	7.58	-0.83	0.41
game point	246.00	62.02	39.12	228.00	52.49	28.88	-0.76	0.45
set point	11.00	515.73	123.69	20.00	598.30	194.77	0.48	0.63
match point	9.00	1466.11	413.47	15.00	1172.27	438.48	-1.48	0.14

	Set							
	Losers			Winners				
	rally length			rally length				
	n	Mean	SD	n	Mean	SD	$F_{(18, 3262)}$	p
lose	663.00	10.90	7.84	455.00	10.12	7.60	-1.09	0.28
point	803.00	8.62	7.04	831.00	8.70	7.78	1.27	0.21
game point	243.00	62.52	39.35	231.00	52.10	28.54	-1.12	0.26
set point	12.00	526.50	122.71	19.00	595.84	200.16	0.96	0.34

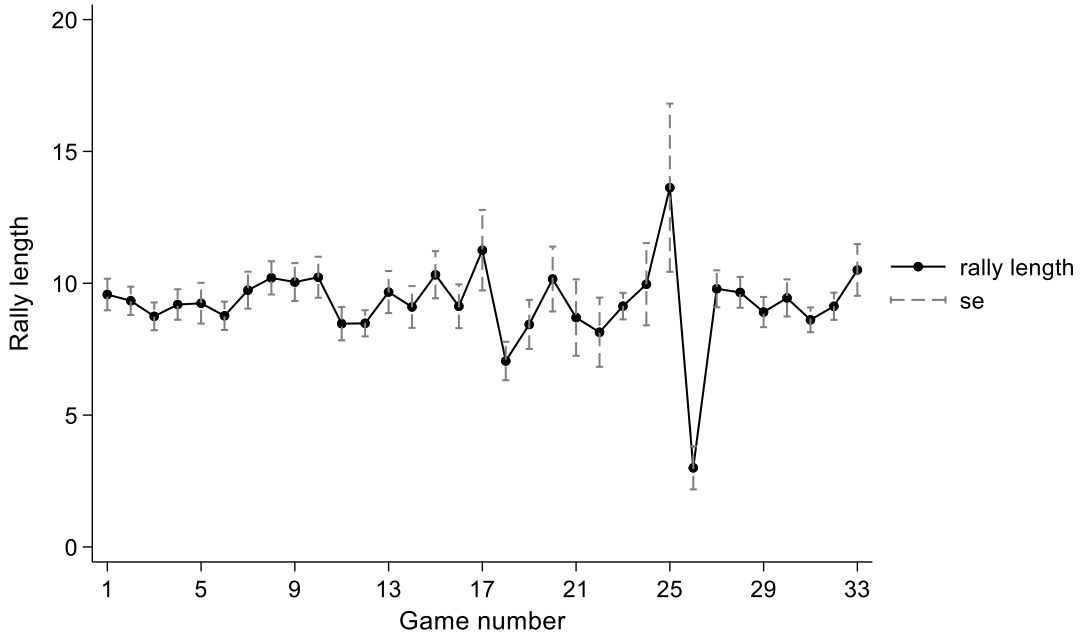
	Game							
	Losers			Winners				
	rally length			rally length				
	n	Mean	SD	n	Mean	SD	$F_{(18, 3262)}$	p
lose	474.00	11.14	8.43	644.00	10.17	7.18	-1.65	0.61
point	315.00	8.81	7.04	1318.00	8.63	7.52	0.48	0.63
game point	114.00	70.64	36.70	360.00	53.26	33.24	-4.32	0.001*

N: number of observations; SD: standard deviation; F: Snedecor-Fisher statistic test; p: p-value.

The number of games did not significantly affect rally length (β=-0.012, p=0.318), as shown in Figure 1.

Figure 1.

