

The Effect of Triceps Press-Down, Seated Rowing and Endurance Methods on Arm Muscle Strength



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ABSTRACT: The purpose of this study was to determine the effect of the triceps press down, seated rowing and endurance exercise methods on increasing arm muscle strength. Factorial method 2 x 2. There were 24 research samples. The pull up test instrument was for endurance and the holding bow digitec test. ANOVA data analysis technique $\alpha = 0.05$. Results (1) there is a significant difference between the triceps press-down exercise and seated rowing exercise in increasing arm muscle strength. (2) There is a significant difference in the effect of athletes who have high and low muscle endurance on increasing arm muscle strength. (3) There is a significant interaction between triceps press down and seated rowing exercises with muscle endurance (high and low) on arm muscle strength in archery athletes.

KEYWORDS: Triceps Press Down, Seated Rowing, Endurance, Arm Muscle Strength

INTRODUCTION

The rapid development of science and technology in the field of sports can improve sports coaching in the future, which is expected to make many people like sports. Sports have a role as daily entertainment and have become a healthy lifestyle. Various forms of sports include invasion, striking and fielding, net game, and target game. One of the sports games that have targeted such as archery. Archery is in demand from various groups, both from the upper and lower classes, both small children, teenagers, and adults, so anyone can take part in this archery sport.

Arrows are a kind of weapon in the form of long objects, sharp at the ends and feathered at the base, which is released with a bow, while archery is releasing arrows at targets or targets (Setiakarnawijaya et al., 2021). Archery is a static sport that requires good physical condition and includes upper-body muscle strength and endurance (Arkin & Budak, 2021). When performing archery techniques when pulling the bowstring, the muscles will experience isotonic contractions, especially in the initial half-pull. In full pull (drawing), the arm that pulls the bowstring, namely the fingers, must touch the chin, and the fingers stick under the chin (anchoring), and for the arm holding the bow (holding), it must be completely locked as well as the pulling arm, so isometric contractions occur.

Archery sport does not require a lot of movement skills, and true archery is a simple sport. Archery is a sport that releasing arrows at the target as precisely as possible. Archery, of course, involves the muscles in pulling the bow and must be of particular concern because these muscles work extra hard in pulling and holding the weight of the bowstring, which is quite heavy and takes place continuously or repeatedly in a series of archery movements. Therefore, these muscles must have strength as well as endurance in order to be able to pull the string consistently and steadily according to the axis of motion. The muscles that must be trained and developed in archery are the shoulder muscles, towing fingers, forearm muscles, wrists, abdominal muscles, leg muscles, and torso muscles (Rizal et al., 2019).

Archery requires good accuracy. When an athlete releases a bow to shoot arrows at the desired target, it requires good accuracy. Many forms of exercise can be used to train archers' accuracy, such as the triceps press down and seated rowing exercises which are useful for strengthening the muscles of the bow-pulling arm when aiming because when releasing an arrow it is necessary to calm down and strengthen the fingers of the bowstring puller. The strokes of the arrows become smooth. The slightest mistake when releasing arrows will have a big effect on the accuracy obtained when releasing arrows.

Exercise comes from words in English that can contain several meanings, such as practice, training, and workout. The main aim and objective of exercise or training are to help athletes to improve their skills and achievements as much as possible. To achieve this, there are four aspects of exercise that athletes need to pay attention to and train carefully, namely (1) physical exercise, (2) technical exercise, (3) tactical exercise, and (4) mental exercise. Therefore the researcher chose the triceps press

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down and seated rowing exercises, where these two exercises are in accordance with the pattern of movement and muscle function in archery. This exercise also involves a shortening of muscle contractions during which normal tension is exercised, so that muscle strength and endurance can be increased by these exercises.

Triceps press down is a weight exercise by pulling the arm muscles, which begins standing straight facing the weight machine, then the movement pulls the handle at chest level, and both upper arms are pressed against the ribs; from this position, straighten the forearms so that the handles touch the thighs, hold for a moment, then return the handles to chest height without moving your upper arms and body (Tumminello, 2022). This triceps press exercise supports the user in a relatively stationary seated position while the user extends his or her arm at the elbow from the initial exercise position to the final exercise position (and often back to the initial exercise position). So, the triceps press-down exercise is a muscle exercise that has an important role, as the main function is to move the elbow joint for extension movement, and this exercise is included in isotonic contractions, namely dynamic exercises that are carried out with the principle of constant load and there is a change in muscle length. This exercise method is useful in strengthening and muscle endurance exercises (Rahmatika et al., 2022).

