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AN ANALYSIS OF SHOOTING ACCURACY TOWARDS ARCHERY ATHLETE'S ARM LENGTH, ARM STRENGTH, AND BODY MASS INDEX (A STUDY OF KONI BANDUNG DISTRICT, ARCHERY DIVISION)

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ABSTRACT

Background : Accuracy in archery is the ability to get results (points) against targets or target faces when arrows leave the bow by using high concentration in carrying out a series of shooting techniques, in carrying out a series of shooting techniques correctly and accurately. In addition to anthropometric measurements, good kinesthetic perception also benefits archers to apply pulling force to shooting accuracy so that they can direct arrows at targets or target faces. There is a significant relationship between arm length, body size, height, pulling power and kinesthetic perception with archery ability. Archery is a sport that really requires coordination, endurance, flexibility, length of pull, and balance to form good archery techniques. The above factors must be supported by good training as well as excellent and long-lasting physical condition. The physical condition referred to here is that an archer not only has great strength, but also must be supported by good endurance so that an athlete's performance is not only good at the start of the match, but consistent until the next match. **Purpose** : To understand the possibility of any potencies or some overviews of sleeve length, arm muscle strength, limb length, and body mass towards the archery accuracy in archery athletes. **Methods :** This research is an analytic observational research with a cross sectional approach, which is a research that emphasizes measurement time or data observation one time at a time, which is done on the dependent variable and independent variable. This research only makes observations, without giving any intervention on researched variables. The data analysis used is pearson correlation test and using hypothesis test, and by performing a linear regression test. **Results :** The pearson correlation test using sleeve length towards the accuracy of archery showed the correlation score (r) equal to 0,576 (p=0,002) significant (p<0.05), limb length towards the archery accuracy with the correlation score (r) equal to 0,631 (p=0,001) significant (p<0,05). And the hipothesis test obtained the arm length, limb length, and body mass index showed that there was not any meanignful correlation towards the accuracy of archery, and dominantly correlating with the arm muscle strength. **Conclusion :** In this study, researchers found that the correlation between arm length, BMI and arm muscle strength had a strong and significant contribution to the results of archery accuracy, while the relationship between archery accuracy and leg length was not significant.

Keywords : *Accuracy of archery, exercise, arm muscle strength*

INTRODUCTION

Archery is a sport which requires stability, flexibility, endurance and balance to create an accurate shoot. These factors must be supported by regular exercise and good physical condition.[1] An archer does not only have great strength, but also must be supported by good endurance so that the athlete's performance is not only good at the beginning of the match, but consistent until the end of the match.[2] Shooting accuracy in archery is the ability to get results (points) from the target using a bow to shoot arrows with high level of consentration of shooting techniques.[3-4]

Shooting accuracy in archery is the ability to achieve score from the target or *Target Face* using a bow to shoot arrows with high level of consentration of shooting techniques. The archery sport in Indonesia has succeeded in launching the best athletes. Based on the number of archery athletes, they have won many championships because they maintain body balance and their physical condition[5-7].

Archery shooting techniques which analyzed with kinesiology are conducted in the form of muscles and joints involvements in each archery shooting technique. The analysis includes set-up techniques (full pre-pull), drawing (full pull), anchoring, loading/transfer to holding (transfer of traction).[8] The set-up is the movement of raising the bow arm to shoulder level and the other hand is ready to pull the bowstring. At this stage, abduction of the shoulder (left arm) occurs, and the arm holding the bow is elevated to shoulder level. Then turn the neck

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to the left, bend the right elbow, and the upper arm is abducted. At this point, posture muscle acts as maintaining body stability.[9-11] In Nurdin YY's study, it was found that body anthropometry has an effect on archery results but does not show a non-significant relationship to archery results at a distance of 30 meters. In contrast to arm muscle strength and arm muscle endurance which both have a significant effect on the results of archery at a distance of 30 meters.[5] There is a significant contribution between arm muscle endurance and archery accuracy in the 2015 Aceh Pengprov Archery Athletes. Arm muscle endurance contributes 80.46% to archery accuracy, meaning that arm muscle endurance plays an important role in archery accuracy.[6] Concentration, arm muscle strength and hand balance have a positive and significant relationship with archery accuracy. The higher the concentration, the stronger the arm muscles and the better the hand balance, the better the shooting accuracy will be. So it can be concluded that the three variables (concentration, arm muscle strength and hand balance) greatly determine the accuracy of archery.[12]

Drawing is the movement of pulling the bow rope until it touches the nose, chin, and lips. Then proceed with anchoring the pulling hand on the chin. At this stage, the left hand contracts isometrically to hold the bow, holding positions in each hand. In the right arm which is the pulling hand, at the stage of pulling the bow string, the shoulder horizontal abduction occurs. In order to reach the anchor position, the posterior deltoid muscles, the latissimus dorsi, and the trapezius are contracting together. Postural muscles that play a vital role in maintaining a standing position in a balanced position, also affect this stage.[12]

METHODS

This research will be carried out at KONI Bandung district in the form of 26 research samples, with a target population of 18 year old males who are archery athletes who shoot at a distance of 30 meters and are still active in KONI Bandung Regency. There were also exclusion criteria from this study, namely having a history of arm injuries that could affect accuracy in archery, having a history of leg injuries that could affect accuracy in archery, having body balance disorders.This research is an observational analitical study with cross sectional approach. A type of research that emphasizes the time of measuring or observing data once at a time on the dependent variable and the independent variable. This research is only conducted observations, without giving any interventions on study variables. The data taken in this study are primary data. Primary data were collected directly by researchers from research subjects. This data includes shooting accuracy in archery. Furthermore, using Pearson Correlation Test and Hypothesis Test, by performing a Linear Regression Test for data analysis

RESULTS

Normality Test

The results obtained from this study with the Normality Test using Shapiro-Wilk.

