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Service Reception Efficiency of the Romanian National Volleyball Team in the CEV European Silver League 2022

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Abstract: *Modern technologies have become indispensable in analysing sports performance and help to improve the strategies and tactics of volleyball. The study analyses the efficiency of the Romanian national volleyball team's service reception in the CEV European Silver League 2022, using the Data Volley software. The research includes 5 played matches, from the final stages of this competition, analysing both quantitative (number of executions) and qualitative (efficiency) aspects of the service reception, with a distinction between jump serve and float serve. The performance of the 8 players responsible for service reception was evaluated by parameters such as reception efficiency (E%), error% (=), very poor% (/), negative% (-), good% (!), positive% (+), and perfect% (#).*
The results show an average team efficiency of 14% service reception, with differences between service types: 5% for the jump serve and 19% for the float serve. The libero (L) outperformed with an efficiency of 29% on the jump serve and 17% on the float serve, compared to outside hitters (OH), who registered -3% and 20%. The study underlines the team's weaknesses, particularly in receiving the force serve and highlights the need for improvement through training for outside hitters. To improve the team's performance in future competitions, continuous refinement of the service reception technique, supported by the consistent use of Data Volley software for progress monitoring and adjustment of game tactics, is recommended.

Keywords: *volley, reception, service, efficiency, soft, game positions.*

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Introduction

Service reception plays a fundamental role in volleyball dynamics, directly influencing offensive organization and overall team efficiency. An effective reception allows the setter to use all attacking options, diversifying plays, and reducing the predictability of the team's actions. Conversely, an inaccurate reception limits attacking choices, forcing predictable executions and reducing offensive efficiency. Studies suggest that both the reception and the player-receiver significantly impact offensive construction, highlighting procedural relationships within high-level teams (Rocha et al., 2023).

Service reception is a crucial element in high-performance volleyball, directly effecting the efficiency of game phases and, consequently, the overall flow of play. In top-level competitions such as the FIVB Nations League, the European Championships, and the World Championships, match analysis has become a fundamental practice for optimizing tactical strategies and enhancing players' skills.

Numerous international studies have demonstrated that elite teams achieving top performances in international competitions are characterized by high efficiency in service reception (Stamm et al., 2016). Beyond indoor and beach volleyball, recent studies have highlighted the relevance of service reception efficiency in Paralympic volleyball. Research has shown that player positioning and service type significantly influence reception performance, affecting the team's overall success (Cavedon et al., 2024).

Technology has transformed volleyball training and competitions, offering coaches advanced tools to monitor and analyse player performance in detail (Sousa et al., 2023). Using technology to analyse player positioning and movement highlights the value of digital tools in gaining detailed performance insights, as shown in the study on basketball analysis (Ştefănescu, 2016). This concept also applies to physical education, where modern technology aids in assessing student performance and improving training programs to meet current needs (Moisescu & Burlui, 2019). Optimizing the training process for a school's male volleyball team, with the objective on improving performance by adapting training programs, was the subject of the research conducted by (Ungurean & Puni, 2019).

A study on machine-based volleyball data analysis demonstrated how advanced technology enhances team performance evaluation and provides detailed insights into players' technical and tactical skills (Dai & Li, 2021). Data Volley software has become a benchmark in statistical game analysis, enabling a comprehensive understanding of every action on the court (Lopez et al., 2022). Utilizing this technology allows teams to precisely detect

performance gaps and adapt tactical strategies during gameplay, thereby enhancing their likelihood of success (Cheng et al., 2022).

The study focuses on service reception as a key factor influencing the effectiveness of ball control and subsequent attack execution in elite volleyball. (González-Silva et al., 2020; Molina-Martín et al., 2022). Research consistently highlights that effective service reception is crucial for controlling the game's rhythm, with top setters' choice of pick-up areas depending on the reception's quality (Barzouka, 2018).

The characteristics of the serve, such as speed and direction, directly affect reception efficiency and the team's tactical decisions (Altundag et al., 2024). Other research has analysed the biomechanics of reception, offering a structured approach to refining techniques and enhancing player efficiency in game situations (Callupe et al., 2022). To highlight the factors influencing overall performance, comprehensive analyses of the service reception area, pick-up area, and attack quality in high-level teams have been conducted (Fatahi et al., 2022). Body and arm movements in service reception are two key elements that highlight how they coordinate to optimize retrieval performance (Benerink et al., 2015).

Studies on elite volleyball have shown that service effectiveness varies by type and significantly impacts game dynamics, with notable differences between men's and women's competitions (Pawlik et al., 2024). The jump serve, known for its rapid speed and unpredictable flight path, poses a considerable challenge for players (Bhasi & Sadanandan, 2022). The volleyball's trajectory was examined by dividing and categorizing its flight path to gain deeper insights into the ball's dynamics and behaviour during gameplay (Chen & Chu, 2021). The team's success in high-level competitions significantly depends on its ability to swiftly adapt to various serves by effectively responding to visual and dynamic cues (Kitsiou et al., 2020). In this context, players adapt their movements based on opponent cues, while effective teamwork is essential for successful service reception (Paulo et al., 2016). Research has identified critical game variables that influence success and performance levels in elite men's volleyball, emphasizing their significance in competitive outcomes (Drikos et al., 2021; Valhondo et al., 2018).

The Rio 2016 Olympic Games demonstrated that reception quality directly impacts attack efficiency, emphasizing the importance of technical synergy in elite volleyball (Araújo et al., 2020). The adaptation of players to receiving in the face of service constraints plays a crucial role in influencing outcomes in elite volleyball (Paulo et al., 2018). A study on elite male volleyball analysed the relationship between service reception, team rotation,

and effectiveness in securing side-out points (Lopez et al., 2022). A statistical analysis of CSM Volei Alba Blaj's service and reception in the final stages of the 2018 CEV Champions League identified key factors affecting performance in crucial moments (Sopa & Szabo, 2019).

