ORIGINAL ARTICLES. SPORT

The relationship between height, arm length, hand grip strength, togok flexibility to petanque shooting accuracy

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Authors’ Contribution: A – Study design; B – Data collection; C – Statistical analysis; D – Manuscript Preparation; E – Funds Collection
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DOI: https://doi.org/10.58962/HT.2024.2.2.33-41

How to site

Abstract

Background and purpose
This research aims to determine the relationship between height, arm length, hand grip strength, togok flexibility to petanque shooting accuracy.

Material and methods
This research was carried out at the Petanque Training Field of Tunas Pembangunan University and Petanque Field Karangasem. In this study used correlational method. Correlational research is a type of research with problem characteristics in the form of correlational relationships between two or more variables. The relationship between these variables can be determined through the calculation of the correlation coefficient using analysis techniques. In this study, a description will be made of the correlation and the amount of contribution between height to petanque shooting accuracy, arm length to petanque shooting accuracy, hand grip strength to petanque shooting accuracy and togok flexibility to petanque shooting accuracy. Data analysis in this study used multiple correlation analysis and partial correlation analysis.

Results
The results of this study show that the For the variables Body Height, Arm Length, Hand Grip Strength and Togok Flexibility on the Petanque Shooting Accuracy variable, the coefficient of determination or R Square was calculated at 0.785, meaning that the independent variables were (Body Height, Arm Length, Hand Grip Strength and Togok Flexibility). Simultaneously have a relationship with the dependent variable Petanque Shooting Accuracy of 0.785 (78.5%), while the remaining 21.5% (100% - 78.5% = 21.5%) is influenced by other variables outside the variables studied.

Conclusions
The conclusion of this research is variables of height, arm length, hand grip strength, togok flexibility together affect the dependent variable Petanque Shooting Accuracy by 78.5%.

Keywords
Height, Arm Length, Hand Grip Strength, Togok Flexibility, Petanque, Shooting Accuracy

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https://doi.org/10.58962/HT.2024.2.2.33-41
Анотація

Ізза Фаджрі Зайдуррахман, Сугіянт, Роні Сайфуллах, Сламет Ріяді. Взаємозв’язок між довжиною тіла, довжиною руки, силою рукоятки, гнучкістю тогока і точністю стрільби з петанку

<table>
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</tr>
</thead>
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<tr>
<td>Матеріал і методи</td>
<td>Це дослідження проводилося на полі для гри в петанк Університету Туас Пембангунан і на полі для гри в петанк Карангасем. У даному дослідженні використовувався кореляційний метод. Кореляційне дослідження – це вид дослідження з характеристиками проблеми у вигляді кореляційних зв’язків між двома або більше змінними. Зв’язок між цими змінними можна визначити шляхом розрахунку коефіцієнта кореляції за допомогою методів аналізу. У цьому дослідженні буде зроблено опис кореляції та величини внеску між ростом і точністю стрільби з петанку, довжиною руки для точності стрільби з петанку, силою рукоятки для точності стрільби з петанку та гнучкістю тогок для точності стрільби з петанку. Аналіз даних у цьому дослідженні використовував множинний кореляційний аналіз і частковий кореляційний аналіз.</td>
</tr>
<tr>
<td>Результати</td>
<td>Результати цього дослідження показують, що для змінних «Ріст тіла», «Довжина руки», «Сила рукоятки» та «Гнучкість тогока» на змінній «Точність стрільби з петанку» коефіцієнт детермінації або квадрат R був розрахований на рівні 0,785, що означає, що незалежні змінні були (Зріст тіла, довжина руки, сила хватати руки та гнучкість Тогок). Одночасно маємо зв’язки із залежною змінною Точність стрільби з петанку 0,785 (78,5%), тоді як на решта 21,5% (100% - 78,5% = 21,5%) впливають інші змінні поза межами досліджуваних змінних.</td>
</tr>
<tr>
<td>Висновки</td>
<td>Висновок цього дослідження полягає в тому, що такі змінні, як зріст, довжина руки, сила рукоятки, гнучкість тогок, разом впливають на залежну змінну точності стрільби з петанку на 78,5%.</td>
</tr>
<tr>
<td>Ключові слова</td>
<td>довжина тіла, довжина руки, сила зчеплення руки, гнучкість тогока, петанк, точність стрільби</td>
</tr>
</tbody>
</table>
Introduction

Sports are also one of the activities that are inclusive and can be enjoyed by all people around the world regardless of one's social status, level of wealth, or position [1]. However, in the current era, sports have undergone changes in value and become a phenomenon that is no longer isolated from political, economic, social, and cultural aspects [2]. Sports can be defined as physical activities performed regularly, which involve any kind of activity or effort to develop and strengthen one's physical and mental potential, both individually and as part of society [3]. Sports are usually presented in the form of races, competitions, games or matches to obtain victory, and development of potential [4].

