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The Relationship Between Body Fat Percentage And The Level Of Anterior Cruciate Ligament Injury In Athletes Jakarta Regional Training Center

Muhammad Arrasyid Putranto[1] , Junaidi[2], Nadya Dwi Oktafiranda[3], Ela Yuliana[4]

[1,2,3]Sports Science Study Program, Universitas Negeri Jakarta, Indonesia
Jl. R.Mangun Muka Raya No.11, RT.11/RW.14, Rawamangun, Kec. Pulo Gadung, Kota Jakarta Timur, Daerah Khusus Ibukota Jakarta 13220
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Abstract
This study aims to determine the relationship between body fat percentage and level of ACL (Anterior Cruciate Ligament) injury. World Health Organization (WHO) states that 42.2% of major health problems in the community are injuries in children and adults. adults. The most commonly encountered injury generally occurs in the knee ligament ligament, which is a tear of the Anterior Cruciate Ligament. Fat is one of the important components of body composition, if the body fat percentage is not ideal, it can potentially lead to overweight or injury. injury may occur. This study uses the type of research Associative quantitative research with correlation method. The sample in this study using the Total sampling technique. The sample amounted to 25 DKI Jakarta regional training athletes Jakarta who suffered an ACL injury. The results showed that the dependent variable (body fat) and the independent variable (ACL injury rate) there is a value of 0.000 <0.05. value of 0.000 <0.05, which means that there is a significant correlation between the between the variable percentage body fat with the level of ACL injury. Meanwhile, the calculated r value (Pearson correlation) for the relationship between body fat and the level of ACL injury is 0.730. Thus, there is a relationship between body fat percentage and ACL injury rate. Based on the degree of relationship, the percentage of body fat with the level of ACL injury has a strong relationship
Keywords: Anterior Cruciate Ligament, Body Fat, DKI Jakarta Regional Athletes

Correspondence author: Muhammad Arrasyid Putranto. Sports Science Study Program, Universitas Negeri Jakarta, Indonesia.
Email: arsrasyiid989@gmail.com

INTRODUCTION

In the world of sports, athlete achievement is not only determined by technical and tactical abilities, but also by excellent physical condition. One important aspect of an athlete's physical condition is body composition, particularly body fat percentage (Zubaida et al., 2024). Ideal body composition can significantly affect athlete performance, especially in terms of speed, agility and endurance (Susilo et al., 2023). However, on the other hand, non-ideal body composition can increase the risk of injury, one of which is knee injury.

Body fat proportion correlates with the balance of calorie intake. Lack of physical exercise will result in the problem of rising body mass index (BMI), leading to obesity. Physical activity can undoubtedly solve the obesity problem if done in a balanced manner (Osiński &

Kantanista, 2017). Some authors argue that if the percentage of body fat is excessive it will cause strain on the ACL and lead to the onset of other injuries (Kızılgöz et al., 2019).

ACL (Anterior Cruciate Ligament) injuries are common in the world of sports. The World Health Organization (WHO) states that 42.2% of major health problems in society are injuries in children and adults. The most commonly encountered injury generally occurs in the knee ligament, namely the tear of the Anterior Cruciate Ligament. The prevalence of ACL injuries each year is calculated at 250,000 to 300,000 cases and around 60,000 to 175,000 ACL reconstruction surgeries are performed in the United States (Villia et al., 2023).

DKI Jakarta, as one of the national sports barometers, the problem of ligament injuries (sprain) is also a serious concern. Based on a report from the DKI Jakarta Indonesian National Sports Committee (KONI), throughout 2012, 41.1% of sprain cases were recorded, which is the most common type of sports injury experienced by DKI Jakarta PON XVIII Pelatda athletes (Junaidi, 2013). This figure shows the specific prevalence of this type of injury without information about the increase in the total number of ACL injury cases explicitly. This is certainly a concern for stakeholders in the Jakarta sports world, considering that ligament injuries can disrupt training programs and reduce athlete performance in competition.

Ideally, an elite athlete has an optimal level of fitness and physical condition to minimize the risk of injury. According to the standards set by the Ministry of Youth and Sports (Kemenpora) in the 2022 National Athlete Development Guidelines, elite athletes should have a controlled body fat percentage, which ranges from 6-13% for male athletes and 14-20% for female athletes, depending on their respective sports (Ministry of Youth and Sports RI, 2022). However, in reality, many DKI Jakarta regional athletes still have a body fat percentage above the ideal standard, although specific data on the number of athletes is not yet available.