A comparative investigation of jump and float serve strategies in Croatia's elite men's volleyball league identified key differences in effectiveness, offering insights for tactical optimization (Aščić et al., 2024). Service reception analysis provides valuable insights into the team's strengths and weaknesses, helping to adjust game strategies (Stankovic et al., 2019).

Although service reception has been examined in numerous international studies, there is limited data on national teams from Central and Eastern Europe. This study provides a new perspective by evaluating Romania's national team using advanced video and statistical analysis methods. The findings offer valuable insights for optimizing high-level team training. Previous research has focused on the impact of technology and game strategies on volleyball team performance, examining service reception, attack efficiency, and the influence of technical and tactical variables on competitive success. In this context, the assessment of service reception in the CEV European Silver League 2022 provides a clear insight into how this technical element affects performance in an international tournament.

This study analyzes the efficiency of service reception in the Romanian national team, comparing the float serve and the jump serve, as well as the individual performances of the players. Based on the collected data and literature, we formulate the following hypotheses:

- We estimate that there will be individual differences in the evaluation of the overall efficiency of service reception in the team.
- We anticipate differences in the efficiency of service reception depending on the type of service (jump serve vs. float serve).
- We predict noticeable differences in the performance of the player positions (libero vs. outside hitters) in terms of service reception.

Material and method

The study included eight players from the Romanian national volleyball team, responsible for service reception, who participated in the final stages of the CEV European Silver League 2022. They were selected based on their specific role in the team, being actively involved in performing this technical skill during the competition. The sample consisted

of two liberos and six outside hitters, reflecting the team's composition for this competition. The participants' ages ranged from 19 to 36 years.

To analyze the efficiency of service reception, this research employs a secondary data analysis based on official match recordings provided by the national team statisticians. The data was subsequently processed and analyzed to highlight the effectiveness of service reception in a competitive context. All data was provided to the Human Performance Research Center of the Faculty of Physical Education and Sport in Galați in 2024. The study adhered to the necessary ethical guidelines for research involving human subjects, ensuring the protection and confidentiality of personal data. The publication of the results was approved by the faculty's Ethics Committee, as per Decision No. 242 dated 10.07.2024.

For the analysis of service reception, recordings from five official matches in the final stage of the CEV European Silver League 2022 were used. The data was collected and processed using Data Volley, a specialized software for statistical game analysis. The first author of this article is also a coach at CS Arcada Galați, where the national team head coach works. This position provided direct access to statistical data and the Data Volley software, facilitating a detailed analysis of service reception.

Employing this specialized software enabled the precise extraction and interpretation of statistical data, providing a robust basis for evaluating service reception efficiency at both team and individual levels (Szabo & Sopa, 2015). Data Volley stands out as a cutting-edge recording system, enabling rapid data capture and analysis through advanced computer technology. Its capabilities in recording, evaluating, and analyzing in-game actions provide a comprehensive platform for performance assessment and strategic development (Data Project, 2024).

Romania	Skill detail														
Skill	Player	*E%	Tot	=	%	/	%	-	%	!	%	+	%	#	%
Reception	Team	53%	195	14	7%	3	2%	37	19%	37	19%	36	18%	68	35%
Player	1	58%	52	3	6%			9	17%	10	19%	13	25%	17	33%
Player	2	41%	22	3	14%	2	9%	5	23%	3	14%	1	5%	8	36%
Player	3	50%	68	4	6%	1	1%	14	21%	15	22%	13	19%	21	31%
Player	4	55%	29	2	7%			6	21%	5	17%	3	10%	13	45%
Player	5	62%	21	2	10%			2	10%	4	19%	6	29%	7	33%

Fig. 1. Example of Service Reception Analysis Using Data Volley

Using standard codes, every play action is transformed into accurate data, providing detailed information about the individual skills of the players and the team as a whole.

Table 1. Service reception analysis with data volley software

	Serve receive
=	Error – a direct point awarded to the opposing team.
/	Very Poor – the ball lands in the opponent's court, granting the opposing team half a point
-	Negative - limited attacking options, allowing only a single offensive play
!	Good- the ball is received beyond the 3-meter line, offering limited attacking possibilities
+	Positive - the ball reaches the 3-meter line, enabling the setter to execute several attacking options, though not all offensive combinations are available.
#	Perfect – the setter has access to all attacking options

Therefore, in addition to its varied range of statistical analysis, the Data Volley software is also equipped with an integrated video analysis and evaluation system, known as Data Video. The obtained information was used to evaluate the efficiency of service reception in the team, with a particular focus on the differences that may occur depending on various technical and individual variables.

Findings

The examination of service reception efficiency provided valuable insights into player performance. The overall efficiency was 14%, with an error rate of 7%. Additionally, 13% of receptions were classified as Very Poor% and Negative%, while Positive% receptions accounted for 19%, and Perfect% for 27%. In addition to the overall obtained results, there were significant variations between players in terms of service reception. The variability in performance between players is clearly highlighted by L1's high efficiency of 29%, with a low Error% (5%) and a considerable percentage for Positive% (26%) and Perfect (29%). On the other side, OH 5 recorded the worst performance, with an efficiency of -8%, highlighting the need for significant improvements in service reception. The data indicates significant performance variability, with liberos excelling in service reception, while outside hitters face challenges.

Table 2. Overall Efficiency of Service Reception

Player	*E%	Tot	Error%	VeryPoor%	Negative%	Good% (!)	Positive%	Perfect%
L 1	29%	42	5%	10%	12%	19%	26%	29%
L 2	24%	109	6%	10%	13%	19%	23%	29%
OH 1	13%	23	9%	13%	13%	22%	13%	35%
OH 2	18%	152	7%	9%	13%	24%	21%	26%
OH 3	13%	99	7%	9%	15%	26%	15%	28%
OH 4	9%	57	7%	16%	12%	21%	18%	26%
OH 5	-8%	13	8%	23%	15%	15%	15%	23%
OH 6	11%	9	11%	11%	11%	22%	22%	22%
Average	14%	504	7%	13%	13%	21%	19%	27%

Figure 2 shows the overall average of service reception efficiency, while also highlighting the significant differences between players, thus emphasizing the individual variations between them.

