



Effect of Distance-Variation Training on Overhand Serve Skills among Female Volleyball Athletes at PBV Bangau Club

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Abstract

Objectives: This study examined the effect of distance-variation training on the overhand serve skills of female volleyball athletes at PBV Bangau Club.

Materials and Methods: A quantitative pre-experimental design with a one-group pretest-posttest model was used. Fourteen female athletes were selected through total sampling. The intervention consisted of 12 training sessions focused on overhand serve practice from gradually varied distances of 3 m, 6 m, and 9 m. Serve skill was measured using an overhand serve target test consisting of six attempts. Data were analyzed using descriptive statistics, the Shapiro-Wilk normality test, and the paired-sample t-test at a significance level of 0.05.

Results: The mean pretest score was 14.57 +/- 1.83, while the mean posttest score increased to 19.86 +/- 2.03. The mean improvement was 5.29 points (36.27%). The Shapiro-Wilk test indicated normally distributed pretest and posttest data ($p = 0.498$ and $p = 0.717$, respectively). The paired-sample t-test showed a significant difference between pretest and posttest scores, $t(13) = -15.614$, $p < 0.001$, with a very large within-subject effect size (Cohen's $d_z = 4.17$).

Conclusions: Distance-variation training significantly improved overhand serve skills among female volleyball athletes at PBV Bangau Club. The program can be used by coaches as a practical drill strategy to develop serve control, accuracy, and consistency.

Keywords: distance-variation training; overhand serve; volleyball; female athletes; skill accuracy

1. Introduction

The overhand serve is one of the most important technical actions in volleyball because it initiates each rally and can directly influence scoring opportunities, opponent reception quality, and team momentum. Although it appears to be a single striking action, a successful overhand serve requires coordinated ball toss, body balance, arm swing timing, contact accuracy, and controlled force production. For developing athletes, inconsistency in these elements often leads to serves that fail to cross the net, land outside the court, or do not reach the intended target area.

Initial observation at PBV Bangau Club showed that several female athletes still had difficulty executing accurate and consistent overhand serves. The main technical problems were unstable ball toss, poor synchronization between arm swing and body movement, less precise ball contact, and inconsistent balance during the striking phase. These problems reduced serve effectiveness and limited the athletes' ability to use the serve as a tactical opening action during play.

One training strategy that may address these problems is distance-variation training. In this method, athletes perform overhand serves from different distances in a gradual sequence. The distance is manipulated from closer



to farther positions so that athletes can repeatedly adjust the force, trajectory, and timing of the movement. This approach is not merely repetitive practice; it exposes athletes to changing task demands, which may improve motor control, accuracy, and confidence when serving from the regulation service area.

Previous studies support the value of structured and varied service practice. Targeted overhand serve drills have been shown to improve overhand serve accuracy in volleyball participants (Mardila et al., 2024), while target-variation training has also been reported to improve service skill, accuracy, consistency, and control (Cadul & Hakim, 2026). From a motor-learning perspective, practice variability and contextual interference can influence volleyball serve acquisition and transfer, indicating that practice structure affects how athletes learn and adapt serving skills (Travlos, 2010; Cruz et al., 2018). However, practical evidence focusing on female club-level athletes using progressive distance variation remains limited, particularly in Indonesian volleyball club settings.

Therefore, this study aimed to determine whether distance-variation training significantly improves overhand serve skills among female volleyball athletes at PBV Bangau Club. The research hypothesis was that athletes would demonstrate significantly higher overhand serve scores after completing a 12-session distance-variation training program.

2. Materials and Methods

2.1 Research Design

This study used a quantitative pre-experimental method with a one-group pretest-posttest design. The athletes were tested before the intervention, completed the distance-variation training program, and were then tested again using the same instrument. This design enabled comparison of skill performance before and after the training program within the same group.