Tabel 1. Normality Test Data

Variabel	Mean ± SD	Median (min – max)	p[£]
Arm Length (cm)	77,00 ± 5,19	77,5 (67 – 86)	0,680*
Limb Length (cm)	89,12 ± 5,14	90 (79 – 98)	0,713*
BMI	42,82 ± 17,34	44,1 (16,9 – 80,6)	0,074*
Arm Muscle Strength	33,39 ± 11,20	36,8 (12 – 47,6)	0,030
Shooting assessment	148,62 ± 20,36	152,5 (111 – 176)	0,501*

Notes : * Normal (p > 0,05); [£] Shapiro-wilk

It can be decribed that the median value for arm length = 77.5 with a p-value (sig value) of 0.680, the median value for limb length = 90 with a p-value (sig value) of 0.713, the median value for BMI = 44.1 with p-value (sig value) of 0.74, median value for arm muscle strength = 36.8 with p-value (sig value) of 0.030 and median value for shooting assessment = 1.152 with p-value (sig value) of 0.501.

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Correlations between Variables

Tabel 2. Pearson Correlation Test

Variables	Correlation Value (r)	Significant (p)
Arm Length	0,576	0,002 (<0,05)
Limb Length	0,234	0,249 (>0,05)
BMI	0,631	0,631 (<0,05)
Arm Muscle Strength	0,793	0,793 (<0,05)

The results of correlation between variables, including arm length and shooting accuracy, showed a significant correlation with the correlation value (r) 0,576 (p=0,002), limb length and shooting accuracy were not significant with correlation values (r) 0.234 (p = 0.249), body mass index and shooting accuracy showed a significant correlation with the correlation value (r) 0.631 (p = 0.001), and arm muscle strength with shooting accuracy also showed a significant correlation with the correlation value (r) 0.793 (p = 0.000)

Regression Hypothesis Testing

Based on this research, the results of the regression hypothesis test showed that the arm length with the accuracy of archery has a statistical significance value (p-value) for arm length towards athlete shooting assessment variable of 0.896, greater than the acceptable error rate of 0.05. Leg length with archery accuracy has a statistical significance value (p-value) for the variable leg length to athlete's archery accuracy of 0.414, greater than the acceptable error rate of 0.05. Body mass index with shooting accuracy has a statistical significance value (p-value) for the BMI on the athletes shooting accuracy variable of 0.250, which is greater than the acceptable error rate of 0.05. Arm muscle strength with shooting accuracy showed a statistical significance test value (p-value) for the arm muscle strength (X4) on the athletes shooting accuracy variable of 0.002, which is less than the acceptable error rate of 0.05.

DISCUSSION

Based on the research results, the normality test of arm length, limb length, body mass index were found to be significant and arm muscle strength was not significant.

The correlation test of this research, there was a significant correlation between the results of the shooting accuracy towards arm length, BMI and arm muscle strength (p <0.05). Meanwhile, the correlation between the results of shooting accuracy towards limb length was found not significant. According to Andi S.B.'s research, anthropometry which is measured simultaneously on physical condition, the results have a low correlation, because every athlete who has good anthropometry does not necessarily have good physical condition but all have poor or poor physical condition.[13]

Mastering the archery techniques skill determines great performance. With proper learning of archery techniques will create consistent movements which, if done continuously, the athletes will have great performance and achievements. Therefore, archery athletes are highly recommended to maintain body and muscle stability in order to achieve shooting accuracy. Based on this study, the correlation between arm length, BMI and arm muscle strength showed a strong and significant contribution, but limb length was found insignificant. In another study, it has been explained that the involvement of body structure to shooting ability in archery athletes was 36.90% and 29.60% by other variables.

Muscles that are very vital in the shooting accuracy, are the dominant ones such as the muscles of the vertebrae, upper extremity, core muscle, lower extremity, and joints related to these muscle groups. These muscles are involved in the archery technique, which is called the drawing technique, is the movement of the bowstring touches the nose, chin and lips. Then proceed with anchoring hand on the chin. In the isometric motion of the left hand, the shoulder muscles are the deltoid muscles, the muscles in the vertebrae are the trapezius muscles, the muscles in the lower leg, which is called

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brachioradialis muscles, the extensor carpi radialis longus muscles, the extensor carpi radialis brevis muscles, the extensor carpi ulnaris muscles. In horizontal shoulder motion (pulling stage), the muscles in the shoulder are deltoid muscles, the muscles in the arms are the tricep brachii muscles, the muscles in the vertebrae are the trapezius muscles, the muscles on the edges of the vertebrae are the latimus dorsi, the articutio humeri, the articulatio cubiti (articulatio humero-ulnaris, articulatio humero-radialis, and articulatio radio-ulnaris proximalis.)[4]

CONCLUSION

In this study, researchers found that the correlation between arm length, BMI and arm muscle strength had a strong and significant contribution to the results of archery accuracy, while the relationship between archery accuracy and leg length was not significant. In this study, the muscles that are very influential in archery accuracy are the muscles of the vertebrae, upper extremities, core muscles, lower extremities, and joints associated with these muscle groups.

For researchers who are interested in re-examining this problem, it is recommended that researchers not only compare but follow up and develop variables, samples/populations, and refine using other test items.

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