

SPEED, SUCCESS, STARTING POINTS AND DESTINATIONS OF SERVE IN MALE VOLLEYBALL TEAMS OF THE ESTONIAN CHAMPIONSHIP LEAGUE IN THE MATCHES OF 2024/2025 SEASON

RAINI STAMM¹, ASKO ESNA¹, MEELIS STAMM²

¹*School of Natural Sciences and Health, Tallinn University, Tallinn, Estonia*

²*Headquarters of Estonian Defence Forces, Tallinn, Estonia*

ABSTRACT

The aim of the study was to find which factors influence the success of serve in volleyball, considering the starting point, speed, trajectory and destination of the serve.

The following research questions were set:

1. From which starting point are the serves the most successful?
2. Serves into which zone are the most successful?
3. Do the serves to different lines of the court (the front line, middle line, back line) fly at different speeds?
4. Serves into which line are the most successful?
5. Are diagonal serves more successful and faster than the serves flying along the sideline?

Four Estonian teams of the Cronimet Baltic League of the 2024/2025 season participated in the study – Bigbank Tartu Volleyball Club, Pärnu Volleyball Club, Barrus Võru Volleyball Club and Selver x TalTech Volleyball Club. Parameters such as the starting point, destination, speed and success of the serve were evaluated. The starting points, destinations and success rates of serves were assessed according to the methodology used in the Data Volley program. The serve speeds were measured with a Pocket Radar SD2000 on a kilometre per hour scale. Serve success was assessed on a five-point scale. A total of 1737 service-related activities were analysed. The data were analysed with Microsoft Excel and Jamovi programs. To find statistical significance, Student's *t*-test was used. The level of significance was set at $p < 0.05$. The analysis of results revealed that the greatest number of balls were served from zone 9, and their

mean success rate was the highest – 1.95. The most successful serve destination zone was the middle zone of the front-line zone where the success rate was 2.5. The mean speeds of the balls served to the different lines of the court were different. The fastest balls were served to the back line (81.179 km/h) and the slowest to the middle line (60.109 km/h). The most successful balls were served to the back line where the success rate was 1.936. The comparison of means between the back line and the middle line revealed statistically significant differences between the serve speeds ($p < 0.05$), serve destinations ($p < 0.05$) and serve success rates ($p < 0.05$). Thus, it can be said that statistically significantly more balls were served to the back line than to the middle line. In addition, the mean speed of the balls served to the back line was statistically significantly higher than the speed of the balls served to the middle line, and the success rate of the balls served to the back line was statistically significantly higher than the success rate of the balls served to the middle line. No statistically significant difference was found between the success rates of the balls served diagonally and along the sideline. The success rate of the serves along the sideline was higher than the success rate of diagonal serves. In the case of service errors, the mean speed was higher than in the case of ace serves

Keywords: *volleyball; serve; speed; success; male volleyball players*

INTRODUCTION

In volleyball, every point won or lost starts from the serve, and the serve is the only element of volleyball that a player performs independently of other players and has complete control over [11].

The more complex the serve, the fewer options the opposing team has for attack [7]. A point scored from a serve has a tactical effect that puts the opposing team under pressure. Good serves play an important role in the entire game of volleyball. The quality of volleyball service is influenced by many factors, with physical fitness and level of skills playing a major role [10]. The quality of the serve is an important indicator that regulates how many players of the team receiving the serve can be involved in the attack. A study on serve speeds was conducted during the 2004 Olympic qualification tournament in volleyball [6]. A total of 377 serves were recorded in this study. The results showed that the most common type of serve was the jump serve (84.9%), followed by the floating jump serve (5.6%) and the standing float serve (9.5%). The mean speed of the jump serve was measured to be 88.01 ± 14.18 km/h, the mean speed of the

floating jump serve was 43.38 ± 12.38 km/h, and the mean speed of the standing serve was 41.29 ± 15.19 km/h [6].