2.2 Participants and Setting

The participants were 14 female volleyball athletes from PBV Bangau Club. Because the population was small, all athletes were included as the sample through total sampling. The study was conducted in June 2026 at the volleyball court of Universitas Katolik Musi Charitas, Palembang, Indonesia. Permission to conduct the study was obtained from the club, and all testing and training activities were carried out under the supervision of the researcher and coach.

2.3 Training Intervention

The intervention consisted of 12 training sessions conducted over three weeks. Each session included warm-up activities, core distance-variation overhand serve drills, and cool-down activities. In the core session, athletes practiced overhand serves from three progressive distances: 3 m, 6 m, and 9 m. The closer distance was used to stabilize ball toss, arm swing timing, and contact point. The middle distance emphasized force control and ball trajectory, while the far distance emphasized regulation-like serve execution and target accuracy. Coaches provided technical feedback on foot placement, body balance, eye focus, ball toss, and timing of contact.

2.4 Instrument and Measurement Procedure

Overhand serve skill was measured using a target-based overhand serve test. Each athlete performed six valid serve attempts from the service area. The court was divided into target zones scored from 1 to 5 according to the landing area. The total score represented the athlete's overhand serve performance, with higher scores indicating better accuracy and control. The score categories were: excellent (≥ 23), good (18-22), moderate (11-17), poor (7-



10), and very poor (≤ 6). The same procedure was used for the pretest and posttest to maintain measurement consistency.

2.5 Data Analysis

The data were analyzed using descriptive statistics, including mean, standard deviation, minimum score, maximum score, and percentage improvement. The Shapiro-Wilk test was used to examine normality because the sample size was less than 50. After the data met the normality assumption, a paired-sample t-test was used to compare pretest and posttest scores. Statistical significance was set at $p < 0.05$. A within-subject effect size was calculated using Cohen's d_z by dividing the mean paired difference by the standard deviation of the paired differences.

3. Results

The descriptive results show a clear improvement in overhand serve performance after the distance-variation training program. Before the intervention, the athletes' mean score was in the moderate category. After 12 training sessions, the mean score increased to the good category. The descriptive statistics are presented in Table 1.

Table 1. Descriptive statistics of overhand serve scores

Test	n	Mean	SD	Minimum	Maximum	Category
Pretest	14	14.57	1.83	11	17	Moderate
Posttest	14	19.86	2.03	16	23	Good
Gain	14	5.29	-	4	8	36.27% improvement

The individual results also show that all athletes improved after the intervention. The pretest scores ranged from 11 to 17, while the posttest scores ranged from 16 to 23. This indicates that the improvement occurred across the sample rather than being limited to only a few athletes.

Table 2. Individual pretest and posttest scores

No.	Pretest	Posttest	Gain
1	13	18	5
2	12	20	8
3	15	23	8
4	11	16	5
5	16	20	4
6	16	21	5
7	13	18	5
8	17	22	5
9	14	19	5
10	15	20	5
11	14	18	4
12	15	19	4
13	16	21	5
14	17	23	6

The Shapiro-Wilk normality test showed that both pretest and posttest data were normally distributed because the significance values were greater than 0.05. Therefore, the paired-sample t-test was appropriate for hypothesis testing.

**Table 3.** Shapiro-Wilk normality test

Variable	Statistic	df	Sig.	Decision
Pretest	0.946	14	0.498	Normal
Posttest	0.960	14	0.717	Normal

The paired-sample t-test indicated a statistically significant difference between pretest and posttest scores. The mean paired difference was -5.286, showing that posttest scores were higher than pretest scores. The significance value was below 0.05; therefore, the null hypothesis was rejected and the research hypothesis was accepted.

Table 4. Paired-sample t-test results

Comparison	Mean diff.	SD diff.	SE	95% CI (lower)	95% CI (upper)	t	df	p	Cohen's dz
Pretest - Posttest	-5.286	1.267	0.339	-6.017	-4.554	-15.614	13	<0.001	4.17

4. Discussion

This study found that distance-variation training significantly improved the overhand serve skills of female volleyball athletes at PBV Bangau Club. The mean score increased from 14.57 to 19.86, with an average gain of 5.29 points or 36.27%. Statistically, the paired-sample t-test confirmed a significant improvement, $t(13) = -15.614$, $p < 0.001$. The very large effect size (Cohen's $d_z = 4.17$) indicates that the change was not only statistically significant but also meaningful in practical coaching terms.

