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CORRELATION BETWEEN BODY MASS INDEX TOWARDS AGILITY FOOTBALL ATHLETES IN MELAWI REGENCY

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ABSTRACT

Agility is used by soccer athletes when passing opponents by dribbling the ball in order to score goals more easily. Body Mass Index (BMI) affects agility. Athletes who have a normal BMI have better agility which is useful for displaying their maximum abilities. Athletes with an abnormal BMI can result in decreased agility and an increased risk of injury. This study aims to determine the correlation between BMI and agility in soccer athletes in Melawi Regency.This research is an analytic observational study with a cross sectional approach. The sample of this study amounted to 105 people who were selected using non-probability sampling technique with purposive sampling method. Agility was measured by t-test, while BMI was measured by the result of body weight (kg) divided by the square of height (m^2) adjusted by category.Based on the non-parametric chi-square analysis test, the results were p = 0.021 ($p<0.05$) which indicates that there is a significant correlation between BMI and agility, where the lower the BMI, the higher the agility. This is because the higher the BMI causes an increase in the load that can inhibit muscle contraction.Based on the results of the study, it can be concluded that there is a significant correlation between body mass index and agility in soccer athletes in Melawi Regency.
Keywords : Body Mass Index (BMI); agility; football athletes

INTRODUCTION

One way to maintain health is to do sports[1]. Sports are various systematic activities to foster, encourage and develop spiritual, physical and social potential. The most famous sport is football. Most of the world's citizens know about soccer. Indonesian football has great potential to build a sense of nationalism for every citizen[2]. The high passion of the Indonesian people towards football is not comparable to the achievements of the Indonesian national team. The senior Indonesian national team has never won the competition. The Indonesian national team was only able to win the AFF in the age group of 16, 19 and 22. This has often happened, many Indonesian soccer athletes excel at the junior level, but their achievements at the senior level have dimmed. This can happen because it is caused by several factors such as loss of direction, unstable performance and a poor lifestyle. Whereas at an early age is a phase of formation of players to achieve maximum performance in the future.

Many factors have resulted in the uneven achievement of football throughout Indonesia, especially in Melawi, West Kalimantan. This can be seen from the lack of athletes from Melawi who take part in the national arena and are not even able to penetrate the national team. This also had an impact on the Melawi team, namely PERSIMEL, who were unable to excel in the events that were followed in 2019, namely Liga [3] and PORPROV West Kalimantan. Internal factors that can affect athlete achievement are tactics, technique, mental and physical conditions.3 Physical condition is the most important component, because it is fundamental in carrying out the sport. Soccer athletes must have physical components such as strength, speed, endurance, explosive power, flexibility and agility[4]. These conditions are needed to form the basis for combining tactical, technical and mental skills of players when on the field.

Many soccer athletes in Indonesia only focus on some biomotor components and pay less attention to other biomotor components, such as agility. Whereas agility is needed by soccer athletes so that their appearance is more perfect[5]. Agility is a person's ability to change the direction and position of the body accurately and quickly in a short time without losing balance. Agility is needed in explosive sports such as football. Agility is very useful when dribbling the ball or doing tricks to get past and trick opponents into scoring goals. If the athlete is less agile, it can increase the risk of injury because he will lose when he collides with the opponent for the ball. Agility also helps athletes not to fall when they are passing opponents. Agility is influenced by several factors, one of which is the athlete's body itself.

Soccer athletes must have an ideal body, which is strong, tall, agile and healthy[6]. The ideal body image can be described through a normal body mass index. Body mass index (BMI) is a standard ratio of weight to height that is often used as an indicator of health. Soccer athletes must have an ideal BMI because it can affect the athlete's appearance. Athletes with a BMI above normal accompanied by excessive fat levels can lead to weakening of muscle strength so that it can cause balance disorders. Athletes who have an excessive BMI are at risk for ACL (Anterior Cruciate Ligament) injury[7]. ACL injuries require a long healing time so that it can interfere with the athlete's career. BMI below normal can also affect balance because it will be difficult to maintain body balance because it is unable to resist external forces. Athletes who have a normal body mass index tend to have better balance so they are more agile[8].

