

THE EFFECT OF THERABAND ROTATOR CUFF STRENGTHENING FOR ARCHERY ATHLETES ACCURACY

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Abstract

Archery is an accuracy sport that requires muscle strength to get good accuracy. This study aimed to analyze the effect of theraband rotator cuff strengthening exercise method and the core stability exercise method on the results of archery accuracy for archery athletes in Klaten district. This study used a quasi-experimental method with a two-factorial design. The population of this study were 80 archery athletes in Klaten district who were sampled from the SMART club, the SETRO ARCHERY club, and the SAROTAMA club. The sampling technique used purposive sampling and a total samples were 40 athletes. Data analysis used Analysis of Variance (Anava) at a significance level of $\alpha = 0.05$. The results are 1) slow and fast theraband rotator cuff strengthening exercise methods were obtained ($p=0.843 > 0.05$), static and dynamic Core Stability Exercise exercises were obtained ($p=0.921 > 0.05$), interactions of theraband rotator cuff strengthening exercise methods slow and static core stability exercise obtained value ($p=0.978 > 0.05$), interaction of slow theraband rotator cuff strengthening exercise method and dynamic core stability exercise obtained value ($p=0.986 > 0.05$), interaction of fast theraband rotator cuff strengthening exercise method and static core stability exercise value obtained ($p=0.978 > 0.05$), interaction of fast rotator cuff strengthening theraband exercise method and dynamic core stability exercise obtained value ($p=0.978 > 0.05$). The conclusions are 1). There is the effect of the rotator cuff strengthening theraband exercise method, slow and fast pulling. 2). There is an influence of static and dynamic core stability exercise methods. 3). Theraband and core stability exercise methods affects the athletes' accuracy, but there is no significant difference in exercise effect between groups.

Keywords: theraband, rotator cuff strenghtening, archery accuracy

INTRODUCTION

Exercise is a way for someone to increase their potential. By exercising, it is possible for someone to learn or improve movements in a technique in the sport they are involved in. "Exercising is a process by which an athlete is prepared for the highest level of performance possible. The ability of a coach to direct the optimization of performance is achieved through the development of systematic exercise plans that draw upon knowledge garnered from a vast array of scientific disciplines" (Bompa and Haff, 2019) "Exercising is a person's effort to prepare himself for a particular purpose. Training is a deliberate process to master a type of skill or improve conditions. In sports studies" (Bompa, 1994), exercise is a process of change in a better direction, namely improving physical, functional body equipment, and psychological quality (Sukadiyanto, 2002).

There are a number of factors that influence the success of an athlete. Those factors consist of intrinsic and extrinsic factors which include physical, psychological, technical, tactical, trainers, training facilities and infrastructure, training, social, and so on. Athlete's performance can be observed from three dimensions, namely: (1) Dimension of physical fitness, including endurance, explosive power, speed, flexibility, agility, reaction, balance, accuracy, and so on.; (2) Dimension of skill, which includes kinesthetics, certain sports skills, motion coordination, and so on.; (3) Dimension of physical innate talent, which includes physical condition, height, weight, body shape, and so on (Sudibyo Setyobroto, 1993).

Archery is the activity of shooting arrows at a target at a certain distance. There are several things to note in archery: (1) Physical condition, which covers: arm muscle strength, body muscle strength, leg muscle strength, muscle endurance, aerobic capacity, flexibility, posture (length of pull), coordination between eyes and arms. (2) Techniques, which include: basic archery techniques, instrument tuning and conformity with body condition and posture, compensation, instrument quality. (3) Tactic, which covers: control of archery commands. (4) Psychology, which includes: motivation, self-confidence, sportsmanship, anxiety, self-control, tenacity to overcome any pressure, concentration, and others (Humaid, 2014). Archery is a recreational sport of strength and power. Art of sport is to, practice or skill of using a bow to shoot arrows. Archery is propelled with arrows and a bow to the target during shooting (Dhawale et al, 2008).

Based on the development of physical condition, there are more specific aspects in archery, namely endurance, strength, flexibility, and structure/accuracy (Lee & Robert, 2005). Good muscle strength and endurance will give the archer a huge advantage to perform at his peak. In addition, archery requires upper body and core muscle strength that moves the major muscle groups (Taha et al, 2018). Archery is a fitness activity that utilizes the muscle area of mental health development. Archery requires precision, control, focus, physical ability and determination (Chander, 2018). On the other hand, *“Archery is a recreational sport of strength and power. Art of sport is to, practice or skill of using a bow to shoot arrows. Archery is propelled with arrows and a bow to the target during shooting”* (Dhawale et al, 2018). Archery and shooting are activities that require visual-motor coordination and the ability to aim at small targets at long distances (Ilham, 2014).