The rowing exercise apparatus is a commonly used apparatus today to elevate the heart rate and exercise the leg and upper body muscles. Typically, a handle and seat move while the feet rest on stationary pedals (R. N. Wong et al., 2022); (Wu et al., 2020). Seated rowing is a weight exercise by pulling the back muscles starting with an upright sitting position, knees slightly bent, grip the handgrip with the position of both hands straight forward, and fingers facing inward, then pull the movement towards the chest (keep your back straight) hold down then return to its original position (Ronai, 2019).

Endurance is the ability to work for a long time. The definition of muscle endurance is the capacity of a group of muscles to contract repeatedly or successively within a certain period of time against a load (Pareja-Blanco et al., 2020). Strength is the ability of a muscle or group of muscles to overcome resistance. Strength is the ability of a muscle to generate tension against a resistance (Staniszewski et al., 2020). Physiologically, muscle strength is the ability of a muscle or group of muscles to carry out one maximum contraction against a load. Muscle strength is also one of the muscles' abilities to fight load in one effort. Muscular endurance is the ability of a muscle or group of muscles to overcome resistance or exercise loads in a relatively long period of time. Arm muscle strength must also be trained so that they have the resistance to lock the target so that when pulling the bow, the hand does not move too much. Endurance is also the ability to work muscles within a certain period of time. In this case, arm muscle strength plays an important role in archery.

Based on the description above, the authors feel the need to conduct this research with the aim of increasing the endurance and strength of the arm muscles in archery athletes, and this is manifested in the form of scientific research entitled "The Effect of Triceps Press Down Exercise, Seated Rowing and Endurance on Increasing Arm Muscle Strength in Archery Athletes.

METHOD

This study used an experimental method with a 2x2 factorial research design. The population used in this study were Archery Athletes of the District. Kulon Progo with a population of 26 athletes. In this study, to obtain the number of samples, a sample size will be taken using the formula from Slovin. The sample in this study were 24 people. The sampling technique used in this study used a simple random sampling technique. Of the total sample used, 24 people were then divided into 2 groups with the highest and lowest results based on the test results of the attributive variables (12 people with the highest test results and 12 people with the lowest tests).

The variables in this study consisted of two independent manipulative variables, namely triceps press exercises and seated rowing exercises, while as an attributive independent variable, namely endurance. Then the dependent variable is the strength of the arm muscles. An instrument to measure arm muscle strength is carried out using a pull up test. The instrument measures arm muscle endurance using the Holding Bow Digitec Test (Prasetyo et al., 2022). To test the hypothesis, it was carried out using two-way ANOVA (two-way ANOVA) and if it is proven that there is an interaction, a further test will be carried out, namely the Tukey test, using the SPSS version 20.0 software program for windows with a significance level of 5% or 0.05.

FINDING

The data from this study are in the form of pretest and posttest data on arm muscle strength. The research process will take place in three stages. The first stage is to do a Pretest to get initial data on the assessment of muscle endurance and arm muscle strength. Descriptive statistical pretest and posttest arm muscle strength is presented in Table 1:

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Table 1. Descriptive Statistical Pretest and Posttest arm muscle strength

Method	Muscle Endurance	Pretest	Posttest
Triceps Press	High (A1B1)	16,00±0,63	21,67±1,21
	Low (A1B2)	14,00±1,09	15,83±1,17
Seated Rowing	High (A2B1)	16,00±0,89	17,67±0,82
	Low (A2B2)	14,00±0,89	17,83±0,98

Based on the table above, it shows that the arm muscle strength of the A1B1 group averaged a pretest of 16.00 and experienced an increase in the posttest of 21.67, the A2B1 group had an average pretest of 16.00 and experienced an increase in the posttest of 17.67, the A1B2 group had an average pretest of 14.00 and experienced an increase in the posttest of 15.83, the A2B2 group had an average pretest of 14.00 and experienced an increase in the posttest of 17.83

