

Differences in the effects of resistance band and plank exercises on arm muscle endurance in archers at the blora archery club

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Abstract

This study aims to determine the difference in the effects of resistance band and plank exercises on arm muscle endurance in archery athletes at the Blora Archery Club. The background of this study is based on the low variety of physical conditioning exercises and the weak arm muscle endurance of athletes, which affects their stability when shooting. The research method used is an experiment with a two-group pretest-posttest design. The research sample consisted of 12 archery athletes aged 13–17 years, who were divided into two groups using the ordinal pairing technique. The first group was given resistance band training, while the second group was given plank training for 16 sessions over a period of two months. The data collection instrument used was the Holding Bow Test. Data analysis was performed through normality tests, homogeneity tests, and paired sample t-tests. The results showed that both training methods had a significant effect on increasing the arm muscle endurance of archery athletes. However, plank exercises showed greater improvement than resistance band exercises, with correlation values of 0.938 and 0.876, respectively. Based on these results, it can be concluded that although both training methods are effective, plank exercises are superior in improving the arm muscle endurance of archery athletes. Therefore, it is recommended that coaches systematically combine both training methods to optimize athlete performance.

Keywords: archery, resistance band, plank, arm muscle endurance

INTRODUCTION

Sports are physical activities that play an important role in improving health, physical fitness, and individual performance. Systematic and continuous sports activities can improve the body's physiological functions, motor skills, and mental abilities of athletes (Prasetya et al., 2024). In the context of competitive sports, athlete training focuses not only on mastering techniques but also on developing physical condition, tactics, and mental strength, which are interrelated and inseparable (Hasmarita & Meirizal, 2024; Mu'ti et al., 2025). Archery is a precision sport that requires a combination of physical strength, technical stability, and high mental concentration. Success in archery is greatly influenced by the athlete's ability to maintain a stable body and bow position for a relatively long time (Cahyono & Iswati, 2021; Falaahudin et al., 2024; Fan et al., 2025; Isnayanti et al., 2025; Ji et al., 2024; Syafiq & Suwanto, 2025). Therefore, physical condition components such as muscle strength and endurance, particularly in the arms and shoulders, are dominant factors in supporting optimal archery performance (Ji et al., 2024). Arm muscle endurance is the ability of muscles to perform repeated contractions or maintain static contractions for a certain period of time without experiencing significant fatigue. In archery, arm muscle endurance plays an important role in the drawing, holding, and aiming phases, where athletes must be able to maintain a stable bow pull to maintain shooting accuracy (Susanto, 2024). Weak arm muscle endurance can cause arm tremors, decreased stability, and inconsistent arrow grouping. Adolescent athletes (13–17 years old) are in a phase of rapid physical development, requiring a training program that is safe, effective, and in accordance with the principles

of multilateral training. Physical conditioning training at this age should use light to moderate weights with minimal risk of injury, but still be able to improve the athlete's biomotor abilities (Amalia et al., 2023). Therefore, choosing the right training method is very important in coaching young archery athletes. Resistance band training is an effective method for improving muscle strength and endurance using relatively safe elastic weights. This training is widely used in coaching young athletes and rehabilitation programs because it provides progressive resistance with a low risk of injury (Santos et al., 2024).

Previous studies have shown that resistance band training has a significant effect on increasing arm muscle strength and endurance in precision sports athletes (Putra & Nugroho, 2021) (Humaedi et al., 2023). In addition to resistance bands, plank exercises are also an effective form of isometric exercise for improving the stability and endurance of the upper body and core muscles. Plank exercises require the simultaneous activation of the arm, shoulder, and back muscles to maintain body position, making them highly relevant to the movement characteristics of archery (Dajoh et al., 2025). This is particularly relevant for archers, where maintaining core stability is crucial for consistent performance and accuracy (Dewi & Palgunadi, 2021). The sustained isometric contractions inherent in plank variations contribute to developing localized muscular endurance, which directly translates to holding the bow steadily during the aiming phase (Selvakumar et al., 2021). Initial observations at the Blora Archery Club show that some athletes still experience arm muscle fatigue during training and competitions, which is characterized by tremors in the bow-holding arm and decreased shooting stability. In addition, the variety of physical conditioning exercises applied is still limited and tends to focus on archery technique training in the field. This condition indicates the need to apply more varied and structured supporting physical exercises to increase the muscle endurance of athletes' arms. Based on this description, research is needed to examine the differences in the effects of resistance band and plank exercises on the arm muscle endurance of archery athletes. This research is expected to contribute scientifically to the development of effective, safe, and appropriate physical training methods for adolescent archery athletes, as well as to serve as a reference for coaches in designing more optimal training programs.