The results of routine health checks conducted by the DKI Jakarta KONI health team in early 2024 showed that around 30% of DKI Jakarta regional athletes had a body fat percentage that exceeded the ideal standard for their sport. This ideal standard is set by the Ministry of Youth and Sports (Kemenpora), where male athletes should have a body fat percentage between 6-13%, and female athletes between 14-20% (Ministry of Youth and Sports RI, 2022). This condition is certainly a challenge for coaches and athletes in an effort to improve performance and minimize the risk of injury. With a high body fat percentage, athletes may face difficulties in achieving optimal fitness, which may impact their performance in competition (Kurnia et al., 2020).

The relationship between body fat percentage and ACL injury rates in athletes is still a topic of debate among sports scientists. Some researchers also mentioned extrinsic factors can

cause ACL injuries, such as physical contact in sports, training factors, and habitual factors. In an effort to improve DKI Jakarta's sporting achievements, KONI DKI Jakarta has set ambitious targets in the 2022-2026 Strategic Plan (Renstra). One of the important points in the Renstra is to reduce the injury rate of athletes by 25% within five years (Rachmat, 2021). To achieve this target, an in-depth understanding of injury risk factors, including their relationship with athletes' body composition, is crucial.

The Ministry of Youth and Sports in Ministerial Regulation No. 8 of 2023 on National Sports Coaching Standards also emphasizes the importance of a scientific approach in coaching athletes (Pemuda et al., 2024). This regulation requires every coach to understand the physiological aspects of athletes, including body composition, and how it can affect performance and injury risk (Zubaida et al., 2024). Thus, research that examines the relationship between body fat percentage and ACL injury rates is very relevant and important in the context of coaching national athletes.

On the other hand, the development of modern sports science has brought about a paradigm shift in athlete injury management and prevention (Habsy, 2022). Recent theories published in various international journals such as the Journal of Athletic Training and Sports Medicine suggest that a holistic approach that considers various risk factors, including body composition, movement biomechanics, and psychological factors, is needed to optimize athlete performance while minimizing the risk of injury (Rusdiawan et al., 2024).

An understanding of the correlation between body fat percentage and the level of injury to the knee can help in building prevention as well as better training strategies, especially for DKI Jakarta regional athletes. Of course this is one of the goals of KONI DKI Jakarta to make Jakarta an example of superior and sustainable sports achievements throughout the country.

Understanding the relationship between body fat percentage and ACL injury rates may help in establishing better methods to prevent injuries. It also serves as an example for athlete training programs in other areas of Indonesia. As the explanation above indicates there is a difference between the expected ideal conditions, where athletes have optimal body composition and minimal risk of injury, but in reality, there are still many DKI Jakarta regional athletes who have a body fat percentage that is above the ideal standard and the level of injury to the ACL. Thus the researcher intends to study and determine the relationship between body fat percentage and the level of ACL (Anterior Cruciate Ligament) injury.

METHODS

This research is an associative quantitative research with correlation method. This study was designed to determine the relationship between the relationship between body fat percentage and the level of ACL injury in DKI Jakarta regional athletes. Correlational research is also known as associational research (Yusuf, 2014). This research design model can be illustrated as follows

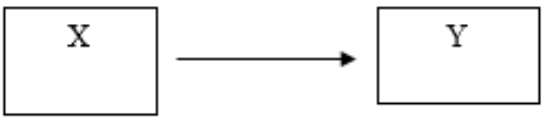

Figure 1. Research design

The population in this study were 25 DKI Jakarta regional training athletes who suffered ACL injuries. The sample was selected through the total sampling technique, namely sampling where the number of samples was the same as the population, so that the sample of this study amounted to 25 respondents.

Data collection techniques using forms on name data, age, gender, weight, height, sports, body fat, visceral fat. For the measurement of body fat, and visceral fat using bioelectrical impedance analysis (BIA) mediana scale. Measurement data will be processed to determine the relationship through statistical tests in the form of normality tests, linearity tests, homogeneity tests, and hypothesis tests using the SPSS version 25 application.