In practice, archery is a sport that really requires coordination, endurance, flexibility, length of pull, and balance to form good archery techniques. (Callaway et al., 2017; Mucedola & Mucedola, 2018; Tan, etl al., 2016). These factors must be supported by good training as well as excellent and durable physical condition. *“Archery is an individual and non-contact, static sports that requires archer to possess muscular strength, upper body endurance, coordination, attention, concentration and high levels of stability with proper precision and focus”* (Arumugam et al, 2016). Based on the development of physical conditions, there are more specific physical components in archery, namely endurance, strength, flexibility, and structure/accuracy (Lee & Robert, 2005). Having good muscle strength and muscle endurance, will provide a big advantage for archers to perform at their peak. In addition, archery requires upper body and core muscle strength that moves the major muscle groups (Taha et al., 2018). The correct archery technique is closely related to the anatomical and mechanical aspects of motion which is very decisive is the process of motion (axis) the axis of motion that must be precise and correct in archery is the axis of motion 1 and the axis of motion 2, the axis of motion 1 is the attitude of the shoulder and the attitude of the arm the bow stop must be a straight line, the shaft of motion 2 is the arrow position and the pulling arm must be a straight line.

Experts state that to get good accuracy, an archery athlete needs good physical, technical, mental, and tactical strength. The title of this study is *“The Effect of Theraband Rotator Cuff-Strengthening for Klaten Regency Archery Athletes’ Accuracy”*. This study aims to create a physical training system that strengthens archery athletes, especially strengthening the rotator cuff muscles, to strengthen the rotator cuff muscles, the researcher will use an instrument, namely theraband. This theraband exercise will target the rotator cuff muscles including the deltoid muscles, supraspinatus muscles, infraspinatus muscles, teres minor muscles, and subscapularis muscles.

Adhesive capsulitis is a condition characterized by functional restriction of both active and passive shoulder motion for which radiographs of the glenohumeral joint are unremarkable except for the possible presence of osteopenia or calcific tendonitis. Despite extensive research, the etiology of adhesive capsulitis is not completely explained, possibly involving a nonspecific chronic inflammatory reaction of subsynovial tissue and resulting in capsular and synovial

thickening affecting the function of the glenohumeral joint. Onset of adhesive capsulitis is usually gradual and idiopathic, but it may also be acute and associated with a history of minor injury to the shoulder joint.

Adhesive capsulitis is divided into 3 stages: the painful stage, the stiffening stage, and the thawing stage. In the painful stage, gradual onset of shoulder pain lasts from weeks to months. Pain, which can be severe, may cause pronounced sleep disturbance. The stiffening stage is characterized by progressive loss of active and passive ranges of motion (ROM) that may last up to 1 year. Most patients lose ROM in glenohumeral external rotation, abduction, and internal rotation during this stage, considered as the “capsular pattern.” The final, thawing phase is characterized by the gradual recovery of ROM.

Shoulder joint being the most mobile joint of the body, articular surface movements of the shoulder rely on the coordinated control of the surrounding muscles. Any impaired muscular performance may influence shoulder movements and then contribute to joint dysfunction. Therefore, the frequently observed pain-induced muscle spasm and muscle weakness around the affected shoulder may also cause pain and restricted movements in individuals with adhesive capsulitis. The supraspinatus, infraspinatus, teres minor, and subscapularis muscles compose the rotator musculotendinous cuff. These muscles are considered to be part of a “cuff” because the inserting tendons of each muscle of the cuff blend with and reinforce the rotator cuff. More importantly, all have action lines that significantly contribute to the dynamic stabilization of the shoulder .

This study was conducted because the researchers observed that the training that had been carried out did not specifically discuss proper physical training for archery athletes. Thus, the authors conducted this study in order to educate coaches who are new to the physical training system. Theraband training is another form of elastic retention that allows people to perform exercises with the aim of increasing muscle strength, mobility, motion, and function. The rotator cuff is a network of four muscles and several tendons that wrap around the upper arm bone (humerus), the rotator cuff holds the humerus in place at the shoulder joint and allows the arm to rotate (*American Academy of Orthopaedic Surgeons*). The rotator cuff is a group of bones and tendons surrounding the shoulder joint that are responsible for keeping the head and upper arm firmly attached to the shoulder socket (hellosehat.com). The muscles involved in rotator cuff movement are: (1) *Supraspinatus*; (2) *Infraspinatus*; (3) *Teres minor*; (4) *Subscapularis*; (5) *Deltoid*.