Educational sports activities are generally applied in various educational institutions of various levels [5]. On the other hand, recreation-based sports activities refer to sports carried out by people with interests and abilities that grow and develop in accordance with the conditions and cultural values of the local community, with the aim of maintaining health, fitness, and providing joy [6]. The target of recreational sports activities covers all circles of society and is adapted to age. Merit-based sports refers to sports activities that aim to nurture and develop athletes in a systematic, planned, tiered, and integrated manner through competition, with the support of sports science and technology [7]. This sports activity is carried out and managed professionally with the aim of achieving optimal achievements in certain sports.

Sports are also one of the activities that are inclusive and can be enjoyed by all people around the world regardless of one's social status, level of wealth, or position [1]. However, in the current era, sports have undergone changes in value and become a phenomenon that is no longer isolated from political, economic, social, and cultural aspects [2]. Sports can be defined as physical activities performed regularly, which involve any kind of activity or effort to develop and strengthen one's physical and mental potential, both individually and as part of society [3]. Sports are usually presented in the form of races, competitions, games or matches to obtain victory, and development of potential [4].

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Athletes have proportional body conditions that have an important influence on field performance when competing. Because of the technique of playing the basic game of petanque, there is a dominant anthropometric part in it. With a proportional body, able to play the basic techniques of petanque games that are accurate, effective and efficient. Differences in the structure and function of body organs lead to variations in the appearance and performance of individuals. Anthropometric measures, which are related to a person's body type or shape, can be used as a parameter of a person's nutritional status [16]. The size of physical anthropometry develops with the development of individuals according to the stages of development. The growth in size of these physical parts is influenced by developmental factors, including genetic factors, environment, as well as various physical activities performed [17]. The anthropometric factor is the supporting capacity.
of the petanque shooting ability, because at the time of shooting there is a dominant anthropometric part and physical condition component [18].

In sports pétanque has various anthropometric parts and physical conditions that support the athlete during training and matches. From the upper extremity to the lower extremities that have their respective roles. Body anthropometry includes height, weight, palm length, arm span, inch length, leg length to foot length. In pétanque itself, the limbs used to release the ball when throwing an iron ball at the target ball are dominant in height, arm length to palm width.

The connection between the hand, ball and target also influences that hand eye coordination provides more factors to the athlete in order to achieve the desired accuracy. The position of the athlete is legally allowed by squatting or standing when throwing the ball towards the target. So that the balance of the body also contributes to the state of the athlete when going to make a target shot. In addition, the condition of biomechanical ball release is influenced by the flexibility of the togok, because the follow-through motion minimizes the occurrence of injury.

**Material and Methods**

This research was carried out at the Petanque Training Field of Tunas Pembangunan University and Petanque Field Karangasem. In this study used correlational method. Correlational research is a type of research with problem characteristics in the form of correlational relationships between two or more variables. The relationship between these variables can be determined through the calculation of the correlation coefficient using analysis techniques. In this study, a description will be made of the correlation and the amount of contribution between height to petanque shooting accuracy, arm length to petanque shooting accuracy, hand grip strength to petanque shooting accuracy and togok flexibility to petanque shooting accuracy.

Data analysis in this study used multiple correlation analysis and partial correlation analysis. The analysis is classified as statistical analysis with the aim of identifying whether there is a relationship between the dependent variable and the independent variable in the study.

**Results**

**Normality Test**

Normality Test is one way in statistics carried out in research in determining the normal distribution or not in a group of data or variables. This study used One Sample Kolmogorov-Smirnov Test where if the significance value (Sig.) is more than 0.05 it is concluded to be normally distributed, while if the significance value (Sig.) is smaller 0.05 it is concluded that it is not normally distributed. The calculation results can be seen from the following normality table.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Significance Value</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height, cm</td>
<td>0,200</td>
<td>Usual</td>
</tr>
<tr>
<td>Arm Length, cm</td>
<td>0,059</td>
<td>Usual</td>
</tr>
<tr>
<td>Hand Grip Strength, cm</td>
<td>0,200</td>
<td>Usual</td>
</tr>
<tr>
<td>Togok Flexibility, cm</td>
<td>0,200</td>
<td>Usual</td>
</tr>
<tr>
<td>Petanque Shooting Accuracy, cm</td>
<td>0,147</td>
<td>Usual</td>
</tr>
</tbody>
</table>