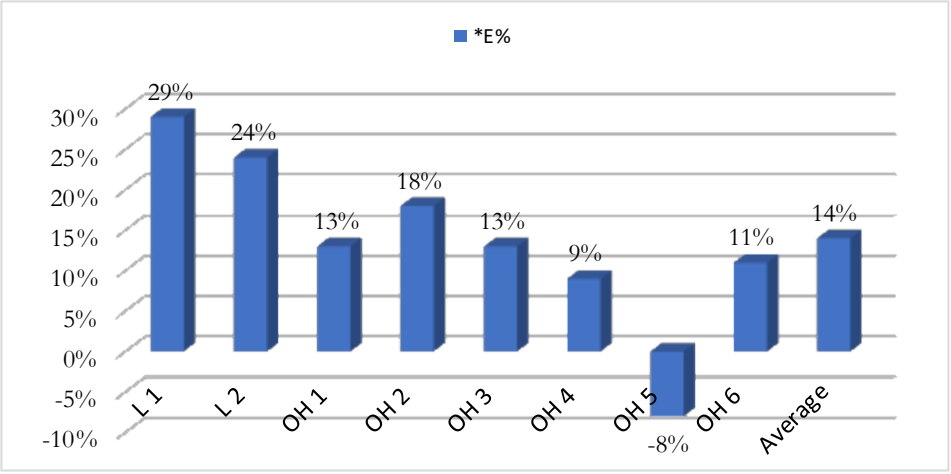


Fig. 2. Average Service Reception Efficiency for all Players

The average efficiency values for the reception of jump serves are shown in Table 3. The overall efficiency recorded is 5% with an Error% of 9%, while the percentages for receives classified as Very Poor% and Negative% are 14% and 12%. However, 23% of receives were Good% and 26% were Perfect%, indicating that the overall efficiency is low. There were also notable performances at certain points in the game.

Table 3. Efficiency of Jump Serve Reception

Player	*E%	Tot	Error%	Very Poor%	Negative%	Good%	Positive%	Perfect%
L 1	32%	28	0%	11%	14%	18%	29%	29%
L 2	26%	92	5%	10%	13%	17%	24%	30%
OH 1	18%	11	9%	9%	9%	27%	9%	36%
OH 2	6%	86	10%	12%	13%	24%	19%	22%
OH 3	7%	45	11%	7%	16%	27%	11%	31%
OH 4	-7%	28	7%	25%	7%	29%	4%	29%
OH 5	-25%	8	13%	25%	13%	25%	13%	13%
OH 6	-17%	6	17%	17%	17%	17%	17%	17%
Average	5%	304	9%	14%	12%	23%	16%	26%

The chart illustrates the differences in efficiency (*E%) at jump serve reception for the analysed players. Liberos 1 and 2 stand out with the highest efficiency percentages, which confirms their key contribution to service reception. As we move to the Outside hitters, the efficiency significantly decreases, with OH 1 performing moderately well, while OH 2 and OH 3 register lower values. The poorest efficiency was recorded for OH 4, 5, and 6, where the lowest efficiency of -25% is distinguished for OH 5, indicating significant reception difficulties.

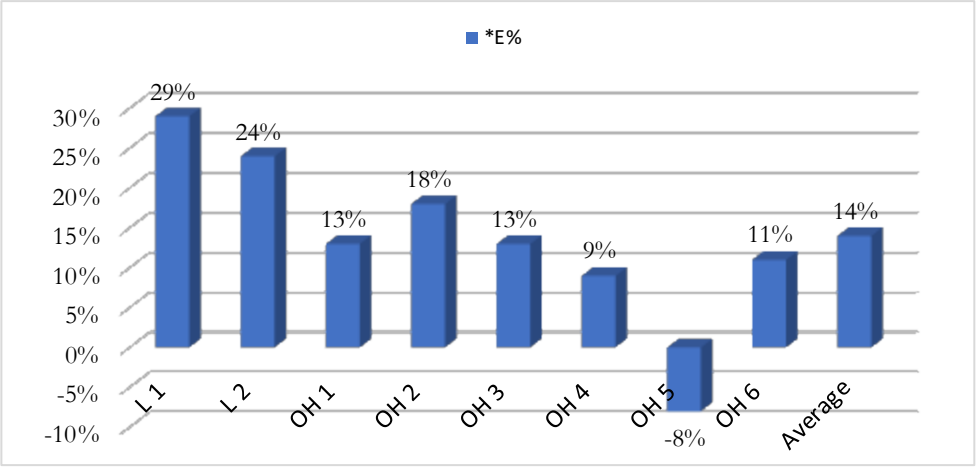


Fig. 3. Average Efficiency of Jump Serve Reception

The analysis of the eight players' performance data in float service receive shows an average team efficiency of 19%, accompanied by an Error% of 5% and a 10% error rate for Very Poor%. These results are correlated with very good percentages for Good% (21%), Positive% (23%), and Perfect% (30%), highlighting a high level of performance in this type of

service reception. We also find significant individual differences in efficiency for the float serve, but these are not as pronounced as the force serve.

Table 4. Efficiency of Float Serve Reception

Player	*E%	Tot	Error%	Very Poor%	Negative%	Good%	Positive%	Perfect%
L 1	21%	14	14%	7%	7%	21%	21%	29%
L 2	12%	17	6%	12%	12%	29%	18%	24%
OH 1	8%	12	8%	17%	17%	17%	17%	33%
OH 2	18%	66	2%	6%	14%	24%	24%	30%
OH 3	19%	54	2%	11%	15%	26%	20%	26%
OH 4	24%	29	7%	7%	17%	14%	31%	24%
OH 5	20%	5	0%	20%	20%	0%	20%	40%
OH 6	33%	3	0%	0%	0%	33%	33%	33%
Average	19%	200	5%	10%	13%	21%	23%	30%

In Figure 4, the significant differences in the efficiency (*E%) of the float serve reception between players are illustrated. Liberos 1 and 2 have the highest initial efficiency values, but the efficiency considerably decreases for OH 1, which has an efficiency of 8%. OH 2 and 3 show a slight improvement, while OH 4 and especially OH 6 reach efficiency peaks, the latter having the highest value.

