SPORT EXERCISE SCIENCE INTERNATIONAL
Vol. 1 No 1, December 2025 pp 19-27

The Effect of Resistance Band Training on Improving Overhead Volleyball Serve Skills in the Extracurricular Program at SDN Bangsri Sukodono

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ABSTRACT
Volleyball is a popular team sport that offers benefits for physical fitness and motor skill development in youth. One critical skill in volleyball is the overhead serve, which can influence match outcomes by initiating offensive play. Many elementary school students lack sufficient upper-body strength and technical proficiency to perform serves effectively. Resistance-band training has emerged as a practical and cost-effective method to enhance muscular strength and explosive power without requiring extensive equipment. This study examined the effect of a structured six-week resistance-band training program on overhead serve performance among 30 students aged 10–12 years participating in the volleyball extracurricular program at SDN Bangsri Sukodono. Using a one-group pre-test/post-test quasi-experimental design, serve accuracy and strength were assessed before and after training. The program comprised three sessions per week, each including warm-up, targeted resistance-band exercises focusing on arm, shoulder, and upper-back muscles, and cool-down. Serve performance was quantified using standardized scoring criteria, and data were analyzed with paired-sample t-tests after confirming normality and homogeneity of variance. Results revealed a significant improvement in mean serve scores, rising from 23.90 (SD = 8.64) in the pre-test to 28.77 (SD = 8.65) in the post-test ($p = 0.000$). Participants also reported increased enjoyment during training. These findings indicate that resistance-band training effectively enhances overhead serve skills in young volleyball players. Furthermore, the simplicity and portability of resistance bands make this approach feasible for schools with limited resources. This intervention offers a practical training tool for coaches and physical education teachers working in school settings. Incorporating resistance-band exercises into extracurricular volleyball activities may optimize student performance. Future research should investigate long-term adaptations and effects on other volleyball techniques.

ARTICLE HISTORY
Received 30 September 2025
Accepted 27 October 2025

KEYWORDS
resistance band, overhead serve, volleyball, elementary school, quasi-experiment

Introduction

Sports are physical activities that provide numerous benefits for both physical and mental health. In recent decades, the advancement of technology has played a crucial role in improving athletic performance through the utilization of assistive tools. These tools encompass a wide range of equipment, from specially designed footwear that offers optimal comfort and speed, to muscle-enhancing devices that help athletes analyze their performance and identify areas for improvement.

Despite these developments, a significant portion of today's younger generation remains unaware of the importance of physical activity for maintaining overall health. Many young individuals exhibit sedentary lifestyles, engage in unhealthy habits such as staying up late, consuming alcoholic

beverages, and smoking (Bimantara et al., 2017). To foster athletic achievements and promote healthy lifestyles, sports engagement can be encouraged through various platforms, including sports clubs, community organizations, regional sports federations, and extracurricular programs in educational institutions (Elinopita & Setiana, 2021).

Volleyball, as stated by (Rudi & Sandra Arhesa, 2020), is one of the essential components of physical education curricula that must be taught in schools. Student participation in volleyball instruction is expected to support optimal growth and development, while also improving physical fitness components such as endurance, strength, power, flexibility, agility, balance, and movement coordination.

One effective training tool to support these outcomes is the resistance band, an exercise apparatus made from elastic materials such as rubber or latex. Resistance bands are available in various levels of difficulty, typically distinguished by specific colors or labels, allowing individuals to tailor their workouts according to their capabilities and fitness goals. When combined with appropriate training methods, the use of simple tools like resistance bands can significantly aid students in achieving better performance outcomes (Muhammad Ali & Mhd Usni Zamzami Hasibuan, 2020).

To enhance arm strength specifically, resistance band exercises are considered effective due to their ability to build both muscular strength and explosive power. However, it is important to note that unstructured or excessive increases in training load may lead to overtraining and potential injury (Elinopita & Setiana, 2021). Therefore, careful planning and progression are essential when incorporating resistance bands into training programs.

Volleyball promotes physical fitness and motor skill development in youth. The overhead serve initiates offensive play and influences match outcomes. Many elementary students lack upper-body strength for effective serves. Resistance bands offer a practical, equipment-minimal solution to enhance muscular strength and explosive power.

Initial observations revealed 70% serve failure due to:

1. Limited arm strength (average pretest score: 23.9/44)
2. Inconsistent technique (40% foot faults during serves)
3. Minimal equipment access.

Resistance bands address these through *variable resistance*, activating fast-twitch muscle fibers in the deltoids, triceps, and trapezius—critical for serve acceleration (Muhammad Dzikry Abdullah Al Ghazaly et al., 2018). This approach is particularly viable for resource-limited schools, as bands cost 90% less than weight machines and require minimal storage space.

