

## Petanque athletes' shooting skills: Hand eye coordination, concentration and arm length

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Published online: August 31, 2024

Accepted for publication : August 15, 2024

DOI:10.7752/jpes.2024.08227

### Abstract

**Problem Formulation and Objectives.** Petanque is one of the sports that has become number 1 among the surrounding community, especially for young and adult athletes, even athletes who are just starting to pursue this sport. However, petanque has two important procedures that are difficult to master, namely the basic shooting strategy. This basic shooting method includes eye-hand coordination, concentration, and anthropometric structure as a precise distance. The core of this study is to discuss whether there is a crucial relationship between dexterity, focus, and adjustable distance to the capacity of basic shooting procedures in the game of petanque.

**Method.** A total of twenty adult athletes were selected as the total sample for this associative quantitative study. The procedures and instruments of this study collected all variable data. Shooting ability (Y) data was obtained using the game station shooting test ability with the recorded result being point 1 of the ball throw, according to the points on the game station shooting resistance with score units. Next, data was obtained for hand eye coordination (X1) using the tennis ball throwing and catching test. The assessment is determined based on the number of balls that can be thrown with the right hand and then caught with the left hand or vice versa according to the participant's habits for 30 seconds but as many assessment units. Next, for concentration (X2), data is obtained using the Grid Concentration Test, the sample value is how many numbers can be connected sequentially within a predetermined time with a score unit. Next, arm length (X3) was measured using an anthropometer test tool. Assessment of arm length measurements using units of measurement in centimeters (cm). The data was then analyzed using descriptive statistics and regression analysis. **Results.** Research findings show that hand eye coordination, concentration and arm length influence the shooting ability of petanque athletes ( $p < 0.05$ ) with a simultaneous influence of 52.50%. The influence of hand eye coordination is 37.29%, concentration is 4.02%, and arm length of 13.37%. Of these three factors, hand eye coordination is the dominant factor that influences an athlete's shooting ability without ignoring other factors (concentration and arm length). **Conclusion.** Good hand eye coordination, good concentration and optimal arm length have an impact on the shooting ability of petanque athletes. This examination is supposed to be helpful for mentors, sports educators and competitors to assess the significance of these variables to acquire ideal shooting results.

**Keywords:** Petanque Shooting Skills, Hand Eye Coordination, Concentration, Arm Length

### Introduction

Sport is a medium that unites the nation, this activity is an important part that can improve the quality of human life. The competency of young athletes generally comes from structured and targeted coaching (Susanto et al., 2023). In sports, talent is a superior ability that a person has, which is genetic and is largely determined by the environment in the process of development until it reaches the optimal stage (Bakhtiar et al., 2023). Socialization and coaching in early childhood to introduce talent development is important (Tonkin & Whitaker, 2021). Petanque is a sport that is able to compete and improve its achievements in every competition (Saputra et al., 2019). Petanque tends to require precision and concentration and does not look at how old the players are, requiring equality and opportunity for each player in every game and competition (Kurniawan et al., 2022). The competition numbers in the sport of petanque are single, double, triple and team for men, women and even mixed (Rizal et al., 2021). Excellent physical condition is very important for optimal performance (Zanada et al., 2023). In the sport of petanque, there are two basic techniques that must be truly mastered, namely shooting and pointing (Soemardiawan & Yundarwati, 2024). The pointing technique is an attempt to deliver the ball to the target (Setiakarnawijaya et al., 2021) & (Nurhasan et al., 2024), while the shooting technique is an effort to keep the opponent's ball away from the target (Rizal et al., 2021), this shooting technique is done while standing (Saddle et al., 2021). However, the fact is that not all athletes are able to do this shooting technique.

Experience, number of throws, and composure are factors that influence accuracy in shooting (Przyborowski, 2023). Coordination and concentration are the main elements in carrying out shooting techniques (Phytanza et al., 2022). Therefore, it requires calm, focus and coordination of all body segments (FA Irawan et al., 2024). Human movement is influenced by biomechanical factors, namely knowing the ideal body angle and torque (Derrick et al., 2020). The magnitude of the angle and torque when throwing and shooting should also receive more intensive attention, because they are closely related to improving performance and preventing injury. Concentration focuses all energy on the target (Van Durme et al., 2021), so taking the right picture requires high concentration. Athletes' anthropometry must also be taken into account, such as arm length (Bonilla et al., 2022). Based on the throwing mechanics in petanque, the main goal is to produce accuracy in throwing and shooting (Helmi et al., 2024).