In a study regarding the relationship between BMI and agility dribbling the ball in 25 students of SMAN 1 Aikmel, it was found that the results showed that the r-count value was equal to 3.801 and the r-table value with a significant level of 5% was obtained 0.396 which means that the calculated r obtained is greater than the limit of the null hypothesis (Ho).6 Based on this research, it can be concluded that there is a relationship between BMI and dribbling agility in male students in SMAN 1 Aikmel soccer extracurricular in 2017. In a study in 2017 to 46 men, the results showed that BMI had a significant relationship with agility ($r = 0.452, p > 0.05$).9 This is the same as the research in 2016 on 45 male athletes which showed that there was a significant relationship between BMI and agility ($r = .543$, $p < 0.05$).10 It was also found that a higher BMI resulted in weaker sports performance. Body type and body composition also affect the relationship between body mass index and agility. The body is classified as an endomorph and weight gain will lead to weakened performance.This study will study the relationship between BMI and agility using control variables such as explosive power and hamstring flexibility to 105 soccer athletes in Melawi Regency.

METHODS

a. Methodology

Study design

This research is an observational study with a cross sectional approach. This research was conducted at Raden Temenggung Setia Pahlawan Stadium, Paal Village, Nanga Pinoh District, Melawi Regency, West Kalimantan Province from July to October 2022.

Subject Requirement

The target population in this study was soccer athletes and the population reached in this study were soccer athletes in Melawi Regency amount 105 people.

Inclusion criteria : Male soccer athletes in Melawi Regency aged 16-23 years; Have participated in at least 2 competitions; The general condition is healthy and vital signs are within normal limits; Has an average category explosive power (41-50 cm); Has good hamstring flexibility (24-28 cm); Willing to be a research sample by signing a letter of consent. Exclusion criteria : The sample is or has been running exercises that can affect agility; Have an ankle sprain/strain in the last 3 months; Post-op fracture of the lower leg in the past 2 years.

Sampling technique

The sampling technique used non-probability sampling technique with purposive sampling method that is selecting samples based on the population that came when the research was carried out and met the inclusion criteria.

b. Material and procedure

Material

1. Weighing scales
2. Meter indicator
3. Stopwatch
4. Books and stationery
5. Cones
6. Bel

7. Sit and reach test bench
8. Camera
9. Laptops
10. SPSS application version 25.0

Procedure

Preliminary Procedure

1. Conduct initial observations to soccer clubs and high schools in Melawi Regency which will be used as research sites
2. Applying for research permits and coordinating regarding research to be carried out to related parties
3. Make an informed consent that must be signed by the research subject. Informed consent contains an explanation that the subject is willing to be a research sample in this study until completion
4. Researchers will conduct research by inviting research participants to the research site or heading to the research participant's training area
5. Conduct inspections to determine inclusion and exclusion criteria

Implementation Procedure

1. Filling in informed consent
   a. The researcher will explain about filling out the informed consent before carrying out the research
   b. Researchers will distribute informed consent to participants
   c. Participants will fill out informed consent and will be assisted by researchers if they experience difficulties
2. Body Mass Index Measurement
3. Agility Measurement

c. Assesment

Hamstring flexibility – sit and reach test

1. Subject sits with legs straight in front of
2. The subject flexes the back as much as possible with both hands moved as far as possible along the table
3. Maintain this position and record the results achieved by the tip of the longest finger
4. In this study using the good category with a range of 24-28 cm

Explosive power – vertical jump test

1. The subject is standing next to the wall tightly and the arms are raised as high as possible
2. Mark the highest point with a marker
3. Subject's fingers were given crushed chalk
4. The subject jumps as high as possible with the finger that has been given the chalk to reach the highest point possible on the wall and mark the point
5. Measure the distance between the two points.
6. The test was carried out 3 times using the best results
7. In this study using the average category with a range of 41-50cm

Body mass index

1. Subjects measure height using a meter and weight using a scale that has been provided
2. These results are entered into the formula $BMI = \frac{weight\ (kg)}{height^2 (m)}$
3. The results were adjusted according to categories, namely <17 including very thin, 17-<18.5 including thin, 18.5-25 including normal, >25-27 including obese and >27 including obesity.

Agility – t-test

1. Prepare and mark an area with an area of 9.2 x 9.2 meters, place the cone at point A, then measure a distance of 9.14 meters ahead, place the cone at point B and 2 cones at points C and D which are 4.57 meters from point B, give the bell at the base of the cone at points B, C and D.

