

The Effect of Band Exercise on the Arm Muscle Endurance and the Accuracy of Elementary School Students' Archery

Yudik Prasetyo¹, Fatkurahman Arjuna¹, Atikah Rahayu¹

¹*Sport Sciences Department, Universitas Negeri Yogyakarta, Jl. Colombo No.1 Yogyakarta, Indonesia*

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Abstract: This study is initiated from the problem of the physical condition of beginner athletes which has not reached its maximum potential. Band exercise is physical training that is suitable for beginners because it does not use weight other than athletes' own body. The purpose of this study is to determine the effect of band exercise on the arm muscle endurance and the accuracy in 20-meter archery. This research is an experimental study that uses one group pre-post-test design research. The number of subjects in this study was 20 athletes. The data were analysed to test the hypothesis using t-paired t-test (before-after). The results show that there is an increase of mean score of the posttest compared to that of the pretest. The results of t count side learning test was $7.255 > 2.093$ with the significance value of 0.000 ($p < 0.05$). The results of the t-test on accuracy in archery was t count $12.839 > 2.093$ with the significance value of 0.000 ($p < 0.05$) with the significance level of 0.05% (determining the level of meaningfulness). Based on that, the null hypothesis (H_0) is rejected. It can be concluded that band exercise has an effect on the endurance of arm muscle and the accuracy of archery done by the elementary school students.

1 INTRODUCTION

Archery has now grown rapidly in Indonesia. There are many enthusiasts on archery ranging from the ages of children to adults. However, archery in Indonesia is dominated by children. Various competitions are held in each region. To improve their athletes' achievement, the Blaburan Archery Club often encourages the athletes to take part in regional to international Junior Championships. However, in terms of achievements, the effort has not been done optimally, especially by young athletes who are in their growth period. Only few numbers of athletes in the pre-starter and beginner classes who gain victory at the national level, whereas they are quite good at the district level. To maximize these achievements, there is a need for training programs that are appropriate for their age. M. Sajoto (1998) states that there are factors need to come under consideration if you want to achieve optimal performance. They are: (1) physical development, (2) development of techniques, (3) tactics, and (4) mental development and mental maturity. The component of physical condition is a whole unit that cannot be separated just like development and continuance.

The dominant component in archery is the endurance of the arm muscles which includes arm and shoulder muscles, and accuracy. One of the ways to increase the endurance of the arm muscles is by weight training. Weight training must be performed carefully because physiologically, the ability of children of their age is still very weak. Therefore, physical exercise for children in the growth period, especially at the age of elementary school, is carried out using their own body weight or using a lightweight tool that will not interfere with its functional development. The intended ability of power is more on strength endurance, meaning paying more attention to the volume rather than the intensity of the weight and the rhythm of the movement that is not fast (Wilson, 2010). What needs to be considered from the muscle endurance training is the portion or the dose of exercise and its appropriateness. One form of proper training is band exercise. Unfortunately, many trainers do not know what band exercise is as well as its benefits and its forms of training. There are so many forms of band exercise, and there is a simple form of band exercise for children which does not reduce its benefits.

Band exercise needs to be developed, aligned with its benefits for the purpose of strengthening the

arm and shoulders muscles and improving stability. It is expected that band exercise can help improve the elementary school students' performance in archery.

2 THEORETICAL REVIEW

2.1 The Definitions of Band Exercise

The word exercise is defined as (1) physical movements and activities involving the use of large muscle groups like dance, calisthenics, more formal games and activities such as jogging, swimming, and running, and (2) any movement arrangement designed to train or improve skills (Kent, 1994). Band exercise uses an elastic rope made of rubber. Band exercise can be used to train the movement ability, strength, and muscles endurance. Since there are varieties of movement in the band exercise, this exercise can be directed to train one of the muscle groups desired by the coach. Generally, rubber ropes are numbered from the smallest to the largest based on their width. Stretch bands will more closely simulate archery, such as the feeling of pulling and releasing a bowstring because of its elasticity (Rabska Don, 2009).

The principle of using bands in archery is like bow training. Bow training is done by pulling strings of the bow, holding them, and correcting the position for a minimum of 15 seconds and a maximum of 30 seconds, and then resting in twice time of the used time. For example, if you do bow training for 15 seconds, you need to rest for 30 seconds (Jake Kaminski, 2017).