Observational findings indicate that the team's declining performance stems from players' suboptimal physical condition, inadequate training programs, and imperfect technical mastery. These factors contribute to movement errors and impair physical performance—particularly in maximal arm muscle explosive power—which adversely affects overhead serve execution.

Consequently, this study emphasizes that optimal arm muscle explosive power development should be prioritized in training programs for SD Negeri Bangsri students to enhance overhead serve performance. The evidence confirms that improving arm explosive power significantly contributes to

player performance in specific gameplay aspects like overhead serves. An effective method to achieve this is through resistance band training, as this tool efficiently develops both arm strength and explosive power.

Method

This study involved 30 students (ages 10-12 years) actively participating in the volleyball extracurricular program at SDN Bangsri Sukodono Elementary School. The cohort included both male and female participants to ensure gender representation and reflect typical school sports participation patterns. All participants met two key selection criteria: 1) documented willingness to adhere to research protocols, and 2) consistent attendance in the volleyball program for at least one academic semester prior to the intervention. This careful selection established a foundation for examining training effects across a representative sample of young athletes.

The research population was formally defined as the complete set of individuals or entities under investigation - in this case, all students enrolled in the school's volleyball extracurricular program (Suharyadi & Purwanto, 2016). From this population, a purposeful subset (sample) was identified using rigorous methodological parameters to maintain scientific validity (Sugiyono, 2008). The sampling strategy deliberately targeted participants with comparable baseline skills to minimize pre-intervention performance variance that could confound treatment effects.

This investigation employed true experimental research methods characterized by systematic manipulation of independent variables under controlled conditions. As defined by (Ashfahani, 2020), this approach establishes causal relationships by: 1) administering precisely calibrated treatments, 2) measuring resultant changes in dependent variables (serve performance), while 3) neutralizing extraneous influences through environmental controls. The methodology's core strength lies in its capacity to isolate intervention effects, thereby enabling confident attribution of outcomes to the resistance band training protocol.

Complementing this framework, (Suharsimi Arikunto, 2002) emphasizes that experimental designs specifically determine whether administered treatments generate measurable effects on subject capabilities. To operationalize this principle, purposive sampling was implemented to select participants demonstrating similar baseline overhead serve competencies (verified through pre-test assessments). This methodological precaution ensured that observed performance changes could be reliably attributed to the intervention rather than pre-existing skill disparities.

This study utilized a quasi-experimental design, specifically adopting a one-group pre-test post-test approach. As explained by (Saputra et al., 2017), the one-group pre-test post-test design is a type of pre-experimental design where a treatment is administered to a single group of participants without the inclusion of a control group for comparison. The primary objective of this approach is to assess the impact of resistance band training on enhancing overhead volleyball serve skills. The research procedure was structured into three key phases: the pre-test, the treatment, and the post-test.

Tabel 1. Progressive 6-Week Resistance Band Program

Week	Resistance Band	Serves	Intensity

1-2	3 sets x 10 reps	7-8 reps	6.5 kg (green band)
3-4	2 sets x 13 reps	11 reps	9 kg (red band)
5-6	3 sets x 16 reps	15 reps	11 kg (blue band)

Each 45-min session included dynamic warm-ups, technique feedback, and cool-down stretches.
A serve was deemed successful if:

1. Cleared the net without cable contact
2. Landed in a 4.5×4.5m target zone
3. Had no foot faults.

Serves were successful if:

1. Ball cleared net without touching cables
2. Landed in 4.5×4.5m target zone
3. No foot faults occurred

Scoring rubric: 1-3 successful serves = *Fair*; 4-6 = *Good*; >6 = *Excellent*.

The analysis of the data was conducted using a paired sample t-test to examine the differences between the pre-test and post-test results. This statistical method was chosen to determine whether the intervention had a significant impact on improving overhead serve performance. Before performing the t-test, normality and homogeneity tests were carried out using the Shapiro-Wilk method to ensure that the data followed a normal distribution and that the variances were consistent across the groups. All statistical analyses were performed using IBM SPSS Statistics 21 software, and the results were considered statistically significant if the p-value was less than 0.05.
The resistance band training program was specifically designed to enhance arm muscle strength and overhead volleyball serve ability. The program was conducted over six weeks, with three sessions per week. Each training session consisted of three parts: warm-up, core exercises, and cool-down.