The higher the players' level, the more versatile are their technical skills, and the more important it is to not only hit the ball hard but also to vary different serve speeds [1].

Serve speed affects the success of the serve greatly, but the fastest serve is not always the most successful.

The subjects of our study were four Estonian men's teams from the Cronimet Baltic League in the 2024/2025 season. The teams were Bigbank Tartu Volleyball Club, Pärnu Volleyball Club, Barrus Võru Volleyball Club and Selver x TalTech Volleyball Club. A total of 77 sets were observed. All teams were analysed equally in five matches where 1737 serves and their parameters – speed, trajectory, starting point, destination, success rate – were recorded. The aim of our study was to find which factors influence the success of the serve in volleyball, considering its starting point, speed, trajectory and destination.

We attempted to find answers to the following questions: From which starting point are the serves the most successful? Serves into which zone are the most successful? Do the serves to different lines of the court (the front line, middle line, back line) fly at different speeds? Serves into which line are the most successful? Are diagonal serves more successful and faster than the serves flying along the sideline?

MATERIAL AND METHODS

Four Estonian teams from the Cronimet Baltic League of the 2024/2025 season participated in the study. The teams of Bigbank Tartu Volleyball Club, Pärnu Volleyball Club, Barrus Võru Volleyball Club and Selver x TalTech Volleyball Club included male volleyball players aged 17–40 years. The study was conducted between 29 September 2024 and 20 December 2024. There was a total of 68 players in four teams, 12 of whom were setters, 15 were middle blockers, 27 were outside hitters, eight were opposite hitters and six were liberos. The mean height of the players of all the teams was 192.8 ± 6.7 cm, their jump height was 331.22 ± 11.32 cm, and their blocking height was 315 ± 11.99 cm. A total of 77 sets were observed. All teams were analysed equally in five matches where 1737 serves were recorded. For all serves, their starting point, speed, destination and serve success were recorded in each observed match.

The starting points, destinations and success of serves were registered according to the analysis of the Data Volley program. The zones of serve starting points and destinations are shown in Figure 1.

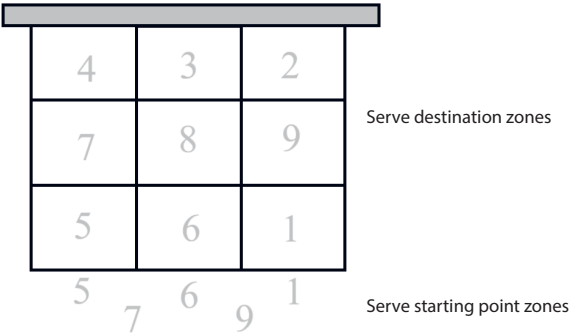


Figure 1. The zones of serve starting points and destinations.

The serve assessment scale is the same as in the Data Volley program where the success of a serve is assessed on a five-point scale.

The success of the serve is assessed as follows:

- 0 – The serve was not received. The player who performed the serve made an error while performing the serve. The player performing the serve stepped onto the end line of the court, the serve was performed into the net, the destination of the serve was outside the court boundaries. The opposing team received a direct point.
- 1 – Weak success of the serve. The serve was very well received by its receivers. The opposing team's setter can perform a set without any problems and lead all the attackers to the attack. The attack can be performed from all zones (zones 1, 2, 3, 4 and 6).
- 2 – Good success of the serve. The serve has been received satisfactorily. The opposing team's setter can lead the attackers to the attack with some difficulty. Attackers can participate in the attack from zones 1, 2 and 4.
- 3 – Very good success of the serve. The serve has been received very poorly. The opposing team's setter and/or some other player are forced to save the ball. The ball is directed to the side of the serving team without an attack.
- 4 – The serve is scored as a point. The serving team gains a direct point from the serve. A player of the receiving team made an error in receiving the serve, or the ball landed on the side of the receiving team.

