

Correlation between Balance and Hand-Eye Coordination towards the Shooting Accuracy of Petanque Athletes of UNY



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ABSTRACT: Petanque is a sport that relies on a high level of shooting accuracy. This research aims to (1) determine the correlation between the levels of balance and shooting results; (2) find out the correlation between hand-eye coordination and shooting results; and (3) figure out the correlation between the level of balance and hand-eye coordination towards the shooting results of UNY petanque athletes. This research was a correlational study. The method was quantitative with multiple regression analysis. The data collection techniques were conducted by using a balance test using the standing stork test, a hand-eye coordination test using throwing and catching a ball, and a test for shooting accuracy using the FIPJP shooting game. The research subjects were 25 UNY petanque athletes. The research sampling method was a nonprobability or total sampling technique. The data analysis was conducted by using correlation analysis, multiple regression (F test), and classical assumption tests. Based on the results of this research, it shows that: (1) there is a significant correlation between balance and the shooting results of UNY petanque athletes with a correlation value of 25.8%, meaning that the correlation between the two variables is strong and has a positive correlation direction; (2) there is a significant correlation between hand-eye coordination and shooting results, for about 53.2%, meaning the correlation between the two variables is strong and has a positive correlation direction; (3) there is a significant correlation between balance and hand-eye coordination towards shooting results of 0.00 and an F-Calculated value of 41.420, F-Table at 3.42. It can be concluded that, H_0 is rejected and H_a is accepted, meaning that there is a correlation between the variables of the level of balance and handeye coordination and simultaneous shooting results.

KEYWORDS: Balance, Hand-Eye Coordination, Shooting Results, Petanque

I. INTRODUCTION

Petanque sport is a new sport in Indonesia, the word petanque comes from the word Les Ped Tanco or Petanca based on the Provençal dialect of the Occitan language which means tight feet. Petanque is an accuracy sport with one of the basic techniques of playing petanque is a tight foot that does not lift the foot that treads on the ground (M. Andika 2019)

The basic techniques of the petanque game are pointing and shooting, the pointing technique is how to bring the iron ball "boules" closer to the small ball target, "jack", which is made of wood, while the shooting technique is how to keep the opponent's iron ball as far as possible until the opponent's iron ball comes out of the match field (Ulpiana, Permadi, and Asy'ari 2022). Pointing and shooting techniques have different characteristics for petanque athletes, pointing is characteristic of a defensive style while shooting is an attacking style of play

Shooting throws can be influenced by several factors such as strong arm muscle strength when throwing, hand eye coordination must be synchronized when shooting. The shooting movement is to direct the iron ball to fall right on the target ball, shooting is an important technique for athletes to get points in the petanque game (Agustini, Nugraheni, and Maulana 2018). Accuracy is a person's ability to direct a movement at a target or target, in other words that accuracy is the conformity between the will (desired) and the reality (results) obtained against a particular target (goal).

The components in shooting movements can be influenced by ball grip, body position towards the target, static leg balance, low body position and leaning forward, ball release or release, and follow through. Balance when throwing the ball greatly affects the accuracy of a petanque athlete's throw which is closely related to balance which is related to accuracy (Isyani and Primayanti 2019).

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According to (Muladi and Kushartanti 2019), “balance is the ability to keep the body balanced in a static or dynamic state”. Balance is a major factor that contributes to the success of physical activities including sports. Good balance allows athletes to be able to maintain a stable and controlled body position during movement. Balance in petanque will help athletes maintain stability when throwing the ball and maintain the body and produce accurate throws.

Hand eye coordination is one component of physical condition that is needed in almost all sports, especially in the sport of petanque. In shooting an athlete will have good coordination if he can move towards the ball while catching it and continuing to throw the ball towards the target with the correct technique (Fransiska and Zulfahri 2024). To be able to produce good coordination throws can be combined with other body senses, namely the eyes and hands (Sani and Lalu Hulfian 2022).

Research that specifically explores the relationship between balance and hand-eye coordination with shooting accuracy in petanque athletes at Yogyakarta State University (UNY) needs to be done. Based on observations, it shows that the level of shooting accuracy of UNY petanque athletes has a poor level of accuracy, which affects the results of the UNY petanque team's achievements in the inter-student championship in the period 2021 to 2023. The championship in the shooting game number gets results that are still far from what is expected. The achievements of UNY petanque athletes that have been achieved include 1st place triple women at the 2021 UNJ dies student national championship, 1st place mix double, 1st place triple mix dies UNY 2022, 1st place double women and 2nd place double mix at the 2023 UNDIKSHA rector cup. The achievements of the UNY 5 team in the shooting game number in the student championship were only able to compete in the initial phase with low scores, namely between 15-25 and far from the expected value to qualify for the knockout phase or win the championship.