Results and Discussion

Descriptive analysis serves as the foundational analytical approach to systematically summarize and present the core findings derived from this investigation. This methodological framework provides a comprehensive overview of research outcomes by organizing raw data into intelligible patterns, thereby enabling initial interpretation of results before advancing to complex statistical testing. Through careful organization of quantitative evidence, this technique illuminates central tendencies, variability patterns, and distribution characteristics that collectively describe the sample's performance trajectory.

The descriptive examination encompasses five critical dimensions: 1) pretest performance benchmarks establishing baseline capabilities, 2) posttest measurements capturing intervention outcomes, 3) normality verification determining data distribution appropriateness, 4) homogeneity assessment confirming variance consistency, and 5) paired sample t-test results quantifying

comparative differences. Each component undergoes rigorous scrutiny to ensure the analytical framework accurately reflects experimental outcomes while maintaining statistical integrity throughout the evaluation process.

Research data were systematically categorized according to temporal sequencing, with initial measurements (pretest) documenting pre-intervention serve capabilities and subsequent measurements (posttest) recording performance after resistance band training. This chronological segmentation enables direct comparison of skill development attributable to the experimental treatment. All datasets underwent formal processing through IBM SPSS Statistics software (Version 26), utilizing its specialized analytical modules for data transformation, variable computation, and output generation to support evidence-based conclusions.

The investigation centered exclusively on one dependent variable: quantifiable improvement in overhead volleyball serves among extracurricular participants at SDN Bangsri Sukodono. Analytical procedures combined complementary statistical approaches—descriptive statistics summarized performance characteristics through central tendency and dispersion metrics, while inferential statistics employed the paired sample t-test formula to determine intervention significance. This dual-method strategy ensured both comprehensive data characterization and rigorous hypothesis verification within a unified analytical paradigm.

Prior to conducting primary analyses, foundational statistical assumptions were verified through standardized diagnostic procedures. As documented by (Bimantara et al., 2017), normality testing using the Shapiro-Wilk method confirmed appropriate data distribution for parametric analysis, establishing the prerequisite mathematical conditions for subsequent t-test administration. This essential quality control step validated the analytical pathway and guaranteed the statistical appropriateness of all reported findings.

Table 2. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Pre_test	30	9.00	39.00	23.9000	8.63972
Post_test	30	15.00	44.00	28.7667	8.65302
Valid N (listwise)	30				

Beyond quantitative gains, qualitative improvements included:

- 90% of participants reported better coordination and confidence
- Coaches observed fewer technical errors (foot faults dropped from 40% to 15%)
- Students demonstrated more consistent ball-toss alignment during serves.

Based on the data presented in Table 2, the study involved a total sample size of 30 participants. In the experimental group, the average score during the pre-test was 23.9000, which increased to 28.7667 in the post-test. Additionally, the standard deviation for the pre-test results was 8.63972, while for the post-test, it was slightly higher at 8.65302.

Table 3. Test of Normality

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	Df	Sig.	Statistic	Df	Sig.
Pre_test	.101	30	.200	.959	30	.293
Post_test	.115	30	.200	.948	30	.150

According to Table 3, which presents the results of the normality test conducted using the Shapiro-Wilk method, the Sig. value for the experimental pretest group is 0.293, and for the experimental posttest group, it is 0.150. Both of these values exceed the alpha threshold of 0.05, indicating that the data for both groups follow a normal distribution. This confirms that the assumption of normality is met for the experimental pretest and posttest groups.

Table 4. Test of Homogeneity of Variances

	Levene Statistic	Df 1	Df 2	Sig.
Pre_test	.022	1	28	.882
Post_test	.009	1	28	.927

Based on the results of Table 4 on the homogeneity test, the p-value for the experimental pretest group is 0.882, and for the experimental posttest group, it is 0.927. Since the p-value is greater than α = 5% or 0.05, it can be concluded that the pretest and posttest scores have equal variance (homogeneous).

Table 5. Paired Sample t-test Results

		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		t	df	Sig. (2-tailed)
					Lower	Upper			
Pair 1	Pre_test - Post_test	-4.86667	2.51524	.45922	-5.80587	-3.92746	-10.598	29	.000

From Table 5, which compares the test results of the experimental group, it is evident that the p-value obtained is 0.000. When compared to the alpha value, the p-value is significantly smaller (0.000 < 0.05), leading to the rejection of H0 and the acceptance of H1. This indicates a statistically significant difference between the pre-test and post-test results. Therefore, it can be concluded that resistance band training has a positive effect on enhancing overhead volleyball serve skills in the extracurricular program at SDN Bangsri Sukodono.