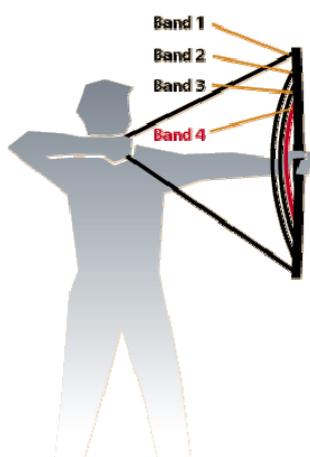


Figure 1: Band exercise (Source: www.bow-trainer.com/instructions).

Like the mode of power training, elastic resistance has several advantages and disadvantages. Athletes should carefully consider merging ERT with a training regimen. The biggest advantages of elastic resistance are portability, low cost, and versatility. Unlike isotonic resistance (free weight, weight training machines, and pulley), elastic resistance depends on the tension of the rubber rather than the gravitational force (Agustinah, 2015).

In archery, the element of endurance of the arm muscles is very much needed, considering the amount of push and pull forces that must be carried out continuously by the arm muscles. The durability element will later have a big effect on the athlete's shooting rhythm.

When making movements in archery, the archer makes the motions of drawing and pushing. In the bow drawing movement, several muscles actively work, include the triceps, biceps, deltoids, and trapezius muscles, whereas the muscles that play roles in pushing the bow are palmar aponeurosis, biceps, triceps, deltoids, and subscapularis. The researcher described the muscles above through the picture below:

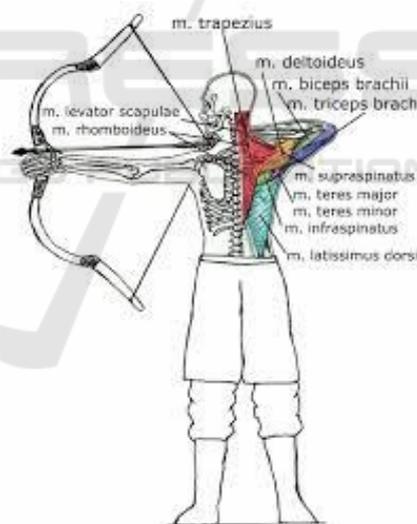


Figure 2: Arm muscles.

2.2 Accuracy in Archery

Accuracy is a primary thing in archery that should be mastered by the athlete. If an archer does not have good shot accuracy, the athlete will find it difficult to win the competition. In archery, the athlete is not required to have perfect techniques. However, an archer is highly demanded to have good shot accuracy supported by the archery

technique. In archery, the techniques are not restricted by the rules. The athletes are free to use any techniques as long as they do not disturb other archers during the match. If the technique is good and steady, it will produce a good shot.

From the above definition, it can be concluded that the accuracy in archery is the level of proximity of the arrows to the X point in the target which is yellow in colour (Score 10).



Figure 3: Archery target face.

3 RESEARCH METHOD

This research adopts experimental design. It is in the form of one group pretest-posttest design, which is an experiment carried out in one experimental group without a control group. This design is formulated as follows:



3.1 Sampling

The purposive sampling was used in this study. Purposive sampling is a technique of determining samples with certain considerations (Sugiyono, 2011). The samples from this study are male and female athletes aged 7-12 years. The sample size is 20 people.

3.2 Data Collection Method

The methods used in this study are test and measurement. The samples are the students who are still in the growth period, that is 7-12 years. Because that ages are at the beginner level of athletes, the forms of exercise are aimed at the formation of general strength.

The instrument of side learning test is used to measure the endurance of arm muscles (Widiastuti, 2011). Before the training program, the initial tests

(pretest) in the form of side learning test and 20-meter archery test were carried out. After that, the training treatment was performed in 21 meetings. The frequency of exercise was 3 times per week with the duration of 1.5 - 2 hours with the arranged exercise program. After that, the final tests (posttest) were carried out.

From the results of the pretest and posttest, it will be decided whether the treatment has an effect or not.

3.3 The Data Analysis Technique

Before the statistical analysis was carried out, the normality test was performed as the assumption test or the requirement test. The normality test is used to determine the normal distribution of the obtained data.

3.3.1 The Normality Test

The Kolmogorof-Sminorv test was used in the normality test. In this test, the sample hypothesis will be tested from the population with normal distribution. The result will be compared with the value of Asymp. Sig of 0.05 to determine whether the hypothesis is rejected or not. The hypothesis is accepted if the value of Asymp.Sig is greater than 0.05. If it does not meet the criterion, the hypothesis will be rejected.

