

# The Difference between Elastic Band Archers Exercise and Dumbbell Rows Exercise for the Accuracy to 10 Metres Archery for Beginner Archer in Rangkas Bitung

Syahmirza Indra Lesmana<sup>1</sup>, Siti Maryam<sup>1</sup>, Mury Kuswari<sup>1</sup>, Nadiya Nurjanah<sup>1</sup> and Jerry Marantis<sup>1</sup>  
<sup>1</sup>Physioterapy Faculty, University of Esa Unggul, Jalan Arjuna Utara Tol Tomang Kebun Jeruk, Jakarta, Indonesia

**Keywords:** The difference, elasticbandarchers exercise, dumbbell rows exercise.

**Abstract:** Object: to find out the difference intervention between elastic band archers exercises with dumbbell rows exercise toward the accuracy of firing an arrow into a target at beginner archers. Methods: This study was a quasi-experimental study using a pretest-posttest group. This research was conducted in extracurricular archery in SMP 5 Rangkasbitung and consisted of 8 beginner archers selected based on total sampling technique, one group consisted of 4 people with elastic band archers exercise and the other group consisted of 4 people with dumbbell rows exercise. Results: normality test was using Shapiro Wilk test  $p\text{-value} > \alpha(0,05)$  normal distribution of data, homogeneity test was using Levene's test  $p\text{-value} > \alpha(0,05)$  data homogenous, hypothesis test resulted in the treatment of Group I and II test using Paired Samples T-Test 0.000 which means Elastic band Archers Exercise and Dumbbell Rows Exercise effectively increased the accuracy of firing an arrow into a target on the Beginner archers. The result of the independent sample t-test  $p\text{-value} = 0,346$ , there was no significant difference effect between both exercises. Conclusion: there was no difference significant effect between elastic band archers exercise with dumbbell rows exercise toward the accuracy of firing an arrow into a target at beginner archery.

## 1 INTRODUCTION

Archery is often considered as a kind of sport that is simple and easy. Many people think that physical condition is not important for this kind of sport. Archery is considered a sport that requires skill only. In fact, this assumption is not true. Archery is a sport that requires several aspects, such as physical aspect, psychological aspect, and technical aspect or skill.

From a physical aspect, every sport has different characteristics. In archery, the dominant physical components are stability, strength, and muscle endurance. Deni Trisjanto, coach of national team of archery, said that the application of physical exercise to strengthen the muscles of the archers' arms affect the accuracy of shooting an arrow, considering the weight of the bow that is about 4 kilograms and the pull that is about 60 pounds. Therefore, the muscles that are involved in pulling the bow must get special attention in archery because the muscles work very hard in pulling and holding the load from the bowstring that is heavy, and it repeatedly happens in the archery movements.

Therefore, archers need special exercise that can improve the endurance and strength of muscles of the archers' arms to achieve a good stability. Many exercises can be done, but archery exercise in Indonesia that pays attention to the improvement of the endurance and strength of muscles is still very rare.

Training the endurance and strength of muscles of the archers' arms requires accuracy in the choice of exercise type that will be given in order for the exercise to give effects that suitable with the needs. According to a research that was done by Setyoningsih (2011), a significant enhancement is obtained that weight training gives effect on the increase of the endurance of the archers' muscles strength.

There is another relevant research which was done by Furqon and Douwes (2003). This research states that to improve the archers' physical condition, aerobic interval training methods and weight-bearing training methods with the circuit can be used, and to improve the endurance of muscles in pulling the bow, the weight training program that is performed should involve the muscles that work on the movement of the arc pull.

Weight training that can be given to improve the endurance and strength of the archers' arm muscles and can be adjusted by involving the muscles that work on the movement of the arc pull is weight training method using elastic band archers exercise or dumbbell rows exercise.

## 2 LITERATURE REVIEW

Archery is a sport which propel arrow with a bow to the target during shooting (Lee, 2009). Shooting in archery can be summarized as drawing the bow, aiming and released the arrow (McKinney and McKinney, 1997). In archery, it is important that the archer be able to hold the pulling force of the bow isometrically at release

During archery shooting, upper limb muscles are the most active muscle compared to the lower-limb muscle due to the needs to pull and hold the bow until released the arrow. However, the extremely vigorous muscle and needs more strength to pull and hold the bow in the forearm. The common forearm muscles which are involved in this shooting are; flexor digitorum and extensor digitorum.