2. Participants start with both feet behind point A.
3. When the examiner gives the signal "go" accompanied by running the time on the stopwatch, then the participant must run as fast as possible
4. Participants run to point B and touch the bell at the bottom of cone B with their right hand.
5. Then run the shuffle to point C and touch the bell at the base of cone C with your left hand, then run the shuffle to point D and touch the bell at the bottom of cone D with your right hand. Then participants run shuffle to point B and touch the bell at the bottom of cone B with their left hand and ends by running backwards past point A.
6. The test was carried out 3 times and the results used were the best results adjusted for categories in men, namely the category for men <9.5 including excellent, 9.5-10.5 including good, 10.5-11.5 including average and >11.5 including poor.
7. The test was repeated if the participant failed to ring the bell at the base of each cone, crossed his legs while dragging, and/or did not face forward throughout the test.

d. Data analysis

Univariate analysis

Univariate analysis is a descriptive analysis that explains the general description of each research variable. Univariate analysis in this study analyzed the percentage of age, gender, explosive power, hamstring flexibility, body mass index and agility.

Bivariate analysis

Bivariate analysis is an analysis to explain the relationship between two variables, namely the independent variable in the form of body mass index to the dependent variable in the form of agility. The two variables produce data in the form of numbers that are entered into categories so that they are ordinal data. Therefore, this study uses a non-parametric chi square analysis.

RESULTS

Subjects who took part in the study were men with average explosive power (41-50 cm) and good hamstring flexibility (24-28 cm).

Frequency distribution of subject characteristics based on age

Table 1 frequency distribution of subject characteristics based on age

Age	Frequency (person)	Percentage (%)
16	7	6,7
17	9	8,6
18	11	10,5
19	17	16,2
20	19	18,1
21	14	13,3
22	17	16,2
23	11	10,5
Total	105	100

Based on from table 1, the research subjects have an average age of 19.88 years with the youngest age being 16 years and the oldest 23 years being aged 16 years as many as 7 people (6.7%), age 17 years as many as 9 people (8.6%), 18 years old as many as 11 people (10.5%), 19 years old as many as 17 people (16.2%), age 20 years as many as 19 people (18.1%), age 21 years as many as 14 people (13.3%), age 22 years 17 people (16.2%), and age 23 years as many as 11 people (10.5%).

Frequency distribution of subject characteristics based on body mass index.

Table 2 frequency distribution of subject characteristics based on body mass index

Category	Frequency (person)	Percentage (%)
Very thin	4	3,8
Thin	8	7,6
Normal	76	72,4
Obese	11	10,5
Obesity	6	5,7
Total	105	100

Based on table 2, subjects who have a body mass index in the very thin category are 4 people (3.8%), skinny category is 8 people (7.6%), normal category is 76 people (72.4%), fat category 11 people (10.5%), and the category of obesity as many as 6 people (5.7%).

Subject characteristic frequency distribution based on agility

Table 3 frequency distribution of subject characteristics based on agility

Category	Frequency (person)	Percentage (%)
Very good	0	0
Good	30	28,6
Average	49	46,7
Less	26	24,8
Total	105	100

Based on table 3, as many as 26 people (24.8%) had poor agility category, 49 people (46.7%) had average agility category and 30 people (28.6%) had good agility category.

Correlation between body mass index towards agility

Table 4 cross table of body mass index against agility

Body Mass Index	Agility						Frequency	p
	Good		Average		Less			
	Frequency	%	Frequency	%	Frequency	%		
Very thin	0	0	2	50	2	50	4	
Thin	3	37,5	3	37,5	2	25	8	
Normal	26	34,2	36	47,4	14	18,4	76	0,021
Obese	1	9,1	7	63,6	3	27,3	11	
Obesity	0	0	1	16,7	5	83,3	6	
Total	30	28,57	49	46,7	26	24,8	105	

Based on the table above, the most subjects who have good agility category are in the lean category body mass index with a percentage of 37.5% as many as 3 people, subjects with the average agility category have the most body mass index in the fat category as many as 7 people with the percentage of 63.6% and the subject with the least agility category was found in the obesity category of body mass index as many as 5 people with a percentage of 83.3%.

Table 4 also shows that there is a significant relationship between body mass index and agility after the chi square test, the results are p = 0.021 (p <0.05). Thus, the results of the data analysis show that there is a significant relationship between body mass index and agility in soccer athletes in Melawi Regency.

