



## Original Article

## Correlation between Body Mass Index and Cardiovascular Fitness of Volleyball Athletes at Athletes Training Center during the Covid-19 Pandemic

Syamsuryadin<sup>1,\*</sup> , Suharjana<sup>1</sup> , Ambardini Rachmah Laksmi<sup>1</sup> , Mahendra Wahyu Dewangga<sup>1</sup> , Andy Sirada<sup>2</sup> , Shodiq Hutomono<sup>3</sup>, Nuruddin Priya Budi Santoso<sup>3</sup>

<sup>1</sup>Department of Sport Science, Faculty of Sport Science, University of Negeri Yogyakarta, Indonesia

<sup>2</sup>Department of Physiotherapy, Faculty of Health Sciences, University of Pembangunan Nasional Veteran Jakarta, Indonesia

<sup>3</sup>Department of Coach Education, Health and Recreation, Faculty of Education, University of Tunas Pembangunan Surakarta, Indonesia

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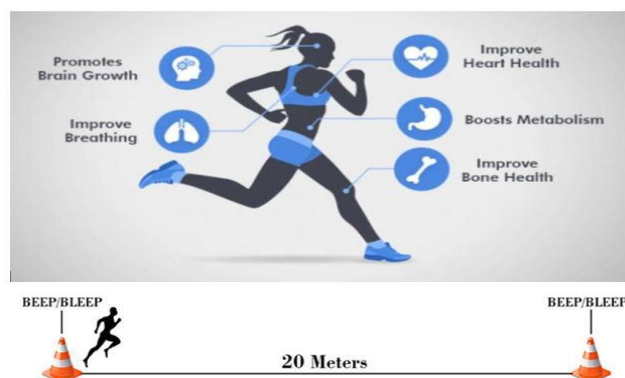
## KEYWORDS

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## ABSTRACT

The COVID-19 pandemic has harmed all sectors, including athletes. Since the COVID-19 pandemic in Indonesia, all activities have been subject to restrictions. The rules of working from home, studying from home, and closing some public facilities make all aspects of this difficult. The athletes' training center is also one of the negatively affected places. Of course, this will impact the decrease in the achievement of athletes due to changes in physical activity, body mass index, and cardiovascular fitness levels. This study aims to determine the correlation between body mass index and cardiovascular fitness levels of volleyball athletes during the COVID-19 pandemic at the Sleman Athlete Training Center, Yogyakarta Special Region of Indonesia. This research is an observational study with a cross-sectional design at the Sleman Regional Athlete Training Center, conducted in September 2021. The sample size is 40 athletes, consisting of 20 male and 20 female athletes. The cardiopulmonary fitness level was measured using a multistage fitness test. The analysis uses the chi-square test to see the relationship between body mass index and cardiovascular fitness level. The results demonstrated no relationship between body mass index and the cardiovascular fitness level of volleyball athletes at the Sleman Athlete Training Center, with a significance value of  $p=0.484$ . This study concludes that there is no correlation between body mass index and cardiovascular fitness levels in volleyball athletes at the Sleman Regional Athlete Training Center during the COVID-19 pandemic.

## GRAPHICAL ABSTRACT



\* Corresponding author: Syamsuryadin

✉ E-mail: [syamsuryadin.2020@student.uny.ac.id](mailto:syamsuryadin.2020@student.uny.ac.id)

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## Introduction

The COVID-19 pandemic has negatively impacted all worldwide circles [1]. The COVID-19 virus is also the cause of the highest death rate right now [2]. The policy of maintaining distance, commonly called "social distancing," is carried out to limit community interaction and prevent the transmission of the COVID-19 virus [3]. The COVID-19 pandemic has also impacted decreasing physical activity in the community [4]. In addition, this policy of distancing is also implemented by several athlete centers. This can have an impact on the level of physical fitness in athletes. Almost all athletes in various sports have been affected by the COVID-19 pandemic. One of the impacts is the cessation of all sports competitions [5]. The termination of this competition will greatly affect the quantity of training for all athletes who are competing, including volleyball athletes.