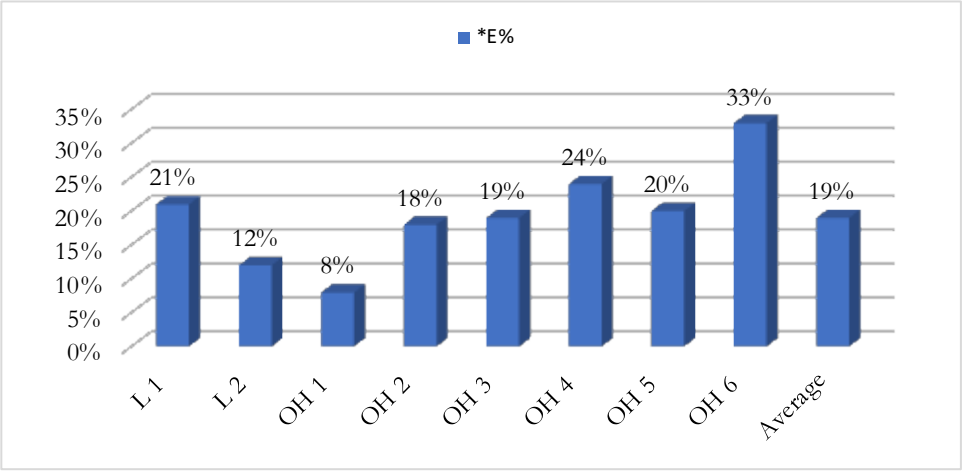


Fig. 4. Average Efficiency of Float Serve Reception

Analysing the average percentages for the libero position, there was an average efficiency of 29%, which indicates a solid performance in jump serve reception. The error rate (Error%) is low, averaging only 3%, reflecting

a low number of errors. Receives categorized as Very Poor% and Negative% have averages of 11% and 14%, suggesting a significant proportion of receives that did not reach the desired level. In contrast, the Good% category averaged 18%, Positive% (27%), and Perfect% an average of 30%, highlighting the libero's good ability to effectively manage the jump service.

Table 5. Efficiency of libero players in jump serve reception

Player	*E%	Tot	Error%	Very Poor%	Negative%	Good%	Positive%	Perfect%
L 1	32%	28	0%	11%	14%	18%	29%	29%
L 2	26%	92	5%	10%	13%	17%	24%	30%
Average	29%	120	3%	11%	14%	18%	27%	30%

The average values of the outside hitters for jump serve reception showed a negative value of -3%, which indicates major difficulties in this compartment. For the Error% criterion, we have a high average of 11%, suggesting a considerable number of errors. The Very Poor% and Negative% receives have high averages of 16% and 13%, showing that almost a third of the receives were sub-optimal. On the other hand, the Good% and Perfect% receives have averages of 25%, indicating that the outside hitters had good moments, but inconsistency reduces their efficiency.

Table 6. Efficiency of Outside Hitters in Jump Serve Reception

Player	*E%	Tot	Error% (=)	Very Poor%	Negative%	Good%	Positive%	Perfect%
OH 1	18%	11	9%	9%	9%	27%	9%	36%
OH 2	6%	86	10%	12%	13%	24%	19%	22%
OH 3	7%	45	11%	7%	16%	27%	11%	31%
OH 4	-7%	28	7%	25%	7%	29%	4%	29%
OH 5	-25%	8	13%	25%	13%	25%	13%	13%
OH 6	-17%	6	17%	17%	17%	17%	17%	17%
Average	-3%	184	11%	16%	13%	25%	12%	25%

The chart clearly highlights the differences in performance between the libero and the outside hitters in service reception. The libero showed significantly higher efficiency, with a low error rate (*Error% 3%) and a high percentage of perfect receptions (*Perfect% 30%). In contrast, outside hitters had a negative average efficiency and a higher error rate (*Error% 11%). The outside hitters also had higher values for receives classified as Very Poor% and Negative%, indicating difficulties in handling this type of service.

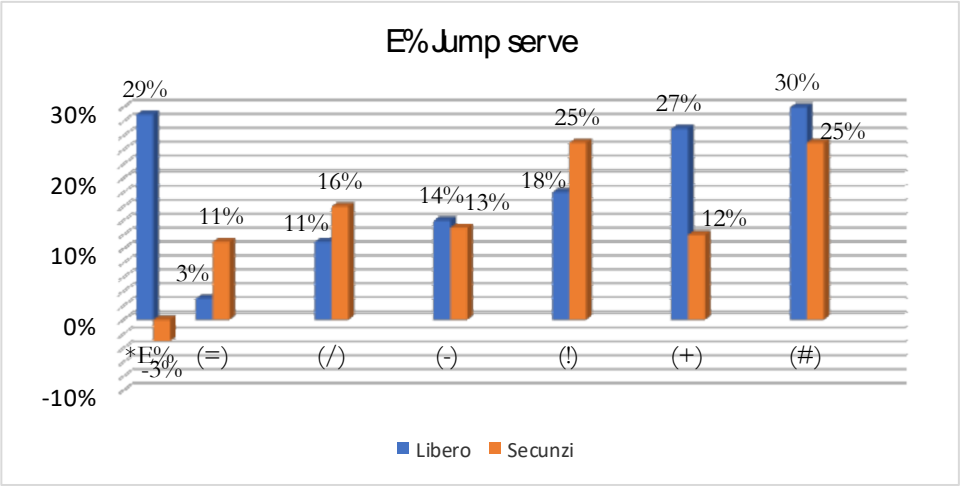


Fig. 5. Average Efficiency Values for Jump Serve Reception by Playing Position (Libero vs. Outside Hitters)

The performance of the two liberos on the float serve shows an average efficiency of 17%, lower than on the jump serve. The error rate (10%) and Very Poor% and Negative% receives (both 10%) indicate consistency problems in the game. However, the Good% (25%), Positive% (20%), and Perfect% (27%) receives show that the libero also had good moments in the game.