Weight training is a common type of strength training for developing the strength and size of skeletal muscles. It utilizes the force of gravity in the form of weighted bars, dumbbells or weight stacks in order to oppose the force generated by muscle through a concentric or eccentric contraction. Weight training uses a variety of specialized equipment to target specific muscle groups and types of movement.

Weight training using elastic band is an exercise commonly used in resistance training exercise. Elastic band archers exercise is a modification of weight training using an elastic band for archers which is a combination of isotonic and isometric weight training where the movement has been adapted with the movement pattern of archery. It is done as if the archers are pulling the bow with the position of their body patching on the wall and the arm forming an angle on the wall. Elastic band archers exercise is performed as a functional modality to stabilize, strengthen, and improve the muscles endurance around the arms, shoulders, and upper back. This exercise can train the proprioceptive system that is aimed to train the body position when doing archery, controlling movements, and coordinating muscles because this exercise really trains the group of muscles that is directly involved in the movement of archery.

Muscles that are working during archery mostly consist of the muscles around shoulders and upper back. Therefore, weight training using dumbbell row can be used for improving strength and endurance of

the archers' arm muscle. Dumbbell row exercise is a modification of weight training using a dumbbell for archers. In doing dumbbell row exercise, not only the back muscle that is trained but also the arm muscle. The development of weight training using dumbbell among archers is still rare even though this exercise has many variations that can be adapted to do. This exercise is performed using a table or chair to support and balance the body when doing the movement of pulling dumbbell to the chest. This exercise is useful to improve resistant slowly, so that muscle can get stimulus progressively to be stronger.

## 3 METHOD

This research is conducted at SMP Negeri 5 Rangkasbitung for 6 weeks. Sampling was done using total sampling technique at archery extracurricular member at SMP Negeri 5 Rangkasbitung which was at a beginner level based on acceptance criteria (inclusive criteria), rejection criteria (exclusive criteria), and dropout criteria. The inclusive criteria are as follows: They had to be the beginner members of archery club at SMP Negeri 5 Rangkasbitung, they had to have a good condition (no neurological disorders, fractures, and psychiatric disorders), they were not in special training period or perform additional exercises similar (using elastic band load/elbow training) exercise/dumbbell row archers exercise), and they were willing to perform all the established research procedures. The exclusive criteria are as follows: They had to be the expert member, they had to get injured, and they had to be in special training that is similar with the intervention that the researcher will provide. The dropout criteria are as follow: The sample got injured when undergoing the research, the sample experienced disease complications that are not allowed to continue the research, the sample did not carry out the research procedure carefully and regularly.

The applied research method is quasi-experimental (experiment pseudo). It is performed to see the difference in the effect of elastic band archers exercise and dumbbell rows exercise towards the accuracy of shooting arrows on beginner level archers. The research design used was pre-test and post-test group design with two kinds of treatment.

The accuracy value of the archery obtained by the sample will be measured using a face target of three rounds. Each round involves three shots with two minutes of shooting time in each round. Then it will be analyzed between treatment group I and treatment group II before and after giving the exercise.

This research is divided into two groups of archers: the archers at the beginner level who are given elastic band archers exercise and the archers at the beginner level who are given dumbbell rows exercise.

mean score  $54.175 \pm 12.129$ . This shows that the archers' accuracy improved after they were given the dumbbell rows exercise.

The difference between the accuracy of each treatment can be seen in this graph.

#### 4 RESULT

The accuracy measurement of each shot from 10 meters per 3 rounds with 3 shots per round per three minutes before the treatment and one per week for six weeks during treatment are explained here.