RESULTS AND DISCUSSION

Result

Characteristics of Research Samples

Based on the results of the analysis of the description of the characteristics of the research sample, it is known that male gender at age obtained an average value of 23 years with a standard deviation of 2.075. The average male body weight is 55 kg with a standard deviation of 6.225. The average male height is 157.25 cm with a standard deviation of 6.225. In the BMI of male athletes, the average is 26.15 with a standard deviation of 8.41. In female athletes, the average age is 24 years with a standard deviation of 4.079. The average female body weight is 85 kg with a standard deviation of 7.890. The average female height is 168 cm with a standard deviation of 4.820. The average BMI of female athletes is 22.19 with a standard deviation of 3.12.

The results of the percentage of body fat in 25 DKI Jakarta Pelatda athletes showed that the average male and female DKI Jakarta Pelatda athletes who suffered ACL injuries had a high percentage of body fat. Of the many sports, kempo and rugby branches are the sports that most athletes experience ACL injuries, namely 16%. The average history of injury in male athletes of the DKI Jakarta regional training is 5.5 months ago with a standard deviation of 1.646. The level of ACL injury to male athletes in grade I amounted to 3 people, grade II amounted to 7 people, grade 3 amounted to 3 people. Meanwhile, female athletes from DKI Jakarta have an average injury history of 6.3 months ago with a standard deviation of 2.357. The level of ACL injury in female athletes in grade I amounted to 4 people, grade II amounted to 4 people, and grade III amounted to 4 people.

Normality Test Results

The normality test was carried out with the One-sample Shapiro Wilk test with the condition that the data was declared normally distributed or not. If the sig. results obtained are> 0.05, it means that the data is normally distributed. The following results are obtained:

Table 1. Normality Test Results

Variables	Sig	Percentage
Fat percentage	0,740	Normal
ACL injury rate	0,283	Normal

Based on the results of the data above, it shows that the percentage of body fat shows a Sig value> 0.05, namely 0.740. meaning that the data is normally distributed. At the ACL injury level the data shows that the sig value> 0.05 is 0.283. So it can be said that the data in the study is normally distributed.

Linearity Test Results

The next data uses a linearity test to determine the relationship between the independent variable and the dependent variable. The results obtained include:

Table 2. Linearity Test Results

Variables	***Deviation From Linearity***
Fat percentage	0,374
ACL injury rate	

Based on the results of the data above, it shows that the independent variable (Body Fat) and the dependent variable (ACL Injury Rate) show sig.deviation from linearity> 0.05, namely 0.374. So it can be said that there is a linear relationship between the independent and dependent variables.

Homogeneity Test Results

The data uses a homogeneity test to ensure that two or more groups of sample data come from a homogeneous population. The Levenne test can be used to perform a homogeneity test.

Table 3. Homogeneity Test Results

Variables	*Test Of Homogeneity Of Variance*
Fat percentage	
ACL injury rate	0,050

Based on the results of the data above, it shows that the sample data comes from the same population (homogeneous). The sample data shows that there is a value of 0.050> 0.5. So it can be interpreted that the data in the sample is homogeneously distributed.

Correlation Test Results

The results of the correlation test to determine whether the X and Y variables have a relationship or not. The results obtained are as follows:

Table 4. Correlation Test Results

Variables	*Pearson correlation*	*Sig. 2 tailed*
Fat percentage	0,730	0,000
ACL injury rate		

Based on the results of the data above, it shows that in the independent variable (body fat) and the dependent variable (ACL injury rate) there is a value of 0.000 <0.05, which means that there is a significant correlation between the body fat variable and the ACL injury rate. Based on the calculated r value (pearson correlation), it is known that the calculated r value for the relationship between body fat and the level of ACL injury is 0.730. So it can be concluded that there is a relationship between the correlation of the variable body fat relationship with the level of ACL injury with a positive value, and correlates with the level of ACL injury.