DISCUSSION

In this study, the sample had good hamstring flexibility (24-28 cm) as measured by vertical jump and average explosive power (41-50 cm) as measured by sit and reach test. Good flexibility hamstring will result better agility[11]. Better muscle power will result in better agility[12]. The majority of soccer athletes who participated in the study had a normal body mass index of 76 people (72.4%). This indicates that the majority of the samples have a healthy lifestyle. With a normal body mass index, athletes have ideal physical conditions that have a good effect on a person's skills in playing soccer6. In addition, athletes who have a normal body mass index can minimize the risk of injury that can hinder performance. Because if you have a body mass index below normal, then the athlete will be more easily dropped.6 If the athlete's body mass index is excessive, it will be at risk for ACL injury[7].

Agility is divided into two types, namely specific agility, which is involved in certain sports techniques, and general agility, which is involved in various sports activities. When doing physical activity, the body will respond physiologically with a response to the cardiorespiratory, musculoskeletal and metabolic systems that try to balance the body[13]. The cardiorespiratory system responds by increasing the use of oxygen by the muscles, including the musculoskeletal system, which increases the frequency of movement. Because soccer is a strenuous sport, the metabolic system responds by providing energy in the form of Adenosine Triphosphate through the aerobic system with an oxidative system.

Based on the test results in table 4, the results obtained p = 0.021 (p < 0.05) which means that there is a significant relationship between body mass index and agility in soccer athletes in Melawi Regency. Thus, the lower the body mass index value, the higher the agility. Vice versa, if the body mass index exceeds the normal category will result in decreased agility.The results of this study prove that agility is influenced by body proportions which are described by body mass index. Athletes who have a normal body mass index will be able to move more freely so that the athlete has better agility. Because agility is influenced by several factors, one of which is weight[14]. Body weight can be described by body mass index. With good agility, soccer athletes can dribble better so that they can pass opponents to open up opportunities to score goals more easily[6].

If the body mass index exceeds the normal category, it will result in a decrease in agility. This is in same like which said that the endomorph body type and increased body weight can lead to decreased agility[9]. In addition, excessive body weight can hinder agility because athletes carry additional weight[10]. Correlational study between BMI and agility with a total sampling technique obtained a correlation coefficient of 0.969 and a coefficient of determination of 94%[15]. Higher BMI is in line with a heavier body weight, resulting in slower movement, so that a good BMI can have good agility as well[15]. Increased fat thickness can increase the risk of obstructed blood flow in the capillaries so that it affects the nutrients and oxygen for the muscles needed to produce muscle strength[16]. The combination of muscle strength and speed produces explosive power that can affect agility.

Physiological adaptations of muscles, namely hyperplasia, hypertrophy, increased mitochondria and muscle strength accompanied by improved performance of the nervous system can lead to increased agility[17]. Therefore, excess body weight can reduce agility due to friction of fat tissue against muscle fibers, resulting in reduced muscle contractility[18]. Efficiency of fast and strong muscle contractions that can maximize speed[19]. The tension generated by muscle contraction can increase muscle strength such as hypertrophy, tension levels and muscle fiber recruitment. Speed is influenced by strength with the greater the strength of the movement will produce explosive power that can increase speed which can increase agility. Regarding the nervous system, if you can control the coordination of muscle group activation properly, it can have an impact on higher agility[20].

Athletes who have good agility have the speed to change motion without losing balance. Therefore athletes need to know movements that can accelerate movement while maintaining balance through biomechanical analysis. Biomechanical analysis is useful for improving performance and reducing the risk of injury to athletes[21]. The thing to note is the leaning of the body and the harmonization of supporting and pushing leg movements and arm movements that are carried out in opposition to the footwork[22]. Balance depends on the Center of Pressure and Center of Gravity because

it is related to the proprioceptive system associated with body sensations with a sense of attitude (statognesia) and a sense of motion (kinetics) of the joint muscles as well as a sense of pressure, a sense of vibration (pallesthesia) and pain in the muscles[23].

CONCLUSSION

The results of the study it can be concluded that there is a significant relationship between body mass index and agility in soccer athletes in Melawi Regency.

CONFLICT OF INTEREST

The authors declare no conflict of interest

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