Table 7. Efficiency of Libero Players in Float Serve Reception

Player	*E%	Tot	Error%	Very Poor%	Negative%	Good%	Positive%	Perfect%
L 1	21%	14	14%	7%	7%	21%	21%	29%
L 2	12%	17	6%	12%	12%	29%	18%	24%
Average	17%	31	10%	10%	10%	25%	20%	27%

For the float serve reception, the outside hitters had an average efficiency of 20%, an improvement over the jump serve. The Error% percentage is low at 3% and Very Poor% and Negative% receives have averages of 10% and 14%. The Good% (19%), Positive% (24%) and Perfect% (31%) receives reflect a good ability to manage this type of service, with a considerable proportion of excellent executions.

Table 8. Efficiency of Outside Hitters in Float Serve Reception

Player	*E%	Tot	Error%	Very Poor%	Negative%	Good%	Positive%	Perfect%
OH 1	8%	12	8%	17%	17%	17%	17%	33%
OH 2	18%	66	2%	6%	14%	24%	24%	30%
OH 3	19%	54	2%	11%	15%	26%	20%	26%
OH 4	24%	29	7%	7%	17%	14%	31%	24%
OH 5	20%	5	0%	20%	20%	0%	20%	40%
OH 6	33%	3	0%	0%	0%	33%	33%	33%
Average	20%	169	3%	10%	14%	19%	24%	31%

The chart illustrates the differences in the performance of the two playing positions for the float service reception. Outside hitters have a higher efficiency of Perfect% (#), while libero players have better percentages of Good% receives (!). At the same time, outside hitters show a lower rate for Error% (=), indicating a higher consistency in this type of serve reception.

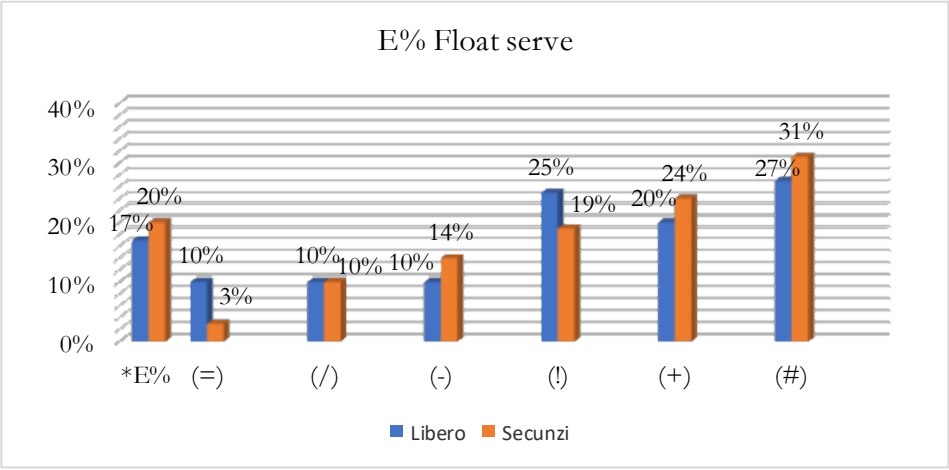


Fig. 6. Comparison of Float Serve Reception Efficiency Between Liberos and Outside Hitters

In addition to the obtained statistical data, the use of the Data Video software allowed a detailed analysis of the players for service reception. Several technical-tactical issues were identified based on the type of serve:

Problems in float serve reception:

- Difficulty controlling the ball when receiving sideways;
- Loss of stability due to unnecessary shifts or jumps during reception;
- Ball played too close to the torso, limiting control and accuracy.

Problems in Jump Serve Reception:

- Players are positioned too far forward, reducing reaction time;
- Inefficient positioning limits reception angles and disrupts the organization of the next phase of play.

These observations highlight key aspects that require improvement during training, providing opportunities to optimize players' technique and coordination depending on the type of received serve.

Discussions

Match analysis plays a crucial role in developing training programs in volleyball (Ciemiński, 2018). Our study confirmed that a detailed evaluation of service reception provided valuable insights into players' weaknesses, facilitating training adjustments. Match analysis directly contributes to training strategy adjustments, providing valuable insights for the development of players' technical and tactical skills (Marques Junior, 2021). Our data supports this idea, highlighting that specific adjustments have primarily focused on service reception.

A previous study highlighted the importance of statistical analysis in optimizing the performance of elite athletes (Fellingham, 2022). Our results support this conclusion, showing that the use of Data Volley software enabled a detailed evaluation of service reception and the identification of individual players' weaknesses.

Previous research has shown that reception efficiency influences the success of attacks, varying according to the players' experience and skill level (Adamec & Přidal, 2024). Our analysis confirms these differences, revealing an average efficiency of 14%, with significant variations among players. Libero 1 achieved an efficiency of 29%, while Outside Hitter 5 (S5) recorded the lowest performance, with an efficiency of -8%.

Previous research has highlighted the importance of technical and tactical factors in the success of teams at the international level. (Cantú-González et al., 2022). The results of our study confirm this idea, showing that precise service reception and quick positioning, based on the type of serve, improved attack organization. The findings indicate significant differences between the two types of services. Reception efficiency for the jump serve was 5%, with an error rate of 9%, whereas the float serve showed higher efficiency at 19% and a reduced error rate of 5%. These results support the hypothesis that notable variations exist between the two serve types, with float serve reception demonstrating greater effectiveness compared to jump serve reception.

Previous studies have highlighted the importance of player coordination during service reception (Mazur, 2021). These findings support this observation, showing that effective collaboration between the libero and outside hitters was linked to improved reception quality and more efficient attack organization.