Research involving the population of UNY petanque athletes can provide information and a deeper understanding of the factors that influence the accuracy of shooting in UNY petanque athletes such as the lack of quality of practice and competition making physical, technical, tactical and mental things not optimal. The results of this study can provide important input to develop more effective training programs and good strategies in improving the skills and achievements of UNY petanque athletes.

II. METHODS

The research method used in this research is quantitative research with correlational research. The technique used in this research is the survey method. The method used is a survey with data collection techniques using tests and measurements.

This research was conducted at the Petanque field, Faculty of Sport and Health Sciences, Yogyakarta State University on November 6 to November 12, 2023. The population in this study were 25 petanque athletes from Yogyakarta State University. The sampling technique in this study used nonprobability techniques, namely saturated samples or often called total sampling.

This research instrument consists of three tests, namely (1) Standing stork test or one leg stand (standing on one leg) is a measuring tool for testing the athlete's balance ability while standing (Sepdanius 2019). (2) throwing the tennis ball to the target wall. The test instrument used to measure hand eye coordination Ismaryanti in (Rasyono and Setiowati 2021). (3) The shooting test instrument used in this study is a petanque game shooting test according to international regulations of the federation international de petanque et jeu provençal (FIPJP). Shooting game is one of the numbers in the petanque game which has five obstacle stations at a distance of 6,7, 8 and 9 meters with a score of 0-5 at each distance.

III. RESULT AND DISCUSSION

A. Result

Based on research on petanque sports games UNY 2023 obtained data which includes; balance (X1), eye-hand coordination (X2) and accuracy of shooting results (Y).

1. Balance

This study uses the standing strock test as a balance test instrument. In this balance test, athletes are asked to stand on one leg, the other leg is placed on the other leg facing opposite the knee and both hands are at the waist. Athletes are asked to stand in that position for as long as they can.

Table 1. Balance test

Category		Sum	Score	Norma
Men	Women			
> 50	> 30	2	5	Very good
41 – 49	23 – 29	4	4	Good
31 – 40	6 – 22	5	3	Average

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20 – 30	10 – 15	8	2	Less
< 20	< 10	6	1	Very less

2. Eye-hand coordination

For the eye-hand coordination test, this study used a ball throwing test on the wall using overhead and underhead techniques. In this test, the athlete throws the ball against a wall 2 meters away from the athlete, the athlete throws the ball using the right hand and is caught using the left hand, followed by a throwing motion using the left hand and catching using the right hand. For this test, athletes are given two opportunities (test-retest).

The test instrument for the eye-hand coordination test has gone through a validity and reliability process, with a validity value of 0.751 (>0.103) which means the test instrument has high validation. As for reliability, the test instrument has a reliability value of 0.689 which means it has a high reliability value. Through this test, the test results of UNY petanque athletes were obtained as follows:

Table 2. Eye-hand coordination test

Category		Sum	Score	Norma
Men	Women			
> 22	> 15	10	5	Very good
16 – 21	10 – 14	12	4	Good
10 – 15	5 – 9	3	3	Average
4 – 9	1 – 4	0	2	Less
< 3	< 0	0	1	Very less

From table 2, it can be concluded that UNY petanque athletes have good eye-hand coordination. There is not a single athlete who is lacking or even very lacking in eye-hand coordination. It can be seen from the table that almost half of the number of petanque athletes sampled got good scores, 10 of them got very good scores, and only 3 athletes scored 3 or were in the medium category.

3. Balance, Eye-Hand Coordination, and Accuracy of Shooting Results

The statistical description results are as follows:

Table 3. Research Variable Data

	N	Min	Max	Sum	Mean	Std. deviation
Balance	25	1	5	63	2.52	1.262
Eye-hand coordination	25	3	5	107	4.28	0.678
Shooting accuracy	25	5	44	536	21.44	10.603
Valid N	25					

Based on table 3. it can be seen that for eye coordination, the minimum value is 3 and the maximum value reaches 5, with an average value of 4.28 (Good). For balance, the maximum value reached 5, but the minimum value was 1. This causes the average balance value of the samples to be 2.52 (less). Meanwhile, for shooting accuracy, the maximum value reached 44 and the minimum value was at 11 with an average shooting accuracy result of 21.44 (less).