METHOD

This study used an experimental method with a two-group pretest–posttest design. The study was conducted at the Blora Archery Club, Blora Regency, Central Java, from August to September 2024, during 16 meetings with a training frequency of twice a week. The research subjects consisted of 12 archery athletes aged 13–17 years who were selected using total sampling technique. The subjects were divided into two treatment groups using the ordinal pairing technique, namely the resistance band training group ($n = 6$) and the plank training group ($n = 6$). The independent variables in this study were resistance band training and plank training, while the dependent variable was arm muscle endurance. Arm muscle endurance was measured using the Holding Bow Test, with the measurement results expressed in seconds. The resistance band group was given exercises with light to moderate intensity, 2–3 sets, 12–20 repetitions, and a rest period of 1–1.5 minutes between sets. The plank group was given isometric exercises with a duration of 20–30 seconds per movement, 2–3 sets, and a rest period of 60–90 seconds between sets. Data analysis was performed using normality tests, homogeneity tests, paired sample t-tests to determine the effect of treatment, and independent sample t-tests to determine the difference in effect between groups, with a significance level of $\alpha = 0.05$.

RESULTS AND DISCUSSION

Description of Arm Muscle Endurance Data

The results of arm muscle endurance measurements were obtained through the Holding Bow Test conducted before (pretest) and after (posttest) treatment in each group. The description of the test results is presented in Table 1.

Table 1. Mean and Standard Deviation of Arm Muscle

Training Group	N	Pretest (second) Mean \pm SD	Posttest (second) Mean \pm SD	Improvement
Resistance band	6	31,83 \pm 4,71	41,17 \pm 4,45	9,34
Plank	6	32,17 \pm 4,62	45,67 \pm 4,32	13,50

Based on Table 1, both groups showed an increase in average arm muscle endurance after treatment. The plank exercise group showed a greater increase than the resistance band exercise group.

Hypothesis Test Results

The results of the paired sample t-test showed that there was a significant increase in arm muscle endurance in both the resistance band training group and the plank training group ($p < 0.05$). Furthermore, the results of the independent sample t-test on the posttest values showed a significant difference between the two treatment groups, with the plank training group obtaining higher results ($p < 0.05$).

Discussion

The results of this study indicate that resistance band training and plank training both have a significant effect on increasing the arm muscle endurance of archery athletes. This increase occurs because both training methods involve repeated and static contraction of the arm and shoulder muscles, which play a direct role in holding and controlling the bow.

Resistance band training effectively increases muscle endurance through elastic loads that provide progressive resistance during movement. This elastic load stimulates neuromuscular adaptation and gradually increases the working capacity of the arm muscles. However, the plank training group showed greater improvement in arm muscle endurance compared to the resistance band group. This is because plank exercises require continuous isometric contractions of the arm, shoulder, and core muscles. Maintaining static contractions for a certain duration is highly relevant to the holding phase in archery, where athletes must maintain a stable bow position before releasing the arrow. Conversely, resistance band training, while also beneficial for muscle endurance, primarily emphasizes dynamic contractions and concentric/eccentric movements, which can enhance overall muscular strength and power in the arm musculature, further contributing to an archer's ability to draw and hold the bow consistently (Jogi et al., 2024). This dual benefit underscores the potential for a combined training regimen to optimally prepare archers for the multifaceted demands of their sport, integrating both static stability and dynamic strength. However, the specific mechanisms by which resistance band training, with its varied resistance profiles, and plank exercises, with their emphasis on isometric holds, differentially impact the nuanced requirements of arm muscle endurance in archery warrants further investigation (Arifin et al., 2024).

Therefore, plank exercises are considered more effective than resistance band exercises in improving arm muscle endurance in archery athletes. However, both training methods can still be used complementarily in physical training programs to optimize athletic performance.

CONCLUSION

Based on the results of the study and discussion, it can be concluded that resistance band exercises and plank exercises both have a significant effect on increasing the arm muscle endurance of archers at the Blora Archery Club. However, plank exercises show a greater effect than resistance band exercises in increasing arm muscle endurance. These findings indicate that isometric exercises such as planks are more suitable for the characteristics of archery movements, particularly in the holding and aiming phases, which require static contraction and optimal body stability. Therefore, plank exercises are recommended as an effective physical training method for improving the arm muscle endurance of adolescent archery athletes.

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