



## Percentage Of Body Fat Related With Functional Capacity In Young Adults

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### ABSTRACT

**Introduction.** The percentage of body fat is a component of body composition in addition to bone mass, muscle mass, and body water content related to obesity. Diseases caused by an increase in body fat will have an impact on decreasing the body's functional capacity, disability, and death. Maximum Oxygen Volume (VO2 max) refers to the maximum amount of oxygen that humans can use during physical activity. It is usually used to test aerobic endurance or cardiovascular fitness so that VO2 max can describe a person's functional capacity. Percentage of body fat can affect VO2 max. Based on data from the Sports Development Index (SDI) in Indonesia, 43.9% of young adults have a poor VO2 max. This study aims to determine whether or not there is a relationship between body fat percentage and functional capacity in young adults. **Methods.** The study used a cross-sectional method and was followed by 92 respondents throughout October and November 2022. Bioelectrical Impedance Analysis (BIA) is used to measure body fat percentage. The 6-minute Walk Test is used to measure VO2 max. **Results.** The results of the study showed that the bivariate analysis of the Fisher's Exact test obtained a significant relationship between body fat percentage (measured by BIA) and body functional capacity (VO2 max) ( $p=0.028$ ). **Conclusion.** There was a significant relationship between body fat percentage through BIA measurements and functional capacity in young adults.

### 1. Introduction

Functional capacity is a person's ability to take in maximum oxygen also called VO2 max. Maximum Oxygen Volume (VO2 max) refers to the maximum amount of oxygen that humans can use during physical activity. VO2 max is the result of calculating the cardiac output and oxygen in the veins and arteries which describes a person's aerobic endurance to carry out activities.<sup>1</sup> Functional capacity can be measured by measuring VO2 max. Factors that can affect VO2 max include age, gender, lung & heart function, exercise, genetics, abdominal circumference, body fat percentage, and a person's nutritional status (determined by BMI).<sup>2</sup> In Indonesia, 43.9% of young adults have a poor VO2 max and 37.4% have a very poor VO2 max.<sup>3</sup> VO2 max is one of the important factors in cardiovascular health. Age is related to a decrease in VO2 max, one of the reasons is that there is a decrease in the level of physical activity with age so aerobic endurance decreases. Storen et al said that there was a decrease in VO2 max of 1% per year. there will be an increased risk of decreasing VO2 max levels during old age.<sup>4-6</sup> The

composition of the human body consists of extracellular fluid, bone, fat, and muscle cells. The combination of these four components at a perfect level will achieve a perfect balance of body composition.<sup>7</sup> Fat is one of the components of the body that is very influential on health. Obesity is one of the effects of increasing high levels of fat in the body.<sup>8-10</sup> An increase in body fat will cause disease that can reduce functional capacity, and disability, and even increase the risk of mortality. Body fat needs to be assessed, this is an effort to prevent the occurrence of metabolic syndrome due to obesity.<sup>11</sup> Bioelectrical Impedance Analysis (BIA) is a common and widely used method of measuring body fat percentage. Measurements using BIA are often carried out because they are easy and quite accurate.<sup>12</sup>

Based on a study conducted by Schnurr TM et al stated that there was a relationship ( $p=0.0034$ ) between the percentage of body fat and VO2 max.<sup>13</sup> Meanwhile, Demirkan E et al stated that there was no relationship ( $p>0.05$ ) statistically between the percentage of body fat with VO2 max.<sup>14</sup> Previous

studies have had different conclusions, so researchers are interested in conducting further research to find out whether or not there is a relationship between body fat percentage and functional capacity in young adults.

## 2. Methods

This research is a cross-sectional study conducted in October - November 2022. This study was followed by 92 respondents aged 18 - 25 years. Respondents who used walking aids had a history of asthma, chronic lung, and heart disease, anemia, and were on long-term glucocorticoid treatment were excluded.

### **Functional Capacity**

The functional capacity of the body is assessed by measuring the respondent's VO<sub>2</sub> max. A 6-minute walking test (6MWT) was performed to assess VO<sub>2</sub> max. The procedure for the 6-minute walk test is as follows: The walking track was a meter wide and 15 meters long, marked by a cone at the end where the subject made a U-turn. The midline was observed every 50 cm to determine the final walking position quickly. The test procedure allows the subject to walk continuously on the track for 6 minutes. Subjects are instructed to stop walking when the time is up and put a mark where the subject stops. These results are then used to calculate the VO<sub>2</sub> max prediction with the following formula:<sup>15</sup>

$$\text{VO}_2 \text{ Max} = 0.053 (\text{distance}) + 0.022 (\text{age}) + 0.032 (\text{Body height}) - 0.164 (\text{Body Weight}) - 2.228 (\text{sex}^*) - 2.287$$

Notes: VO<sub>2</sub> max in kg/b.w/min, Distance in meters, Age in years, Body height in cm, Bodyweight in kg, Sex: male = 0 and Female = 1

Interpretation :

1. Poor: <15 ml/ kg/b.w/min
2. Average: 15,1 – 30 ml/ kg/b.w/min
3. Good: 30,1 – 37,5 ml/ kg/b.w/min
4. Excellent : > 37,6 – 45 ml/ kg/b.w/min

### **Body Fat Percentage**

In this study, the percentage of body fat was measured using Bioelectrical Impedance Analysis (BIA): a digital scale (brand: KOVA Body Scale Smart). Subjects were asked to stand on the scales in an upright position to measure total fat.

