



The Effect of Target Area Training on Open Smash Accuracy in Volleyball Players

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Abstrak

Akurasi open smash yang masih rendah di kalangan atlet bola voli serta terbatasnya penerapan metode latihan yang berorientasi pada peningkatan akurasi masih menjadi tantangan penting dalam pembinaan bola voli. Penelitian sebelumnya lebih banyak berfokus pada latihan berbasis target untuk keterampilan servis dan passing, sedangkan penerapan program latihan target area yang disusun secara progresif dengan memanfaatkan variasi posisi target, jarak target, dan arah serangan untuk meningkatkan akurasi open smash masih belum banyak dikaji. Oleh karena itu, penelitian ini bertujuan untuk mengetahui pengaruh metode latihan target area terhadap peningkatan akurasi open smash pada atlet Klub Bola Voli PERBVOB Tawangmangu. Penelitian ini menggunakan pendekatan kuantitatif dengan desain quasi-experimental one-group pretest-posttest, yang melibatkan 20 atlet laki-laki berusia 16–23 tahun yang dipilih melalui teknik purposive sampling. Intervensi dilaksanakan selama enam minggu dengan frekuensi dua kali latihan per minggu, sehingga total terdapat 12 sesi latihan. Data dikumpulkan menggunakan tes akurasi open smash berbasis zona target dan dianalisis menggunakan statistik deskriptif, uji normalitas Shapiro-Wilk, paired-samples t-test, serta analisis ukuran efek Cohen's d menggunakan IBM SPSS Statistics versi 27. Hasil penelitian menunjukkan adanya peningkatan akurasi open smash yang signifikan secara statistik setelah diberikan intervensi ($p < 0,001$), dengan nilai Cohen's d sebesar 4,80, yang menunjukkan efek praktis yang sangat besar. Temuan ini menunjukkan bahwa program latihan target area dapat menjadi pendekatan yang efektif untuk meningkatkan akurasi open smash atlet sekaligus menawarkan model latihan berbasis akurasi yang lebih kontekstual dalam pembinaan bola voli. Meskipun demikian, ukuran sampel yang relatif kecil serta penggunaan desain quasi-eksperimental tanpa kelompok kontrol membatasi generalisasi hasil penelitian. Oleh karena itu, penelitian selanjutnya disarankan menggunakan desain eksperimen yang lebih ketat dengan kelompok kontrol dan jumlah sampel yang lebih besar untuk mengonfirmasi efektivitas metode latihan target area.

Kata kunci: Atlet, akurasi open smash, latihan target area, bola voli

Abstract

Low open smash accuracy among volleyball athletes and the limited application of accuracy-oriented training methods remain important challenges in volleyball coaching. Previous studies have primarily focused on target-based training for serving and passing skills, whereas the application of a progressively structured target area training program incorporating variations in target position, target distance, and attack direction to improve open smash accuracy has received limited attention. Therefore, this study aimed to examine the effect of the target area training method on improving open smash accuracy among athletes of the PERBVOB Tawangmangu Volleyball Club. A quantitative approach using a quasi-experimental one-group pretest-posttest design was employed, involving 20 male athletes aged 16-23 years selected through purposive sampling. The intervention was conducted over six weeks, with two training sessions per week, resulting in a total of 12 training sessions. Data were collected using a target zone-based open smash accuracy test and analyzed using descriptive statistics, the Shapiro-Wilk normality test, a paired-samples t-test, and Cohen's d effect size analysis

with IBM SPSS Statistics version 27. The results revealed a statistically significant improvement in open smash accuracy following the intervention ($p < 0.001$), with a Cohen's d value of 4.80, indicating a very large practical effect. These findings suggest that the target area training program may provide an effective approach for improving athletes' open smash accuracy while offering a more contextual accuracy-based training model for volleyball coaching. Nevertheless, the relatively small sample size and the use of a quasi-experimental design without a control group limit the generalizability of the findings. Therefore, future studies are recommended to employ more rigorous experimental designs with control groups and larger sample sizes to further confirm the effectiveness of the target area training method.

Keywords: *athlet, smash open accuracy, target area training, volleyball.*

INTRODUCTION

Sports are planned, structured, and repetitive physical activities aimed at improving physical fitness, technical skills, and the competitive abilities of individuals or groups. In the context of education and sports development, these activities function not only as a means of improving health, but also as a medium for developing motor skills, cognitive abilities in decision-making, and teamwork attitudes. One sport that embodies this complexity is volleyball, which is played in teams and involves the coordination of technique, tactics, and optimal physical condition (Rahmi, 2025). The implementation of volleyball requires mastery of various fundamental techniques such as serving, passing, smashing, and blocking, which are performed systematically to achieve maximum performance in competition (Sistiasih et al., 2019).