4. Classical Assumption Test

To find out whether eye-hand coordination and balance affect the shooting accuracy of UNY petanque players, multiple regression has been carried out to obtain information related to the relationship between two independent variables and one dependent variable. Before running the multiple regression analysis, the classical assumption test of multiple regression has been carried out.

a. Data Normality Test

Each research variable to be analyzed forms a normal distribution. One of the requirements that must be met in regression analysis is that the data and regression model are normally distributed. Data normality can be seen from the Kolmogorov-Smirnov normality test of each variable. If the probability is greater than 0.05, the research data can be concluded to be normally distributed.

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It can be seen from table 6 that the value of asym. Sig. is 0.2, which is greater than the p-value ($0.2 > 0.05$). Because the significant value is higher than the p-value, it can be concluded that the variable data is normally distributed.

Table 4. Research Variable Data

			Unstandardized residual
N			25
Normal parameters	Mean		0.0000000
	Std. deviation		4.85709359
Most extreme	Absolute		0.141
	Positive		0.103
	Negative		-0.141
Test statistic			0.141
Asymp. Sig. (2-tailed)			0.200

It can be seen from table 6 that the value of asym. Sig. is 0.2, which is greater than the p-value ($0.2 > 0.05$). Because the significant value is higher than the p-value, it can be concluded that the variable data is normally distributed.

b. Linearity Test

In general, this linearity test aims to determine whether two variables have a significant linear relationship or not. A good correlation should have a linear relationship between the predictor variable and the criterion variable.

For the linearity test, if the Sig. value is greater than 0.05, it can be concluded that there is a significant linear relationship between the variables of eye-hand coordination, balance, and shooting accuracy. The linearity test can also be seen from the F value. If F count is smaller than F table, it can be concluded that there is a significant linear relationship between variables.

Table 5. Linearity Test

			Sum of squares	df	Mean squares	F	Sig.
Balance shooting accuracy	Between groups	(Combined) Linearity	2230.202	4	557.550	23.829	0.000
		Linearity	2128.260	1		90.959	0.000
		Deviation From Linearity	101.941	3	33.980		0.258
	Within groups		467.958	20	23.398		
	Total		2698.160	24			
Hand eye coordination shooting accuracy	Between groups	(Combined) Linearity	1670.427	2	835.213	17.879	0.000
		Linearity	1436.218	1	1436.218	30.744	0.000
		Deviation From Linearity	234.209	1	234.209	5.014	0.036
	Within groups		1027.733	22	46.715		
	Total		2698.160	24			

From table 4, it can be seen that the Sig. value obtained in Deviation from linearity is 0.258. This Sig. value is greater than the p-value ($0.258 > 0.05$). In addition, the calculated F value is 1.452 where the F table is 3.10, then $F \text{ count} < F \text{ table}$. Thus, it can be concluded that there is a significant linear relationship between the balance variable and the shooting accuracy variable.

c. Multicollinearity Test

Multicollinearity test is part of the classic assumption test in multiple regression analysis. The multicollinearity test aims to test whether the regression model found a correlation (strong relationship) between independent variables or independent variables,

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where the occurrence of multicollinearity symptoms in the regression model indicates that the regression model is not a good regression model.

To test for multicollinearity, if the Tolerance value is greater than 0.10, it can be concluded that there are no symptoms of multicollinearity in the regression model and vice versa. The multicollinearity test can also be seen from the VIF value, where the VIF value is less than 10.00, it can be concluded that there is no multicollinearity in the regression model.