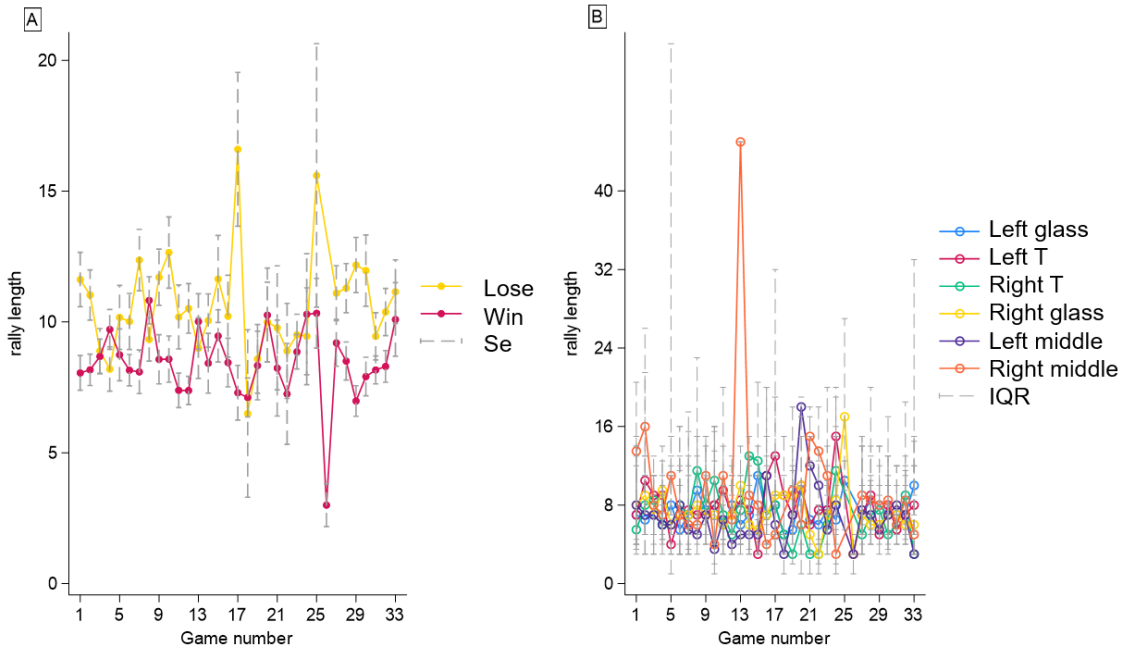
Mean rally length ± standard error over the games.



Differently, rally length widely decreased in winning scores by 19.24% (β=-2.045, p<0.001; Figure 2A). Figure 2B shows how the serves direction influenced the rally length over games, with a wider reduction directed to the middle of the left side (β=-1.618, p=0.05).

Figure 2.

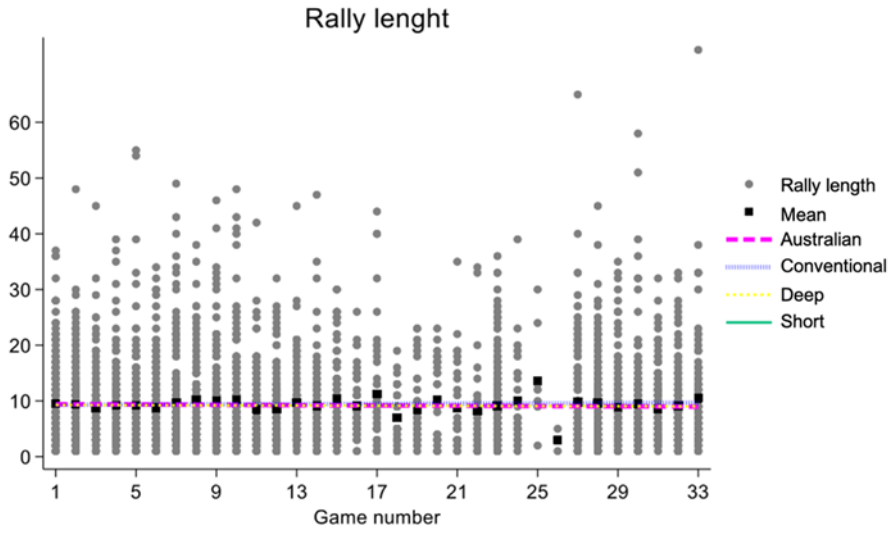
Mean rally length ± standard error over games accounted for won or lost points (A), and median rally length with interquartile range over games accounted for serve direction (B).



Neither serve tactics nor the depth of the opponent's response significantly influenced rally length (β=-0.352, p=0.461; β=-0.281, p=0.721; Figure 3). Even if it was not statistically different, the interaction of serve depth and direction exhibited how a deeper serve in the right T reduced the rally length (β=-1.67, p=0.096). Finally, the rally length significantly increased by a second serve of 9.11% (p=0.012). In addition, the logistic regression showed that each additional shot decreased the probability of winning the point at serve by 3.84% (p<0.001). The second serve increased the chance of losing by 21.57% (p=0.014), whereas serving to the middle of the left side with the conventional formation increased by 70.50% the likelihood of winning (p=0.004).