In the dynamics of modern volleyball, the smash is a primary attacking technique that contributes significantly to a team's point scoring, particularly the open smash executed from the wing side. This technique requires a combination of strength, speed, coordination, and precision in directing the ball to areas that are difficult for opponents to reach (Yanka et al., 2023). Therefore, the success of a smash is determined not only by physical ability alone, but also by precise technical skills and rapid decision-making in dynamic game situations. This aligns with the increasingly competitive development of volleyball, in which the effectiveness of attacks is greatly influenced by variations in technique and ball placement strategies. Empirical evidence shows that variations in smash types and the appropriate selection of target areas play a significant role in improving the success of team attacks (Palinata, 2023).

The high popularity of volleyball in Indonesia further reinforces the importance of developing effective and innovative training methods to improve athlete performance. Volleyball has become one of the sports favored by various groups, both at the school and club levels, making systematic coaching an essential need that cannot be overlooked (Jayadilaga et al., 2023). However, in practice, many training programs still place greater emphasis on strength and repetitive technical drills in general, without giving special attention to the accuracy of ball placement. In the context of modern play, however, accuracy is a key factor that determines the success of an attack, especially in match situations that demand efficiency and effectiveness in every available opportunity (Yoga et al., 2025).

One approach considered relevant to address this need is the target area training method, a training method that emphasizes achieving specific targets through directed and measurable movement repetitions. This method provides clear visual stimuli for athletes, enabling them to improve control over the direction and height of the ball according to the tactical demands of the game. In addition, this approach allows for more optimal skill transfer into match situations, particularly when the training design is developed by considering its alignment with real-game contexts (Shinta et al., 2025). In this regard, training functions not only as a means of movement repetition, but also as a learning process involving the integration of perception, decision-making, and movement execution.

The effectiveness of a training method is also strongly influenced by the clarity of objectives, the selection of appropriate strategies, and the provision of systematic and continuous feedback. Directed feedback enables athletes to identify movement errors and make gradual improvements, resulting in more significant skill enhancement (Keswando & Septi Sistiasih, 2022). In this context, target area-based training becomes increasingly relevant because it can improve concentration, motor control, and hitting accuracy through an emphasis on achieving specific targets. Therefore, this method is oriented not only toward final outcomes, but also toward a more effective motor learning process.

From a motor learning perspective, variation in training is one of the key factors contributing to long-term skill improvement. Training variations such as changes in position, pass speed, and target



variation have been shown to strengthen sensorimotor adaptation and enhance athletes' decision-making abilities in different situations (Ramara et al., 2025). This approach emphasizes that monotonous training tends to be less effective in developing adaptive skills. Therefore, the target area training method should be designed by considering structured variations in order not only to improve accuracy temporarily, but also to maintain performance under actual match conditions.

In addition to technical aspects and motor learning, improvements in smash accuracy are also inseparable from the contribution of physical components, particularly muscular power and neuromuscular coordination (Bompa et al., 2019). Research shows that strength and movement speed are related to hitting effectiveness; however, strength alone is not sufficient without technical training focused on ball direction control. Therefore, training programs that integrate physical and technical aspects, particularly through the target area method, have the potential to provide more comprehensive improvements in smash skills. On the other hand, evaluation is also an important part of the training process, where the use of valid and reliable measurement instruments is necessary to objectively assess smash accuracy and measure the effectiveness of the interventions provided (Jariono et al., 2023).

In the context of sports coaching at the club level, such as among volleyball athletes at PERBVOB Tawangmangu Club, a common issue is the suboptimal accuracy of open smashes and the absence of training methods specifically oriented toward improving hitting accuracy. Existing training programs tend to remain general in nature and have not systematically applied a target-based approach. This condition indicates a gap between training needs and field implementation, highlighting the need for more directed and contextual training method innovations. Research at the club level is important because the effectiveness of an intervention is strongly influenced by real conditions in the field, such as the availability of facilities, training intensity, and coach competence (Ramara et al., 2025).

Furthermore, this study offers novelty by integrating dynamic target zone variations and the use of digital visual feedback within the target area training method. This approach is expected to improve visual-motor coordination, strengthen attentional focus, and support athletes' real-time decision-making. Although several previous studies have examined the use of target-based methods to improve the accuracy of basic skills such as serving and passing, studies specifically investigating the effect of the target area method on open smash accuracy remain relatively limited. Therefore, this study makes an important contribution to filling this knowledge gap while providing more specific empirical evidence regarding the effectiveness of this method.

