



Concentration Level and Arm Muscle Endurance Relationship to Archery Accuracy

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Keywords

Psychology; Muscle;
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Abstract

Archery is an individual sport that requires physical, psychological and skill. In this study, the aim is to determine the relationship between concentration and endurance of the arm muscles to archery accuracy in archery athletes in Boyolali Regency. This study uses a test survey with a correlational approach and a cross sectional or one-time data collection design. The population and sample in this study used 45 samples with a total sampling technique. Data analysis uses a simple correlation test and a multiple correlation test. The results show that of the study show that it can be concluded that there is a strong relationship between concentration and endurance of arm muscles to archery accuracy in archery athletes in Boyolali Regency with an R square value of 0.581. The higher the concentration and endurance of the arm muscles, the higher the accuracy of the archery. The meaning is that the concentration and endurance of the arm muscles contributed 58.1% to archery accuracy in archery athletes in Boyolali Regency.

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INTRODUCTION

Archery is a game of shooting arrows at the target using a bow that requires special skills in terms of precision, coordination, concentration and precision (Hardi & Nurama, 2019). Archery sports in Indonesia there are 4 sports that are contested, namely national, *Recurve*, *Compound* and *barebow* (Almunawar et al., 2020). Archery is competed in the Olympic event with the aim of the final result using the score. The result of the score is the result of throwing an arrow at the target (Scott, et al., 2021). Archery is one of the sports that requires high concentration, good technique, and also continuous practice. According to Komarudin, 2015:48 (in Fatahilah & Firlando, 2020) An athlete must have a good mental structure in order to achieve his or her achievements. And the role of a coach is very important in the psychological condition of the athlete during training and matches. The success of archery athletes is influenced by many factors such as concentration, arm muscle strength, wind direction, and many others according to Hidayatullah M (Marwan, 2023).

Achievements in athletes are influenced by several factors consisting of physical, technical, and psychological factors. Psychological factors in the athlete's mentality affect performance which can be evaluated by sports coaches for teams and athletes (Lestari & Dewi, 2022). Sports achievement coaching has 4 mental pillars, namely concentration, confidence, motivation, and anxiety (Amalia et al., 2019). These mental aspects cannot be separated to achieve achievements (L. M. Putri & Sungkowo, 2022). Exercise has benefits for physical and psychological health that can help in increasing self-confidence (Bayu Nur Soma Febrianto, 2021).

Psychological factors such as calmness, concentration, and confidence can produce maximum archery accuracy during training and competitions (Izzah & Setyawati, 2023). Concentration can be interpreted as the ability to focus one's mind on a certain object or goal. Basically, all activities require concentration because without good focus, you cannot produce as expected (Yachsie et al., 2021). According to Septiyanto & Suharjana, 2016 (in Sobarna et al., 2019) mentioned that an unstable level of concentration or attention will affect the quality of the technique to be carried out. Concentration is an important aspect of archery that is very dominant because it allows an athlete to self-control to shoot arrows at the target with high accuracy (F. Putri et al., 2015). Concentration on this archery sport is highly prioritized to be able to produce maximum archery accuracy (Marwan, 2023).

Weinberg & Gould (2007, p. 367) state "Concentration is the ability of the sportsman to maintain his focus of attention in a relevant match environment" (Taufik, 2019). StuRat 2000:224 (in Fatahilah & Firlando, 2020) states "concentration is an important aspect of sport not only during the match but also during training". However, concentration can be disturbed, therefore concentration is closely related to emotions through the mind (McCarthy et al., 2013). Archery requires concentration as explained by Wilson, V. E., Peper, E. & Schmid, A. (2006) explaining that concentration is able to concentrate without interference from external or internal stimuli (Hardi & Nurama, 2019). Concentration is one of the psychological factors that greatly affects the performance of an archery athlete. However, not only concentration supports an archery athlete, one of which is physical.

In archery sports, physical ability is needed, especially the strength and endurance of the arm muscles. Especially trained muscle endurance is very necessary to be able to perform archery techniques to pull the bowstring correctly. According to Muchtamadji 1999 (in Luluk Septiana, Widiyanto, 2020) Endurance arm muscles are tasked with maintaining balance and stability to get results *Release* smooth so that the arrow can be right on the intended target. Arm muscle endurance is a group of muscles to contract consecutively and can maintain static contractions for a long time. And, when doing archery activities, of course, archers make pulling movements and pushing the bow where the endurance element of the arm muscles affects the rhythm of the archery (Pratomo et al., 2022).