The success rate was calculated using the following formula:

$$\text{Success rate} = \frac{\text{Sum of serve grades}}{\text{Number of serve performances}}$$

All serve speeds were measured with a Pocket Radar SD2000 on a kilometre per hour scale. This radar records speeds ranging from 40–209 km/h. According to the manufacturer, measurement accuracy of ± 2 km/h can be achieved.

To process all data, Microsoft Excel and Jamovi 2.6.25 programs were used. Minimum and maximum values, means and standard deviations were calculated. Student's *t*-test was used to compare the mean speeds and success rates in different zones of serve. Student's *t*-test was also used to assess the difference in means for balls served diagonally and balls served along the sideline to compare their mean success rates and mean speeds. The level of statistical significance was set at $p < 0.05$.

RESULTS

Table 1 shows that a total of 1737 serves were performed; their mean speed was 75.560 km/h.

Table 1. Serve starting point zones and serve speeds

Serve starting point zone	Number of performances	Mean speed (km/h)	Min speed (km/h)	Max speed (km/h)	SD
Service zone 1	572	77.2	40	121	20.288
Service zone 9	603	87.184	40	116	16.364
Service zone 6	192	77.976	42	122	19.227
Service zone 7	39	72.437	42	106	18.428
Service zone 5	331	63.005	40	101	12.392
Mean		75.56	40.8	113.2	
Serves total	1737				

Note: Serve starting point zones considering all the points gained

Considering all the points gained in the sets, it turned out that the greatest number of serves were performed from zone 9 from which 603 serves were delivered, but the fewest serves were performed from zone 7, from which serves were delivered 39 times. Serves were delivered at the highest speed from zone 9 where the mean speed of the serve was 87.184 km/h. Serves at the lowest speed were delivered from zone 5 where the mean speed of the serve was 63.005 km/h.

The lowest speed of a serve was 40 km/h, and it was served from zone 5; the serve with the highest speed, 122 km/h, was delivered from zone 6.

The starting point of the fastest serves was zone 9, and the starting point of the slowest serves zone 5. The comparison of the mean speeds revealed that the serves from zone 5 were statistically significantly slower ($p<0.01$) than the serves delivered from zone 9.

The analysis considering serve destinations shows that serves were most often delivered into zone 6 – 527 times. The mean speed of the serve was also the highest in this zone – 82.792 km/h. The fewest serves were delivered into zone 2. The serves at the lowest mean speed were delivered into zone 4 with the mean speed 58.111 km/h. Service errors occurred 276 times in total and the mean speed of erroneous serves was 84.634 km/h. The maximum speed of a serve delivered onto the court was 121 km/h and, in the case of an error, 122 km/h. The lowest serve speed was 40 km/h both for a serve delivered into play and in the case of an error.

Table 2 shows the speeds of the serves delivered into three different lines of the volleyball court. The ball was served into the line in front of the net 15 times; the success rate of the serves was 1.685 and the mean speed 64.611 km/h. The minimum speed of balls served to the front line was 50 km/h, which was the highest compared to the other lines. To the middle line, the ball was served 308 times; the success rate of the serves was 1.739 and the mean speed 60.109 km/h. The greatest number of serves were delivered to the back line – 1138 times; there, the success rate of the serves was 1.936 and the mean speed of the serve 81.179 km/h. The maximum speed was the highest in the back line, 121 km/h. Service errors occurred 276 times in total and the mean speed of the serve was 84.634 km/h. In the case of service errors, the minimum speed of the serve was 40 km/h and the maximum speed of the serve 122 km/h.

Table 2. Service success rates and speeds when serves were directed to the front line, middle line or back line and service errors.