Based on the description above, the problem addressed in this study focuses on the low accuracy of athletes' open smashes and the suboptimal implementation of training methods oriented toward accuracy improvement. This study aims to analyze the effect of the target area training method on open smash accuracy among volleyball athletes at PERBVOB Tawangmangu Club. The findings are expected to provide theoretical contributions to the development of sports coaching science, particularly regarding accuracy-based training methods and motor learning, as well as practical benefits as a reference for coaches in designing more effective training programs, helping athletes improve smash performance, and supporting the sustainable development of sports coaching systems at the club level.

METHOD

This study employed a quantitative approach using a quasi-experimental method with a one-group pretest-posttest design to examine the effect of the target area training method on open smash accuracy by comparing participants' performance before (*pretest*) and after (*posttest*) the intervention (Jariono et al., 2025). The study was conducted at the PERBVOB Tawangmangu Volleyball Club training court, Karanganyar Regency, Indonesia, from January to February 2026 over a six-week period, with two training sessions conducted each week, resulting in a total of 12 training sessions for all participants. The study population consisted of 30 active volleyball athletes, while the sample comprised 20 male athletes selected through purposive sampling (Sutama et al., 2022) based on the following criteria: (1) aged 16-23 years, (2) actively participating in the club's regular training program, (3) willing to complete the entire research protocol, and (4) free from injury throughout the study. The sample size

was considered adequate for a quasi-experimental study with repeated measures and was consistent with recommendations from previous sport intervention studies. Prior to data collection, all participants received detailed information regarding the study objectives, procedures, potential benefits, and possible risks, and provided written informed consent before participating. Ethical approval for the study was granted by the management of the PERBVOB Tawangmangu Volleyball Club, and all research procedures were conducted in accordance with the ethical principles of the Declaration of Helsinki.

The research procedure consisted of three stages: pretest, intervention, and posttest. The pretest was administered to assess the athletes' baseline open smash accuracy. Participants then completed a six-week target area training program comprising 12 training sessions. Each session lasted approximately 90 minutes, including a 15-minute warm-up, 60-minute main training session, and 15-minute cool-down. During the main training session, athletes completed five sets of ten open smash attempts directed toward predetermined target zones, with a one-minute rest interval between sets. The training protocol incorporated progressive variations in attack direction, starting position, target distance, and target location on the opponent's court. Training difficulty was gradually increased every two weeks by modifying target size and combining different attack directions to enhance ball control and hitting accuracy. All training sessions were supervised by the same club coach to ensure consistency of the intervention. Upon completion of the training program, a posttest was conducted using the same procedures as the pretest to evaluate improvements in open smash accuracy.

Data were collected using the open smash accuracy test developed by Jariono et al (2023). The instrument consisted of a standard volleyball court equipped with designated target zones to assess ball placement accuracy. The instrument demonstrated satisfactory content validity through expert evaluation and acceptable internal consistency reliability, with a Cronbach's alpha coefficient of 0.706. Each athlete performed ten open smash attempts. Scores were awarded according to the designated target zone successfully hit by the ball, whereas invalid attempts or balls landing outside the court were assigned a score of zero. The total score obtained by each athlete was used as an indicator of open smash accuracy.

Data analysis began with descriptive statistics, including the mean, standard deviation, minimum and maximum values, and score range for both the pretest and posttest (Sugiyono, 2019). The Shapiro-Wilk test was subsequently performed to examine data normality. If the data were normally distributed, a paired-samples t-test was applied; otherwise, the Wilcoxon signed-rank test was used, with the level of statistical significance set at $p < 0.05$. Inferential statistical results were reported comprehensively, including the test statistic (t or Z), degrees of freedom (df), p-value, mean difference, 95% confidence interval (95% CI), and effect size to determine the magnitude of the intervention effect (small, medium, or large). All statistical analyses were performed using IBM SPSS Statistics version 27.

RESULTS AND DISCUSSION

Results

Open smash ability data were obtained through measurements using a test instrument developed by Jariono et al (2023), which was administered in two stages; before treatment (pretest) and after the interval training intervention (posttest). The measurement results were then statistically analyzed using SPSS software to provide an overview of changes in performance. Before hypothesis testing was conducted, prerequisite analysis in the form of a normality test was carried out to ensure that the data distribution met the assumptions of parametric statistics. The normality test in this study used the Shapiro-Wilk method, which was selected because the sample size was relatively small, consisting of 20 players from PERBVOB Club, making this method the most appropriate and sensitive for detecting normality in a limited sample size.

