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The Relationship between Physical Fitness Level with Body Mass Index of Medical Students at Indonesian Christian University, Jakarta

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Aims: This research aims to understand the relationship between physical fitness level and body mass index (BMI) of students at the Faculty of Medicine, Indonesian Christian University, especially the class of 2021.
Study Design: The research design used in this study was observational with a cross-sectional approach.
Place and Duration of Study: This research will be conducted at the Faculty of Medicine, Indonesian Christian University Laboratory in December 2022.
Methodology: The population in this study were all students from the Faculty of Medicine, class of 2021. The research sample consisted of 57 students from the Faculty of Medicine, class of 2021,

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who were selected using a sampling technique, namely consecutive sampling. The physical fitness test uses the Harvard Step Test.
Results: From the research results, it was found that the physical fitness level of 57 students registered at the Faculty of Medicine, Indonesian Christian University could be categorized as follows: 44 students (77.2%) were in the less ability, 8 students (14.0%). included in the moderate ability, and 5 students (8.8%) were included in the good ability. Apart from that, an analysis of the body mass index (BMI) of students at the Faculty of Medicine, Indonesian Christian University, Class of 2021, showed that the largest proportion consisted of individuals who were classified as having a normal weight, namely 31 people (54.4%), obesity, 12 people (21 .1%), underweight as many as 6 people (10.5%), overweight as many as 4 people (7.0%) and Obesity II as many as 4 people (7.0%). Based on bivariate analysis, the results showed that there was no significant relationship between Physical Fitness and Body Mass Index. This was concluded by obtaining a chi-square value, namely p = 0.740.
Conclusion: From the research results, it can be concluded that the Body Mass Index is not a determining factor that guarantees physical fitness, likewise other moderate variables such as age and gender also have no relationship with physical fitness.

Keywords: Physical fitness; body mass index; relationship.

1. INTRODUCTION

1.1 Background

Physical fitness refers to a state where a person can carry out activities with optimal effectiveness and good efficiency without feeling high fatigue. Physical fitness plays an important role in a person being involved in physical activities and sports, thus having a positive influence on their cognitive, psychomotor, and affective development [1].

It is sought that people who have a high level of physical fitness will demonstrate increased receptivity to instruction, resulting in better academic performance. Physical fitness refers to the capacity to perform tasks effectively, even under challenging conditions, which cannot be achieved by individuals who have poor physical fitness. Physical fitness is a fundamental and crucial asset for humans [2]. Physical fitness assessment can be done through a fitness test. The experiment began with respondents engaging in a fitness assessment known as the Harvard Step Test. This test aims to evaluate students' physical performance abilities by measuring their pulse rate with their current physical fitness condition [3]. The main purpose of conducting fitness test experiments, especially the Harvard Step Test, is to assess the respondents' aptitude, physical fitness, and work capacity. Next, understand the correlation between physical fitness level and Body Mass Index (BMI) [3-7].

A person's physical fitness level can naturally increase, but it can also decrease independently when a person does minimal physical activity. Body mass index (BMI) is recognized as a significant determinant of a person's level of physical fitness [8]. Body Mass Index (BMI) refers to a direct way to assess the nutritional status of individuals aged 18 years and over. It calculates the ratio of body weight to height, without distinguishing the contribution of muscle mass, bone, fluid, or fat to the overall weight [9]. According to the researchers' writing, this study intends to examine the correlation between physical fitness level and body mass index for students enrolled at the Faculty of Medicine, Indonesian Christian University.

1.2 Research Problem

The research problem is whether a relationship exists between physical fitness level and body mass index among students at the Faculty of Medicine, Indonesian Christian University Class of 2021.

1.3 Research Purposes

This research aims to determine the correlation between physical fitness level and body mass index in students at the Faculty of Medicine, Indonesian Christian University Class of 2021.

1.4 Benefits of Research

1.4.1 Benefits for health facilities

It is hoped that it will help and educate clinicians to be able to determine the patient's fitness condition with the Harvard Step Test and it is hoped that in the future it can be applied in primary health facilities.