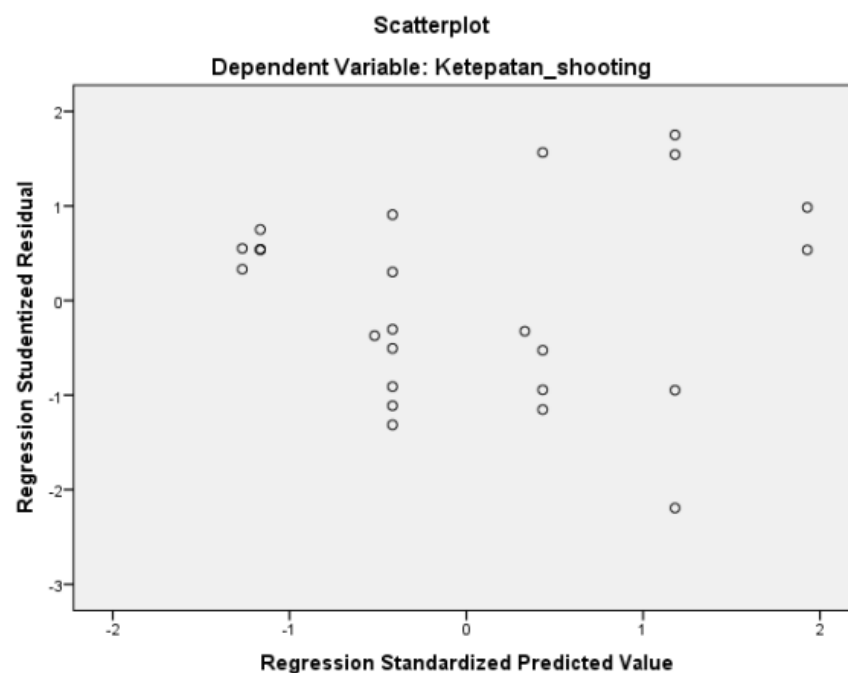
Table 6. Multicollinearity Test

Model		Unstandardized coefficients		Standardized coefficients	t	Sig.	Collinearity Statistics	
		B	Std. error	Beta			Tolerance	VIF
1	Constant	-0.427	8.402		-0.051	0.960		
	Balance	7.050	1.356	0.839	5.199	0.000	0.366	2.732
	Hand-eye coordination	0.958	2.524	0.061	0.380	0.708	0.366	2.732

Can be seen from table 5. The Tolerance value is 0.366 (<0.10), so there are no symptoms of multicollinearity in the regression model. Meanwhile, the VIF value is 2.732 (<10.00), so there is no multicollinearity in the regression model.

d. Heteroscedasticity Test

The Heteroscedasticity test aims to test whether in the regression model there is an inequality of variation in the residual value between one observations to another. If the variation value is fixed, then there are symptoms of homoscedasticity in the regression model. Meanwhile, if the variation value is different, it can be concluded that there are symptoms of heteroscedasticity in the regression model



To test heteroscedasticity in the regression model, this study uses scatterplot analysis to determine the presence of heteroscedasticity symptoms in the regression model.

From Figure 1, it is obtained that the points in the scatterplot are spread unevenly with an unclear pattern and the points spread abstractly above and below the 0 value of the Y axis.

e. Hypothesis Test

This study uses multiple linear regression analysis to test the research hypothesis regarding the relationship between eye coordination, balance, and shooting accuracy. Multiple regression analysis provides several outputs that can be interpreted to

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determine the relationship between the independent variables X1 and X2 to the dependent variable. Note the model summary table below.

Table 7. Hypothesis Test

Model	R	R Square	Adjusted R Square	Std. Error of The Estimate	Change Statistic				
					R Square Change	F Change	df1	df2	Sig. change
1	0.730	0.532	0.512	7.407	0.532	26.176	1	23	0.000
2	0.889	0.790	0.771	5.073	0.258	27.034	1	23	0.000

Table 7. displays the contribution of independent variables to the dependant variable. From the table, it can be seen that the R square value is .790. This R square value means that simultaneously (together), variable X1 (balance) and variable X2 (eye-hand coordination) affect the shooting accuracy variable by 79%.

Meanwhile, the contribution of each independent variable to the dependent variable can be seen in the R square change column, where the balance variable contributes 25.8% while eye-hand coordination contributes 53.2%.

From the results of spss, to answer the research questions are as follows:

1) There is a significant relationship between the level of balance on the shooting accuracy of UNY petanque athletes.

To find out if there is a significant relationship between the balance variable and the shooting accuracy of UNY petanque athletes, the sig. F change for the balance variable must be smaller than the p-value of 0.05. From table X, it can be seen that the Sig. F change 51 for the balance predictor is 0.00 (<0.05). Thus, the balance variable has a significant relationship with the shooting accuracy of UNY petanque athletes. So that hypothesis 1 that there is a significant relationship between the balance variable and the shooting accuracy of UNY petanque athletes is "accepted". The contribution of the balance variable to the shooting accuracy of petanque athletes is 25.8%.

2) There is a significant relationship between the level of eye-hand coordination on the shooting accuracy of UNY petanque athletes.

To find out if there is a significant relationship between the balance variable and the shooting accuracy of UNY petanque athletes, the sig value. F change for the balance variable must be smaller than the p-value of 0.05. From table X, it can be seen that the Sig. F change for the balance predictor is 0.00 (<0.05). Thus, the balance variable has a significant relationship with the shooting accuracy of UNY petanque athletes. So that hypothesis 2 that there is a significant relationship between the balance variable and the shooting accuracy of UNY petanque athletes is "accepted". The contribution of eye-hand coordination variables to the shooting accuracy of petanque athletes is 53.2%.

3) There is a significant relationship between the level of balance and hand-eye coordination on the shooting accuracy of UNY petanque athletes.