NORMALITY TEST

The data normality test in this study used the Kolmogorov Smirnov method. The data summary is presented in Table 2:

Tabel 2. Uji Normalitas

Data		sig	Description
Pretest	A1B1	0,518	Normal
	A2B1	0,968	Normal
	A1B2	0,573	Normal
	A2B2	0,968	Normal
Posttest	A1B1	0,956	Normal
	A2B1	0,682	Normal
	A1B2	0,926	Normal
	A2B2	0,646	Normal

Based on the statistical analysis of the normality test that was carried out using the Kolmogorov Smirnov test, in all pretest and post-test data, the strength of the arm muscles was obtained from the results of the data normality test with a significance value of $p > 0.05$, which means that the data is normally distributed.

HOMOGENEITY TEST

A homogeneity test was carried out to test the similarities of several samples, namely homogeneous or not. The homogeneity test is intended to test the similarity of the variance between the pretest and posttest. The homogeneity test in this study is the Levene Test. The homogeneity test results are presented in Table 3.

Table 3. Homogeneity Test

Group	sig	Description
Pretest-Posttest	0,656	Homogen

Based on the statistical analysis of the homogeneity test that has been carried out using the Levene Test. In the pretest-posttest, a significance value of $0.073 \geq 0.05$ was obtained. This means that the data group has a homogeneous variant. Thus the population has the same variance or homogeneity.

HYPOTHESIS TEST RESULTS

Testing the research hypothesis was carried out based on the results of data analysis and interpretation of the two-way ANOVA analysis. The results of the Hypothesis Test are presented in table 5:

Table 5. ANOVA test

Source	Type III Sum of Squares	F	Sig.
Exercise Method	7.042	5.671	0.027
Muscle Endurance	51.042	41.107	0.000
Exercise Method * Muscle Endurance	51.042	41.107	0.000

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A diagram of the interaction results between the triceps press down exercise and seated rowing exercises with muscle endurance (high and low) on arm muscle strength can be seen in Figure 1:

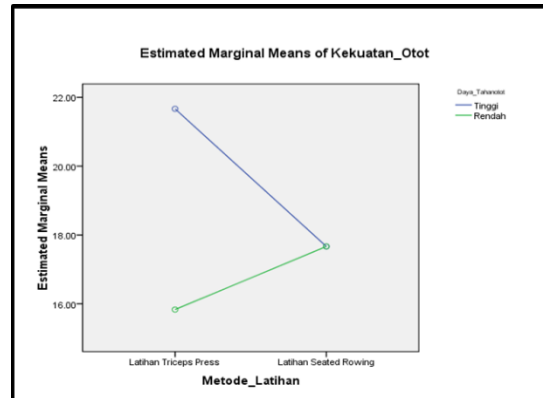


Figure 1. Interaction Results

Based on the calculation results of the Tukey test on the asterisk sign (*) it shows that the pairs that have significantly (significant) different interactions or partners are: (1) A1B1-A2B1, (2) A1B1-A1B2, (3) A1B1-A2B2, (4) A2B1-A1B2, (5) A1B2-A2B2, while the other pairs that are stated to have no difference in effect are: A2B1-A2B2.

DISCUSSION

The Difference in the Effect of Triceps Press-Down And Seated Rowing Exercises On Increasing Arm Muscle Strength

Based on hypothesis testing, it is known that there is a significant difference in the effect of triceps press-down and seated rowing exercises on increasing arm muscle strength in archery athletes. The triceps press-down exercise group was higher (good) compared to the seated rowing exercise in increasing arm muscle strength in archery athletes. In weight exercise in its application for 4 weeks with 3 times a week, 3 sets of repetitions of 20 times were carried out with an intensity of 1 RM for weeks I & II 40% and weeks III & IV 50% (Bemben & Bemben, 2011); (Kramer et al., 1997) had an effect on arm muscle endurance in the treatment group because, with the given loading, significant results were obtained compared to standard archery exercise that the exercise had an effect on muscle endurance-strength. Based on the research results from the calculation of the t-test obtained t-count (18) > t-table (2.16) for t-table at a significant level $\alpha = 0.05$, it can be concluded as follows, there is a significant effect of barbell curls and triceps pushdown exercises on muscle hypertrophy upper arm muscles in members of the Padang City Max Power Gym & Aerobics (Cakrawala & Agus, 2019).