Research has shown that anticipating the trajectory and distance of the serve based on sensory cues enhances reception efficiency (Sors et al., 2018). The findings align with this perspective, indicating that players who maintained optimal positioning and responded quickly achieved higher reception efficiency while reducing errors.

The results indicate that the libero demonstrated high efficiency in jump serve reception, with 29% E%, 30% perfect receptions, and only 3% errors. In contrast, the outside hitters had lower efficiency (-3%), with 11% errors and 25% perfect receptions. For the float serve, the libero's efficiency dropped to 17%, with 27% perfect receptions and 10% errors. On the other hand, the outside hitters managed this type of serve better, achieving 20% E%, only 3% errors, and 31% perfect receptions. These differences confirm that service reception efficiency varies depending on the player's position and the type of serve received.

Our study confirms international findings on the importance of service reception efficiency, positioning, and quick adaptation to different serves. Unlike research focused on team tactics, we analyzed technical efficiency, emphasizing individual differences. Video analysis helped identify key reception details, aligning with methods used in top competitions. This study enhances existing knowledge by providing a detailed perspective on individual performance in elite volleyball.

This data provides coaches with essential insights for adjusting training methods and implementing specific drills aimed at improving service reception techniques. For example, positioning exercises and correcting body orientation during reception can optimize players' efficiency against jump and float serves. Additionally, individualized video analysis facilitates the identification and correction of technical details, while communication drills between liberos and outside hitters enhance on-court collaboration. Integrating these methods into team training, regardless of the competitive level, can enhance athletes' performance and contribute to a deeper understanding of the tactical aspects of the game.

To better illustrate these concepts, the images below present several positioning solutions for players based on the type of service and the zone from which it is executed, providing a visual guide for tactical adjustments in training and game situations. For jump serves from Zone 1, the "left-hand

rule" applies to balls between players, while for serves from Zone 5, the "right-hand rule" is used. For short serves from Zone 6, outside hitters are responsible for handling short balls.

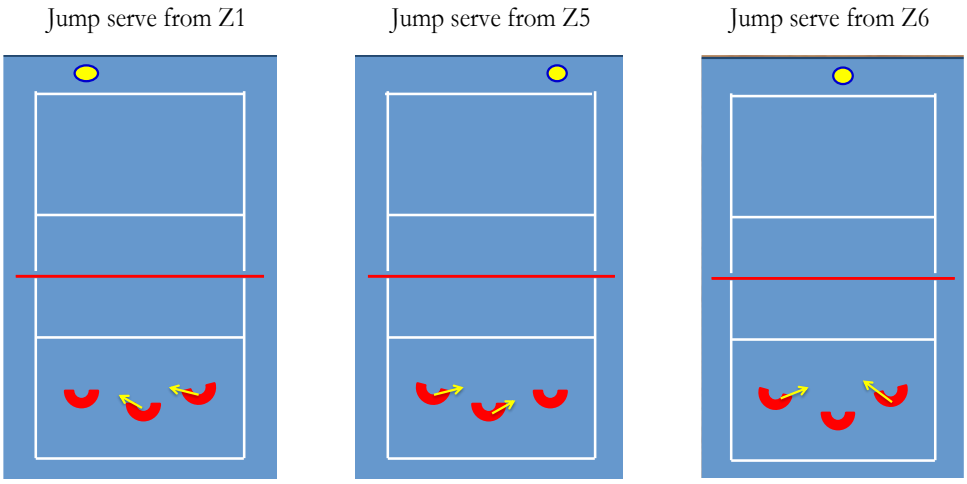


Fig. 7. Player positioning for receiving a jump serve based on the opponent's serving zone (Zones 1, 5, and 6).

Player positioning for float serve reception. For serves from Zones 1 and 5, the formation protects the outside hitter in Zone 4. For serves from Zone 6, outside hitters cover short balls and body-targeted serves, while the libero handles deep balls and body-targeted receptions.

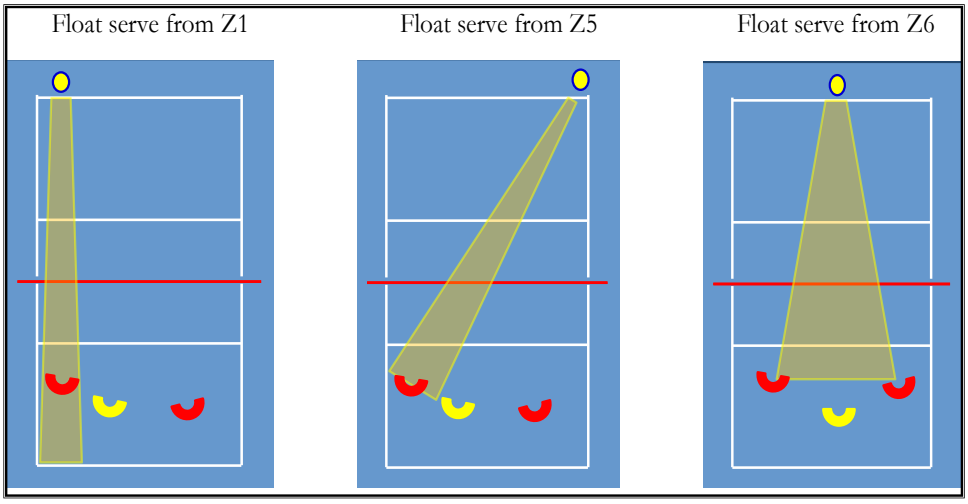


Fig. 8. Player positioning for receiving a float serve based on the opponent's serving zone (Zones 1, 5, and 6)

Study limitations: This research presents certain limitations that should be considered. One key aspect is the sample size, which was limited to eight players from Romania's national team. While the results provide valuable insights into service reception efficiency, a larger sample, including players from other teams or competitions, could offer a broader perspective on this technical element. The analysis was based on data from the CEV European Silver League 2022, without comparisons to other competitions. Expanding the study to include additional tournaments could provide a more comprehensive understanding. Furthermore, the study focused exclusively on service reception efficiency, without examining its impact on other aspects of the game.