To find out if there is a significant relationship between the balance and hand-eye coordination variables with the accuracy of shooting UNY petanque athletes, the Sig. value must be smaller than the p-value of 0.05 and the calculated F value must be greater than the F table value. From table X, it can be seen that the Sig. value is 0.00 (<0.05) and the calculated F value of 41.420 is greater than the F table of 3.42. Thus, it can be concluded that the balance and eye-hand coordination variables simultaneously have a significant relationship with the shooting accuracy of UNY petanque athletes. So that hypothesis 3 that there is a significant relationship between the balance variable and the shooting accuracy of UNY petanque athletes is "accepted". The contribution of the balance variable to the shooting accuracy of petanque athletes is 79%.

B. DISCUSSION

The results showed that UNY petanque athletes have a balance that is still lacking, but they have very good eye and hand coordination skills. Meanwhile, through the shooting accuracy test, it was found that UNY petanque athletes had good shooting accuracy.

Using repeated measure ANOVA, the relationship between balance, eye-hand coordination, and shooting accuracy can be explored to draw conclusions regarding the relationship of each variable and the contribution of variables. From the results of statistical analysis, it is proven that there is a significant relationship between the level of balance and eye-hand coordination with the shooting accuracy of UNY petanque athletes.

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The results of statistical analysis show that balance has a significant relationship with shooting accuracy, with a contribution of 25.8%. The results of this study are in line with the findings of previous research, such as research by (1) which shows that dynamic balance contributes 36.74% to the shooting accuracy of petanque athletes and research by Nurfatoni and Hanief (2020) which states that the contribution of balance to shooting accuracy is 44.22%.

The importance of balance in shooting accuracy data is seen in the results of this study. Athletes who have poor balance will find it difficult to achieve high scores in shooting. This is due to low self-control in maintaining a static position when making shooting preparations and low ability to maintain a stable dynamic position when making throwing movements (Irawan et al. 2022). Thus, it can be concluded that the balance factor is one of the key factors in improving the shooting accuracy of petanque athletes.

In addition, this study also validated a significant relationship between the level of eye-hand coordination and shooting accuracy, with a contribution of 53.2%. The existence of a significant contribution by eye coordination to shooting accuracy in this study supports the findings of previous research studies (Nurfatoni and Hanief 2020).

The significance of the contribution of eye-hand coordination to shooting accuracy is due to the timing and accuracy factors in eye-hand coordination. Athletes with good eye-hand coordination have good timing and accuracy. With good timing, they can determine when they are ready to shoot the ball at the target. Meanwhile, accuracy is the most vital thing in shooting accuracy. So, with good accuracy, the probability of shooting well will also increase. For that, it can be concluded that the level of eye-hand coordination has an important role in achieving optimal shooting accuracy in petanque athletes.

In addition to showing significant results from each variable, this study also found that there is a significant simultaneous relationship between balance and eye-hand coordination with shooting accuracy, with a contribution of both of 79%. This finding supports the findings of (Karim and Ikadarny 2020), which showed that balance and eye-hand coordination contributed 80.8%. Thus, the combination of balance and eye-hand coordination together has a vital impact on shooting accuracy.

Overall, the results of this study not only confirm previous research findings on the role of balance and eye-hand coordination in the shooting accuracy of petanque athletes, but also contribute to our understanding of the simultaneous relationship and interaction between the two factors.

From this research on UNY petanque athletes, it can be concluded that balance and eye-hand coordination affect the shooting accuracy of athletes. Although the percentage magnitude of the two variables is different, both have a significant relationship with shooting accuracy, so athletes need to practice both tests regularly to improve their shooting accuracy. Meanwhile, from the research data it was found that the athletes' balance was still below average. Although the contribution of balance in shooting accuracy is not as great as eye coordination, the balance factor also needs to be considered in UNY petanque athletes. The implication is that coaches and training program developers can use the results of this study to design a more focused, comprehensive and effective training approach to improve the performance of petanque athletes.

V. CONCLUSIONS

From the results of research and discussion, the following conclusions can be obtained:

1. There is a significant relationship between balance and the accuracy of the shooting results of UNY petanque athletes, with a correlation coefficient value of 25.8%.
2. There is a significant relationship between hand eye coordination with the accuracy of the shooting results of UNY petanque athletes, with a correlation coefficient value of 53.2%.
3. There is a significant relationship between balance, hand eye coordination with the accuracy of shooting UNY petanque athletes, with a correlation coefficient of 79%.

ACKNOWLEDGMENT

Thank you to all parties who have been involved directly or who have supported the researchers indirectly.

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