According to (Sports Science et al., 2016) Muscle endurance is the ability of muscles to continue to perform repetitive movements by resisting weight or resistance for a certain period of time. Arm muscle endurance is the ability of muscles to be able to do physical activity for a long time and can recover quickly according to Parahita, 2009: 3 (Saputra et al.,

2020). Muscular endurance or *Muscle Endurance* is a person's ability to use their muscles continuously for a relatively long time. Some muscles are needed to pull and heal are the fingers, trapezius, biceps, rhomboid, deltoid, and tricep according to Harsono, 2004 (Pratomo et al., 2022). It is the elements of endurance that will have a great influence on the rhythm of the athlete's shot and the arm muscles of the archery sport consisting of the upper arm muscles, lower arm muscles and hand muscles (Pratomo et al., 2022).

Accuracy is the main element in archery which is required to focus in order to get maximum accuracy in the way that archers must actively practice (Izzah & Setyawati, 2023). Performance *Shooting* in archery is defined as the ability to *Shooting* with accuracy (Syahputra & Amin, 2024). Accuracy in archery is how to fire arrows at the target as accurately as possible (Pratomo et al., 2022). In reality, accuracy in shooting is often lacking, one of the factors is resistance in aiming which affects the arm muscles (Wiranda & Putro, 2019). In archery sports, technical and physical training are needed. Both types of training are very important because they play a role in improving the archer's ability to achieve good accuracy when hitting the target (Pratomo et al., 2022). According to (Zhang & Lin, 2024) Shooting consistency refers to the position of an archer's body when repeating archery movements after forming a stable pattern and will result in the same shooting accuracy.

According to (Hardi & Nurama, 2019) There is a significant relationship between concentration and archery accuracy. and (Muhamad Roofid Briliansyah, Rian Triprayogo, 2024) stated that there is an effect of plank exercise on muscle endurance and archery accuracy of archery athletes. According to (Pratomo et al., 2022) stated that there is an effect of plank exercise on muscle endurance and archery accuracy in athletes. The research that will be carried out has novelty in three variables involving sports psychology, physicality, and archery skills which are one relationship model, namely concentration, endurance of arm muscles to archery accuracy in the guidance of athletes in Boyolali regency.

The problem raised in this study is related to how concentration, endurance of arm muscles affect archery accuracy in Boyolali district athletes in 2026. Although the exercise has been carried out regularly, other factors can influence. Therefore, this study aims to analyze the relationship between athletes to be able to increase the effectiveness of coaching programs to training to be able to support the achievements of athletes in Boyolali Regency.

METHODS

This study uses a test survey with a correlational approach and a *cross sectional* or one-time data collection design. The design of this study was used to look at concentration (X1), endurance (X2), archery accuracy (Y). This research will be carried out in Boyolali Regency which is located in the field of the Kebogiro stadium in April 2026. The population used in this study has 45 national division Junior archery athletes. And this study uses a sample of perpani boyolali athletes with a *total sampling technique* with a sample of 45 athletes of the junior national division.

The research instrument used for concentration using A measuring instrument named *Concentration Grid Test* (CGT) from Harris & Harris (1894) and Marten (1933); and Heinen (2011) this measuring tool was adopted from (Taufik, 2019) with the reliability value of using (re-test) with *product moment correlation of* $r = .79$ ($p < .05$). Steps – The steps to do this test are as follows:

The test has 10 x 10 boxes where each box contains a two-digit number ranging from 00 to 99.

To do this test, the sample only needs to connect the smallest to the largest number by giving a check or cross mark to each number found.

The assessment is determined by the number of numbers they find in order. This concentration test was carried out once. To implement this test, the sample sits in the place provided, then the sample works on the available questions according to the instructions given. The work on this test is given a time of 60 seconds.

The criteria used in the assessment of concentration levels using the *Concentration Grid Test* (CGT) can be seen at:

Table 1. Assessment Criteria Concentration Grid Test (CGT)

Yes	Categories	Value
1	21 and above	Excellent
2	16 – 20	Good
3	11 – 15	Enough
4	6 – 10	Less
5	5 and below	Very Less

Instruments for arm muscle endurance using tests *Push-ups* from (Nasrulloh et al., 2021) to be an instrument for the endurance of the arm muscles. With the following series:

1. Done for 60 seconds or 1 minute.
2. Lie on the mat with your arms shoulder-width apart and your arms fully extended.
3. Lower your body to 90 degrees
4. Return to the starting position with your arms fully extended
5. Do *push-ups* continuously without a break
6. Do *as many push-ups* as possible
7. Keep track of the number of push-up reps you can do

Women tend to have relatively lower strength, so the push procedure is slightly modified with a knee support and starts from lying on a mat.