Table 1. Test of Normality

Test of Normality						
	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	Df	Sig.
Pretest	.113	20	.200*	.960	20	.537
Posttest	.169	20	.138	.954	20	.425

*. This is a lower bound of the true significance.

a. Lilliefors Significance Correction



The results of the normality test showed that the open smash ability data in both the pretest and posttest were normally distributed and met the assumptions for parametric analysis. In the initial measurement (pretest), the significance value was 0.537 (> 0.05), with a mean score of 19.35 and a standard deviation of 2.960, while the score range extended from a minimum of 15 to a maximum of 25. Meanwhile, in the final measurement (posttest), the significance value of 0.425 (> 0.05) also indicated a normal distribution, with the mean increasing to 24.25 and a standard deviation of 2.863, and scores ranging from a minimum of 19 to a maximum of 29.

The increase in the mean score from pretest to posttest indicates a tendency toward improvement in open smash ability after the treatment was administered. In addition, the relatively stable standard deviation values in both measurements indicate consistent data dispersion across subjects. Since all significance values were above the $\alpha = 0.05$ level, the assumption of normality was considered fulfilled, meaning the data were appropriate for analysis using parametric statistical techniques, namely the paired sample t-test. The fulfillment of this prerequisite strengthens the validity of hypothesis testing, allowing interpretations regarding the effect of the target area training method on improving open smash accuracy to be made more accurately, objectively, and reliably.

Table 2. Paired Samples Test

		Paired Differences				T	df	Sig. (2-tailed)
		Mean	Std.Deviation	Std. Error Mean	95% Confidence Interval of the Difference Lower Upper			
Pair 1	Pretest- Posttest	- 4.9000	1.02084	.22827	-5.37777 -4.42223	- 21.466	19	<.001
		t						

Hypothesis testing in this study was conducted using a Paired Sample t-test to determine whether there was a difference in open smash ability before and after the target training treatment was administered. The results of the analysis showed a mean difference of -4.90 between the pretest and posttest scores. This difference indicates a change in open smash ability following the treatment. Based on the statistical calculation, the obtained t-value was -21.466 with 19 degrees of freedom (df). In addition, the significance value (Sig. 2-tailed) was reported as <.001, which is far lower than the established significance level of 0.05.

Thus, these results indicate a significant difference in open smash ability before and after the target training intervention. Therefore, it can be concluded that target training had a significant effect on improving open smash ability among PERBVOB club athletes, suggesting that this training method can be considered an effective alternative for enhancing attacking technique performance in volleyball.

Table 3. Paired Samples Effect Sizes

		Paired Samples Effect Sizes			95% Confidence Interval	
			Standardizer ^a	Point Estimate	Lower	Upper
Pair 1	Pretest- Posttest	Cohen's d	1.02084	-4.800	-6.370	-3.219
		Hedges' correction	1.04155	-4.705	-6.243	-3.155

a. The denominator used in estimating the effect sizes.

Cohen's d uses the sample standard deviation of the mean difference.

Hedges's correction uses the sample standard deviation of the mean difference, plus a correction factor.

The results of the paired samples effect size analysis showed an improvement in performance from pretest to posttest. This was indicated by a mean difference of -4.800, suggesting that the posttest

scores were higher than the pretest scores. In addition, the 95% confidence interval ranged from -6.370 to -3.219 and did not cross zero, indicating a significant difference. The obtained effect size values, namely Cohen's *d* of -4.800 and Hedges' *g* of -4.705, were classified as very large, meaning that the treatment had a very strong effect on improving open smash ability outcomes.

Discussion

The findings of this study demonstrated a significant improvement in the open smash performance of volleyball athletes following participation in the target area training program. The significant difference between the pretest and posttest scores ($p < 0.001$), accompanied by a very large effect size, suggests that the observed improvement was likely associated with the implementation of the training method. Although the one-group pretest-posttest design does not permit definitive causal inferences due to the absence of a control group, these findings provide empirical evidence that target area training has the potential to be an effective approach for improving open smash accuracy among volleyball athletes.

