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Abstract

One of the most often utilized measures in calculating body proportion criterion is the BMI. The goal of this study is to see if there is a link between BMI and glucose levels in students who are given virtual physical activity. A high sedentary lifestyle is thought to be linked to the high prevalence of metabolic disorders among students. A rise in BMI or waist circumference levels indicates that a person may be at risk for a variety of metabolic disorders as a result of body mass index. An experimental study was utilized to investigate if there was a difference in the respondents' body mass index and waist circumference before and after the intervention. Before and after the treatment, there were significant variations in waist circumference (76.921.51 vs 74.651.47 cm, p0.001) and BMI (23.540.76 vs 23.050.77 cm, p0.001). Furthermore, with a value of r=0.895 and p0.001, there is a high link between BMI and waist circumference.

Key word: body mass index, waist circumference, exercise, sedentary life, obesity

Introduction

More than 2.1 billion people in the world have gained weight, accounting for roughly 30% of the worldwide population. 2019 (Blüher) The Body Mass Index (BMI) calculation is one way that can be used to determine ideal body weight. BMI is calculated by multiplying weight (kg) by height squared (meters). The BMI numbers obtained are not affected by age or gender. The BMI can be used to evaluate how much a person's weight can put them at risk for specific diseases. (Karchynskaya and colleagues, 2020) According to various research, rising body weight leads to an increase in waist circumference. This could be attributed to a buildup of central fat. Our bodies store fat in two places: the central area and the visceral area. Diabetes, diabetes mellitus, hypertension, heart and blood vessel disease, and the metabolic syndrome are all linked to central obesity. As a result, determining obesity requires not just calculating BMI but also determining the kind of obesity. BMI and waist circumference measures are suggested by the American Heart Association for determining body fat. Another anthropometric approach that is more precise in evaluating body fat distribution and has a strong link to morbidity and death is waist circumference. Waist circumferences of 94-102 cm in men and 80-88 cm in women are linked to a moderate risk of metabolic syndrome, whereas values of 102 cm in men and 88 cm in women are linked to a higher risk. A rise in weight in young adults has been linked to an increased risk of diabetes in numerous studies. As a result,

both of these examinations, BMI and waist circumference, must be performed when calculating body fat in connection to the possibility of disease. (Koseoglu and colleagues, 2020)

According to certain research, a sedentary lifestyle can raise the risk of metabolic disease due to increasing body weight and glucose levels. A sedentary lifestyle is one in which a person's daily physical activity falls below the recommended level. A person who leads a sedentary lifestyle frequently neglects physical activity and engages in low-energy pursuits. This can happen to groups that have a tendency to go through the motions passively, such as students. Data on the degree of physical activity of medical students is still relatively low, according to research performed at the Faculty of Medicine, Universitas Brawijaya (60 percent). It can be noticed that students are mostly responsible for the present trend of time shifting by sitting idly in front of a computer screen. 2021 (Nugraheni et al.) Living a sedentary lifestyle causes a person to be extremely busy at work, preventing them from exercising. Light physical activity reduces energy output, resulting in an energy imbalance where energy input exceeds energy output. As a result of the lack of energy that leaves the body, the remaining energy is stored as fat, causing the person to gain weight and become obese. According to a study, persons who live a sedentary lifestyle are more likely to become obese (Dumith et al., 2011) Body fat, cholesterol, and triglycerides have all been demonstrated to be reduced by physical activity and exercise. As a result, someone who has a proclivity for obesity can exercise on a regular and structured basis. It is required to intervene in physical activity in the form of an exercise program that is in accordance with good, proper, quantifiable, and regular standards in order to encourage medical students in behaving in a healthy and active manner. Yang and colleagues (Yang et al., 2018). The American College of Sports Medicine (ACSM) and the American Heart Association (AHA) have come together to encourage structured physical activity based on frequency, intensity, kind, and duration.

2021) (Alshammari). As a result, in this study, a virtual 12-week physical exercise intervention will be given to Uhamka Medical Faculty students in order to determine the relationship between waist circumference before and after the intervention, as well as to see if there is a correlation between body mass index (BMI) and waist circumference.

Method

This is an experimental study with the goal of determining the changes in BMI and waist circumference before and after the intervention, as well as the relationship between BMI and waist circumference. The study was conducted in the Uhamka Medical Faculty's area.

