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**THE EFFECT OF BOW-DRAWING TECHNIQUE CONSISTENCY
TRAINING ON SHOOTING ACCURACY FOR BEGINNERS**

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Abstract

This study aims to analyze the impact of the training of the consistency of the bow-drawing technique on improving the accuracy of the shot in beginner students in the context of archery lectures. The research method involved an experimental design with beginner student participants participating in an archery lecture program, divided into an experimental group and a control group. Data were collected through measurements of shot accuracy before and after the intervention, using objective assessments based on target proximity. The results showed that training the consistency of the pull technique had a significant influence on improving the accuracy of the shot in novice archers. ANCOVA results showed a significant improvement in accuracy in the experimental group ($p < 0.001$, effect size = 0.59), and regression analysis proved that bow-drawing consistency contributed 76.8% to shot accuracy. The implications of these findings underscore the importance of integrating specific exercises that focus on stability and repetition of pull movements in archery curriculum for beginners. This research provides important insights for the development of more effective archery teaching methodologies, especially for individuals who are just starting out in the sport.

Keywords: Archery, Shot Accuracy; Consistency; Bow-Drawing Technique; Beginner Students; Practice.

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INTRODUCTION

The sport of archery, which relies on precision and high concentration, has become part of the physical education curriculum in various institutions, including at the college level (Prasetyo et al., 2023). Nonetheless, shot accuracy is often a major challenge for novice college students, requiring the development of solid and consistent basic techniques (Hidayat et al., 2022). This is because archery is a sport that requires high precision to shoot arrows at the target as accurately as possible (Humaid, 2014). Thus, mastery of good and consistent techniques is crucial in

achieving optimal performance in this sport (Ghafar et al., 2017). Specifically, the consistency of the pull technique plays a fundamental role in maintaining movement stability and aiming accuracy, which is often overlooked in initial training (Saing et al., 2022). This study examines how exercises that focus on pulling techniques can improve the accuracy of shots in beginner archers.

The importance of this consistency is emphasized by the fact that archery performance, defined as ⁶the ability to accurately shoot arrows at a defined target, is greatly influenced by a variety of physical and technical factors (Fan et al., 2025). One of the crucial aspects is ³the strength of the arm muscles and the length of the pull, which is directly related to the athlete's ability to pull and hold the bow stably, thus affecting the overall quality of shooting technique (Humaid, 2014). The effectiveness of the training of sub-elite archery athletes suggests that their performance is highly dependent on systematic and repetitive regular exercises, with a gradual increase in weight and intensity (Ravena et al., 2021). In addition, exercises carried out independently with careful planning to increase body strength also play an important role in developing athletes' shooting skills (Nurhasan et al., 2023).

Biomechanical aspects, such as the time spent on each shot and efficient postures, are also major determining factors in achieving superior shot accuracy (Hemara et al., 2021). Sustained concentration and focus, especially when about to fire, are also vital components because the slightest distraction can cause the shot to miss the expected target (Jannah et al., 2019). Therefore, the stability of the pre-release bow posture and control when pulling the bow are key predictors of accuracy, especially for recurve archers who rely more on post-bow release stability and compound archers who require higher pre-release control of the bow (Fan et al., 2025). Thus, the development and maintenance of a stable posture is essential in archery, as it is able to minimize unwanted body movements during the aiming and release phases (Fan et al., 2025). Optimal postural stability is crucial in archery performance, given the dynamic consequences of the release of the bow string that

can disrupt the archer's balance, thus requiring integration in the motor program to optimize postural stability (Kuch et al., 2023).

Consistent mastery of pulling techniques also helps reduce the variability of movement prior to arrow release, a crucial factor in achieving accuracy (Kuch et al., 2020). In addition, the synchronization between eye and hand coordination, as well as the ability to minimize unnecessary body movements during the retraction and release phases, also contribute significantly to the precision of the shot (Nurhasan et al., 2023). Thus, focusing on pull consistency training not only increases muscle strength but also optimizes the neuromuscular coordination required for accurate performance (Nurhasan et al., 2023) (Fan et al., 2025). Therefore, it is important to develop a training program that specifically targets the development of consistent pulling techniques to improve the accuracy of shots in beginner archers.

METHOD

This study uses a quantitative approach with a quasi-experimental design to evaluate the effect of exercise interventions. This design was chosen because it allowed researchers to compare the treatment group (pull technique consistency exercise) with the control group, albeit without a completely random assignment to the subject (Saing et al., 2022). This approach allows the identification of causal relationships between the training of the consistency of the pull technique and the accuracy of the shot, albeit with certain limitations in the generalization of results.