Based on table 1, the normality test of the independent variable and the dependent variable is obtained. In the height variable (X1), a significance value of 0.200 > 0.05 is obtained, meaning that the height data is normally distributed. In the variable arm length (X2), a significant value of 0.059 > 0.05 is obtained, meaning that the arm length data is normally distributed. In the variable hand grip strength (X3), a significance value of 0.200 > 0.05 is obtained, meaning that the variable data of hand grip strength is normally distributed. In the togok flexibility variable (X4), a significance value of 0.200 > 0.05 is obtained, meaning that the togok flexibility variable data is normally distributed. In the variable variable Petanque Shooting Accuracy (Y), a significance value of 0.147 > 0.05 is obtained, meaning that the variable data of the Petanque Shooting Accuracy variable is normally distributed.
Linearity Test

The Linearity Test aims to determine whether the variable tested has a linear relationship or not significantly. This study uses Anova Table where if the significance value (Sig.) is less than 0.05, it is concluded that the relationship between the two variables or more is declared linear, while if the significance value (Sig.) is more than 0.05, it is concluded that there is no relationship between the two variables or more is declared linear. The calculation results can be seen from the following linearity table 2.

<table>
<thead>
<tr>
<th>Relationship between Variables</th>
<th>Significance Value</th>
<th>Conclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accuracy and Height</td>
<td>0.000</td>
<td>Linear</td>
</tr>
<tr>
<td>Accuracy and Arm Length</td>
<td>0.000</td>
<td>Linear</td>
</tr>
<tr>
<td>Hand Grip Precision and Strength</td>
<td>0.955</td>
<td>Non-Linear</td>
</tr>
<tr>
<td>Togok Precision and Flexibility</td>
<td>0.899</td>
<td>Non-Linear</td>
</tr>
</tbody>
</table>

Based on table 2, a linearity test is obtained between the independent variable and the dependent variable. In the height variable (X1) against the shooting petanque variable (Y) has a significance value of 0.000 < 0.05, meaning that height data on the accuracy of shooting petanque has a linear relationship. In the variable arm length (X2) to the variable shooting petanque (Y) has a significance value of 0.000 < 0.05, meaning that the variable arm length data on the accuracy of shooting petanque has a linear relationship. In the variable hand grip strength (X3) to the shooting petanque variable (Y) has a significance value of 0.955 > 0.05, meaning that the hand grip strength data on the accuracy of shooting petanque has a non-linear relationship. In the variable flexibility (X4) to the shooting petanque variable (Y) has a significance value of 0.899 > 0.05, meaning that the flexibility data of the shock to the accuracy of shooting petanque there is a non-linear relationship.

Model Meaningfulness Test

The Significance Test aims to test the significance or not of the test or model, this test uses a T test with a standard of more than 5% of regression models are significant, while less than 5% of regression models are insignificant. The calculation results using SPSS can be seen in the following table.

<table>
<thead>
<tr>
<th>Free Variable</th>
<th>Coefficient</th>
<th>T count</th>
<th>Significance</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-66,687</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height, cm</td>
<td>0,196</td>
<td>236,819</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>Arm Length, cm</td>
<td>0,820</td>
<td>102,304</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>Hand Grip Strength, kg</td>
<td>-0,036</td>
<td>29,106</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>Togok Flexibility, cm</td>
<td>0,037</td>
<td>17,112</td>
<td>0.000</td>
<td>Significant</td>
</tr>
</tbody>
</table>

Notes: Bound Variable = Petanque Shooting Accuracy F count = 22.845 Sig = 0.000 \( R = 0.886 \) \( R^2 = 0.785 \) Std Error = 2.42816

Based on table 3 of the T test, it is obtained that the height variable (X1) against the accuracy of shooting petanque (Y) has a significance value of 0.000 < 0.05, meaning that the variable height and the variable of the accuracy of shooting petanque regression are significant. In the variable arm length (X2) against the shooting accuracy petanque (Y) has a significance value of 0.000 < 0.05, meaning that the variable arm length and the variable shooting accuracy petanque regression are significant. In the variable hand grip strength (X3) against petanque shooting accuracy (Y) has a significance value of 0.000 < 0.05, meaning that the variable hand grip strength and the variable of regression petanque shooting accuracy are significant. In the variable of strike flexibility (X4) to the accuracy of shooting petanque (Y) has a significance value of 0.000 < 0.05, meaning that the variable of togok flexibility and the variable of shooting accuracy petanque regression is significant

Hypothesis Testing Results

The Pearson Product Moment test is used to test the hypothesis between predictor variables and criterion variables. The variables tested were the Body Height variable (X1) on the Petanque Shooting
Accuracy variable (Y), the Arm Length variable (X2) on the Petanque Shooting Accuracy variable (Y), the Hand Grip Strength variable (X3) on the Petanque Shooting Accuracy variable (Y), Togok Flexibility variable (X4) to Petanque Shooting Accuracy variable (Y). Test results are as follows.