The finding is consistent with Mardila et al. (2024), who reported that targeted overhand serve drill exercises improved overhand serve accuracy in volleyball extracurricular participants. It is also in line with Cadul and Hakim (2026), who found that target-variation training significantly improved overhand service skills, accuracy, consistency, and control. The similarity between these studies and the present research suggests that service improvement is more likely to occur when athletes repeatedly practice with clear targets, progressive task demands, and direct technical correction rather than relying on monotonous serving repetition.

The improvement can be explained through motor-learning principles. Distance variation required the athletes to continuously recalibrate the relationship between ball toss, arm swing, contact point, body balance, and force production. When the distance changed from 3 m to 6 m and 9 m, the athletes had to adjust the strength and trajectory of the serve while maintaining accuracy. This kind of variable practice is supported by Travlos (2010), who showed that practice composition affects acquisition and transfer of volleyball serving skill. Similarly, Cruz et al. (2018) demonstrated that constant and random practice conditions can influence the learning of volleyball serve parameters. Therefore, the progressive distance changes used in this study likely helped athletes build more flexible movement control rather than a single fixed serving pattern.

Measurement considerations also support the interpretation of the findings. Costa et al. (2024) reported that a volleyball overhand serve accuracy test can be a viable alternative for assessing beginner performance in teaching-learning contexts, with acceptable validity and test-retest reliability. This supports the use of a target-based scoring approach in the present study because the objective was to measure serve accuracy and control rather than only observe technical form. In addition, the technical feedback provided during the intervention may have helped athletes focus on relevant movement cues. Otte et al. (2020) emphasized that feedback and instructions in sport



training can support self-regulation and improve coaching interventions when they are directed toward meaningful task information.

From a practical standpoint, distance-variation training can be recommended as a simple and low-cost coaching strategy for volleyball clubs. The method allows athletes to learn overhand serve execution gradually, beginning from a manageable distance before moving toward a regulation-like distance. This progression may reduce early failure, build confidence, and strengthen consistency. For coaches, the method is easy to organize because it only requires a standard volleyball court, balls, target zones, and planned repetition.

This study has several limitations. First, the design used only one group without a control group, so the improvement cannot be compared with athletes who received conventional training. Second, the sample was limited to 14 female athletes from one club, which restricts generalization to other populations. Third, the study measured immediate posttest performance but did not include a retention test. Future research should use a controlled experimental design, involve a larger and more diverse sample, and add retention or transfer tests to determine whether the improvement remains stable in match-like situations.

5. Conclusions

Distance-variation training had a significant positive effect on the overhand serve skills of female volleyball athletes at PBV Bangau Club. After 12 training sessions, the athletes showed higher serve scores, better performance category, and a statistically significant improvement from pretest to posttest. The results indicate that progressive practice from varied distances can improve serve accuracy, force control, and consistency. Coaches are encouraged to integrate distance-variation drills into regular volleyball training programs, particularly for athletes who still need to stabilize overhand serve technique.

Practical Recommendations

1. Coaches should begin serve training from closer distances before progressing to the regulation service area so that athletes can first stabilize technique and confidence.
2. Target zones should be used during serve practice to make accuracy measurable and to help athletes focus on specific landing areas.
3. Technical feedback should focus on ball toss, contact point, arm swing timing, foot position, and body balance.
4. Future training cycles should include retention tests and match-based serve assessment to evaluate whether improved serve performance transfers to real game situations.

Acknowledgements

The author thanks the coach and athletes of PBV Bangau Club for their cooperation during the training and testing process.

Conflict of Interest

The author declares no conflict of interest related to this study.

Data Availability

The data used in this article are presented in the Results section. Additional raw data may be made available by the author upon reasonable academic request.



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