1.4.2 Benefits to society

This research helps share explanations with the public so that it can be a means of education in maintaining and monitoring physical fitness by practicing the Harvard Step Test.

1.4.3 General research benefits

It is hoped that the results of this research can be used as a reference in developing this research further, and It is hoped that the Harvard Step Test can become a reliable test for testing physical fitness

2. MATERIALS AND METHODS

2.1 Material

2.1.1 Definition of physical fitness

The level of physical fitness can be assessed based on an individual's ability to carry out daily activities without feeling tired. Physical fitness is generally associated with an individual's capacity and ability to perform routine tasks consistently, efficiently, and effectively over a long period without experiencing fatigue, thereby enabling them to maintain their energy to engage in additional activities [10]. Physical fitness refers to the ability to carry out daily activities with energy and attention. Therefore, individuals can maintain sufficient energy levels to engage in recreational activities and manage unexpected crises effectively without experiencing excessive fatigue [11]. If a person can perform his daily tasks with high efficiency and minimal fatigue. Individuals demonstrate a good level of physical fitness. A person can still derive pleasure from their leisure time [12].

2.1.2 The physical fitness test uses the harvard step test

The Harvard Step Test is a cardiovascular endurance assessment that evaluates the physiological capacity of the heart and lungs. This assessment can measure an individual's aptitude to sustain prolonged physical activity without experiencing fatigue. Participants were instructed to climb up and down the bench at a height of 40 cm. Participants were instructed to perform a series of repetitions on a bench, alternating between up and down movements, for five minutes. This exercise continues until the respondent reaches a state of exhaustion, rendering them unable to participate further in the test. Fatigue occurs when the respondent cannot maintain his stride for 15 seconds. After the respondent sits down and the test is completed, their pulse will be counted within 1, 2, and 3 minutes [13,14]. There are many examples of terminology, such as cardiorespiratory endurance, cardiovascular endurance, aerobic power, cardiovascular endurance, cardiorespiratory endurance, and aerobic fitness, which have the same definition [15,16].

The Harvard Step Test classification or what can be called the physical fitness index (IKJ) is divided into 3, namely poor ability, moderate ability, and good ability [17,18].

2.1.3 Body mass index

Body Mass Index (BMI) is a widely used approach to assess an individual's weight status and potential health problems. This involves calculating an individual's BMI by dividing their body mass in kilograms by the square of their height in meters. Additionally, body mass index (BMI) is a direct, economical, and non-intrusive approach. Body Mass Index (BMI) fails to account for variations in muscle mass and body fat distribution [19,20].

According to the World Health Organization (WHO), the classification of body mass index (BMI) consists of five categories. These categories are as follows: underweight, indicated by a BMI of less than 18.5; normal body weight, indicated by a BMI ranging from 18.5 to 22.9; overweight with associated risks, indicated by a BMI ranging from 23 to 24.9; class I obesity, indicated by a BMI ranging from 25 to 29.9; and class II obesity, indicated by a BMI equal to or greater than 30 [21].

Table 1. Harvard step test classification

Classification	Score
Poor Ability	<50
Moderate Ability	50 - 80
Good Ability	>80

Table 2. BMI classification

Classification	BMI
Underweight	<18,5
Normal Body Weight	18,5 – 22,9
Being Overweight with Risks	>23 – 24,9
Obesity I	25 – 29,9
Obesity II	≥30

2.2 Methods

2.2.1 Research design

The research design used in this study was observational with a cross-sectional approach.

2.2.2 Place and time

This research will be carried out at the Laboratory of the Faculty of Medicine, Indonesian Christian University on December 14 2022

2.2.3 Population and sample

The research focused on the student population of the Indonesian Christian University Faculty of Medicine who were actively registered in the Class of 2021.