METHOD

This study entitled “The Effect of Theraband Rotator Cuff-Strengthening for Klaten Regency Archery Athletes’ Accuracy”. This study used a quasi-experimental method with pre-test and post-test design, using the Two-way Anava Test. The population in this study were all archery athletes in the Klaten district who are members of the official PERPANI (Indonesian Archery Association) club in the Klaten district. This Experiment Used Purposive Sampling technique. There are 80 archery athletes of all ages officially recorded in Klaten district. The sample requirements in this study were: 1) Male and female archery athletes in Klaten district, 2) Archery athletes who are still actively training at least 3-4 times per week, 3) Archery athletes who have participated in open competition (at least) 4) Archery athletes who are still at junior and senior high school levels, 5) Archery athletes who are willing to take part in the study treatments. The samples in this study were 20 people, who would then be divided into 2 treatment groups, namely the *slow pull rotator cuff strengthening theraband* group and the *fast pull rotator cuff strengthening theraband* group. Each group has 10 members.

This study was conducted at Bonyokan field, Koni Klaten field, and Club Smart field. This study was carried out for 7 weeks with a frequency of exercise 3 times a week. Training on

Tuesday, Thursday and Saturday was carried out at the Bonyokan field and at the Koni Klaten field. Wednesday, Friday and Sunday training take place at the Smart Club field.

Meetings for the exercise were held for 1 hour 30 minutes, namely in the afternoon, at 16.00 - 17.30 on Tuesday, Wednesday, Thursday, Friday. On Saturday and Sunday, they were held at 11.00 - 12.30. This exercise was carried out for 21 meetings.

Accuracy assessment in this study was carried out by giving athletes the opportunity to shoot 36 arrows and then all the values of the arrows that hit the target were added up. There were 2 ways to do the rotator cuff theraband exercise method: the first way is by pulling the rubber slowly and then by pulling the rubber quickly. The speed of pulling the rubber is determined by the metronome beat of 90 bpm for slow tempos and 140 bpm for fast tempos, both using 4 beats per bar and 1 clicks/beat, the application used is Metronome Beats.

The following is the division of the groups in the theraband rotator cuff strengthening research with slow pulls and fast pulls category.

Table 1. Groups in the theraband rotator cuff strengthening research with slow pulls and fast pulls category

Theraband Exercise Method (A) Attributive Variable (B)	Rotator Cuff Strengthening Exercise Method	
	Slow Pull Theraband (A1)	Fast Pull Theraband (A2)
Male (B1)	A1 B1	A1 B2
Female (B2)	A2 B1	A2 B2

Based on Table 1, it can be seen that there are four groups namely Group 1 (Slow Pull & Male), Group 2 (Slow Pull & Female), Group 3 (Fast Pull & Male), and Group 4 (Fast Pull & Female).

The training program consisted of 3 meetings in a week. Each athlete was grouped according to their treatment. The training program is as follows on Table 2:

Table 2. Training Program

Group	Training Material	Training Volume						
		Week						
		1	2	3	4	5	6	7
1 & 2	1. Opening and Briefing							
	2. Warm up							
	3. Theraband rotator cuff strengthening with slow pull	70%	75%	80%	80%	85%	90%	95%
	4. Cooling down							
3 & 4	1. Opening and Briefing							
	2. Warm up							
	3. Theraband rotator cuff strengthening with fast pull	70%	75%	80%	80%	85%	90%	95%
	4. Cooling down							

The visualization of rotator cuff Strengthening theraband exercise method can be seen in Figure 1 below:

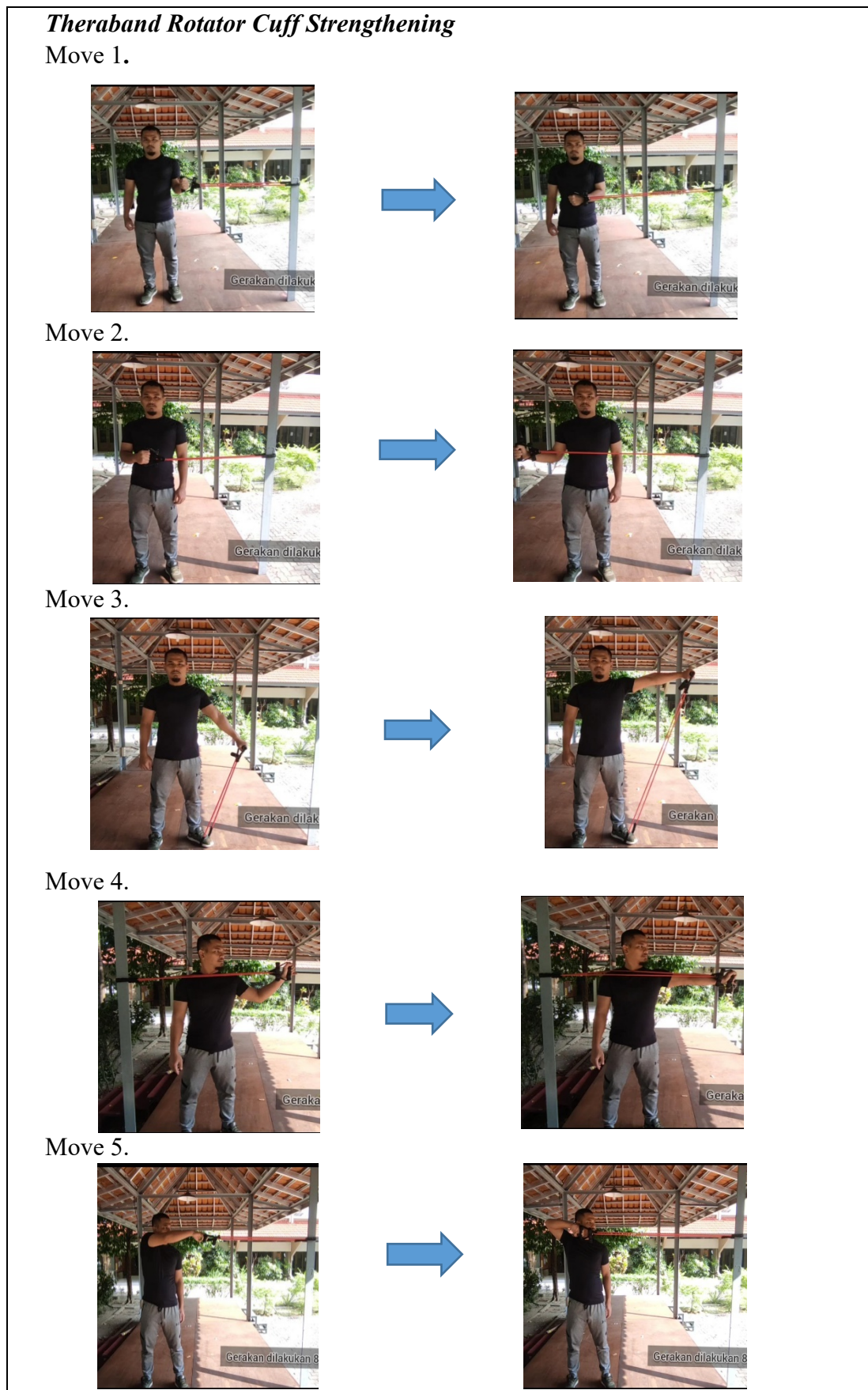


Figure 1. Rotator cuff strengthening theraband exercise method

RESULTS AND DISCUSSION

This study aimed to determine the effect of theraband rotator cuff training to Klaten archery athletes' accuracy. The results are as follows on Table 3:

Table 3. Effect of theraband rotator cuff training to Klaten archery athletes' accuracy

No	Group	N	Accuracy	
			Mean ± St. Deviation	
			<i>Pre Test</i>	<i>Post Test</i>
1	A1B1 (Thera Slow & Male)	4	272.0 ± 44.21	304.25 ± 49.51
2	A1B2 (Thera Slow & Female)	6	253.83 ± 25.63	271.50 ± 33.02
3	A2B1 (Thera Fast & Male)	5	274.20 ± 46.30	298.6 0± 48.20
4	A2B2 (Thera Fast & Female)	5	251.00 ± 13.17	268.80 ± 14.93

The purpose of the normality test is to find out whether the data obtained from each analyzed variable follows a normal distribution pattern or not. The variable normality test was carried out using the Shapiro Wilk formula. The rule used to determine the normality of a distribution is: $p > 0.05$ means the distribution is normal, and if $p < 0.05$ means the distribution is not normal.