Triceps press down is a weight exercise by pulling the arm muscles which begins standing straight facing the weight machine, then the movement pulls the handle at chest level, and both upper arms are pressed against the ribs, from this position straighten the forearms so that the handles touch the thighs, hold for a moment, then return the handles to chest height without moving your upper arms and body (Barr, 2021). In this exercise, the triceps play an important role, which has the main function of activating the elbow joint for extension movements. The dominant tricep muscle has type II fast twitch muscle fibers which have relatively good resistance. This exercise is included in isotonic contractions, namely dynamic exercises carried out with the principle of constant load and there is a change in muscle length. This exercise method is useful in muscle strengthening and endurance exercises.

Strength exercise affects muscle hypertrophy, biochemical changes, changes in muscle composition, and changes in flexibility. Thus the physiological response and impact of strength exercise are characterized by the process of adaptation to muscle innervation, muscle hypertrophy (enlargement), adaptation of cells, muscle endurance, cardiovascular adaptation, biochemical changes, changes in muscle composition, and changes in flexibility (Krause et al., 2019); (Yoon et al., 2019).

In endurance exercise, the greatest adaptation occurs in the biochemical processes in the muscles. By utilizing mechano growth factors where these substances play a role in the process of increasing protein synthesis used in the adaptation of muscle contractions to a given exercise load. In this case, in addition to the response from the muscle fibers, it also causes an increase in the size of the capillaries, thereby increasing the use of oxygen in the muscle fibers. Muscle enlargement (hypertrophy) may occur, but only slightly. This hypertrophy is caused by an increase in protein synthesis (actin and myosin) which will stimulate amino acids and increase the number of mitochondria in muscle cells. Inside the myofibril cells will increase in size and number (Sartori et al., 2021); (Schiaffino et al., 2021). In the increased ATP and CP metabolic systems, the supply of myoglobin and creatine phosphokinase enzymes also increases. This increases the tensile strength of the tendons, ligaments, and connective tissue in the muscle in other words increasing the thickness of the connective tissue which contributes to the overall growth or

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hypertrophy of the muscle.

Muscular hypertrophy can be increased through strength exercise and other short-duration, high-intensity anaerobic exercises. Long-duration, low-intensity anaerobic exercise generally does not produce effective tissue hypertrophy, as endurance-focused athletes only increase fat and carbohydrate storage in muscle, such as neovascularization. Basically, need an adequate supply of amino acids to produce muscle hypertrophy. The given load increases contraction and stimulates motor neurons in the muscles, the contraction of these motor units simultaneously causes muscle contractions along the muscles which stimulate the activity of motor neurons. Weight exercise also affects the adaptation of nerves associated with increased recruitment of a number of muscle groups. The more motor units recruited the more active muscle fibers. Many researchers agree that motor units are generally activated based on the existence of a definite recruitment order due to neuromuscular activity that binds definitely and repeatedly, known as the principle of orderly recruitment, namely the provision of a stimulus that binds gradually to the motor unit so that the ability of the muscles increases (Edström & Grimby, 1986).

These triceps press exercises support the user in a relatively fixed sitting position while the user extends his or her arms about the elbow from an exercise starting position to an exercise ending position (and often returns to the exercise starting position). So, the triceps press-down exercise is a muscle exercise that has an important role, as the main function is to move the elbow joint for extension movements, and this exercise is included in isotonic contractions, namely dynamic exercises that are carried out with the principle of constant load, and there is a change in muscle length. This exercise method is useful for strengthening and endurance exercises (D. P. Wong et al., 2013).