This research used a portion of the 138 students currently registered at the Faculty of Medicine, Indonesian Christian University Class of 2021 which was calculated using a sample formula, namely the Slovin formula. After calculating using the Slovin formula, the required sample was 57 people. The chosen methodology uses a non-probability approach, specifically using a consecutive sampling design to determine people from the population who meet certain conditions as samples.

2.2.4 Inclusion and exclusion criteria

Inclusion Criteria

a. Active student at the Faculty of Medicine, Indonesian Christian University Class of 2021
b. Willing to do research
c. Aged 18-21 Years
d. Male and female gender

Exclusion Criteria: There were no exclusion criteria in this study.

2.2.5 Data collection

Before taking the test, participants are given a pre-test briefing that covers the protocol and related aspects related to the Harvard Step Test. The experimental procedure involved traversing a 40 cm platform or ladder cyclically, synchronized with a metronome set at intervals of 120 beats per minute. The above process is carried out continuously until the respondent's strength decreases, provided that the duration of the process does not exceed 300 seconds. The test is considered invalid if the execution of the steps is not in sync with the rhythm of the metronome or if the participant experiences a fall during the process of setting up and lowering the bench. The Indonesian Christian University laboratory will be used to carry out measurements.

2.2.6 Data analysis

2.2.6.1 Univariate analysis

Univariate analysis aims to explain the attributes of each variable evaluated through the use of frequency distribution tables.

2.2.6.2 Bivariate analysis

Bivariate analysis uses cross-tabulation as a tool to test potential correlations or relationships between two variables, especially the independent variable and the dependent variable. This research uses the Pearson statistical correlation coefficient to analyze research data. The chi-square test is a statistical method used to determine the significance of the relationship between categorical variables. A correlation is considered significant when the p-value is less than 0.05, indicating a statistically significant association between two dependent variables. When the p-value exceeds 0.05, this indicates that no statistically significant correlation was obtained between the two variables under consideration

3. RESULTS AND DISCUSSION

3.1 Results

This research aims to see whether or not there is a relationship between the level of physical fitness and the Body Mass Index (BMI) of students at the Faculty of Medicine, Indonesian Christian University Class of 2021. The research was conducted on December 14 2022 at the UKI FK Laboratory. This research sample was taken using the Slovin formula method and the results obtained were 57 people. The results of the analysis from this research are as follows.

3.1.1 Univariate analysis: Distribution of respondents based on body mass index (BMI)

Frequency Distribution Based on Body Mass Index can be presented in Table 3:

Based on the frequency data in Table 3, it can be seen that the BMI frequency distribution of 2021

FK UKI student respondents is dominated by students with a normal weight classification, 31 people (54.4%). Obesity I was 12 people (21.1%), Underweight was 6 people (10.5%), Overweight was 4 people (7.0%) and Obesity II was 4 people (7.0%).

3.1.2 Univariate analysis: Frequency distribution of physical fitness

The frequency distribution of respondents based on the results of the physical fitness test using the Harvard Step Test is presented in Table 4:

3.1.3 Bivariate analysis: Relationship between physical fitness and body mass index

The results of bivariate analysis using the chi-square test to see whether there is a relationship between body mass index and physical fitness are presented in Table 5.

Based on the data from the analysis in Table 5, it can be seen that the Chi-Square calculation results obtained (p=0.740) which can be interpreted as meaning that the relationship between physical fitness level and BMI is not proven to be related where the value shows >0.05.

3.2 Discussion

Based on research that has been conducted regarding the relationship between physical fitness level and Body Mass Index (BMI) among 57 students at the Faculty of Medicine, Indonesian Christian University Class of 2021, calculated using the Slovin formula, it is known that the average age of the students used as a sample is 19 years, the average body mass index is 25.25 kg/m2, and the average physical fitness as measured through the Harvard Step Test regarding the Physical Fitness Index (IKJ) score is 44.12.