Table 4. Normality test

Variable		<i>P</i>	<i>Sig.</i>	Description
Archery Accuracy	1 (Male)	0.387	0.05	Normal
	2 (Female)	0.212	0.05	Normal

Homogeneity test is useful for testing the uniformity of the sample. The sample variance is taken from the population. The criteria for homogeneity are: arithmetic significance level (p) > 0.05 means it is homogeneous, while arithmetic significant level (p) < 0.05 means it is not homogeneous. Table 5 displays the results of homogeneity test:

Table 5. Homogeneity test

F	df1	df2	Sig.
1.870	3	16	0,175

Table 5 shows that the significance value is (0.175) > 0.05 , meaning that the variance is homogeneous.

Hypothesis testing is done to find out whether the proposed hypothesis can be accepted or rejected. Testing the hypothesis in this study used two-way analysis of variance (Two Way Anova) at a significant level of $p \leq 0.05$. The results of testing the first hypothesis can be shown in the Table 6:

Table 6. Hypothesis test 1

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Theraband	49.408	1	49.408	0.019	0.891

From the results of the ANOVA test Table 6 above, it can be seen that the significance value of p is 0.891 (> 0.05). It shows that there is no significant effect of the slow pull theraband rotator cuff strengthening exercise method and the fast pull theraband rotator cuff strengthening exercise method on increasing the accuracy of archery athletes in Klaten, Central Java.

Hypothesis testing is done to find out whether the proposed hypothesis can be accepted or rejected. Testing the hypothesis in this study used two-way analysis of variance (Two Way Anova) at a significant level of $p \leq 0.05$. The results of the second hypothesis can be seen in the Table 7:

Table 7. Hypothesis test 2

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Gender	6611.433	1	6611.433	2.608	0.126

From the results of the ANOVA test Table 7 above, it can be seen that the significance value of p is 0.126 (> 0.05). This means that it shows that there is no significant effect of male and female gender on increased accuracy of archery athletes in Klaten, Central Java.

Hypothesis testing is done to find out whether the proposed hypothesis can be accepted or rejected. The hypothesis test in this study used two-way analysis of variance (Two Way Anova) at a significant level of $p \leq 0.05$. The results of testing the interaction hypothesis between theraband rotator cuff strengthening exercise method and gender are shown in the Table 8:

Table 8. Hypothesis test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Theraband*Gender	2.657	1	2.657	0.01	0.975

Table 8 show that the p significance value of 0.975 (> 0.05). It means that there is no significant effect in the slow pull theraband rotator cuff strengthening exercise method for both male and female groups and and theraband rotator cuff strengthening the quick pull of both male and female groups towards increased accuracy of Klaten archery athletes.

Archery athletes are highly recommended to maintain body and muscle stability in order to achieve shooting accuracy (Ghaida, et al, 2023). An archery athlete must have a consistent arrow shooting technique, because it can increase achievement (Baskoro, 2016). Because if an athlete delays releasing an arrow, then the results of his shooting accuracy will be imperfect because the bow is quite heavy and the time of the match is long causing the athlete to release one draw of the bow only 3-4 seconds (Aryani, 2017).

Theraband training is another form of elastic retention that allows people to perform exercises to improve muscle strength, mobility and function. With this exercise, archery athletes will have good arm muscle strength, so that when they pull the bow, the athletes can have a calm posture which then will help them aim the target. This dynamic movement exercise can also help increase arm muscle strength.

Theraband exercise is a revolutionary replacement to traditional static stretching devices. When used with dynamic contract-relax stretches, it helps to improve flexibility and muscle strength. Stabilize the humeral head and the pectoralis major latissimus dorsi serratus anterior biceps and deltoid all contract to decelerate the arm. The latissimus plays a major role in controlling deceleration and diminishing the eccentric over load on supraspinatus tendon (Viswanath, 2018). Theraband training is another form of elastic retention that allows people to perform exercises with the aim of increasing muscle strength, mobility, motion, and function. The rotator cuff is a network of four muscles and several tendons that wrap around the upper arm bone (humerus), the rotator cuff holds the humerus in place at the shoulder joint and allows the arm to

rotate. The rotator cuff is a group of bones and tendons surrounding the shoulder joint that are responsible for keeping the head and upper arm firmly attached to the shoulder socket.