This research is necessary because the basic techniques in the sport of petanque are very important because the importance of the basic shooting technique in the sport of petanque is to keep the opponent's boule away from the jack as far as possible to get a score (Yanti, 2024). Apart from keeping the opponent's ball away, this basic shooting technique can also be used as pointing if the ball we shoot stops right at the target (FA Irawan et al., 2022). Furthermore, basic shooting techniques can also be used to set attack or defense patterns (Saddle et al., 2021). Good basic shooting techniques can be a strong foundation for a team to win matches (Lubis et al., 2023).

The solution provided in this research is to see or measure what factors influence basic shooting techniques in order to get optimal results. For example, coordination, coordination that can be taken or related to shooting, namely hand-eye coordination. Next is concentration, because concentration is the main element in the success of this shooting technique. Next is anthropometry, in this study the power taken in anthropometry is the length of the athlete's arm.

Therefore, researchers are interested in conducting this research with the aim of analyzing how much hand eye coordination, concentration and arm length have a relationship with the basic shooting technique abilities of petanque athletes. These findings are important for instructors, coaches, practitioners and athletes in improving agility.

## Method

### Study Design

This study is quantitative and aims to show the relationship between at least two factors. The relationship used is a causal relationship, consisting of hand-eye coordination (X1), focus/concentration (X2), and arm length/anthropometry (X3) as independent factors and shooting skills (Y) as dependent variables.

### Participant

Total sampling was used to collect 20 petanque athletes as samples for this study. The samples for this study were classified as adolescent to adult or senior athletes, the samples were male (n=12) and female (n=8). They have stated their capacity to follow the standards during the test and participate consciously through written understanding.

### Procedures and Instruments

#### Shooting Ability

Shooting ability is measured using a test shooting game station. This test aims to measure athletes' shooting abilities. The result recorded is point 1 of the ball thrown, according to the point on the shooting game station obstacle. (Figure 1)






Atelier 1					Atelier 2					Atelier 3					Atelier 4					Atelier 5				
Boule seule					Boule derrière but					Entre deux boules					Sautée					But				
Carreau: 5 p Réussi: 3 p Touché: 1 p Manqué: 0 p					Carreau: 5 p Réussi: 3 p Touché: 1 p Manqué: 0 p					Carreau: 5 p Réussi: 3 p Touché: 1 p Manqué: 0 p					Carreau: 5 p Réussi: 3 p Touché: 1 p Manqué: 0 p					Carreau: 5 p Touché: 3 p Manqué: 0 p				
																								
6m	7m	8m	9m	Tot	6m	7m	8m	9m	Tot	6m	7m	8m	9m	Tot	6m	7m	8m	9m	Tot	6m	7m	8m	9m	Tot

Figure 1. Points on the shooting game station obstacles

Atelier is a discipline or station. Carreau, specifically the ball goes into the goal, the goal ball appears and gets 5 points. Réussi is the ball goes into the goal and the goal ball appears and gets 3 points. Well played is the ball only touches the goal ball and gets 1 point. Manqué, which is not hitting the target and gets no points. The following is the classification of shooting test game stations. (Table 1)

Table 1. Classification of test shooting game stations

Category	Category
Very good	Mean + 1.5 SD More
Good	Mean + 0.5 SD to Mean + 1.5 SD
Enough	Mean - 0.5 SD sd Mean + 0.5 SD
Not Enough	Mean - 1.5 SD sd Mean - 0.5 SD
Less than once	Mean - 1.5 SD not enough

Note: "Score" Unit Results

*Hand Eye Coordination*

The test instrument used to measure hand eye coordination uses a tennis ball throw and catch test and a circular field with a diameter of 30 cm. The aim is to measure hand-eye coordination. (Figure 2)

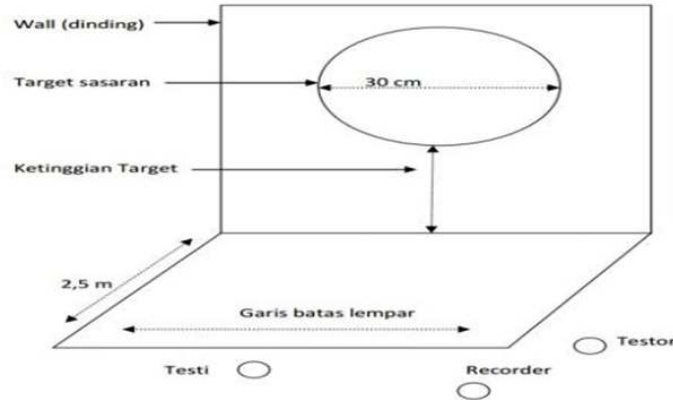


Figure 2. Hand Eye Coordination Test

The score is calculated based on the number of balls that can be thrown with the right hand and then caught with the left hand or vice versa, according to the participant's habits for as many times as possible in 30 seconds. The following is a classification of hand eye coordination tests. (Table 2)