Furthermore, the Body Mass Index (BMI) of each student was categorized into five different groups, namely underweight, normal, overweight, obesity level I, and obesity level II. A total of 6 people (10.2%) showed a BMI that was included in the thin category, while 31 people (54.4%) were classified as having normal weight. In addition, 4 people (7.0%) were categorized as overweight, 12 people (12.1%) were classified as obese group I, and 4 people (7.0%) were classified as obese group II.

Table 3. Frequency distribution based on body mass index

BMI Classification	Number of Respondent	Percentage (%)
Underweight	66	10.3
Normal Body Weight	31	54.4
Being Overweight with Risks	4	7.0
Obesity I	12	21.1
Obesity II	4	7.0
Total	57	100

Table 4. The frequency distribution of respondents based on the results of the physical fitness test using the harvard step test

Physical Fitness Classification	Number of Respondent	Percentage (%)
Poor Ability	44	77.2
Moderate Ability	8	14.0
Good Ability	5	8.8
Total	57	100

Table 5. The results of bivariate analysis using the chi-square test to see whether there is a relationship between body mass index and physical fitness

Chi-Square Tests			
	Value	**df**	**Asymptotic Significance (2-sided)**
Pearson Chi-Square	5.165[a]	8	.740
a. 23 cells (92.0%) have an expected count of less than 5. The minimum expected count is .07.			

The physical fitness of students at the Faculty of Medicine, Indonesian Christian University Class of 2021 was measured using the Harvard Step Test and the results of the Physical Fitness Index (IKJ) were obtained. Next, each student is grouped into groups based on their level of physical fitness, namely: low, medium, and high. There were 44 students (77.2%) in the low group, 8 students (14.0%) in the medium group, and 5 students (8.8%) in the high group. This shows that students at the Faculty of Medicine, Indonesian Christian University, Class of 2021, have poor physical fitness on average.

The findings of this research, as determined by the Pearson chi-square correlation test, obtained a significance value (p) between physical fitness level and Body Mass Index (BMI) of (p=0.740). This shows that the level of physical fitness and Body Mass Index (BMI) are not related. A 2023 study in India by Chinmoyee Baruah Hazra et al. revealed a significant relationship between physical fitness and Body Mass Index (BMI), as assessed through the Harvard Step Test experiment, and the calculation of Body Mass Index (BMI) [22,23].

This research is in line with a previous study conducted in 2021 by Aprianto D et al. which examined the correlation between body mass index and the level of physical fitness among staff at the Ministry of Health. This study used the Pearson Chi-square correlation test to examine the relationship between Body Mass Index (BMI) and the level of physical fitness of Ministry of Health employees. The analysis findings show that there is no significant correlation between BMI and physical fitness level (p=0.159) [24,25].

The differences between the two studies can be influenced by several factors, one of which is the number of samples used, the samples used by Chinmoyee Baruah Hazra et al. had as many as 100 while in this study there were only 57 people, and apart from that, according to Aprianto D et al. [25]. Activities before the pre-test can also influence the results of this test. One of the obstacles in this research is the absence of measurements of various variables that could potentially influence the results of this test. For example, factors such as daily exercise intensity and level of physical activity can influence a person's physical fitness. Apart from that, lifestyles such as smoking, genetic heredity, nutrition, and pre-test student activities can also influence the results of this research.

4. CONCLUSION

Based on the research results, it can be concluded that Body Mass Index does not have a significant relationship with Physical Fitness. This is proven by the results of bivariate analysis with a p-value = 0.740 > sig 0.05.

5. SUGGESTION

It is recommended that future researchers carry out additional investigations, using more accurate and comprehensive measurement tools, to evaluate potential confounding variables, such as physical activity and exercise, which influence the amount of physical fitness and can also add a pre-test questionnaire before conducting the Harvard experiment. Step Test. Apart from that, efforts are also needed to improve physical fitness, which is one way to involve yourself in sustainable and rhythmic sports activities that involve most of the body's muscles. Examples of such activities include running, swimming, and gymnastics.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc) and text-to-image generators have been used during writing or editing of manuscripts.

CONSENT AND ETHICAL APPROVAL

It is not applicable.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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