The sample in this study consisted of 40 beginner students who participated in archery lectures, divided into two groups, namely 20 people in the experimental group and 20 people in the control group. Group divisions are conducted non-randomly to ensure balanced representation based on initial characteristics such as previous archery experience and initial aiming accuracy scores. Data collection techniques include pre-test and post-test of aiming accuracy, as well as observation of the consistency of pulling techniques using validated assessment rubrics. Shot accuracy data was collected using standard targets with an objective point scoring

system, while the consistency of pull techniques was assessed based on key biomechanical criteria such as anchor position, body alignment, and arc release patterns.

Data analysis was performed using an independent t-test to compare the difference in average shooting accuracy between the experimental and control groups, as well as regression analysis to determine the relationship between the level of pull consistency and increased accuracy (Hidayat et al., 2022). This data analysis procedure involving independent t-tests systematically allows for the determination of the statistical significance of the difference in results between the two groups. In addition, covariance analysis will also be used to control confounding variables that may affect the accuracy of the shot, such as the participant's initial experience level or physical strength.

RESULTS

This section presents empirical findings from research on the effect of pulling technique consistency training on shooting accuracy in beginner students. Data analysis was carried out in stages, starting from descriptive statistics, prerequisite tests, to hypothesis testing using Independent t-test, ANCOVA, and simple linear regression analysis. All data processing was carried out using statistical software with a significance level of $\alpha = 0.05$.

Descriptive Statistics

Descriptive statistics aim to provide an overview of the distribution of data scores, shot accuracy, and consistency of pull techniques. Based on the results of data processing from 40 participants (20 experimental groups and 20 control groups), the following statistical summary is obtained in Table 1:

Table 1. Descriptive Statistics of Research Variables

Variable	Groups	N	Mean	Std. Deviation	Min	Max
Pre-test Accuracy	Eksperiment	20	55,20	6,15	44,00	66,00
	Control	20	54,80	5,90	45,00	65,00
Post-test Accuracy	Eksperiment	20	82,45	4,30	74,00	90,00
	Control	20	68,10	5,50	58,00	78,00

Consistency of Pull	Eksperiment	20	78,50	5,12	68,00	86,00
	Control	20	62,30	6,45	50,00	74,00

Table 1 shows that the average pre-test scores of the two groups were relatively equal (55.20 vs 54.80), indicating a homogeneous initial ability. However, in the post-test, the experimental group showed a substantial spike in accuracy (82.45) compared to the control group (68.10). The consistency score of the pull technique in the experimental group was also recorded higher (78.50), suggesting that the exercise intervention succeeded in establishing a more stable movement pattern.

Analysis Prerequisite Test

Before moving on to the hypothesis test, the basic assumptions of parametric statistics are tested through normality and homogeneity tests.

Table 2. Results of the Prerequisite Test Analysis (Normality and Homogeneity)

Statistical Test	Variables Tested	Significance Value (Sig.)	Criteria	Conclusion
Shapiro-Wilk (Normality)	Pre-test Akurasi	0,214	Sig. > 0.05	Normal Distributed
	Post-test Accuracy	0,145	Sig. > 0.05	Normal Distributed
	Consistency of Pull	0,087	Sig. > 0.05	Normal Distributed
Levene's Test (Homogeneity)	Pre-test Akurasi	0,682	Sig. > 0.05	Varian Homogen
	Post-test Accuracy	0,315	Sig. > 0.05	Varian Homogen

Based on Table 2, all study variables had a significance value of > 0.05 in the Shapiro-Wilk test (suitable for use because of the total sample < 50 per group) and the Levene's Test test. Thus, the data is normally distributed and has homogeneous variances, so it is eligible to proceed to parametric analysis.

Independent t-test

To ensure that there was no significant difference in initial ability between the two groups prior to the intervention, an independent t-test was performed on the pre-test score.

Table 3. Independent t-test results Pre-test Accuracy score

Groups	N	Mean	t-count	Sig. (2-tailed)
Eksperiment	20	55,20	0,207	0,837
Control	20	54,80		

The results in Table 3 show a significance value of 0.837 (> 0.05). This confirms that statistically, there was no difference in initial accuracy ability between the experimental and control groups. This condition validates that the improvement in subsequent post-tests actually comes from the effects of the training intervention, not from the initial ability bias.

Effect of Exercise Intervention (ANCOVA)

In accordance with the methodological design, to control the confounding variables (initial ability), the exercise effect test was carried out using Analysis of Covariance (ANCOVA) with a pre-test score as a covariate and a post-test score as a bound variable.