Based on the result it is known that all of the group have the same result. Group 1 (Thera slow & male) shows an increase in the accuracy result from pre test to post test after being given theraband slow training. Group 2 (Thera slow & female) shows an increase in the accuracy result from pre test to post test after being given theraband slow training. Group 3 (Thera fast & male) shows an increase in the accuracy result from pre test to post test after being given theraband fast training. Group 4 (Thera fast & female) shows an increase in the accuracy result from pre test to post test after being given theraband fast training.

The morbidity associated with shoulder pain is commonly encountered in primary care and physiotherapy (Littlewood Chris, et al., 2022) where rotator cuff pathology is considered the most common cause (Lewis J, 2009). Following a rotator cuff strengthening training protocol, which involved drills, the subjects showed no improvement in their sense of joint position (Lin & Karduna, 2016).

This result demonstrates the positive effects of the throwing exercise with the TheraBand on muscle strength in the experimental group. If the purpose of treatment is regaining the strength of the rotator cuff and shoulder muscles, passive and active stretching should be followed by strengthening exercises (Manske R et al. 2013). As the control group only underwent stretching exercise, increasing in muscle strengthening did not occurred in these participants. increases in shoulder muscle strength because they believed the two tests were appropriate for assessing elevation in the scapular plane with a stabilizing effect on the rotator cuff. This supports the development of a gold standard rehabilitation protocol. Similar findings (Brindisino et al., 2020) are clinically significant and there is a resulting increase in function as measured by the Constant Score on archery accuracy results (Brindisino et al. 2020). In addition, it was shown that the force from the antagonist muscles is useful as a source of resistance for the agonists (MacKenzie et. All. 2010). Rotator cuff exercises were not found to be more effective (Pallavi, et all. 2017). The usefulness of standard, accepted, evidence-based rehabilitation protocols for treating rotator cuff impingement is evident (John E. 2009).

In this study, fast pull rotator cuff strengthening theraband and slow rotator cuff strengthening theraband can improve archery accuracy, because this exercise system strengthens the rotator cuff muscles namely the deltoid muscle, supraspinatus muscle, infraspinatus muscle, teres minor muscle, and subscapularis muscle. It is reported that there is significant gains in strength in subjects who trained with theraband during a two-week, twice-daily (24-session) training program (Yasuda et all. 2010).

Although a relatively retracted scapula has been shown to produce greater force generation of the rotator cuff muscles (Kibler WB & Sciascia A. 2010). a significant increase in rotator cuff activation during the modified exercises was not found in this present study. The results of this study suggest that applying resistance to the posterior scapula increases activation of some of the scapular stabilising muscles particularly in the lower ranges of abduction. Trapezius activation, particularly middle trapezius, was significantly. So that there is a direct effect of arm muscle strength on FITA recurve round archery performance (Humaid, H. 2014).

Archers' reaction to the fall of the clicker by M. extensor digitorum contraction was faster than that of archers. Their release occurred about 100 ms after the fall of the clicker whereas the release took place about 200 and 300 ms after the fall of the clicker, respectively (Ertan, et all. 2003). These findings reveal a positive effect of rotator cuff strategy in archery. Archers develop a rotator cuff strategy to accurately shoot an arrow to a given target.

It can be concluded that theraband training can improve the accuracy results of archery athletes. This result is proven by 4 research groups whose archery accuracy results increased after being given theraband rotator cuff strengthening. However, there was no significant difference in archery accuracy results between the 4 groups.

Based on this results, this study is worthy of being used as a reference for archery coaches to train the strength of the rotator cuff of archery athletes in order to improve the results of archery accuracy.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that: There is no significant difference between the slow pull and fast pull theraband rotator cuff strengthening exercise methods on Klaten archery athletes' accuracy. Slow pulling and fast pulling theraband rotator cuff strengthening exercises affect the Klaten archery athletes' accuracy. However, there is no significant difference between the results from groups 1 to 4, or the four groups have more or less the same effect on the increased accuracy. Based on the above conclusion, there are several suggestions: For archery athletes whose accuracy are still low, they can improve it by training routinely by combining fast pull and slow pull thearaband rotator cuff strengthening exercises. For coach, thearaband rotator cuff strengthening exercises with fast pulls and slow pulls can be used as a program to improve archery athletes' accuracy. For future researchers, they should conduct research with a wider sample and population, as well as different variables so that the thearaband rotator cuff strengthening exercises can be identified more broadly.

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