The lack of a training schedule caused by the COVID-19 pandemic carried out by the team to maintain and improve physical fitness is feared to reduce the optimal condition of athletes when the competition starts again [6]. Even with the negative impact caused by reducing the training schedule, there is a decrease in the athlete's fitness level, uncontrolled athlete's weight, and decreased athlete's ability [7].

Physical fitness can be interpreted as the body's ability to maintain and adjust physiological functions to conditions efficiently without being tired so that they can still carry out other activities [8]. The components of physical fitness related to health (health-related fitness) are muscle strength, endurance, flexibility, cardiorespiratory endurance, and body composition. Of all these components, the most important one is cardiorespiratory endurance [9]. The most effective measure of cardiorespiratory endurance is to assess a person's VO<sub>2</sub>max [10].

Body mass index (BMI) is one of the factors associated with VO<sub>2</sub>max. Body mass index (BMI) is a simple way to monitor adults' nutritional status, particularly those related to being underweight or overweight (obesity) [11]. According to WHO, body mass index (BMI) can be

classified into five categories, including bodyweight underweight with a BMI score of 18.5. Body mass index (BMI) of 18.5-22.9. Being overweight with a BMI of 23-24.9. Obese bodyweight I with a BMI of 25-29.9 and obese bodyweight II with a BMI greater than 30 [12].

The author is a Sleman Regional Athlete Training Center volleyball team coach. The author made observations related to physical fitness during the COVID-19 pandemic. Therefore, researchers are interested in conducting a study that aims to determine the relationship between body mass index (BMI) and cardiovascular fitness levels in volleyball athletes of the Sleman Regional Athlete Training Center during the COVID-19 pandemic.

## Martials and Methods

This research is a descriptive-analytic study with a cross-sectional design. The population of this research is volleyball athletes from the Sleman Regional Athlete Training Center. Sampling was done by purposive sampling of as many as 40 people. There are two research variables: BMI as the independent variable and cardiovascular fitness as the dependent variable. BMI data was collected using a test method, and anthropometric status was measured with scales and a microtoise [13]. Fitness level, especially in cardiovascular endurance through the Multistage Fitness Test. A cardiovascular fitness check will be carried out at the resumption of training in early September 2021.

**Table 1:** Body mass index category

Category	BMI Score
Underweight	<18.5
Normal	18.5-22.9
Overweight	23-24.9
Obesity I	25-29.9
Obesity II	>30

A cardiovascular fitness test using the Multistage Fitness Test with the following equipment: cadence tape for running back and forth, running track, cassette player (tape recorder), beep rhythm, and outdoor or indoor space marked with a distance of 20 meters on the surface [14]. Subjects were asked to run according to the back and forth track according to the rhythm of the

played beep. Furthermore, the data is entered into the beep test calculator application to determine the level of cardiovascular fitness.

Data from the research variables were then analyzed using the chi-square test.

**Table 2:** Categories of multistage fitness test

Category	VO2Max Score	
	Male	Female
Very Good	>57	>49
Good	52-56	44-48
Enough	44-51	35-43
Less	39-43	29-34
Very Less	<38	<28

**Results and Discussion**

Of the 40 respondents, there were 20 (50%) male and 20 (50%) female respondents, according to Table 3.

**Table 3:** Gender characteristics of respondents

Gender	Frequency	Percentage (%)
Male	20	50%
Female	20	50%
Total	40	100%

Of the 40 respondents divided into 20 respondents aged 17 years. For female respondents were male, and 20 were female, respondents were male, and 20 (50%). There are 4 respondents aged 15 years in the male respondents. 6 respondents aged 16 years, and 10

respondents aged 17 years. For female respondents, there are 1 respondent aged 13 years, 5 respondents aged 14 years, 4 respondents aged 15 years, 6 respondents aged 16 years, and 4 respondents aged 17 years.