Figure 3.

Rally length distribution and mean over games, with predicted linear trend for tactics and depth of serve



When players were at serve, the odds ratio of winning the game was 2.97 higher than losing (95% CI: 2.38, 3.71; p<0.001). The OR to win the game for players at serve significantly decreased as the rally length increased by 2.15% (95% CI: 0.97, 0.99; p<0.001) for each additional shot, whereas serve tactics (OR=1.00, 95%CI: 0.76, 1.31), depth (OR=1.29, 95% CI:0.83, 2.00) and number (OR=1.23, 95% CI:0.84, 1.81) did not report significant results. Serving at the T of the left side increased the odds of winning by 1.81 rather than losing (95% CI: 1.00, 3.26; p=0.05), while the T of the right side decreased the probability of winning by 41.64% (95 CI: 0.41, 0.83; p=0.003). Although the serve direction was not affected by its depth, serving in the middle with the conventional formation detected higher winning odds direct to the left side (OR=2.39, 95% CI: 1.40, 4.09; p=0.045) but lower direct to the right side (OR=0.45, 95% CI: 0.21, 0.98; p=0.002).

Discussion

The following manuscript mainly investigates the role of serve strategies on match scores and results. To our hypothesis, serving at conventional or Australian formations may affect the events involved in one single point of the game differently. During a match, several human-based and environmental factors may influence any game situation, and it appears impossible to investigate the cause-effect behind each player's action (Sánchez-Alcaraz,

Cánovas et al., 2022). Investigators reach for associations between one exposition trait and the following event. Although the padel serve is not supposed to be a winning stroke (Prieto-Lage et al., 2024), we retained that serve tactic, serve direction and serve depth are related to the padel match score. We found that padel Australian and conventional formations are strongly associated with the serve side, the direction and the number of games played. Players who served from the right side prefer the conventional formation. Serving at the T prevalence increased throughout the Australian formation, while the glass direction favours conventional. These choices are justified by space-time and playing situations given that the glass is along the farthest line of the player who serves, and it follows reduced time to cover that area if receiving opponent shots. In fact, the observed frequency of serving at the right glass decreased because the opponent may shoot along the disclosure zone with the forehand, which is considered the most comfortable shot (Ramón-Llin et al., 2013). In addition, left-side players should attack more than righters, given that they play with an advantaged angle and a forehand stroke from the court centre (Courel-Ibáñez, 2021). So, the conventional formation serving from the right side could quickly increase the likelihood of the winner's score.

Although the number of games played did not seem to directly influence the final score of the match (Amieba & Salinero, 2013; García-Benítez et al., 2016), it may have a relationship with the total fatiguability (Díaz-García et al., 2021) and energy expenditure (Carrasco et al., 2011) because of the wider amount of distance to cover with the Australian formation. We found that players who preferred the conventional position played 7.5% more games than the Australian one. Just one more game for a match could contribute to an average of 53 up to 70 rallies, which means from 75 up to 144 additional meters to run (Amieba & Salinero, 2013). This result links to the relevant contribution appointed by the rally length during each point of the match. We found that players at serve who won played about 25% fewer rallies per game than those who lost. Previous investigations found that players who won the match played longer than those who lost (Courel-Ibáñez et al., 2017). However, they considered rally length in terms of seconds and associated it with court location and effectiveness during the point. In addition, they did not consider the serve and serving efficiency, which is a good predictor of winning, especially in the first two sets (Martín-Miguel, Muñoz, et al., 2024). In addition, the investigation of Martín-Miguel, Muñoz, et al. (2024) found that there is a positive correlation in men's padel between the number of strokes and win points with a 42% chance of winning the point in the first four rallies and decreasing the probability of winning the point as the number of strokes increases, losing the advantage on serve from the 10th stroke onwards. This factor also occurs in women's padel, where this advantage disappears after the 12th shot (Bueno-García et al., 2024). These observations align with the following investigation that shows a 19% rally length decrease in winners. Also, Sánchez-Alcaraz et al. (2020) exhibited according to outcomes. In addition, as previously shown (Martín-Miguel, Muñoz, et al., 2024), the serve tactic did not affect the rally length. One quantitative interesting pattern emerged: each additional rally decreased the probability of winning the point by 3.84%. Whilst playing at the net increases the probability of winning the point (Courel-Ibáñez et al., 2017), and the serving team prefers winning during the first three to six rallies, players at the net account for many forced and unforced errors. According to our results, prolonging strokes and adopting strategic decisions could be effective for response players. Oddly, the depth of the serve did not influence the point rate score, but serving at second highly decreased the likelihood

of winning that point. This result accords with previous authors who showed that first-serve effectiveness is close to 90% (Sánchez-Alcaraz et al., 2020).