The archery accuracy instrument in this study used an instrument with a 30-meter distance archery test score with 36 children. Tools and materials that need to be prepared are each bow, scorebook, stationery, target face, pads. This instrument has a validity value of 0.922 and a reliability value of 0.738 (Saputro, Hadi, et al., 2022).

RESULTS AND DISCUSSION

The research data was obtained from the concentration test, the arm muscle endurance test and the archery accuracy test by shooting 36 arrows at a distance of 30 meters. Using a sample of 45 athletes from Perpani, Boyolali Regency. This research will be carried out on April 3-5, 2026. Then, below is a table of statistics that have been taken:

Table 2. Descriptive Statistical Results of Research Results

	N	Minimum	Maximum	Red	Std. Deviation
Concentration	45	14	29	21,82	4,158
Arm muscle endurance	45	19	38	27,89	4,937
Archery accuracy	45	281	345	315,11	13,886

Table 3. Normality Test Results

	Shapiro-Wilk		
	Statistic	df	Sig.
Concentration	0.983	45	0.749
Arm Muscle Endurance	0.957	45	0.091
Archery Accuracy	0.963	45	0.156

The Normality Test is a test to be able to determine whether the variables in the study have a normal distribution or not. The normality test used IMB SPSS *Statistic* 25 and the researcher used *shapiro wilk* because the number of respondents was 45 people. And the data can be said to be normal if the significance value is more than 0.05.

The data in the table above has a total of 45 athletes with a significance value in the concentration variable of $0.749 > 0.05$ and in the arm muscle endurance variable of $0.091 > 0.05$ and in the archery accuracy variable of $0.156 > 0.05$. So it can be concluded that all data is distributed **normally**.

Table 4. Linearity Test Results

	Deviation from Linearity	
	df	Sig.
Archery Accuracy*Concentration	14	0.915
Archery Accuracy*Arm Muscle Endurance	17	0.114

A linearity test is used to see if any model specifications that can be used are correct or not. The linearity test will obtain information on whether the empirical model should be linearity if the value of Sig. *Deviation from linearity* > 0.05 then the linearity assumption is met and if the Sig. *Deviation from linearity* value is <0.05 then the linearity assumption is not met.

Based on the results of the table above, it can be seen that Sig. *Deviation from linearity* in the concentration variable with archery accuracy was 0.915 > 0.05. And the value on the arm muscle endurance variable with archery accuracy had a value of 0.114 > 0.05. So it can be concluded that the data **assumes linearity is fulfilled**.

Table 5. Multicollinearity Test Results

	Collinearity Statistics	
	Tolerance	VIF
Concentration	0.698	1.432
Arm Muscle Endurance	0.698	1.432

The multicollinearity test is used to see how strong the correlation is between two or more independent variables. If the Tolerance value > 0.100 and VIF < 10.00, then it can be stated that independent variables do not occur symptoms of multicollinearity. If the opposite happens, the independent variable will have symptoms of multicollinearity. And the following is a table of the results of the multicollinearity test using IMB SPSS *Statistic 25*.

Based on table 4. It can be known that the variables of concentration and endurance of the arm muscles have a Tolerance value of 0.698 > 0.100 and VIF 1.432 < 10.00, so it can be concluded that **there are no symptoms of multicollinearity**.

Table 6. Results of the Relationship of Concentration to Archery Accuracy

	Correlations		
	N	r	Sig.(2-tailed)
Concentration*Archery Accuracy	45	0.702	0.000

Based on the results of the analysis, using the pearson correlation test in table 4. A calculated r value of 0.702 indicates that there is a positive relationship between concentration and archery accuracy. In addition, the value (Sig. 2- tailed) of 0.000 < 0.005 indicates that the relationship is statistically significant.

Table 7. Results of the Relationship of Arm Muscle Endurance to Archery Accuracy

	Correlations		
	N	r	Sig.(2-tailed)
Arm Muscle Endurance*Archery Accuracy	45	0.633	0.000

Based on the results of the analysis, using the pearson correlation test in table 4. The r-value of 0.633 indicates that there is a positive relationship between arm muscle endurance and archery accuracy. In addition, the value (Sig. 2- tailed) of 0.000 < 0.005 indicates that the relationship is statistically significant.