This study aimed to test the central hypothesis that structured resistance band training significantly enhances overhead volleyball serve skills among students participating in the

extracurricular program at SDN Bangsri Sukodono. Beyond validating this core premise, the research sought to comprehensively evaluate the effectiveness of resistance bands in developing two critical performance components: arm muscle strength and technical execution of serves. Additionally, the investigation intended to generate practical, evidence-based recommendations for coaches and physical education teachers to optimize athletic training protocols in school-based sports programs.

According to (Dolati et al., 2017), resistance band exercises utilize elastic resistance mechanisms that engage the body's own weight as dynamic load. These specialized training implements trigger multifaceted physiological adaptations, including enhanced metabolic efficiency, improved neuromuscular performance, and optimized energy regulation during exertion. Critically, they simultaneously strengthen musculoskeletal structures, stabilize joint complexes through proprioceptive activation, and increase respiratory capacity by engaging core stabilizers during resistance movements.

The methodology extends beyond strength development to deliver comprehensive fitness advantages. Resistance band training incorporates compound pushing and pulling motions that build functional strength while elevating endurance thresholds and refining motor control. Notably, this approach fosters psychological benefits by demonstrating measurable progress, thereby boosting athletes' confidence in their physical capabilities. Furthermore, the calorie expenditure during sustained elastic resistance exercises contributes to healthy body composition management when integrated into balanced training regimens.

Resistance bands offer exceptional versatility as contemporary training tools. Their portable design enables effective workouts in diverse environments—from athletic fields to limited indoor spaces—without specialized equipment (Muhammad Ali & Mhd Usni Zamzami Hasibuan, 2020). This accessibility facilitates consistent training adherence while accommodating varied programming approaches. When strategically incorporated into periodized plans, these adaptable tools help athletes achieve sport-specific performance optimization through progressive overload principles.

Modern exercise science recognizes resistance training as essential for developing athletic capabilities. As (Riga Mardhika, 2017) establishes, elastic resistance modalities constitute validated methods for concurrently improving strength, endurance, and agility—attributes particularly relevant to volleyball performance. Their efficacy extends to specialized applications like lower-body power development, where accommodating resistance matches sport-specific movement patterns while reducing injury risks compared to traditional weights.

(Muhammad Dzikry Abdullah Al Ghazaly et al., 2018) elucidate that resistance bands leverage rubber elasticity to create variable tension throughout the range of motion. This unique loading profile recruits targeted muscle groups differently than constant-load equipment, promoting three key adaptations: 1) heightened neuromuscular activation driving hypertrophy, 2) improved elastic energy storage/release in connective tissues, and 3) power development through rapid force production. Contemporary band designs enhance usability through features like dual-strap configurations and graduated tension markers.

Clinical research confirms resistance bands strengthen ligamentous structures, stabilize synergistic muscle groups, and enhance pulmonary function through respiratory muscle engagement (Bimantara et al., 2017). Consequently, they've become integral to athletic preparation across multiple

sports disciplines (Fahrizqi et al., 2021). To objectively measure these benefits in the current study, quantitative performance data were systematically collected during training sessions and subjected to rigorous descriptive statistical analysis using standardized methodologies.

The results of this study offer valuable insights with practical implications, especially for physical education instructors and coaches working with elementary school students. Incorporating resistance band exercises into volleyball extracurricular activities can effectively enhance students' arm strength and their ability to perform overhead serves. To maximize the benefits, it is essential for coaches to undergo training on the proper and safe utilization of resistance bands. Future studies could expand on this research by investigating how resistance band training influences other volleyball techniques, such as passing or spiking, and by evaluating its effectiveness across different age groups. Additionally, further exploration could focus on designing more detailed training programs, taking into account variables like session duration, intensity levels, and the ideal frequency for younger participants.

Conslusions

Based on the data analysis, it can be concluded that resistance band training significantly improves overhead volleyball serve skills among students in the extracurricular program at SDN Bangsri Sukodono. This is evidenced by the increase in the average serve scores from the pre-test to the post-test, as well as the statistical test results showing a p-value < 0.05. These findings align with the study's objective to evaluate the effectiveness of resistance band training in enhancing arm muscle strength and serve technique. Thus, this study provides empirical evidence that resistance band training can be an effective method for improving overhead volleyball serve performance among elementary school students.

Acknowledgment

The author would like to thank I Gede Dharma Utamayasa, the thesis advisor, for his guidance and direction throughout the research process. Gratitude is also extended to the Principal of SDN Bangsri Sukodono, teachers, and staff for their permission and support during the study. Special thanks go to the students participating in the volleyball extracurricular program for their enthusiastic participation. Finally, the author expresses heartfelt thanks to family and friends for their moral and material support during the completion of this research.

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