



## The Effect of Resistance Bands on Underhand Passing Accuracy in Extracurricular Volleyball Players Aged 15-18 Years

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### Abstract

This study was to analyze the effect of resistance band use on underhand passing accuracy in volleyball players aged 15-18 years in extracurricular activities. This study was a quasi-experimental study using a pretest–posttest with a control group design. The sample consisted of 14 students (8 males and 6 females) in each of the intervention and control groups. The resistance band training method was carried out for 6 weeks, covering arm muscle strengthening, shoulder stability, underhand passing coordination with elastic loads. The training intensity was arranged progressively from 60%-80%. Data collection used a modified Brady Volleyball Test. The results of this study, the Wilcoxon test showed that the intervention group had an effect on improving underhand passing accuracy (male: sig. 0.011 and female: sig. 0.026). Meanwhile, the control group had no effect. Mann-Whitney test showed a posttest difference between the intervention and control groups, with a sig. 0.001 for male students and a sig. 0.004 for female students. This conclusion suggests that the intervention group experienced increased accuracy in underhand passing after being given a training program using resistance bands. Future research could involve a larger sample size, a longer intervention duration, and addition of supporting variables.

Keyword: Resistance Band, Strength Training, Underhand Passing Accuracy, Volleyball Player, 15 – 18 Years Old

### INTRODUCTION

Volleyball is a sport that demands mastery of basic technical skills, one of which is underhand passing. Underhand passing is a basic technique used to receive serves, attacks, and low balls. The goal is to accurately direct the ball to a teammate, especially the setter, so that it can be organized into an effective attack (Afifah et al., 2025; Janiva et al., 2025). The success of a team in building an attack pattern is largely determined by the quality of accurate, stable and controlled passing from the ground (Trimizi et al., 2020). Therefore, underhand passing is the main foundation in the modern volleyball game system, especially in youth development.

Biomechanically and motorically, successful underhand passing is influenced by various factors, both internal and external. Internal factors include arm, shoulder, and core muscle strength, hand-eye coordination, body balance, postural stability, joint flexibility, and

neuromuscular control (Sahabuddin et al., 2024). Meanwhile, external factors include the quality of training, learning methods, intensity and frequency of training, training facilities and infrastructure, and the use of media or training aids (Riyadi et al., 2023; Permana et al., 2025). The combination of these factors greatly determines the level of accuracy of underhand passes, especially for players aged 15–18 years who are still in the physical, motoric and coordination development phase (Andriansyah et al., 2025; Prabowo et al., 2025).

Various previous studies have shown that strength training and resistive training have a significant influence on improving basic technical performance in sports, including volleyball. (Jariono et al., 2024). Several studies have reported that the use of assistive devices such as resistance bands is effective in increasing upper extremity muscle strength, shoulder joint stability, movement control, and functional coordination (Ayyub et al., 2023; Yolla et al., 2024). Other research also reveals that resistance band-based training can improve the quality of passing, serving, and smashing by increasing muscle capacity, postural stability, and movement efficiency (Darius Yobee et al., 2025). However, most research focuses on improving general physical strength, while studies specifically linking resistance band training to passing accuracy in adolescent players, particularly in extracurricular school settings, are relatively limited.

Based on observations, extracurricular volleyball activities frequently encounter problems such as low accuracy of underhand passing, unstable ball direction, and poor control of movement when receiving serves or attacks. Training sessions are generally conventional, repetitive, and lack the use of varied equipment-based training methods. This situation results in stagnant development of players' technical skills and suboptimal team performance. Therefore, a more innovative, effective, and appropriate training approach is needed for the 15–18 years old population, one of which is the use of resistance bands as a functional training tool.

This study aims to analyze the effect of resistance band use on the accuracy of underhand passing in volleyball players aged 15–18 years in extracurricular activities. The novelty of this study lies in the integration of resistance band exercises specifically designed to support underhand passing movements, not just as general strength training, and focusing on the context of school coaching through extracurricular activities. Thus, this study is expected to provide scientific contributions in the development of evidence-

based practice volleyball training models and serve as a practical reference for coaches and physical education teachers in improving the quality of basic volleyball technique training in adolescents.

## **METHODS**

### *Research Design*

This study employed a quantitative approach with a quasi-experimental research design using a pretest–posttest with a control group design. The research process began with the planning stage, which included problem identification, determination of research variables (independent variable: resistance band training; dependent variable: underhand passing accuracy), preparation of research instruments, and preparation of a training program. The test used for data collection was a modified Brady Volleyball Test (Afifah et al., 2025).