Table 8. Results of the Relationship between Concentration and Endurance of Arm Muscles on Archery Accuracy

	Change Statistics			
	R	R ²	F	Sig. F Change
Concentration(X1), Arm Muscle Endurance(X2)*Archery Accuracy(Y)	0.762	0.581	29.086	0.000

The results of the multiple correlation calculation in table 4. It shows that the value of r calculated (R) is 0.762 with a strong relationship level, while the value of R square (R^2) is 0.581. Furthermore, the results of the regression F test produced an F count of 29,086 with a Sig. F Change value of 0.000 (0.05). This means that simultaneously the two free variables have a statistically significant relationship to the bound variable, namely archery accuracy.

The Relationship of Concentration to Archery Accuracy

Concentration is one of the important roles to support the development of training until the results of the match. One of the psychological aspects that has an influence on the effectiveness of training for athletes. These findings are reinforced by research conducted by (Hardi & Nurama, 2019) It was stated that there was a significant relationship between concentration and archery accuracy of $r = 0.827$. This research is in line with (Taufik, 2019) The level of concentration of an athlete has a relationship with an athlete's skill in sports where the higher the concentration, the better the skill in sports. And according to (Yachsie et al., 2021) showed the results of the study of Sig. 0.000 ($p < 0.05$) which means that there is a significant relationship between high concentration and the ability of athletes to shoot at a distance of 30 meters where archery requires high concentration.

The results obtained and supported by previous research can be concluded that concentration has a very important role in supporting the effectiveness of athletes' training. Strong and meaningful relationships show that cognitive aspects such as focus need to be trained in a balanced way with physical aspects in the training process. Thus it can result in an increase in concentration which will be one of the main factors to achieve optimal results which is archery accuracy.

The Relationship of Arm Muscle Endurance to Archery Accuracy

The ability of athletes to be able to withstand stable weights is to have muscles that have stable endurance. This research is in line with (Muslim, Drs. Saripin, 2016) stated that there was a relationship between arm muscle endurance and the results of the 30-meter shot in PPLP Archery athletes of the Riau Dispora with a calculated r value of 0.684. And according to (Muhamad Roofid Briliansyah, Rian Triprayogo, 2024) shows that there is an effect that plank exercise exercises have an effect on arm muscle endurance and archery accuracy of archery athletes.

The results of this study and supported by empirical evidence from previous studies can be concluded that arm muscle endurance has an important role in maintaining stability during archery posture which will affect the accuracy of the archery that produces the score. Arm muscle endurance has a strong and significant relationship of the two variables that can confirm that one of the training processes. Arm muscle endurance can help athletes to achieve the results of training and matches they want to achieve.

The Relationship of Concentration and Endurance of the Arm Muscles to Archery Accuracy

Concentration, endurance of the arm muscles has a close relationship to archery accuracy. The results of the regression F test resulted in a F calculation of 29,086 with a value of Sig. F Exchange by 0.000 (0.05). This means that simultaneously the two free variables have a statistically significant relationship to the bound variable, namely archery accuracy. These findings are in line with research (Taufik, 2019) which states concentration and skill level has a positive relationship and if the higher the concentration, the higher the level of archery skill so that the accuracy of archery will automatically be higher and better. In research (Muslim, Drs. Saripin, 2016) It also states that the relationship between arm muscle endurance and archery shot results at a distance of 30 meters has a strong and positive direction. So, the more

endurance the arm muscles are stronger, the higher the accuracy of archery at a distance of 30 meters.

The results of the analysis and comparison of previous research can be concluded that the concentration and endurance of the arm muscles are simultaneously significantly related to archery accuracy in Perpani athletes in Boyolali Regency. This strong relationship has a comprehensive approach from psychological to physical to be able to produce stable skills for an archery athlete. Therefore, a coach and sports coach must be able to provide programs from physical to mental development so that athletes' performance can improve to achieve achievement goals.

CONCLUSION

Based on the results of the analysis and discussion, it can be concluded that concentration has a strong and direct relationship with archery accuracy, so the better the level of concentration a person, the higher the accuracy in archery. In addition, arm muscle endurance also shows a strong and positive relationship with archery accuracy, which means that the ability to maintain arm muscle strength also plays a role in improving shot yield. Together, concentration and arm muscle endurance have a strong and significant relationship with archery accuracy, so both are important factors that affect success in achieving the goal of achieving optimal archery results.

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