Table 2. Classification of Hand Eye Coordination Tests

Category	Man	Woman
Very good	>35	>30
Good	30 - 35	25 - 30
Enough	25 - 29	20 - 24
Not Enough	20 - 24	15 - 19
Less than once	<20	<15

Note: "Score" Unit Results

*Concentration*

The instrument used to obtain athlete concentration data was carried out using the *Grid Concentration Test*. *Grid Concentration Test* is a form of measuring tool to determine concentration levels using numbers. This test has a validity of 0.87 and a reliability of 0.96. This test contains the number 100 with 2 digits consisting of the numbers 00 to 99 which are placed randomly in 10 rows x 10 columns. The sample is given a time of 1 minute or 60 seconds. The sample value is how many numbers can be connected sequentially within the specified time. Following is the classification *Grid Concentration Test*. (Table 3)

Table 3. Classification of Grid Concentration Test

No	Criteria	Information
1	21 and above	Very good
2	16 - 20	Good
3	11 - 15	Enough
4	6 - 10	Not Enough
5	5 and below	Less than once

Note: "Score" Unit Results

*Sleeve Length*

Collecting arm length data is done using an anthropometer or meter test tool which aims to measure arm length. The validity used is content validity, by calibrating measuring instruments with the Meteorological Agency. The assessment of arm length measurements uses units of measurement in centimeters (cm).

*Statistic analysis*

Information were investigated utilizing expressive insights to decide the characterization level of each examination variable. Connection and relapse examination are then used to demonstrate the connection between factors. All stages were examined utilizing IBM SPSS variant 24.

**Results**

The description of information aims to describe the quality of testing and estimation of each variable. With the aim that the level/order is known. Table 4 shows the average and standard deviation of shooting ability scores of  $17.17 \pm 2.98$  for male athletes and female athletes  $17.00 \pm 2.67$ . Hand eye coordination in male athletes  $19.83 \pm 0.58$  and in female athletes it is equal to  $19.88 \pm 1.13$ . Concentration for male athletes was  $11.33 \pm 0.89$  while for female athletes it was  $12.13 \pm 0.64$ . Furthermore, arm length for male athletes is  $72.25 \pm 1.86$  and for female athletes it is  $73.00 \pm 1.07$ .

Figure 3 shows that the mean score of women is higher than that of men, as far as hand-eye coordination capacity, concentration, and arm length are concerned but not regarding shooting skills. The consequences of the Kolmogorov-Smirnov regularity test and the Linearity Test also show that each variable has an average and direct delivery ( $p > 0.05$ ) (Table 5). Investigation of connections and relapses were used to determine the relationship between these factors.

Table 6 shows that hand eye coordination, concentration and arm length have a significant relationship with shooting ability both partially and simultaneously ( $p < 0.05$ ). The correlation between hand eye coordination and shooting ability is 0.598 and the contribution is 37.29%. The correlation between concentration and shooting ability is 0.557 and the contribution is 4.02%. The correlation between arm length and shooting ability is 0.300 and the contribution is 13.37%. Furthermore, the correlation between eye-hand coordination, concentration and arm length is 0.725 and the contribution is 52.50%.

Figure 4 shows a graphic plot forming a line pattern from bottom left to top right. Therefore, each variable has a linear and significant relationship with shooting ability ( $Y = 2.0956 + 24.498 X_1$ ;  $Y = 0.6392 + 24,546 X_2$ ; and  $Y = 0.6353 + 63.194 X_3$ ). Meanwhile, simultaneously obtained the Regression model  $Y = 26.120 + 2.087X_1 + 0.262X_2 + 0.653X_3$

Table 4. Descriptive Statistics

Gender	Variable	N	Minimal	Maximum	Mean	Standard Deviation
Man	Shooting (scoring)	12	13	20	17,17	2.98
	Hand Eye Coordination (score)		18	20	19.83	0.58
	Concentration (score)		10	13	11.33	0.89
	Sleeve Length (cm)		70	75	72.25	1.86
Woman	Shooting (scoring)	8	12	20	17.00	2.67
	Hand Eye Coordination (score)		18	22	19.88	1.13
	Concentration (score)		11	13	12,13	0.64
	Sleeve Length (cm)		72	75	73.00	1.07