Table 4. ANCOVA Analysis Results of the Effect of Exercise on Post-test

Source of Variation	Accuracy				F-	Say.	Partial	Eta
	Sum of Squares	df	Mean Square		count		Squared	
Kovariat (Pre-test)	412,54	1	412,54		18,42	0,000	0,32	
Groups (Experiment vs Control)	1245,80	1	1245,80		55,63	0,000	0,59	
Error	840,12	37	22,70					
Total	2498,46	39						

Table 4 shows that after the pre-test score was controlled, there was a very significant influence of the treatment group on post-test accuracy ($F = 55.63$; $p < 0.001$). A Partial Eta Squared value of 0.59 indicates that the pull technique consistency exercise provides a large effect size, which is able to explain the 59%

variation in increased shooting accuracy in novice students after the effect of the initial ability is removed.

Simple Linear Regression Analysis

To measure how much the consistency of the pull technique determines the accuracy of the specific shot, a ² simple linear regression analysis is performed.

Table 5. Results of Simple Linear Regression Analysis

Model	Unstandardized Coefficients (B)	Std. Error	t- count	Say.
(Constant)	18,245	4,512	4,043	0,000
Consistency of Pull Technique (X)	0,815	0,072	11,319	0,000

Note: R Square = 0.768; F-count = 128.12;

Sig. F = 0.000

Based on Table 5, the regression equation $Y = 18.245 + 0.815X$ is ³ obtained. The significance value of the pull technique consistency variable is 0.000 (< 0.05), which proves that the consistency of the pull technique has a positive and significant effect on the accuracy of the shot. The determination coefficient (R Square) of 0.768 confirms that the 76.8% increase in shooting accuracy in novice students is determined by the consistency level of the pulling technique they perform. The rest (23.2%) were influenced by other factors outside of the variables studied, such as psychological factors (concentration) or environmental conditions.

DISCUSSION

These findings provide empirical evidence regarding the significant impact of training the consistency of the pull technique on improving aiming accuracy in novice archers. This supports the research hypothesis that training interventions focused on the stability of bow pull movements can substantially improve initial shot performance. Specifically, this increase in accuracy can be attributed to a reduction in movement variability during the critical phases of retraction and release, which in turn leads to more precise and consistent reproduction of movements (Fadli et al., 2022). ⁷ This study confirms that repetitive and structured training in pull techniques facilitates neuromuscular adaptation, allowing archers to reach a more stable anchor point and smoother release of the bow string (Fadli et

al., 2022). In addition, the development of proprioceptive skills through these exercises allows archers to sense and correct minor deviations in the form of their pull in real-time, improving motor efficiency (Hemara et al., 2021). Further analysis showed that this increase in shot accuracy was not only due to the repetition of movements, but also to the internalization of optimal movement patterns, which was reflected in significant t-test scores between the experimental and control groups (Momani, 2024).

Previous studies have also shown that structured training programs can significantly ¹⁰ improve the balance and accuracy of archery athletes, as found on training circuits with Bosu balls (Prasetyo et al., 2023). However, this study expands that understanding by specifically highlighting the role of the consistency of pull techniques as a key determinant of accuracy, not just general postural stability.

The implication of these findings is that the archery curriculum for beginners should place more emphasis on developing and maintaining the consistency of pull techniques as a foundation before introducing other aspects of archery skills. This approach has the potential to improve learning efficiency and reduce the time it takes for beginners to achieve an adequate level of accuracy. In addition, ² these results are also in line with studies showing that motor calibration plays an important role in improving accuracy after obtaining visual feedback on performance results, albeit in different contexts (Christensen et al., 2024). The study emphasizes that the consistency of pulling techniques is a strong predictor of shot accuracy, distinguishing it from other biomechanical factors that may contribute to overall archery performance (Shafizadeh & Davids, 2024). Another crucial aspect identified is that the stability and postural control of the upper body during the bow pulling process directly affects the athlete's ability to maintain accuracy (Kuch et al., 2020).

CONCLUSION

This study comprehensively confirms that exercises focused on the consistency of pull techniques significantly improved the accuracy of shots in novice students in archery lectures, as evidenced by the ⁸significant differences between the experimental and control groups. This increase in accuracy is mainly due to neuromuscular adaptations that allow for a more precise and stable reproduction of movements during the withdrawal and release phases, which are crucial components in effective archery biomechanics (Edmizal et al., 2024). Therefore, an emphasis on developing proprioceptive skills and internalizing optimal movement patterns in pulling techniques should be a priority in archery training programs for beginners (Yachsie et al., 2023).

Nonetheless, further research needs ⁷to explore the optimal duration and frequency of pulling technique consistency training to maintain improved shot accuracy in the long term. It is also worth investigating whether the skill transfer from this pull consistency exercise can be applied to a wide range of environmental conditions and competition pressures. In addition, future research may investigate the impact of the consistency of pull techniques on fatigue levels and how it affects the accuracy of the shot over time. Considering these factors will provide a more holistic understanding of the effectiveness of training interventions, the consistency of pull techniques, and their application in the development of novice archery athletes.

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