The research program was conducted in the form of a structured training experiment using resistance bands as the primary medium for increasing arm, shoulder, and wrist muscle strength and body stability, which play a role in volleyball's underhand passing technique. The training program for the intervention group was administered for 6 weeks, with a training frequency of 3 times per week and a duration of 60 minutes per session. The training included basic underhand passing movement exercises using resistance bands, arm muscle strengthening exercises, and other exercises. (arm extension, elbow flexion - extension), shoulder stability exercises, as well as coordination exercises for lower pass movements with elastic weights. The training intensity was arranged progressively at 60% - 80%, starting from light to moderate resistance, with the principle of progressive overload and adjusted to the characteristics of 15-18 years old. The control group continued to receive conventional lower pass exercises without the use of resistance bands with the same duration and frequency, so that the difference in results can be directly attributed to the experimental treatment.

### *Population and Sample*

The population in this study were all volleyball extracurricular participants aged 15-18 years at Semesta Bumiayu Vocational School, Brebes, Indonesia. The characteristics of the population included students who actively participated in extracurricular training, were in healthy physical condition, and did not experience any

injuries to their upper limbs during the study. The sampling technique used purposive sampling, with the following inclusion criteria: (1) aged 15-18 years, (2) actively participating in volleyball extracurricular activities for at least the last 3 months, (3) willing to participate in the entire training program, and (4) obtaining permission from the school and parents. The selected samples were then divided into two groups in a balanced manner, namely the experimental group and the control group, taking into account the equality of initial abilities based on the pretest results. Thus, the number of samples involved was 28 students (16 male students and 12 female students), which were divided into 14 students in the experimental group and 14 students in the control group.

### *Statistical Analysis*

The analysis of the results of this study used SPSS 27 software. Before the analysis to test the effectiveness of the independent variables, normality and homogeneity tests were required. However, the results of this study were not normally distributed, so the analysis used non-parametric tests. The first stage was the Wilcoxon test to analyze the pretest-posttest differences. The second stage was the Mann-Whitney test to analyze the differences in training outcomes based on the experimental and control groups.

## **RESULTS AND DISCUSSION**

### **Results**

This research analysis report begins with descriptive statistics to analyze the minimum, maximum, and mean scores based on the modified Brady Volleyball Test. The descriptive results are shown in Table 1.

Table 1. Descriptive analysis of the ability of underhand passing accuracy

	Min	Max	Mean	Std. Deviation
Intervention Group - Male. Pretest	32	39	35,88	2,232
Intervention Group - Male. Posttest	42	48	45,75	2,252
Control Group - Male. Pretest	32	39	35,00	2,268
Control Group - Male. Posttest	32	36	34,00	1,309
Intervention Group - Female. Pretest	26	31	29,00	1,789
Intervention Group - Female. Posttest	36	40	38,00	1,414
Control Group - Female. Pretest	26	31	28,33	2,066
Control Group - Female. Posttest	26	30	28,17	1,472

Based on the descriptive results in Table 1, the mean improvement score of the male intervention group showed 9.87 while the mean improvement score of the male

control group showed 1.00. Then, the mean improvement score of the female intervention group showed 11.00 while the mean improvement score of the female control group showed 0.16. The following analysis aims to test the effect of training results through the Wilcoxon test ( $p < 0.05$ ) as shown in table 2.

Table 2. Results of the influence based on the intervention group and control group

	Z	Asymp. Sig. (2-tailed)
Intervention group – male	-2.530	0,011
Control group – female	-.957	0,339
Intervention group – male	-2.232	0,026
Control group - female	-.368	0,713

Based on the results of Table 2, the intervention group-male showed Asymp. Sig. (2-tailed) 0.011 and the intervention group-female showed Asymp. Sig. (2-tailed) 0.026. So the intervention group that used resistance bands had a significant effect on increasing the accuracy of underhand passing. Meanwhile, the control group based on male and female students showed more than 0.05 so there was no significant effect. Then the next analysis was the analysis of differences through the Mann Whitney test ( $p < 0.05$ ) which is presented in Table 3.

Table 3. Average difference results

	Mann-Whitney U	Asymp. Sig. (2-tailed)
Pretest differences between males	19,000	0,168
Posttest differences between males	0,000	0,001
Pretest differences between females	12,000	0,327
Posttest differences between females	0,000	0,004

Based on the results of table 3, the posttest difference in male students was Asymp. Sig. (2-tailed) 0.001 and female students showed Asymp. Sig. (2-tailed) 0.004. So there is a difference in the posttest scores of the intervention group and the control group, in addition, based on descriptive statistics, the posttest score of the intervention group is higher than the posttest score of the control group. Meanwhile, the pretest scores of male and female students did not show a statistical difference, so the initial ability of passing accuracy was balanced.

## Discussion

The results of this study indicate that resistance band training has a positive effect on the accuracy of underhand passing in extracurricular volleyball players aged 15–18 years, both male and female students in the intervention group. In contrast, the control

group showed no significant improvement. Furthermore, the absence of differences in pretest scores between the male and female groups indicates that the initial abilities between the groups were relatively equal, while the emergence of differences in the posttest strengthens the hypothesis that the performance changes are more related to the treatment given. This pattern of findings is consistent with various studies showing that training specifically designed for passing can improve the accuracy and quality of basic volleyball techniques in young athletes (Aini, 2021; Aditya & Darmanto, 2025).