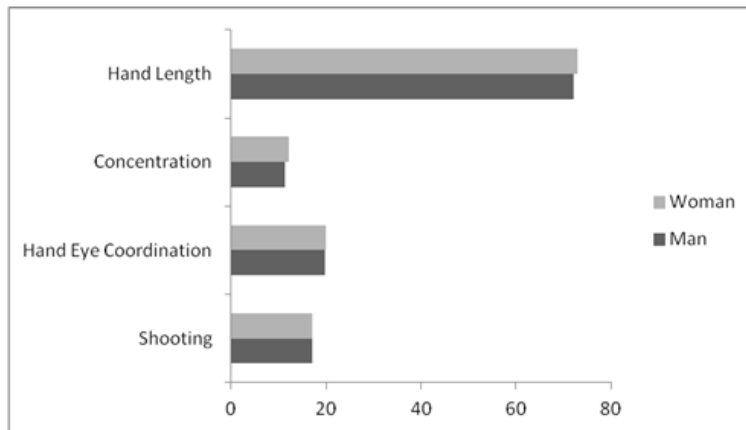


Figure 3. Differences in Average Scores Between Men and Women

Table 5. Normality and Linearity Test

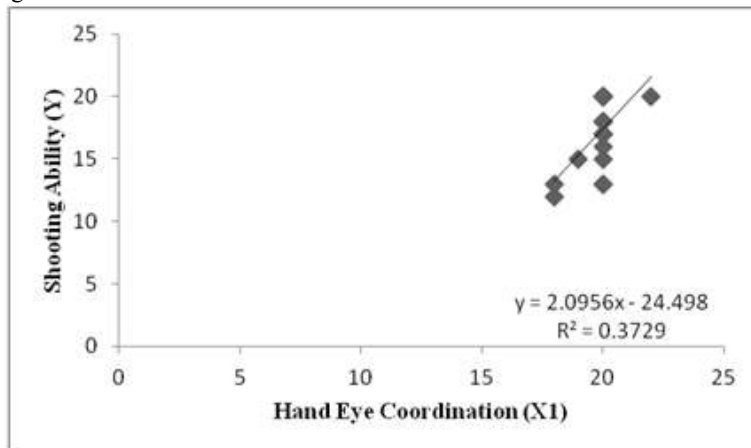
Variable	Normality Test (p*)	Linearity Test (p*)
YX1	0.169	0.487
YX2	0.275	0.197
YX3	0.380	0.078

\*Data is normally and linearly distributed ( $p > 0.05$ )

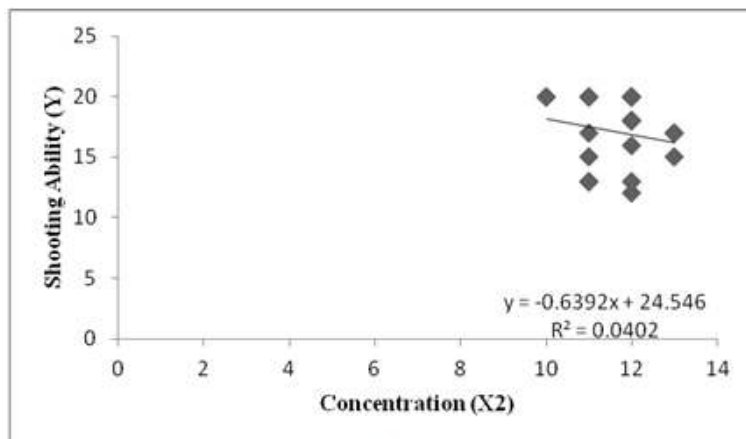
Table 6. Multiple Analysis and Correlation

Variable	B	R	Rsquare	Q	P
Hand Eye Coordination	2.0956 24,498	0.598	0.3729	3,487	0.003
Concentration	0.6392 24,546	0.557	0.0402	0.471	0.004
Sleeve Length	0.6353 63,194 26,120	0.300	0.1337	2,175	0.045
Simultaneous	2,087 0.262 0.653	0.725	0.525		0.007