Interpretation

1.Fair:

Male:11 - 14%

Female: 16 - 19%

2.Normal:

Male: 15 - 18%

Female: 20% - 25%

3.Overweight:

Male: 19% - 24%

Female: 26% - 29%

4.Obese:

Male: 25 - >25%

Female: 30 - >30%

Data analysis used in this study is univariate and bivariate analysis. Univariate analysis was used to analyze the variables studied by explaining the characteristics of each variable. The results of the data are expressed in percentages and presented in tabular form. Bivariate analysis is used to determine the relationship between body fat percentage and functional capacity. The collected data were processed in Microsoft Excel and then analyzed using the Fisher's Exact test through the Statistical Software Package for Social Sciences version 27 (SPSS v.27) program. This research has received ethical approval from the Health Research Ethics Committee, Faculty of Medicine, Universitas Trisakti (No:78//KER-FK/VII/2022).

## 3. Results

### **Characteristics of Research Respondents**

Based on the results of the univariate analysis provided in Table 1, it was observed that the majority of participants, 57.6% or 53 individuals, were female. Moreover, a significant proportion of the participants, 66.3%, had a fair-normal range of body fat percentage. In terms of functional capacity, it was found that the VO<sub>2</sub>max results categorized 89.1% of the participants as being in the poor-average category. Based on the study findings (Table 2), it has been established that the respondents' body fat percentage is 22.16% on average. Likewise, the average VO<sub>2</sub> max level, which is 21.61 ml/kg/b.w/min, has also been determined.

### **Body Fat Percentage Relationship with Functional Capacity**

Based on the data presented in Table 3, it can be concluded that 95.1% of the respondents had a fair to normal body fat percentage and poor-average functional capacities. Meanwhile, the remaining 4.9% of the respondents had good - excellent functional capacities. Furthermore, out of the respondents with overweight - obese body fat percentage, 77.4% had poor - average functional capacity, while 22.6% had good-excellent functional capacity.

The results of the Fisher's Exact test indicate a significant relationship between body fat percentage and functional capacity in young adults, with a probability value of 0.028 ( $p=0.028 < 0.05$ ). This suggests that body fat percentage may have a significant impact on the functional capacity of young adults.

**Table 1. Characteristics of research respondents (n = 92)**

Characteristics	Frequency (n)	Percentage (%)
Gender		
Male	39	42,4
Female	53	57,6
Body Fat Percentage (BIA)		
Fair - Normal	61	66,3
Overweight - Obese	31	33,7
Functional Capacity (VO2max)		
Poor - Average	82	89,1
Good - Excellent	10	10,9

**Table 2. Distribution of body fat percentage and VO2max based on gender**

Gender		Body Fat Percentage (BIA) (%)	VO2max (Functional Capacity) (ml/ kg/b.w/min)
Male	Mean	17,325	24,179
	N	39	39
	St. Deviation	4,77597	5,41039
Female	Mean	25,718	19,713
	N	53	53
	St. Deviation	4,578	4,44222
Total	Mean	22,160	21,606
	N	92	92
	St. Deviation	6,236	5,33147

**Table 3. Relationship of body Fat Percentage (BIA) with Functional Capacity (VO2max)**

Characteristics	Functional capacity (VO <sub>2</sub> max) (ml/ kg/b.w/min)		Total n(%)	p-value
	Poor - Average	Good - Excellent		
	n(%)	n(%)		
Body Fat Percentage				
Fair - Normal	58 (95,1)	3 (4,9)	61 (66,3)	.028*
Overweight - Obese	24 (77,4)	7 (22,6)	31 (33,7)	

#### 4. Discussion

Based on the findings of this study, it appears that women tend to have higher body fat percentages than men. This is due to the fact that women have increased fat stores in certain areas of the body, such as the upper arms, breasts, and hips. In addition, it was observed that women generally have lower VO<sub>2</sub> max levels compared to men. This is because their total volume of circulating red blood cells tends to decrease, leading to a lower maximum capacity to deliver oxygen to muscles. It should also be noted that age can also affect VO<sub>2</sub> max levels. Starting at age 20, there is a gradual decrease that continues until age 55, where there is a significant drop of 27% compared to age 25.

Moreover, it was discovered that the majority of participants in the study, specifically 66.3% or 61 out of 92, had a fair-normal body fat percentage. Young adults were also observed to fall into this category, most likely due to their balanced energy source from food intake and physical activity. Urban

young adults were found to engage in moderate physical activity, which could contribute to their fair-normal body fat percentage.

The average VO<sub>2</sub> max in young adults is 21.61 ml/kg/min which is included in the average category. Most of the young adults aged 18-25 years are students and workers. they often spend their time sitting in front of gadgets to study and work so they rarely do regular exercise.<sup>16</sup>

In this study, 82 people (89.1%) had a poor-average VO<sub>2</sub> max. the average VO<sub>2</sub> max in adolescents is 21.61 ml/kg/min which is included in the average category. Most of the young adults aged 18-25 years are students and workers. they often spend their time sitting in front of gadgets to study and work so they rarely do regular exercise.<sup>16</sup>

In this study, it was found that there was a relationship between the percentage of body fat (BIA) and functional capacity with a value of p = 0.028 (p <0.05), the higher the percentage of body fat, the lower a person's VO<sub>2</sub> max. VO<sub>2</sub> max is not

only influenced by body fat percentage but also by physical activity which is one of the important factors and greatly affects a person's functional capacity.<sup>17</sup> The results of a previous study conducted by Huldani et al said that there was a significant relationship between the percentage of body fat and VO<sub>2</sub> max with a value of  $p=0.013$ , where the percentage of body fat in the overweight-obese category had a lower VO<sub>2</sub> max value than people with a normal body. In obese people, it will be more difficult for them to move causing tissue fat to increase. This fatty tissue can ultimately inhibit the functional capacity of the body's cardiorespiratory system.<sup>2</sup>

## 5. Conclusion

There was a significant relationship between body fat percentage through BIA measurements and functional capacity in young adults.

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