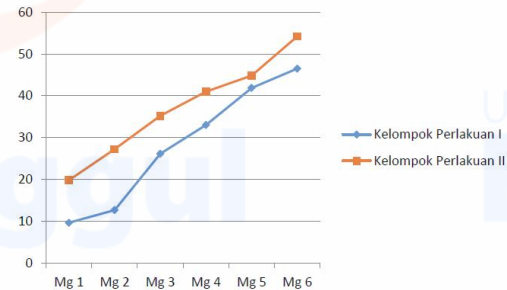


Figure 1: The differences Group 1 and 2

Table 1: Value of Accuracy of Shooting Arrows Goal to the group 1

| Sampel | Ketepatan Tembak Anak Panah<br>(dihitung perminggu dalam bentuk %) |        |        |        |       |        | Selisih<br>awal - akhir |
|--------|--|--------|--------|--------|-------|--------|-------------------------|
|        | 1  | 2      | 3      | 4      | 5     | 6      |                         |
| 1      | 18,7   | 35,2   | 42,9   | 50,6   | 49,5  | 58,3   | 39,5                    |
| 2      | 8,8  | 11     | 27,5   | 29,7   | 46,4  | 48,4   | 39,5                    |
| 3      | 4,4  | 4,4    | 17,6   | 28,6   | 29,7  | 36,3   | 31,9                    |
| 4      | 6,6  | 0      | 16,5   | 23,1   | 41,8  | 42,9   | 36,3                    |
| Mean   | 9,625  | 12,65  | 26,125 | 33     | 41,85 | 46,475 | 36,85                   |
| SD     | 5,737  | 15,698 | 12,228 | 12,083 | 8,695 | 9,306  | 3,598                   |

According to the table above, there is accuracy improvement for treatment group I. Before they were given the elasticband archers exercise, they have mean  $9,625 \pm 5,737$  and after the last exercise, they have mean score  $46.475 \pm 9.306$ . This shows that the archers' accuracy improved after they were given the elasticband archers exercise.

According to the graph, it can be seen that there is a significant improvement on the accuracy after the six weeks treatment for each treatment groups.

Treatment group I who was given the elasticband archers exercise recorded  $9,625 \pm 5,737$  mean, and after the last exercise they recorded  $46.475 \pm 9.306$  means. Treatment group II who were given the dumbbell rows exercise recorded  $19.8 \pm 8.845$  means, and after the last exercise, they recorded  $54.175 \pm 12.129$  mean. Based on the mean score, treatment group II recorded a better result than treatment group I. However, it can be stated that both treatments can improve the accuracy for beginner archer.

Table 2: Value of Accuracy of Shooting Arrows Goal to the group 2

| Sampel | Ketepatan Tembak Anak Panah<br>(dihitung perminggu dalam bentuk %) |        |        |        |        |        | Selisih<br>awal - akhir |
|--------|--|--------|--------|--------|--------|--------|-------------------------|
|        | 1  | 2      | 3      | 4      | 5      | 6      |                         |
| 1      | 29,7   | 42,9   | 47,3   | 50,6   | 58,3   | 69,3   | 39,1                    |
| 2      | 17,6   | 34,1   | 40,7   | 44     | 40,7   | 49,5   | 31,9                    |
| 3      | 23,1   | 18,7   | 26,4   | 35,2   | 48,4   | 57,2   | 34,1                    |
| 4      | 8,8  | 13,2   | 26,4   | 34,1   | 31,9   | 40,7   | 31,9                    |
| Mean   | 19,8   | 27,225 | 35,2   | 40,975 | 44,825 | 54,175 | 34,25                   |
| SD     | 8,845  | 13,691 | 10,512 | 7,797  | 11,231 | 12,129 | 3,395                   |

According to the table above, there is accuracy improvement for treatment group II. Before they were given the dumbbell rows exercise, they have mean  $19.8 \pm 8.845$  and after the last exercise, they have

Table 3: Normality test

| Variabel | Saphiro Wilk Test    |            |                       |            |
|----------|----------------------|------------|-----------------------|------------|
|          | Kelompok Perlakuan I | Keterangan | Kelompok Perlakuan II | Keterangan |
| Sebelum  | 0,296                | Normal     | 0,979                 | Normal     |
| Sesudah  | 0,955                | Normal     | 0,973                 | Normal     |
| Selisih  | 0,241                | Normal     | 0,117                 | Normal     |

The total samples are less than 30 persons, then the normality test of the data distribution used Saphiro Wilk Test. After the normality test for the accuracy score for each treatment, it can be concluded that the distribution of the samples is normal.

Table 4: Homogeneity Test

| Variabel              | Levene's Test |            |
|-----------------------|---------------|------------|
|                       | P             | Keterangan |
| Kelompok Perlakuan I  | 0,497         | Homogen    |
| Kelompok Perlakuan II |               |            |

Based on the homogeneity test (Levene's test), it can be concluded that the data variation of the samples is homogenous. The score of the test is p-value 0.497, which means that the data is homogenous, so the hypothetical test of this research is a parametric test.

Table 5: Test for Hypothesis I

| Variabel  | Mean   | SD    | Nilai P |
|-----------|--------|-------|---------|
| Sebelum 1 | 9,625  | 5,737 | 0,000   |
| Sesudah 1 | 46,475 | 9,306 |         |

Table V explained that hypothetical test I using Paired Sample T-Test resulting in  $p = 0,000$  ( $p < 0,05$ ). This means that the  $H_0$  is rejected and that elasticband archers exercise can improve the accuracy for beginner archer.

