THE EFFECT OF BODY COMPOSITION ON PHYSICAL FITNESS IN PEOPLE WITH OBESITY

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Abstract

The aimed of study to investigate the effect of body composition on physical fitness of adults with obesity. This study applied a cross-sectional design and it involved 80 adults aged 30-45 years consisting of 46 men (12.79±0.38) and 34 women (12.77±0.46). The BMI mean scores of male and female subjects were (24.41±5.55) kg/m2 and (21.64±4.98) kg/m2 based on fitnessgram test and validated PAR-Q questionnaire. None of the subjects had moderate, good, or very good physical fitness levels. Most of the subjects have a low physical fitness level. The increase of BMI will decrease the physical fitness level.
Keywords: body composition, physical fitness, obesity

INTRODUCTION

At present, the prevalence of obesity in adults is increasing sharply throughout the world. The prevalence in Indonesia in the last three decades has increased from 14.8% to 21.8% (Kesehatan et al., 2019). Adults often experience dramatic changes in body composition that affect physical activities and responses to exercises. There is an increase in bone size and muscle mass and changes in the size of the distribution of storage of body fat (Greenway & Pekarovics, 2012). Moreover, low physical fitness is thought to be a precursor to mortality in adults, whereas moderate physical fitness levels show a protective effect on several predictors of mortality such as smoking, hypertension, and hypercholesterolemia (Gutin et al., 2002). Based on the result of a study conducted by the Indonesian Ministry of Health, 41.5% of adults have moderate physical fitness, while 41.1% have weak physical fitness level (Kesehatan et al., 2019).

One way to determine obesity is to use the Body Mass Index (BMI). BMI can describe excessive body fat. It is simple and can be used in large-scale population research. The measurement only requires two aspects, namely body weight and height, both of which can be done accurately by someone with a little practice (Greenway & Pekarovics, 2012). Given the importance of physical fitness in adults and the increasing trend of obesity prevalence in Indonesia, studies need to be conducted on the relationship of obesity to physical fitness levels in Indonesia. It seems that the number of such studies is still limited. This study was conducted to determine the relationship of the body mass index to the level of physical fitness along with its components.

MATERIALS and METHODS

Study design dan Participants

The design of this study was cross-sectional. Eighty subjects consisting of males (46 men (35.79±3.38)) and females (34 women (34.77±3.46)) at the Universitas PGRI Semarang and STIKes Muhammadiyah Gombong in Central Java Province were recruited via e-mail and the researchers also distributed flyers in both universities (Table 1).

Inclusion criteria covered obese aged 30-38 years old with BMI category of ≥ 25-29.9 (World Health Organization, 2000). Not suffering from muscular and bone defects, heart disease, asthma triggered by physical activity or not suffering from a severe illness that requires hospital care and not taking drugs that affect body composition; as in Cushing's syndrome, type I diabetes mellitus, hypothyroid. Each participant completed a PAR-Q (Adams, 1999) and physical activity and health record questionnaires before initiating the study. The participants were given a detailed explanation regarding the purpose and procedure of this study and then they voluntarily signed an informed consent form.

Table 1: Characteristics of participants

Variable	Men (n=46)	Women (n=34)
Age (Years)	35.79±3.38	34.77±3.46
Height (cm)	160.97±1.35	151.28±1.29
Weight (kg)	67.58±1.61	60.69±1.66
BMI (kg/m2)	28.41±2.41	27.64±1.04
Hb (g/dl)	14.74±0.65	13.74±0.88
Physical activity		
Active	60.87%	48.75%
Not active	39.13%	51.25%
Exercise		
Yes	17.39%	16.25%
No	82.61%	83.75%

Outcome measures

The weight of the subjects was measured to the nearest 0.1 kg with an electronic scale (Tanita BWB-800S, Tanita Corporation, Tokyo, Japan) and they were required to wear light clothes. Meanwhile, the height was measured to the nearest 0.5 cm using a portable stadiometer (SECA 214, Seca Corporation, Hanover, MD). Both anthropometrics were conducted barefoot. BMI was calculated as [weight (kg)/height2 (m)]. Participants wore tight spandex clothes and a swim cap to ensure accurate measures of body volume. Any metal, such as jewelry and eyeglasses was removed.