**Table 4:** Age characteristics of respondents

Age	Male		Female	
	Frequency	%	Frequency	%
13 y.o	0	0	1	5%
14 y.o	0	0	5	25%
15 y.o	4	20%	4	20%
16 y.o	6	30%	6	30%
17 y.o	10	50%	4	20%
Total	20	100%	20	100%

Of the 40 respondents divided into 20 respondents were male, and 20 were female, respondents were male, and 20 (50%). There are 2 respondents with underweight body mass index, 15 respondents with normal mass index, 3

respondents with obese body mass index I. In female respondents, there are 13 respondents with normal body mass index, 5 respondents with a body mass index of overweight, 2 respondents with a body mass index of obesity I.

**Table 5:** Characteristics of respondents' body mass index

BMI	Male		Female	
	Frequency	%	Frequency	%
<i>Underweight</i>	2	10%	0	0%
Normal	15	75%	14	70%
Overweight	0	0%	4	20%
Obesity I	3	15%	2	10%
Obesity II	0	0%	0	0%
Total	20	100%	20	100%

Of the 40 respondents divided into 20 respondents were male, and 20 were female, respondents were male, and 20 (50%). There are

4 respondents with sufficient cardiovascular fitness level in the male respondents. There are 7 respondents with cardiovascular fitness levels.

There are less than 9 respondents with very poor cardiovascular fitness levels. In female respondents, there are 2 respondents with a sufficient level of cardiovascular fitness, 16

respondents with a low level of cardiovascular fitness, 2 respondents with a deficient level of cardiovascular fitness.

**Table 6:** Cardiovascular fitness

VO2Max Score	Male		Female	
	Frequency	%	Frequency	%
Very Good	0	0%	0	0%
Good	0	0%	0	0%
Enough	4	20%	2	10%
Less	7	35%	16	80%
Very Less	9	45%	2	10%
Total	20	100%	20	100%

In respondents who have an underweight BMI, there is 1 respondent with a low fitness level and 1 respondent with a deficient fitness level. There are 6 people with adequate cardiovascular fitness levels, 15 respondents with fewer fitness levels, and 8 respondents with very few fitness levels. In respondents who have an overweight BMI, there are 4 respondents with a low level of cardiovascular fitness. In respondents who have

BMI Obesity I, there are 3 respondents with fewer fitness levels and 2 respondents with significantly fewer fitness levels. The analysis results with chi-square get a value of  $p = 0.484$ . This result proves that there is no correlation between body mass index and the level of cardiovascular fitness of the Volleyball athletes at the Sleman Regional Athlete Training Center.

**Table 7.** The relationship between BMI and cardiovascular fitness

BMI	Cardiovascular Fitness Level					Total	P Value
	Very Goog	Good	Enough	Less	Very Less		
Underweight	0	0	0	1	1	2	0.484
Normal	0	0	6	15	8	29	
Overweight	0	0	0	4	0	4	
Obesity I	0	0	0	3	2	5	
Obesity II	0	0	0	0	0	0	
Total	0	0	6	23	11	40	

The results of this study indicate that the level of physical fitness of athletes who take part in training at the athlete's training center in the Sleman area is more than 80% in the less and less category. Meanwhile, those who fall into the sufficient category are only around 10%. This condition is concerning, considering that the athlete must be prepared for the competition that they will face. This illustrates that during the COVID-19 pandemic, athletes did not carry out physical exercise activities, so their fitness level decreased. Physical fitness is essential for an athlete, so it is necessary to develop and maintain a person's physical fitness as an athlete [15]. Physical fitness is an essential factor in a person. In today's era, people and athletes must realize how vital activities are in good sports in sports

education for achievement and health [16]. In this study, athletes must be aware of and understand their physical fitness state. Good physical fitness can make athletes participate in training or carry out competitions with a sense of enthusiasm to fight to give good and very satisfying results. So, with the exemplary achievements that have been achieved by an athlete, the sense of wanting to exercise, and a sense of increasing physical fitness in each athlete, they want to add to the training load, which is getting heavier and heavier [17].