The Difference in Effect Between Athletes who have High and Low Muscle Endurance on Arm Muscle Strength

The results of the analysis show that there is a significant difference in the effect of athletes who have high and low muscle endurance on increasing arm muscle strength in archery athletes. Athletes who have high muscle endurance are higher (good) compared to athletes who have low muscle endurance to increase arm muscle strength in archery athletes. Endurance is the ability to work for a long time. Arm muscle strength is an important element in archery. Physiologically, muscle strength is the ability of a muscle or group of muscles to carry out one maximum contraction against a load (Nasrulloh et al., 2022). Muscle strength is also one of the muscles' abilities to fight load in one effort. Endurance strength (muscle endurance) is the ability of a muscle or group of muscles to overcome exercise resistance/load over a relatively long period of time. Arm muscle strength must also be trained so that they have the resistance to lock the target so that when pulling the bow, the hand does not move too much. Endurance is also the ability to work muscles within a certain period of time.

The more dominant endurance in archery is muscle endurance. Muscular endurance refers to a group of muscles that are capable of carrying out consecutive contractions, one of which is the arm muscles. Arm muscle endurance is the ability of a muscle or group of muscles to be able to contract dynamically or statically by holding a load for a relatively long time, to be able to maintain stability between the traction and thrust exerted by the arm muscles in order to create consistency of movement from the start. End of the game (Langer et al., 2022). The use of arm muscle endurance in archers is when pulling the bow, aiming (holding), and releasing arrows. Therefore, increasing the endurance of the arm muscles and the physical condition of the archers are felt to be very important to achieve optimal results.

The endurance function of the arm muscles in archery is very much needed, given the amount of traction and thrust that must be exerted continuously by the arm muscles. These elements will later affect the athlete's shooting rhythm because doing repetitive movements that require maximum muscle endurance. In addition, muscle endurance plays an important role because archery matches require a relatively long time. Match time can reach 4-5 hours or release as many as 108 arrows in the qualifying round or in one day. From this, it can be seen that archery is a sport that requires high arm muscle endurance. The stronger the muscle endurance, the stronger the driving force is to hold the load so that it will produce a steady movement in pulling the bowstring for a relatively long time.

The Interaction between Triceps Press Down and Seated Rowing Exercises with Muscle Resistance (High And Low) on Arm Muscle Strength

Based on the results of this study, there was a significant interaction between triceps press down and seated rowing exercises with muscle endurance (high and low) on arm muscle strength in archery athletes. The results showed that the triceps press down group was more appropriate for athletes with high muscular endurance, while seated rowing exercises were suitable for athletes with low muscular endurance. From the results of the interaction form it appears that the main research factors in the form of two factors show a significant interaction. In the results of this study the interaction means that each cell or group has a different effect on each group that is paired. Couples who have significantly (significantly) different interactions or partners are as follows.

1) The group of athletes who were trained using the triceps press exercise with high muscle endurance was better than the

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group of athletes who were trained using the seated rowing exercise with high muscle endurance, with a p-value <0.05.

- 2) The group of athletes who were trained using the triceps press exercise with high muscle endurance was better than the group of athletes who were trained using the triceps press exercise with low muscle endurance, with a p-value <0.05.
- 3) The group of athletes who were trained using the triceps press exercise with high muscle endurance was better than the group of athletes who were trained using the seated rowing exercise with low muscle endurance, with a p-value <0.05.
- 4) The group of athletes who were trained using seated rowing exercises with high muscle endurance was better than the group of athletes who were trained using triceps press exercises with low muscle endurance, with a p-value <0.05.
- 5) The group of athletes who were trained using the triceps press exercise with low muscle endurance was better than the group of athletes who were trained using the seated rowing exercise with low muscle endurance, with a p-value <0.05.

CONCLUSION

Based on the research results and the results of data analysis that has been done, the following conclusions are obtained. (1) There is a significant difference in the effect of triceps press down and seated rowing exercises on increasing arm muscle strength in archery athletes. The triceps press down exercise group was higher (good) compared to the seated rowing exercise in increasing arm muscle strength in archery athletes. (2) There is a significant difference in the effect of athletes who have high and low muscle endurance on increasing arm muscle strength in archery athletes. Athletes who have high muscle endurance are higher (good) compared to athletes who have low muscle endurance to increase arm muscle strength in archery athletes. (3) There is a significant interaction between triceps press down and seated rowing exercises with muscle endurance (high and low) on arm muscle strength in archery athletes.

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