These findings are consistent with Yoga et al (2025), who identified open smash accuracy as one of the primary indicators of attacking effectiveness in competitive volleyball. The present study also supports the findings of Fauzi and Jariono (2022), who reported that smash performance is influenced not only by mastery of fundamental techniques but also by the implementation of structured training programs. More broadly, the results are consistent with motor learning theory, which proposes that improvements in motor skills depend on the quality of practice experiences and opportunities to adapt movement patterns to varying task conditions (Schmidt & Lee, 2019).

The improvement in open smash accuracy observed in this study may be associated with the characteristics of the training program, which incorporated systematic variations in target position, attack direction, and target distance throughout the intervention. These variations encouraged athletes to continuously adjust their perception of the target while executing the movement, allowing skill acquisition to rely not only on repetitive practice but also on the ability to adapt to changing task demands. This interpretation is consistent with the concept of perception-action coupling within the framework of ecological dynamics, which emphasizes that sport skills emerge through continuous interactions between athletes and practice environments that closely represent competitive situations (Woods et al., 2020).

This interpretation is further supported by the studies of Palinata (2023), Yanka et al (2023), and Santoso (2018), which demonstrated that successful open smash performance results from the interaction of multiple components, including biomechanical coordination, upper-limb explosive power, wrist flexibility, and efficient movement sequencing from the approach phase to ball contact. Therefore, the improvement in accuracy observed in the present study was likely influenced not only by increased hitting power but also by enhanced movement coordination and greater precision in directing the ball through practice involving varied target locations.

The primary novelty of this study lies not in the use of technology or visual feedback systems, but in the implementation of a progressively structured target area training program incorporating systematic variations in target position, target distance, and attack direction. This approach extends conventional target-based training, which typically relies on static targets, by providing athletes with opportunities to adapt their attacking skills to a wider range of game-like situations. Consequently, this study offers a more contextual target-based training approach for improving open smash accuracy.

The present findings also extend those of Ismail and Tunggal (2020), who emphasized the importance of sport-specific training for enhancing volleyball attacking performance. Unlike their study, which primarily focused on improving physical capacity through bench step exercises, the present study emphasizes the development of hitting accuracy through systematic training variations. This approach is consistent with the principle of variable practice, which suggests that practicing under varying conditions enhances skill retention and transfer because athletes continually adapt their movements to different task constraints (Schmidt & Lee, 2019). The findings also support Khoerunnisa et al (2023), who argued that physical conditioning should be integrated with training models that facilitate skill adaptation in order to optimize technical performance.

From a practical perspective, the findings suggest that the target area training method may serve as an effective alternative for designing volleyball training programs aimed at improving attacking accuracy. The use of varied target locations enables coaches to create more contextual practice environments without requiring sophisticated equipment. This approach is consistent with the concept of representative learning design, which emphasizes the importance of designing practice environments



that closely resemble competitive performance demands to facilitate effective skill acquisition (Wulan et al., 2025). Therefore, the method has the potential to be incorporated into attacking skill development programs across different levels of athlete development.

Despite these promising findings, several limitations should be acknowledged. The use of a quasi-experimental design without a control group means that the influence of other factors contributing to performance improvement cannot be entirely ruled out. In addition, the relatively small sample size and the inclusion of athletes from only a single volleyball club limit the generalizability of the findings. Future studies are therefore encouraged to employ stronger experimental designs with control groups, recruit larger and more diverse samples, and examine the effectiveness of the target area training method across different age groups and levels of playing experience.

Overall, this study provides empirical evidence that a progressively structured target area training program has the potential to improve open smash accuracy in volleyball athletes. The principal contribution of this study lies in demonstrating the effectiveness of systematic target variations as a more contextual training strategy compared with conventional static target practice. These findings contribute to the growing body of knowledge on volleyball attacking skill development and provide a foundation for future research to further evaluate target-based training interventions using more rigorous experimental designs.

CONCLUSION

Based on the research findings, data analysis, and statistical testing, it can be concluded that the target area training method has a significant effect on improving open smash accuracy among athletes of PERBVOB Tawangmangu Club. The implementation of this method was proven to enhance open smash accuracy performance, as reflected in the differences between pretest and posttest scores after the treatment was administered. The results of the paired sample t-test showed a significance value of <0.001 ($p < 0.05$), confirming a meaningful difference between conditions before and after training. These findings were strengthened by a Cohen's d effect size value of 4.80, which falls into the large effect category, indicating that the effect of the training was not only statistically significant but also had a strong practical impact on improving athlete performance. Therefore, the target area method can be recommended as an effective training approach for developing open smash accuracy, as well as an alternative accuracy-based training model in volleyball performance development.

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