Based on table 7, almost 60% of athletes have a normal body mass index. These results illustrate that the weight of the majority of athletes is ideal and indicates that adequate nutrition is sufficient. However, this is the opposite. The statistical test

results show no relationship between body mass index and the level of cardiovascular fitness of athletes who are members of the Athlete Training Center with a p-value of 0.484. There were no respondents with a low level of cardiovascular fitness in nearly 80% of the sample. There are respondents with a body mass index who are underweight, overweight, and obese, and there are no respondents with a good level of physical fitness. There is no relationship between BMI and cardiovascular fitness; it can be caused by the activities carried out by athletes during the COVID-19 pandemic [18].

Because physical activity can stimulate muscle contraction, When a muscle contracts, muscle contractile protein synthesis proceeds much faster than the rate of destruction, resulting in the actin filaments and the myofibrils themselves breaking down within each muscle fiber into hypertrophy. The hypertrophied fiber results in an increase in the components of the phosphagen metabolic system, including ATP and phosphocreatine. This increases the ability of the aerobic and anaerobic metabolic systems to increase energy and strength. In addition, it can be caused by several factors, including heredity, nutritional factors, and physical activity. Nutritional status is influenced by two factors, namely direct factors, and indirect factors. Direct factors include infectious diseases and food intake, while indirect factors such as education, knowledge, skills, and food security are related to meeting food needs. Even though heredity and nutritional factors can cause thinness, if you are active regularly, you can get fit because, with regular activities, your heart's workload will be reduced [19]. In addition, it can also be influenced by several reinforcing factors, namely socio-economic factors. Income is the essential factor in determining the quality and quantity of food, and there is a close relationship between income and nutrition. Low income will affect food demand so that it determines the dishes in the family in terms of food quality, the number of meals, and the variety of dishes [20].

At a glance, from the results of these two studies, on the one hand, the cardiovascular fitness of athletes is in the poor category, while, on the

other hand, the athlete's BMI is in the normal category. The results of this study show that there is a condition that describes the absence of a linear relationship between poor physical fitness and the ideal condition of an athlete's body weight during the COVID-19 pandemic. By adjusting the diet, a person can achieve the ideal body weight. However, it does not necessarily mean that their physical fitness is also in good status. For this reason, the researcher recommends that athletes continue to practice programming at home or do physical exercises with coaches online using media zoom, Google Meet, or others. This is necessary to achieve good fitness and maintain an ideal body mass index.

### **Conclusions**

Based on the results and discussion above, it can be concluded that there is no correlation between body mass index and cardiovascular fitness in volleyball athletes who are members of the Sleman Regional Athlete Training Center. Researchers advise athletes and coaches to continue to carry out physical exercise activities during the COVID-19 pandemic on a regular, measurable, and programmed basis. This is done so that athletes still have good cardiovascular fitness and remain ready for the upcoming competitions.

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### **Authors' contributions**

All authors contributed toward data analysis, drafting and revising the paper and agreed to responsible for all the aspects of this work.

### Conflict of Interest

The authors have no conflicts of interest relevant to this article.

### ORCID:

Syamsuryadin Syamsuryadin

<https://www.orcid.org/0000-0003-3422-2528>

Suharjana Suharjana

<https://www.orcid.org/0000-0003-0984-8086>

Rachmah Laksmi Ambardini

<https://www.orcid.org/0000-0001-9687-3866>

Mahendra Wahyu Dewangga

<https://www.orcid.org/0000-0002-2777-268X>

Andy Sirada

<https://www.orcid.org/0000-0002-6733-7244>

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