Table 1: Results of the normality test using the Kolmogrov-Smirnov Test.

No	Variable	Asymp.Sig	Category
1	Arm muscle endurance (pretest)	0.646	Normal
2	Arm muscle endurance (posttest)	0.773	Normal
3	Score on 20-meter archery (pretest)	0.673	Normal
4	Score on 20-meter archery (posttest)	0.523	Normal

Based on the table above, it can be seen that the value of Asymp.Sig of the two data variables was > 0.05, meaning that the two variable data are normally distributed. It means that the data are normal.

3.3.2 The Homogeneity Test

Homogeneity tests are useful to test the similarity of samples and the sample variants taken from the population. The criterion of homogeneity is if

$F_{count} < F_{table}$. If $F_{count} > F_{table}$, the samples are considered as not homogeneous. The results of this homogeneity test can be seen in the following table:

Table 2: Results of homogeneity test.

Test	Df	Ftable	Fcount	P	Criteria
Arm muscle endurance	1:38	4.10	0.016	0.901	Homogen
Score on 20-meter archery	1:38	4.10	0.434	0.514	Homogen

The results of the homogeneity test on the arm muscle endurance data and accuracy scores show that $F_{count} < F_{table}$ (4.10), meaning that the variance is homogeneous.

4 RESULTS AND DISCUSSION

4.1 Result

There is a significant difference between the pretest and the posttest of the arm muscle endurance and 20-meter archery of the beginner archery athletes in Magelang regency after given the treatment of band exercise. The results of the t-test in determining differences of the two variables between the pretest and the posttest can be seen in the following table:

Table 3: Result of the t-test.

Pretest – posttest	Df	T table	T count	P	Sig. 5 %
Arm muscle endurance	19	2.093	7.255	0.000	0.05
Score on 20-meter archery	19	2.093	12.839	0.000	0.05

From these results, it can be seen that tcount of arm muscle endurance is 7.255, greater than t (0.05) (19) = 2.093 and tcount of the 20-meter archery is 12.839, greater than t (0.05) (19) = 2,093 at the significance level of 0.05%. It means that the null hypothesis (H_0) is rejected. Thus, the alternative hypothesis (H_a) states that band exercise has an effect on the arm muscle endurance and the elementary school students' accuracy in archery.

4.2 Discussion

Based on the results of this study, band exercise can be used as an exercise model for beginner archery

athletes. It is because band exercise has several advantages, such as elasticity or having thickness with different weight pull functions so they can be adjusted. Furthermore, band exercise can be done both in indoor or outdoor. Endurance training using elastic bands is often applied in strength training, sports rehabilitation, and muscle training. Using elastic tape for 8 weeks can increase muscle strength by 14% -26%. In further research, it is found that besides enhancing strength, balance, proprioception, and function, band exercise has a preventive effect on pain and chronic damage (Kang Dong Hyun, et al., 2016). The movement of band exercise conducted in this study was like archery so that the muscles affected were the same as when doing archery. According to Sezer Süreyya Yonca (2017) the purpose of physical training in archery is to provide competition-like conditions in terms of body and mind for the archers. Archers who have good physical condition are those who could control the strength of the heartbeat and their entire body when playing archery.

Archery requires consistency and stability of movements. To shoot arrows accurately at the target, archers need to control the distribution of the right strength, balanced pose, changes in breathing, and so on. The incompatibility of these factors can directly affect performance (Jeong-Min Park, 2016). When archers do band exercise regularly, it will increase their muscle endurance so that the stability of their technique in drawing and releasing the bowstring will be well preserved. The mastery of the right archery techniques would allow consistency of movements both in the practice and competition in order to make an achievement (Prasetyo, 2013).

The factors need to come under consideration in order to achieve optimal achievement are (1) physical development, (2) development of techniques, (3) tactics, and (4) mental development and maturity (Sajoto, 1998). The component of physical condition is a whole unit that cannot be separated just like development and continuance. In archery, physical condition that needs to be considered is the endurance of arm muscles. The importance of arm muscle endurance and accuracy in archery is based on the long duration of archery, meaning that having good arm muscle endurance will help stabilize movements affecting on the high accuracy and scores. Therefore, to get good accuracy, an archer must have good arm muscle endurance. Based on the reason, band exercise that is routinely done is needed to increase the ability in well-trained and stable archery.

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