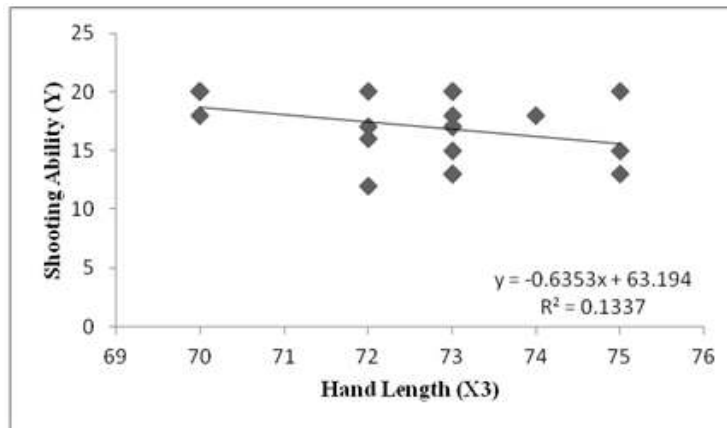
Note: The dependent variable is ability $_{shooting}$ , significance ( $p < 0.05$ ). “B” is the regression model; “R” is the magnitude of the relationship; “RSquare” is the contribution amount; “T” is the importance of the relationship; “P” is regression significance.



(A)



(B)



(C)

Figure 4. Linearity curve, (a) hand eye coordination with shooting ability, (b) concentration with shooting ability, (c) arm length with shooting ability.

### Discussion

These findings show that eye-hand coordination, concentration and arm length affect the shooting ability of petanque athletes (simultaneous influence of 52.50%). Hand eye coordination has an influence of 37.29%, concentration is 4.02% and arm length is 13.37%. Of these three factors, hand eye coordination is the dominant factor that influences shooting ability, without ignoring other factors (concentration and arm length). The results of this study are consistent with previous research, reporting that hand eye coordination is very important for accuracy sports (R. Irawan et al., 2024) And (Haryanto & Amra, 2020).

Previous research also confirmed that, for all sports that involve accuracy, you must have good eye-hand coordination (Ellison et al., 2020), good concentration (Purnomo, 2020) and have good anthropometry (Bonilla et al., 2022). Not only that, physical condition also influences the success of accuracy sports (Rogowska et al., 2022), good motor skills and good balance can also influence the success of accuracy sports (Aminudin et al., 2020) and motivation, both internal and external, can also influence the success of accuracy sports (Rogowska et al., 2022) and (Komaini et al., 2024), as well as good muscle strength (Welis et al., 2024).

Basic shooting technique skills in the sport of petanque are very important (Abdurrahman et al., 2024), because shooting ability is a determining factor in victory (Canossa et al., 2020), apart from that, shooting abilities can be used to set attack strategies (Pawarrangan et al., 2024). Shooting ability is also available becomes pointing if the ball we shoot stops right at the target (Branet et al., nd). The main goal of shooting ability is to keep the opponent's boule away from the jack as far as possible (Yanti, 2024).

Not only does hand-eye coordination have an influence, concentration also has an influence, although not as much as hand-eye coordination. This is in line with previous research which states that accuracy sports such as petanque, archery and shooting really require good concentration to support optimal performance (Uludaug et al., 2021) and (Komarudin et al., 2021). Apart from hand eye coordination and concentration, previous research also stated that anthropometry, such as the length of an athlete's arms, is also a determining factor for athletes to achieve optimal performance in accuracy sports (Lima-Borges et al., 2022).

Based on information obtained in the field, the ideal shooting skills of petanque athletes are influenced by several variables, including hand-eye coordination, concentration, and proper arm length/anthropometry. However, there are several obstacles that need to be considered in further research. The examples used are still not uniform, from teenagers to adults so that more varied, more in-depth, and more in-depth examples are needed. The variables used are still limited, namely hand-eye coordination, concentration, and proper arm length/anthropometry. Therefore, it is necessary to add several factors that influence the shooting skills of petanque athletes. Of the three factors, hand-eye coordination is the most dominant factor influencing the shooting ability of petanque athletes, without ignoring other factors (concentration and arm length). This shows that the shooting ability of petanque athletes is influenced by hand-eye coordination, concentration, and optimal arm length.

### Conclusion

Based on these findings we conclude that hand eye coordination, concentration and arm length influence the shooting ability of petanque athletes (simultaneous effect 52.50%) with significance ( $p < 0,05$ ). Hand eye coordination has an influence of 37.29%, concentration is 4.02% and arm length is 13.37%. Good hand eye coordination, good concentration and optimal arm length have an impact on the shooting ability of petanque athletes. This research is expected to be useful for coaches, sports instructors and athletes to evaluate the importance of these factors to obtain optimal shooting ability results.

### Conflict of interest

The authors disclose that there is no conflict of interest.

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