For future research, it is recommended to expand the player sample and analyze a larger number of matches. Incorporating additional factors, such as the biomechanical characteristics of reception, the impact of fatigue levels, and the influence of competitive stress, could provide a more detailed perspective on the efficiency of this skill. Additionally, examining opponents' serving strategies and player communication could further contribute to optimizing game strategies.

Conclusions

Our study highlighted significant differences in the efficiency of jump serve and float serve reception, emphasizing the role of player positioning based on the type of serve. The results indicate that liberos were more effective in receiving jump serves, while outside hitters adapted better to float serves. These findings underscore the need for an individualized training approach, tailored to serve type and player role, to enhance team performance. Beyond these practical implications, this study expands the understanding of serve reception strategies in elite volleyball by providing data on a national team from Central and Eastern Europe, a region less covered in previous research. The methodology applied aligns with approaches used in international performance analysis and can serve as a model for optimizing training strategies globally.

Continuous monitoring of service reception through video and statistical analysis provides coaches with essential tools for identifying player vulnerabilities and adjusting training methods. Expanding this type of analysis to other teams or competitions could offer a broader perspective on effective service reception strategies. Future research should explore the impact of player positioning and opponent tactics on reception efficiency, as well as incorporate additional factors such as the biomechanics of movements and the influence of competitive stress. This approach could contribute to the development of more precise recommendations for optimizing training and enhancing team performance.

Author contributions

All authors played a significant role in the research process, contributing to the conceptual framework, data analysis, and manuscript development, ensuring the scientific accuracy and coherence of the final publication.

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References

Adamec, P., & Přidal, V. (2024). The relationship between serve-receive quality and attack performance across different age categories in women's elite volleyball. *Journal of Physical Education & Sport*, *24*(5), 1133–1138. https://doi.org/DOI:10.7752/jpes.2024.05130

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

Araújo, C., Tosini, L., Freire, A., Costa, G., & Jr, C. (2020). Original Article Reception-attack relation in men's and women's volleyball during the Rio 2016 Olympics. *Journal of Physical Education and Sport*, *20*, 2008. https://doi.org/10.7752/jpes.2020.s3271

Aščić, S., Marinović, M., Kuna, D., Ćurić, M., & Marelić, M. (2024). Analyzing Volleyball serve strategies: comparing jump and float serves in the Croatian Men's Volleyball Superleague. *Sports Science and Health*, *28*(1), 13–17. https://doi.org/10.7251/SSH2401013A

Barzouka, K. (2018). Comparison and assessment of the setting zone choices by elite male and female volleyball setters in relation to the reception quality. *Journal of Physical Education and Sport*, *18*, 2014–2021. https://doi.org/DOI:10.7752/jpes.2018.s5299

Benerink, N. H., Bootsma, R. J., & Zaal, F. T. J. M. (2015). Different temporal bases for body and arm movements in volleyball serve reception. *Scandinavian Journal of Medicine & Science in Sports*, *25*(5), 603–609. https://doi.org/10.1111/sms.12384

Bhasi, S. U., & Sadanandan, C. (2022). Analysis of jump serve takeoff velocity among national level male volleyball players. *International Journal of Physiology, Nutrition and Physical Education, 7*(1), 149–151. https://doi.org/10.22271/journalofsport.2022.v7.i1c.2447

Callupe, R. L., Chau, J. M., Garcia, J. G., Chicoma, C. G., Arrese, C. F., Artieda, M. H., Elias, D. A., & Villota, E. R. (2022). Testing protocol for evaluating underhand serve-reception biomechanics in volleyball. *Proceedings of the Institution of Mechanical Engineers, Part P: Journal of Sports Engineering and Technology*, 175433712211063. https://doi.org/10.1177/17543371221106360

Cantú-González, J. R., Hueyotl-Zahuantitla, F., Castorena-Peña, J. A., & Aguirre-López, M. A. (2022). The attack-block-court defense algorithm: a new volleyball index supported by data science. *Symmetry*, *14*(8), 1499. https://doi.org/10.3390/sym14081499

Cavedon, V., Sandri, M., Zuccolotto, P., Biasiolo, C., Zancanaro, C., & Milanese, C. (2024). Serving to win: Exploring serve-reception effectiveness in high-level male and female sitting volleyball players. *Frontiers in Sports and Active Living*, *6*, 1471094. https://doi.org/10.3389/fspor.2024.1471094

Chen, C.-N., & Chu, W.-T. (2021). How it flies and why it flies? Volleyball trajectory segmentation and classification. *IEEE Transactions on Circuits and Systems II: Express Briefs*, *68*(5), 1591–1595. https://doi.org/DOI: 10.1109/TCSII.2021.3067027

Cheng, X., Liang, L., & Ikenaga, T. (2022). Automatic data volley: Game data acquisition with temporal-spatial filters. *Complex & Intelligent Systems*, *8*(6), 4993–5010. https://doi.org/10.1007/s40747-022-00752-3

Ciemiński, K. (2018). The efficiency of executing technical actions in volleyball and the teams' gender and sports level. *TRENDS in Sport Sciences*, *25*(3), 159–165. https://tss.awf.poznan.pl/pdf-189069-110305?filename=110305.pdf

Dai, X., & Li, S. (2021). Volleyball data analysis system and method based on machine learning. *Wireless Communications and Mobile Computing*, *2021*(1), 9943067. https://doi.org/10.1155/2021/9943067

Data Project. (2024). *Data Volley 4 Media*. https://dataprojectwebsoftware.blob.core.windows.net/software/dvw4media/DataVolleyMedia_handbook.pdf

Drikos, S., Barzouka, K., Nikolaidou, M.-E., & Sotiropoulos, K. (2021). Game variables that predict success and performance level in elite men's volleyball. *International Journal of Performance Analysis in Sport*, *21*(5), 767–779. https://doi.org/10.1080/24748668.2021.1945879