Physiologically and biomechanically, the positive effects of resistance bands can be explained by the media providing progressive resistance along the trajectory of motion, allowing the arm, shoulder, and core muscles to work more actively to stabilize body position and control the direction of movement. In the context of volleyball, underhand passing not only requires precise ball contact but also requires body stability, neuromuscular coordination, and the ability to generate consistent propulsion from the legs, trunk, and arms. A recent systematic review in team sports showed that elastic band training effectively improves several components of physical performance that support sports movements (Stanković et al., 2025), and other reviews in young populations concluded that resistance training can improve physical performance and joint stability when administered correctly and supervised (Wagner et al., 2020). In young female volleyball players, receiving efficiency has also been reported to be related to upper limb strength (Pawlik et al., 2022), specifically shoulder internal rotator strength, grip strength, and medicine ball throws.

In the male group of students, the increase in underhand passing accuracy following the resistance band program suggests that the training likely improved physical components closely related to technique execution, particularly functional arm strength, postural control, and arm platform stability when receiving the ball. These findings are directly supported by previous research in male volleyball players aged 16–18 years, which reported that six weeks of resistance band training significantly improved underhand passing ability (Aditya & Darmanto, 2025). Additional support also comes from research in young male volleyball players showing that eight weeks of structured strength training can improve dynamic balance, strength, and performance-related fitness components, all of which are important foundations for accurate and repeatable technique execution (Mesfar et al., 2022). Thus, in male students, the improvement in underhand

passing can not only be understood as the result of technical training alone, but also as the result of adapting to physical conditions that better support movement quality.

In the female group, the results of this study also showed a positive effect of resistance bands on underhand passing accuracy. This finding is important because it confirms that elastic resistance-based training is not only relevant for male players but also effective for adolescent female players. In young female volleyball players, upper limb strength has been shown to be associated with serve-reception efficiency, particularly shoulder and arm strength capacity, which plays a significant role in maintaining contact quality (Pawlik et al., 2022). In addition, other research on young extracurricular athletes shows that strength training in the form of circuit bodyweight training can improve underhand passing ability in both male and female students (Afifah et al., 2025). This demonstrates that developing functional strength and coordination can have positive effects across genders. Based on this, the results in the female group in this study can be explained as an adaptive response to training that improves stability, motor control, and technical consistency when performing underhand passes.

The lack of an effect in the control group, for either male or female students, indicates that routine training without the addition of resistance bands may not have provided enough specific stimulus to improve underhand passing accuracy during the study period. Several studies have shown that target games, butterfly passing drills, endurance passing drills, and a combination of part-whole training can significantly improve passing accuracy (Aini, 2021; Feryantono et al., 2024; Permana et al., 2025). Therefore, the unchanged performance of the control group in this study can be understood as a consequence of the absence of additional overload and the less specificity of the training stimulus compared to the intervention group.

The findings of this study have important implications for extracurricular coaches, physical education teachers, and school team coaches. Resistance bands are a relatively inexpensive, portable, and flexible training tool that can be used in school environments with limited resources. Because resistance training for adolescents is also considered safe and beneficial when designed appropriately for their age and properly supervised, resistance bands can be incorporated into specific warm-up sessions, supporting physical exercises, and core training sessions for underhand passing techniques. In the context of school coaching, this approach can even be combined with

other, more engaging techniques learning models, such as game-based training or cooperative learning.

Although the results of this study show positive findings, several limitations should be noted. First, the sample size is relatively small, so generalizations of the results should be made with caution. Second, the quasi-experimental design means that control for all external variables is not as strong as in a true experiment. Third, this study focused only on underhand passing accuracy, so it does not directly explain changes in supporting physical variables such as arm muscle strength, core stability, or hand-eye coordination. However, other research has shown that underhand passing skills are related to arm muscle strength and hand-eye coordination, while receiving efficiency in volleyball is also related to upper limb strength. Therefore, future research should involve a larger sample size, a longer intervention duration, and include supporting variables such as arm strength, balance, core stability, and coordination to more comprehensively elucidate the mechanism of resistance band influence on underhand passing accuracy.

## **CONCLUSION**

This study shows that the use of resistance bands has a positive effect on the accuracy of underhand passing in extracurricular volleyball players aged 15–18 years. In the intervention group, both male and female students experienced an increase in underhand passing accuracy after being given a training program using resistance bands. In contrast, in the control group, neither male nor female students showed a significant increase. Furthermore, there was no difference in pretest scores between the intervention and control groups for male or female students, indicating that the initial abilities of both groups were relatively equal. However, a difference was found in the posttest between the two groups, with the intervention group having a higher average score than the control group, for both male and female students. Thus, resistance bands can be considered an effective training medium to support the improvement of underhand passing accuracy in adolescent volleyball players in extracurricular activities. These findings indicate that resistance bands can be used as a practical, simple, and applicable training alternative for coaches and physical education teachers in developing basic volleyball skills in the school environment.

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