However, both previous and the following studies confirmed that players prefer to serve against the wall, independently of right or left position (Martín-Miguel, Muñoz et al., 2024; Sánchez-Alcaraz et al., 2020), and male elite padel players performed a higher percentage of straight return, especially directed to players at serve (Escudero-Tena, Ibáñez et al., 2024). Although we found similar outcomes in terms of preferred serve target zones (glass), we interestingly discovered that serving to the middle of the left side reduced the rally length by 18.95%, increasing the likelihood of winning. This probability is enhanced by over 70% when the conventional formation is adopted. In addition, serving on the left side, middle, or T is a successful decision with conventional formation, whereas serving on the right opponent's body or the right T is unfavourable. It may segue the time-space relationship between the shorter diagonal distance the ball covers, which could induce left players to shoot with less time for accurate decisions. In addition, stroking with the forehand could erroneously appear as a situational benefit that leads to stronger or more difficult strokes (unforced errors). Differently, the right players may perceive the situation as disadvantageous because of hitting with a backhand stroke and prefer easy shots to prolong the rally. Unfortunately, no previous studies have investigated the effectiveness of serve directions, and a direct comparison is not possible, so many observations are needed.

These findings reinforce the strategic nature of padel and highlight the critical role of technical-tactical mastery in guiding effective training and match preparation. The observed differences emphasise the need for continuous tactical adjustment, particularly during service situations. Understanding that most serves do not reach the wall, that serving increases the chance of winning the point—though this advantage decreases on second serves—that each additional shot reduces the likelihood of success, and that serve effectiveness and rally duration vary depending on the court side, serve direction, and formation used, underscores the importance of adapting tactics to specific game contexts. Therefore, training should include the development of players' ability to recognise specific in-game scenarios where certain technical-tactical actions can increase the probability of winning the point on serve. This approach would enhance decision-making efficiency and improve tactical adaptability during competition.

This study includes many limitations to take into account: a) we analysed only male players, and the outcomes cannot cover female populations; b) mechanical parameters such as ball speed and height have not been considered; c) a baseline assumption concerning homogeneity in players' training status and fatiguability has been considered; d) physiological parameters such as heart rate and blood lactate have not been accounted for.

Conclusions

This study provides relevant evidence on the influence of serve tactics and rally characteristics on performance in padel. Most matches ended in two sets, with a high percentage of points won on serve (62.09%), highlighting the importance of serve direction, formation, and strategy. The conventional formation and serving toward the glass were the most frequent patterns.

Notably, 88.9% of serves did not reach the back wall, suggesting not a technical limitation but a tactical decision by returners to reduce the server's time to reach the net and avoid errors caused by the rebound.

Although most tactical variables did not significantly affect rally length, winners tended to engage in shorter rallies (53.26 vs. 70.64), indicating greater efficiency through winners or forcing errors. In contrast, losing pairs needed longer rallies to win points, underscoring the importance of minimising unforced errors and improving offensive effectiveness. Serving increased the odds of winning a point by 2.57 times.

Second serves were associated with longer rallies (+9.11%) and a 21.57% higher chance of losing the point, reinforcing the importance of the first serve. Additionally, each extra shot reduced the odds of winning the point on serve by 3.84%, supporting strategies that seek to shorten exchanges.

Serve direction also influenced outcomes. Serving to the centre from the left side using conventional formation showed the highest effectiveness (70.50%). Serving to the "T" from the right increased success (OR = 1.81), while the same direction from the left reduced it (−41.64%). These findings highlight the tactical relevance of serve side, direction, and formation.

Finally, although serve depth and return position were not individually significant, their interaction may subtly affect point development. Overall, optimising serve direction and formation and managing rally length appears critical for enhancing padel performance.

Conflict of interest

The authors declare that they conducted the research without any commercial or financial relationships that could be a potential conflict of interest.

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