Discussion

The relationship between body fat and the level of ACL injury in DKI Jakarta regional athletes

Based on the results of research data analysis conducted using hypothesis testing in this study using the SPSS Version 25 application. Tested at a significant level of 5%. The test shows whether it is significant or not in the variable body fat relationship with the ACL injury rate. Terms of test value sig level. <0.05, if the value> 0.05 then the variable is not significant. Table 4 shows that the results of the correlation test on body fat with the level of ACL injury show significant data, namely 0.000 <0.05. In the calculated r value there is a positive value on the variable (independent) body fat and the variable (dependent) ACL injury rate, which is 0.730. The result of the calculated r value is positive. Thus the results of this study indicate a relationship in the percentage of body fat with the level of ACL injury in DKI Jakarta regional athletes. Related research is in line with previous research, namely the analysis of the relationship between Body Mass Index and Anterior Cruciate Ligament injuries in futsal players built by the DKI Jakarta regional training team (Wada & Amallia, 2023). Although the study describes the Body Mass Index, body fat is one of the components of the Body Mass Index.

The knee joint contains a ligament called the Anterior Cruciate Ligament or ACL. ACL injuries are the most common knee injuries experienced by athletes. These injuries are usually caused by sports activities such as soccer, basketball, volleyball, and futsal that require zigzagging movements, changes in direction, and sudden changes in speed (acceleration-deceleration). Most injuries are caused by twisting mechanisms and non-contact Valgus knees (Suharsono et al., 2022).

Knee joint instability can result from ACL tears of more than 50% or even full tears. The athlete's performance in sports will decrease due to frequent knee vibration, persistent pain, and edema. Instability in the knee joint can also result in additional damage, such as damage to the cartilage and meniscus joint cushion. The knee is the most complex joint in the human body and one of the most susceptible to damage (Wijayasurya & Setiadi, 2021). ACL injuries are sometimes referred to as career ending injuries as they force many athletes to end their careers.

Assessment of the degree of ACL injury can be done based on the tear that occurs, namely: (Keumala et al., 2024)

1. Grade I: Micro tear of the ligament. Generally causes symptoms of instability and can be reactivated with healing.
2. Grade II: Partial tear with bleeding. There is a functional decline in the body, such as walking, bending,
3. Grade III: Total tear with symptoms of complete instability.

Based on the results of the study, it is known that the average history of injury to male athletes of the DKI Jakarta regional plate is 5.5 months ago with a standard deviation of 1.646. The level of ACL injury to male athletes in grade I amounted to 3 people, grade II amounted to 7 people, grade 3 amounted to 3 people. Meanwhile, female athletes from DKI Jakarta have an average injury history of 6.3 months ago with a standard deviation of 2.357. The level of ACL injury in female athletes in grade I amounted to 4 people, grade II amounted to 4 people, and grade III amounted to 4 people.

Injury to the ACL can have a bad impact on anyone who experiences it, especially athletes. Treatment of ACL injuries can be done with conservative management (non-operative) or reconstructive surgery (operative). Tears that occur in the league can affect the handling of the injury (Maharani & Abidin, 2024). Here are some of the stages when examining an ACL injury:

1. Anamnesis, an interview of the injured patient. During history taking, details regarding the patient's medical history, family history, social history, and other risk factors that may affect their health are collected. (Irianto et al., 2024)
2. Lachman test, while performing this examination, the patient externally rotates the leg while bending the knee to a 30 degree angle (Khairunnisa et al., 2024)
3. MRI (Magnetic resonance imaging), this technology uses radio waves and magnetic technology to create photographs of anatomical structures. (Khairunnisa et al., 2024)
4. RICE (rest, ice, compression, elevation), this method is carried out by resting the knee, after that applying ice cubes to the knee area that is experiencing inflammation (inflammation), giving an elastic bandage as a compress, and positioning the leg higher than the body. (Rafyansyah et al., 2023)
5. Exercise Therapy is one of the treatment methods in sports injuries, especially ACL injuries. With the aim of optimizing the functional of the injured body. (Simatupang et al., 2024)
6. TENS (Transcutaneous electrical nerve stimulation). A therapeutic method that uses low electric current to relieve pain. TENS works by sending an electric current through electrodes placed on the skin in the area experiencing pain. (Husin et al., 2024)

CONCLUSION

Based on the implementation of the research, it can be concluded that in this study there is a relationship between the percentage of body fat and the level of ACL injury in DKI Jakarta regional training athletes. Findings based on research data analysis using SPSS Version 25 tools for hypothesis testing in this study. In the correlation test results there is a significant relationship between body fat and the level of ACL injury, with a strong degree of relationship. It is hoped that further research can multiply examine variables related to ACL injury and increase the number of research samples.

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