Table 6: Test for Hypothesis II

| Variabel  | Mean   | SD     | Nilai P |
|-----------|--------|--------|---------|
| Sebelum 1 | 19.8   | 8.845  | 0,000   |
| Sesudah 1 | 54.175 | 12.129 |         |

Table VI explained that the hypothetical test II using Paired Sample T-Test resulting in  $p = 0,000$  ( $p < 0,05$ ). This means that the  $H_0$  is rejected and the dumbbell rows exercise can improve the accuracy for beginner archer.

Table 7: Test for Hypothesis III

| Variabel  | Mean  | SD    | Nilai P |
|-----------|-------|-------|---------|
| Selisih 1 | 36,85 | 3,598 | 0,346   |
| Selisih 2 | 34,25 | 3,395 |         |

Based on the result of Independent Sample t-Test from table VII, the result of the test is  $p = 0,346$  where the score  $p > \alpha$  (0,05). It can be concluded that there is no difference in the impact between elasticband archers exercise treatment and dumbbell rows exercise treatment with the accuracy for the beginner archer.

## 5 DISCUSSION

### 5.1 Hypothesis I

Based on the hypothetical test I using paired sample t-test, obtained the score of shooting accuracy in treatment group I before the treatment which is 9,625 mean with the deviation standard score 5,737 and after the treatment which is 46.475 mean with the deviation standard score 9.306 with  $p = 0,000$  ( $p < 0,05$ )  $H_0$  is rejected. It shows that elastic band archers exercise can improve the shooting accuracy at beginner level archers.

Based on the research from Ronny (2015) titled "Assessment of muscle activity using elastic resistance in strength exercise", the elastic band is effective to improve the strength and endurance of muscle, both for athlete or non-athlete. There is another research that has a similar idea of the research from Ronny (2015) which is the research from Jamie J et al. (2009) titled "The Effects of A 7-Week Heavy Elastic band and Weight Chain Program on Upper Body Strength and Upper Body Power".

Those studies explain that elastic band which a weight training using elastic band (elastic resistance band) utilizing the recoil effect of rubber can improve the strength and endurance of muscle.

Based on the result above, exercising using elastic band through elastic band archers exercise can improve the strength and the endurance of arm muscle, also can train the body position when doing archery. It can improve the ability of the archer's stability when doing archery so that the archer can shoot consistently and steadily to get a better shooting result.

### 5.2 Hypothesis II

In hypothetical test II using the Paired Sample T-Test, it shows that the accuracy for treatment group II before the treatment is 19.8 mean, with the deviation standard 8.845. After the dumbbell rows exercise treatment, they recorded 54.1725 mean with deviation standard 12.129, with the result  $p = 0,000$  ( $p < 0,05$ ). The  $H_0$  is rejected, and this shows that the dumbbell rows exercise can improve the accuracy for beginner archer.

Previous research by Lars L Anderson (2010) titled "Muscle Activation and Perceived Loading During Rehabilitation Exercise: Comparison of Dumbbells and Elastic Resistance" concluded that weight training using dumbbell is effective to improve muscle strength.

This research shows that training with a dumbbell is an isotonic training that has two muscle contraction phases, concentric and eccentric. Muscle

contraction will improve the neuromuscular coordination that caused the improvement of motor unit recruitment, which will improve the number of myofibril. At the same time, the number of actin and myosin will also be improved.

The improvement of neuromuscular coordination is also affecting the proprioceptive stimulation in the muscle, joint, and ligament, so it will stimulate the afferent neuron to send the information to the central neuron about body position. This will also increase the kinesthetic sense which will improve the stabilization. At the same time, muscle contraction will improve muscle strength. With the biomotor components of the archers, they can improve their accuracy.

### 5.3 Hypothesis III

In hypothetical test III, using a parametric test (Independent Sample T-Test), the result is  $p = 0,346$  where the score  $p > \text{score } \alpha (0,05)$ . It can be concluded that the  $H_0$  is rejected and there is no difference in the impact between elasticband archers exercise treatment and dumbbell rows exercise treatment with the accuracy for the beginner archer.

Both of the treatment groups did not have a significant difference, which may be caused by the measurement tools that lack the accuracy to measure arm muscle strength, the durability of the arm muscle, and the archery ability.