Physical fitness

Physical fitness levels were assessed using the fitnessgram test (Plowman & Mahar, 2013). The speed assessment used a 50 m sprint test and the collected data were the best required time to perform this activity and it was expressed in seconds with 0.1-second sensitivity. The assessment of muscle explosive strength was measured using a long jump ice test without a prefix and the results obtained were the furthest leaps measured from the jump start line to the closest point of the heel touch on the ground and it was expressed in centimeters with 0.1 cm sensitivity. The assessment of static strength and endurance of arms/shoulders was differentiated by sex. Men were assessed by tests depending on body weight and the number of movement passing the poles during the test. In women, it was assessed by a test depending on bending the elbow and the results showed the required time from the first time the subjects did it until they could not do it again, expressed in seconds with 0.1-second sensitivity. The agility was assessed by running back and forth of 4x10 meters and the collected data were the best time required to do this activity and it was expressed in seconds with a sensitivity of 0.1 seconds. The abdominal muscle endurance was assessed by a 30-second bed rest test and the results showed the number of sitting beds done for 30 seconds. The flexibility was assessed by the shape of the bowel to the front and the results obtained were the best scale achieved by both subjects' fingertips and expressed in cm with a sensitivity of 0.1 cm. The result was considered positive if the scale was below the bench surface but it was considered negative if it was higher than the bench surface. The cardiorespiratory was assessed by running for 800m (for females) and 1000m (for males) and the collected data were the required time to do this activity, expressed in minutes with 0.1-minute sensitivity. The Hb level was measured by the Cyanmethemoglobin method using a standardized autoanalyzer in gram/dl with 0.1 sensitivity. Examinations were performed by nurses and experts in a laboratory in the laboratory.

Data analysis

The data were analyzed using SPSS for Windows 21.0 program. The relationship between BMI and physical fitness level was analyzed by the Spearman correlation test because the BMI normality test showed an abnormal distribution. Data transformation was done to normalize the BMI data which were not normally distributed but the results also showed abnormal distribution. The correlation values were considered good (r>0.8), moderate (0.6-0.79), weak (0.4-0.59), and very weak (<0.4-0.56). The relationship between physical fitness level and

Hb level and age were analyzed by the Spearman correlation test. The relationship between physical fitness level and physical activity, training, and gender were analyzed by the Lambda correlation test.

RESULTS

There was a negative correlation between BMI and physical fitness level which showed that the higher the BMI the lower the level of physical fitness. The correlation value of males (r=-0.666) was stronger than females (r=-0.442). Based on the fitnessgram test, 48 subjects showed a very weak level of physical fitness. Most males showed a very weak level of physical fitness (58.7%). Most female subjects showed a very weak level of physical fitness (61.8%) (Table 2).

Based on the correlation test, there was no correlation between physical fitness level and physical activity, Hb level, age, sex, and exercise (p>0.05) (Table 3).

Table 2: Result of physical fitness test

FITNESSGRAM	Men (n=46)	Women (n=34)
Speed	10.15±1.60	11.04±1.15
Muscle explosive strength	150.15±33.20	125.18±26.72
Static strength and endurance of arms/shoulders	0.07±0.25	1.58±3.87
Agility	12.72±1.62	13.56±1.12
Endurance of abdominal muscles	14.70±7.99	13.68±5.44
Flexibility	0.00±8.64	2.68±7.27
Cardiorespiration	8.51±1.95	6.79±1.11

Table 3: Physical fitness on confounding variables

Variable	r	P
Physical activity	0.282	0.43
Exercise	0.061	0.186
Hb level	0.176	0.077
Gender	0.143	0.207
Age	0.11	0.922

DISCUSSION

In this study, 86.49% of people with obesity had weak physical fitness level. None of the obese has a good level of physical fitness. However, 72% of non-obese also have weak physical fitness level. This shows that most subjects have low physical fitness levels. It shows a negative relationship between BMI and physical fitness level in which the higher the BMI the lower the level of physical fitness.

A positive relationship between BMI and cardiorespiratory endurance which is assessed through the long-distance running test. This means that the higher the BMI, the longer the required time for running. The long-distance running test can assess cardiorespiratory fitness which is the most important component of physical fitness. It is consistent with a study conducted in Birmingham which found a negative correlation between cardiorespiratory fitness and increased fat tissue (Greenway & Pekarovics, 2012). In addition, Fisher et al. (2015) found that there was a correlation between BMI and VO2max which indicates cardiorespiratory fitness for females but not for males. Fisher et al. (2015) state that there was a significant negative correlation between aerobic fitness and the increase rate of fat tissue. Based on the overall relationship between BMI and various components of physical fitness, it is found that the correlation value is higher in males than that of females. It might be because males generally have better physical fitness than women. There is a big difference in terms of fat loss responses to exercise between males and females.

CONCLUSION

To improve physical fitness some efforts including reducing the Body Mass Index need to be done through a continuous and rhythmic exercise that involves most of the body's muscles, such as swimming, running, and gymnastics. Further research is needed with more appropriate instruments to assess confounding factors such as physical activity and exercise that affect physical fitness levels.

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