Fatahi, A., Molla, R. Y., Drikos, S., Alriyami, S. A., & Jadidoleslam, S. (2022). A comprehensive analysis of the serve reception zone, set zone and attack quality of the top-level volleyball players. *European Journal of Human Movement*, *48*, 54–63. https://doi.org/10.21134/eurjhm.2022.48.6

Fellingham, G. W. (2022). Evaluating the performance of elite level volleyball players. *Journal of Quantitative Analysis in Sports*, *18*(1), 15–34. https://doi.org/10.1515/jqas-2021-0056

González-Silva, J., Fernández-Echeverría, C., Conejero, M., & Moreno, M. P. (2020). Characteristics of serve, reception and set that determine the setting efficacy in men's volleyball. *Frontiers in Psychology*, *11*, 222. https://doi.org/10.3389/fpsyg.2020.00222

Kitsiou, A., Sotiropoulos, K., Drikos, S., & Malousaris, G. (2020). *Tendencies of the volleyball serving skill with respect to the serve type across genders*. 564–570. https://doi.org/DOI:10.7752/jpes.2020.02083

Lopez, E., Diez-Vega, I., & Molina, J. (2022). Reception and performance in high level male volleyball: A relational study. *Journal of Human Sport and Exercise*, *17*. https://doi.org/10.14198/jhse.2022.172.16

Marques Junior, N. K. (2021). Match analysis for elaborate the volleyball training: A review. *Journal of Sports and Games*, *3*(1), 1–7. https://doi.org/10.22259/2642-8466.0301001

Mazur, L. (2021). Identification of the mapping models of the players cooperation in serve reception in volleyball. *Central European Journal of Sport Sciences and Medicine*, *35*(03), 71–85. https://doi.org/DOI: 10.18276/cej.2021.3-07

Moisescu, P. C., & Burlui, R. M. (2019). The perception of physical education in the Romanian educational system. *Bulletin of the Transilvania University of Braşov. Series IX: Sciences of Human Kinetics*, 113–122. https://doi.org/10.31926/but.shk.2019.12.61.2.46

Molina-Martín, J. J., Diez-Vega, I., & López, E. (2022). Reception-attack transition in volleyball: analysis of spike effectiveness. *Apunts. Educació Física i Esports*, *149*, 53–62. https://doi.org/10.5672/ apunts.2014-0983.es.(2022/3).149.06

Paulo, A., Davids, K., & Araújo, D. (2018). Co-adaptation of ball reception to the serve constrains outcomes in elite competitive volleyball. *International Journal of Sports Science & Coaching*, *13*(2), 253–261. https://doi.org/10.1177/1747954117722727

Paulo, A., Zaal, F. T., Fonseca, S., & Araújo, D. (2016). Predicting volleyball serve-reception. *Frontiers in psychology*, *7*, 1694. https://doi.org/10.3389/fpsyg.2016.01694

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), 17286. https://doi.org/10.1038/s41598-024-68262-5

Rocha, A. C. R., Laporta, L., Rodrigues, G. P., Barbosa De Lira, C. A., De Oliveira Castro, H., & De Conti Teixeira Costa, G. (2023). Is it possible for the reception and the player-receiver to influence the offensive construction in volleyball? An ecological vision and Intragame procedural relationships in high-level teams. *International Journal of Performance Analysis in Sport*, *23*(4), 319–333. https://doi.org/10.1080/24748668.2023.2229204

Sopa, I. S., & Szabo, D. A. (2019). Statistical comparison related to service and reception of the volleyball team CSM Volei Alba Blaj in the CEV Champions League Final Four 2018. *Timişoara Physical Education and Rehabilitation Journal*, *12*(23). https://doi.org/DOI: 10.2478/tperj-2019-0009

Sors, F., Lath, F., Bader, A., Santoro, I., Galmonte, A., Agostini, T., & Murgia, M. (2018). Predicting the length of volleyball serves: The role of early auditory and visual information. *PLoS One*, *13*(12), e0208174. https://doi.org/10.1371/journal.pone.0208174

Sousa, A. C., Marques, D. L., Marinho, D. A., Neiva, H. P., & Marques, M. C. (2023). Assessing and monitoring physical performance using wearable technologies in volleyball players: A systematic review. *Applied Sciences*, *13*(7), 4102. https://doi.org/10.3390/app13074102

Stamm, R., Stamm, M., Vantsi, M., & Jairus, A. (2016). Comparative analysis of serve and serve reception performance in pool B of European Men's Volleyball Championship 2015. *Papers on Anthropology*, *25*(2), 55-69. https://doi.org/10.12697/poa.2016.25.2.06

Stankovic, M., Ruiz Llamas, G., Perić, D., & Quiroga, M. (2019). Point-scoring plays related to level of set win and in-game role during volleyball rules testing. *Journal of Human Sport and Exercise*, *14*. https://doi.org/10.14198/jhse.2019.141.07

Szabo, D. A., & Sopa, I. S. (2015). Study on the interpretation of the results in a volleyball game by using a specific program of statistics. *Procedia-Social and Behavioral Sciences*, *180*, 1357–1363. https://doi.org/10.1016/j.sbspro.2015.02.277

Ştefănescu, A. C. (2016). Digital analysis of player's positioning and movement during a basketball official game. *Ovidius University Annals, Series Physical Education & Sport/Science, Movement & Health*, *16* (2, Supplement): 674-679. https://www.analefefs.ro/anale-fefs/2016/i2s/pe-autori/60.pdf

Ungurean, B. C., & Puni, A. R. (2019). Optimizing the contents of training for the men's representative volleyball school team. *Bulletin of the Transilvania University of Braşov. Series IX: Sciences of Human Kinetics*, 179–186. https://doi.org/10.31926/but.shk.2019.12.61.27

Valhondo, Á., Fernández-Echeverría, C., González-Silva, J., Claver, F., & Moreno, M. P. (2018). Variables that predict serve efficacy in elite men's volleyball with different quality of opposition sets. *Journal of Human Kinetics*, *61*(1), 167–177. https://colab.ws/articles/10.1515%2Fhukin-2017-0119