Line	Number of perfor- mances	Mean success rate	SD	Mean speed (km/h)	Min speed (km/h)	Max speed (km/h)	SD
Front line (zones 2, 3, 4)	15	1.685	1.474	64.611	50	109	18.277
Middle line (zones 7, 8, 9)	308	1.739	1.167	60.109	40	114	10.614
Back line (zones 1, 6, 5)	1138	1.936	1.204	81.179	42	121	18.708
Mean		1.786		68.633	44	114.666	
Total	1461						
Service error	276			84.634	40	122	18.615
Total	1737						

The comparison of the mean speeds of the back line and the front line was made using Student's *t*-test, but no statistically significant difference was found. Also, no statistically significant difference was found when comparing the mean success rate of the back line and the front line. However, a significant difference was found between the number of serves delivered to the back line and the number of serves delivered to the front line where $p < 0.01$. Thus, statistically significantly more serves were directed to the back line than to the front line.

The comparison of means between the back line and the middle line revealed statistically significant differences between the serve speeds ($p < 0.05$), serve destinations ($p < 0.05$) and serve success rates ($p < 0.05$). Thus, it can be said that statistically significantly more balls were served to the back line than to the middle line. In addition, the mean speed of the balls served to the back line was statistically significantly higher than the speed of the balls served to the middle line, and the success rate of the balls served to the back line was statistically significantly higher than the success rate of the balls served to the middle line. The level of statistical significance was set at $p < 0.05$.

DISCUSSION

The study revealed the factors that influence the success of a serve, considering its starting point, speed, trajectory and the progress of the set in the match.

1737 serves were assessed throughout the study, and the range of serve speeds was 40–122 km/h. The average speed of the serves in the current study was 75.56 km/h, which is nearly the same as in a study conducted in Turkey [3].

The greatest number of serves were performed from behind the end line of the court, from zone 9, which is the second from the right among the serve starting zones. Four authors [2, 4, 8, 9], however, have found in their studies that the greatest number of serves were performed from the rightmost zone. However, since there are more right-handed than left-handed volleyball players, we are of the opinion that right-handed players find it more comfortable to perform serves from the right-hand zone of the court, and therefore more serves are performed just from there. Both the success rate and the mean speed of the serves were higher for serves delivered along the sideline than for serves delivered along the diagonal. More serves were delivered from zone 1, both in the case of serves delivered along the sideline and along the diagonal.

The authors of the study think that more serves were made along the diagonal because the court is diagonally longer than along the sideline, and, therefore, the chance of making an error (hitting the ball out of bounds behind

the back line) is smaller. In the case of serves along the sideline, there is less time to receive the serve than in the case of diagonal serves, and, therefore, in our opinion, the serves along the sideline are more successful. An important detail about the high success of serves along the sideline may also be the fact that when the serve is made from zone 1, the serve receiver is also a front-line attacker, and he may already be focused on the attack, and, therefore, serve reception may remain weaker. On the other hand, if the serve along the sideline is made from zone 5, and the opposing team's setter is coming from zone 1 to set the ball, then he may disturb the serve receiver, and, therefore, the serve reception is weaker.

Interestingly, the most successful were the serves delivered to zone 3. This is the middle zone of the court in front of the net. Since all players are expecting a strong serve, all receivers are in the back line of the court during the reception. If the server performs a strong jump serve, it is expected to land in the back line of the court. However, some serves touch the net and, therefore, change their trajectory and land immediately behind the net into zone 3 of the front line. Therefore, the serves made into zone 3 turned out to be the most successful, although there were not many of them. However, all serves, particularly fast serves, do not land within the court boundaries. Our results revealed that 2.117 errors were made per an ace serve. Lima et al [5], however, found that three errors were made per an ace serve. Thus, our study revealed that, compared to ace serves, fewer errors were made in the Cronimet League than, according to the study of Lima et al in the Golden League in 2018. The number of service errors depends on how much the players want to risk at serve. In the case of a service errors, the mean speed is higher than in the case of ace serves. We believe that the higher the speed of the serve, the more likely a service error will be made. Based on our study, it can be summarised that the greatest number of serves were delivered from zone 9 and their mean success rate was the highest.

The most successful serve destination zone was zone 3 – the middle zone of the front line.