Total sampling was used to calculate the sample size. FK Uhamka was used to conduct the sampling. Studentss, between the ages of 18 and 20, were the study's subjects. The research subject has signed a written agreement to be the topic of research for scientific objectives. The formula for calculating BMI is weight (Kg) divided by height in meters squared (m2). The World Health Organization (WHO) guidelines are used to calculate BMI (Gaw, 2012). When determining the presence of central obesity, the WHO suggests examining the pelvic circumference rather than calculating the ratio of waist circumference to hip circumference.

If a person's waist circumference is greater than 90 cm in men or 80 centimeters in women, they are said to have central obesity. This means that if a person's hip circumference is bigger than the range of values listed above, the likelihood of developing a disease is increased. Bioelectrical Impidance Analysis (BIA), as well as a filled-out form with the respondent's consent signature, are used to calculate BMI.

Results

Karakteristik	Deskriptif	CI 95%
Jenis kelamin Pria, n(%)	8 (20%)	1,67 - 1,93
Wanita, n(%)	32 (80%)	18,04 – 18,56
Usia, mean (min-max) IMT	18 (17 – 20)	
kurang	7 (17,5%)	
normal	19 (47,5%)	21,99 – 25,08
berlebih	10 (25%)	
obese	3 (7,5%)	71,6 – 77,6
Lingkar Pinggang, mean (min-max)	74,65□1,47	

The number of male research subjects as many as 8 people (20%) while 32 female subjects (80%). So the total number is 40 people. The subjects of this study were people aged 17¬-20 years. From the data obtained based on BMI, it was found that 47.5% of the respondents were in the normal BMI category, while the BMI was 17.5% underweight, 25% overweight and 7.5% obese. As for the abdominal circumference after the intervention, the average was 74.65 cm.
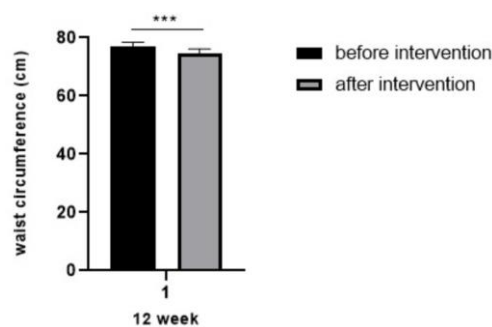

Figure 1 shows a significant decrease in waist circumference of research subjects between before and after the intervention (76,92□1,51 vs 74,65□1,47 cm , p<0,001)

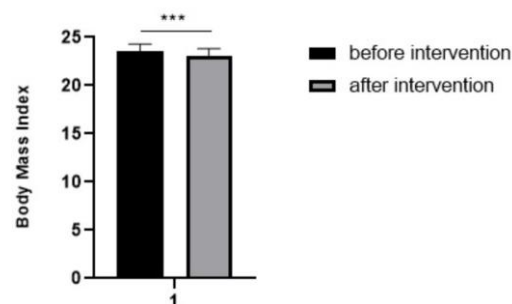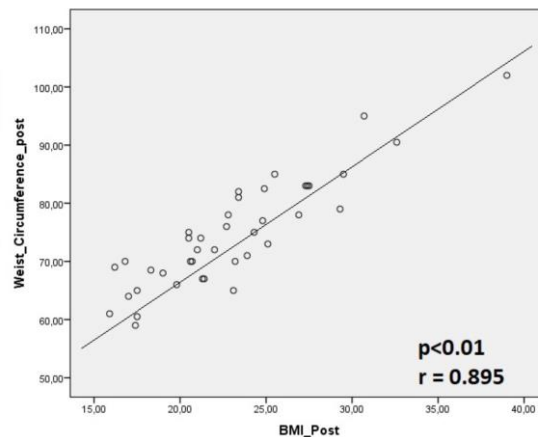
Figure 2 shows a significant decrease in BMI of the research subjects between before and after the intervention (23,54□0,76 vs 23,05□0,77 cm , p<0,001)

Based on Figure 3, by looking at the significant value, it is obtained that there is a strong correlation between BMI and abdominal circumference (r = 0.895; p<0.001)

Discussion

In this study, it was discovered that regular physical activity can lower BMI and improve health conditions. This is in line with the findings of Yang et alstudy. .'s (Yang et al., 2018). Physical exercise programs have been shown to be useful as a preventive strategy and treatment for a variety of chronic diseases. Obesity prevention requires physical activity. (Johnson and colleagues, 2015) The underlying molecular mechanism involves the activation of PGC-1, a master regulator of mitochondrial biogenesis in skeletal muscle, during the metabolic adaptation of skeletal muscle to physical exercise.