Table 4
Pearson Product Moment Test Results

<table>
<thead>
<tr>
<th>Relationship between Variables</th>
<th>Pearson Correlation (r)</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height and Accuracy</td>
<td>0.747</td>
<td>0.000</td>
</tr>
<tr>
<td>Arm Length and Accuracy</td>
<td>0.788</td>
<td>0.000</td>
</tr>
<tr>
<td>Hand Grip Strength and Precision</td>
<td>0.021</td>
<td>0.913</td>
</tr>
<tr>
<td>Togok Flexibility and Accuracy</td>
<td>-0.025</td>
<td>0.895</td>
</tr>
<tr>
<td>Body Height, Arm Length, Hand Grip Strength, Strike Flexibility and Accuracy</td>
<td>0.785</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Based on table 4, the Pearson product moment test shows that:

In the variable Body Height (X1) with the variable Petanque Shooting Accuracy (Y), a Pearson correlation value of 0.747 was obtained, meaning that the height variable (X1) had a relationship of 0.747 (74.7%) with the petanque shooting variable (Y).

In the Arm Length variable (X2) with the Petanque Shooting Accuracy variable (Y), a Pearson correlation value of 0.778 was obtained, meaning that the arm length variable (X2) had a relationship of 0.778 (77.8%) with the Petanque shooting variable.

In the Hand Grip Strength variable (X3) with the Petanque Shooting Accuracy variable (Y), a Pearson correlation value was obtained of 0.021, meaning that the Hand Grip Strength variable (X3) has no relationship with the Petanque shooting variable.

For the Togok Flexibility variable (X4) to the Petanque Shooting Accuracy variable (Y), a Pearson correlation value was obtained of -0.025, meaning that the Togok flexibility variable (X4) has no relationship to the Petanque shooting variable.

For the variables Body Height, Arm Length, Hand Grip Strength and Togok Flexibility on the Petanque Shooting Accuracy (Y) variable, the coefficient of determination or R Square was calculated at 0.785, meaning that the independent variables were (Body Height, Arm Length, Hand Grip Strength and Togok Flexibility). Simultaneously have a relationship with the dependent variable Petanque Shooting Accuracy (Y) of 0.785 (78.5%), while the remaining 21.5% (100% - 78.5% = 21.5%) is influenced by other variables outside the variables studied.

Discussion

Body anthropometry of a dominant athlete is height at the time of shooting petanque treatment. Anthropometry that has a variety of different athletes has an influence on shooting accuracy in petanque games [19]. Various athletes have different heights so they have certain shooting accuracy that needs to be explored. The distance of the thrower to the target ball has a different range, thus affecting the quality of the right shooting for the athlete. Height will affect every range for athletes who shoot at their targets [20].

Other anthropometry besides height is the arm length of the athlete being a factor that affects the implementation shooting, the distance between the thrower athlete and the target has the effect that the athlete's arm length has a deeper influence shooting. The length of each athlete's arm is different, giving it a certain level of accuracy effectiveness that needs to be explored. And arm length also affects the body's biomechanics when releasing a ball thrown towards the target. The diversity of arms owned by athletes will affect the quality shooting what to want [21].

In addition to body anthropometry that affects the quality of an athlete, there are physical conditions that must be considered by every athlete to support the quality of shooting they have. In the release of shooting pétanque has many physical conditions that must be considered such as, flexibility of the togok, hand grip strength, body balance to the eye coordination of an athlete. This kind of physical condition is one of which must be considered and trained by an athlete in order to obtain peak
performance in every game. From various physical conditions have different influences in each Shooting what an athlete does [22].

In physical condition there is a grip strength of an athlete contributes to shooting petanque. The grip force will give the effect of releasing the ball from the arm to the targeted target more accurately. An athlete has a palm that can support grasping an iron ball to throw. In this case, the strength of the hand grip affects the biomechanics of shooting pétanque when Newton's Law 1 is implemented. Therefore, hand strength gives power to certain athletes so it is worth exploring how influential it is.

In addition to the strength of the hand grip that can affect the quality of the athlete's throw when Newton's Law 1 is implemented, there is flexibility of the strike that contributes to the influence of shooting. The flexibility of the shock in an athlete's body has a relationship with height that is in the upper extremities of the athlete's body. The flexible togok influences the athlete when making advanced movements when shooting. Advanced motion serves as minimizing body parts to avoid injuries experienced [23]. In addition, the flexibility of the togok also contributes to the biomechanics of the body When Newton's law 3 is implemented. So that a flexible strike can affect the quality of the athlete's throw. Each athlete has a different quality of strike flexibility, so it is worth exploring how effective and efficient the effect of strike flexibility on the accuracy of shooting pétanque.

**Conclusion**

The conclusion of this research is variables of height, arm length, hand grip strength, togok flexibility together affect the dependent variable Petanque Shooting Accuracy by 78.5%.

**References**


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