The balls served to the different lines of the court had different mean speeds. The fastest balls were served to the back line and the slowest to the middle line. The serves to the back line proved to be the most successful.

No statistically significant difference was found between the success rates of the balls served diagonally and along the sideline. The mean success rate of the serves along the sideline was somewhat higher than the success rate of diagonal serves.

In the case of service errors, the mean speed of the serve was higher than in the case of ace serves.

REFERENCES

1. Altundag E., Soylu C., Akyildiz Z. (2024). Multidimensional analysis of serving speed in volleyball players by position, sets, and league types: interactions and statistical differences. *BMC Sports Science, Medicine and Rehabilitation*, 16 (1), 240. <https://doi.org/10.1186/s13102-024-01031-z>
2. Barzouka K., Sotiropoulos K., Drikos S., Kitsiou A., Angelonidis Y. (2020). Current trends of the serve skill in relation to the in-game roles of the elite volleyball players: Comparison between genders. *Journal of Human Sport and Exercise*, 16 (2). <https://doi.org/10.14198/jhse.2021.162.08>
3. Çinar Medeni Ö., Akarcesme C., Cerezci S., Özünlü Pekyavas N., Colakoglu F. F., Baltaci G. (2019). Effects of serve type, position, and gender on the serve speed of elite volleyball players. *Spor ve Performans Araştırmaları Dergisi Spor Journal of Sports and Performance Researches*, 10 (2), 131–139. <https://doi.org/10.17155/omuspd.473025>
4. Kitsiou A., Sotiropoulos K., Drikos S., Barzouka K., Malousaris G. (2020). Tendencies of the volleyball serving skill with respect to the serve type across genders. *Journal of Physical Education and Sport*, 20 (2), Art 83, 564–570. <https://doi.org/10.7752/jpes.2020.02083>
5. Lima R. F., Palao J. M., Moreira M., Clemente F. M. (2019). Variations of technical actions and efficacy of national teams' volleyball attackers according to their sex and playing positions. *International Journal of Performance Analysis in Sport*, 19, 491–502. <https://doi.org/10.1080/24748668.2019.1625658>
6. Moras G., Busca B., Pena J., Rodriguez S., Vallejo L., Tous J., Mujuka I. (2008). A comparative study between serve mode and speed and its effectiveness in a high-level volleyball tournament. *Journal of Sports Medicine and Physical Fitness*, 48 (1), 31–36.
7. Pawlik D., Bobula G., Mroczek D. (2024). The effectiveness and types of serves used in elite women's and men's volleyball in the 2021/2022 season. *Scientific Reports*, 14, 1–9. <https://doi.org/10.1038/s41598-024-68262-5>
8. Quiroga M. E., Garcia-Manso J. M., Rodriguez-Ruiz D., Sarmiento S., De Saa Y., Perla Moreno M. (2010). Relation between in-game role and service characteristics in elite women's volleyball. *The Journal of Strength & Conditioning Research*, 2010, 24, 2316–2321. <https://doi.org/10.1519/JSC.0b013e3181e3812e>
9. Stankovic M., Ruiz-Llamas G., Peric D., Quiroga-Escudero M. E. (2018). Analysis of serve characteristics under rules tested at Volleyball Men's Under 23 World Championship. *Retos: nuevas tendencias en educación física, deporte y recreación*, 33, 20–26. <https://acceda.cris.ulpgc.es/handle/10553/41495>

10. Tao Z., Liang X. (2019). Analysis of factors affecting serving effectiveness in volleyball matches. In: 4th International Social Sciences and Education Conference (ISSEC). Wuhan University of Technology Press; 187 – 190.
11. Viera B. L., Ferguson B. J. (1989). *Teaching Volleyball. Steps to Success*. Leisure Press.

Address for correspondence:

Raini Stamm

Institute of Health Sciences and Sport, Tallinn University

Sireli 4, Tallinn, 10913, Estonia

E-mail: raini@tlu.ee