The researchers used a single target put in a 10 metres distance to see the accuracy from the samples. Based on the research, the ability and skill of each sample are very influential. The sample which has a better skill has a better score. Meanwhile, the test should have emphasized the significant difference between each treatment for muscle strength and muscle durability for the data. This test could not give a specific explanation for these two data (muscle strength and muscle durability). However, it shows that the accuracy of the samples is improved during the exercise.

Another reason for why the results are not significantly different is because there is a dose modification for some samples. The dose of the exercise was set at 60%. This was modified since some of the samples felt that the dose is too heavy. Therefore, based on Holly J. Benjamin (2003) said on a journal titled "*Strength Training for Children and Adolescents, The Physician and Sports Medicine*", weight training for adolescents start at maximum 2 kgs since they are still adapting physiologically to the training. After that, it can be increased gradually based on their ability. In this case, the samples are students who were active on extracurricular activities such as volleyball, national flag raising ceremony,

and scout. These activities involved some weight training which made them adapt to the first weight toleration (2 kgs). In the treatment group I, the elasticband weighted 6kgs per pull, which still can be tolerated by the samples. As for the treatment group II, the researchers gave the same weight for the samples by increasing their repetition.

## 6 CONCLUSION

Based on the analysis of research that has been done, we can conclude that elasticband archers exercise can improve the shooting accuracy to the target with 10 meters distance at the beginner archers in SMP Negeri 5 Rangkasbitung meant the value of ( $p = 0,000$ ). Dumbbell rows exercise can improve the shooting accuracy to the target with 10 meters distance at the beginner archers in SMP Negeri 5 Rangkasbitung meant the value of ( $p = 0.000$ ). On the other hand, based on the hypothesis test II, we can conclude that there is no different effect towards the improvement of the shooting accuracy to the target with 10 meters distance at the beginner archers in SMP Negeri 5 Rangkasbitung meant the value of ( $p = 0,346$ ).

## REFERENCES

- Dony DS, Soegiyanto, Taufiq H. (2015, Juli). Pengaruh Latihan Hand Grip Terhadap Peningkatan Ketepatan Tembakan Anak Panah Ke Sasaran *Triangel Target Face* Pada Klub Panahan Mustika Blora. *Journal of Sport Sciences and Fitness* ISSN 2252-6528.
- Munawar. (2013). Prediksi Prestasi Panahan Ronde Nasional Berdasarkan Daya Tahan Otot Lengan, Ketajaman Pengelihatan dan Kecemasan Terhadap Siswa PPLP Panahan Jateng. Fakultas Ilmu Keolahragaan Universitas Sebelas Maret, Surakarta.
- M. Furqon H dan Muchsin Doewes. (2003). Analisis Kebutuhan Fisik dan Implikasi Latihan dalam Olahraga Panahan. Litbang KONI Pusat dengan Puslitbang-OR UNS Surakarta.
- Ertan H. (2009). *Muscular activation patterns of the bow arm in recurve archery*. ELSEVIER. *Journal of Science and Medicine in Sport*. Turki.
- Beachle, Thomas R and Groves, Barney R. (2008). *Weight Training Steps to Success*. Dialih bahasakan oleh Razi Siregar. Jakarta: PT Raja Grafindo Persada.
- Setyoningsih, N. (2011). *Weight Training Untuk Meningkatkan Daya Tahan Kekuatan Otot Pemanah*. Ilmu Keolahragaan Universitas Sebelas Maret, Surakarta.
- Humaida Hidayat. (2014). Influence of Arm Muscle Strength, Draw Length and Archery Technique on

- Archery Achievement. Canadian Center of Science and Education. Asian Social Science. Indonesia.
- Taha Z, Jessnor AM, Syed FSO, dan Edin S. (2016). Correlation Between Archer's Hands Movement While Shooting and Its Score. ELSEVIER. *ProcediaEngineering* 147 ( 2016 ) 145 – 150. Malaysia.
- Ronny Berquist. (2015). Assessment of muscle activity using elastic resistance in strength exercise. *Human movement science*. Norwegia.
- Mürsel B, Mustafa Ö, Firat A, BeKÉR M, süleyMaN P.(2015). Effect of Strength Training Program with Elastic Band on Strength Parameters. *Biology of Exercise : JBe – VOL. 11.2*.
- WilliamJK, dan Nicholas AR. (2014). *Fundamentals of Resistance Training: Progression and Exercise Prescription*. American College of Sports Medicine : *Med. Sci. Sports Exerc*, Vol. 36, No. 4, pp. 674-688.

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