An increase in the ratio of adenosine monophosphate to adenosine triphosphate (AMP/ATP) causes an increase in the activation of AMP-activated Protein Kinase (AMPK), which then increases the expression and activation of PGC-1. AMPK plays a crucial role in the suppression of adipose tissue inflammation. In the liver, greater AMPK activation resulted in enhanced fatty acid oxidation. Furthermore, an increase in reactive oxygen species (ROS) promotes the activation of Mitogen Activated Protein Kinases (MAPK), which leads to an increase in PGC-1 production and activation. PGC- 1 is then involved in the regulation of transcription of related genes that increase skeletal muscle oxidative capacity while decreasing muscle glycogen usage. (Gureev and colleagues, 2019)

When it comes to energy metabolism, skeletal muscles get the majority of their energy from lipid oxidation at rest. Lipids and glucose are equally oxidized by actively contracting skeletal muscles during moderate-intensity physical activity. The main source of energy for skeletal muscle during high-intensity physical activity is glucose. The decrease in the transport and oxidation of free fatty acids is directly proportional to the rise in the intensity of physical exercise. Because the rate of utilization of free fatty acids falls below the basal value during high-intensity physical exercise, the energy supply of contracting muscles is predominantly based on muscle glycogen and blood glucose.

After a few hours, muscle glycogen depletion returns to normal, triggering a higher amount of lipid oxidation in the 24 hours following high- intensity exercise compared to moderate-intensity exercise. (Mendes and colleagues, 2019) Physical activity has an impact on the aging of adipose tissue. Adipose tissue has been shown to be more dynamic than previously considered in recent investigations. When energy intake is low, white adipose tissue stores energy in the form of triglycerides, which are then released when energy intake is high. Brown adipose tissue has a higher number of mitochondria and plays a larger role in energy production in the form of heat. The Cannon/Nedergaard group discovered a third form of adipose tissue dubbed beige/brite adipose tissue in their research.

This adipose tissue combines the features of white and brown adipose tissue, allowing it to serve as a lipid storage and thermogenesis site. A beiging/browning procedure is used to create this beige adipose tissue (Stanford et al., 2015) Several stressors, such as cold stimuli and physical exertion, might cause this browning process. The browning process involves the transformation of white adipocytes into beige adipocytes. According to Santoso et al research, .'s physical exercise can impact this process by activating the protein irisin, which then activates AMPK (Santoso et al., 2021)

Recommended physical exercise protocols to improve or improve overall physical health and fitness profiles include a combination of intensity and frequency of exercise. Research by Castillo et al. in 22 obese men showed that a combination program of aerobic and resistance exercise maintained plasma irisin levels, in terms of preventing the decrease in plasma irisin levels caused by obesity. Therefore, in this study it was suggested that the possibility of physical exercise with a higher frequency of exercise was more effective in increasing lipid oxidation. High-intensity physical exercise causes a faster decrease in ATP, compared to moderate-intensity physical exercise. This in turn causes an increase in the AMP/ATP ratio, thereby activating AMPK in skeletal muscle. (Gasparrini et al., 2016) AMPK in skeletal muscle acts as an energy sensor and subsequently works as an enzyme that works to restore energy homeostasis. The role of AMPK involves phosphorylation of MEF2, which then works to increase the expression of PGC-1α. This combined exercise program causes a decrease in waist circumference and body fat percentage and a decrease in levels can act as a preventive line for metabolic disorders. triglycerides and glucose are significant in obese individuals. In addition, it was found that there was a negative correlation between irisin levels and the variables of waist circumference, triglycerides, and glucose. (Castillo-Quan, 2012)

Based on the results of statistical tests using the Spearmen correlation test, it shows that there is a significant relationship between body mass index and waist circumference with a p-value of 0.000 (p<0.01) and a correlation coefficient of 0.894. Body mass index is closely related to the degree of fat tissue. In this study, it was seen that the decrease in BMI was in line with the decrease in the abdominal circumference of the sample. This is because, to assess the degree of fat tissue, waist circumference measurements can be carried out because fat accumulation is around the central pelvis. Waist circumference is said to have a high correlation with the amount of intra-abdominal fat. Intra-abdominal fat tissue consists of visceral fat or fat. Visceral fat is an accumulation of intra-abdominal fat (central obesity) that is stored under the skin deeper than subcutaneous fat. The increased secretion of inflammatory mediators seen in visceral fat in obese individuals reflects ongoing chronic inflammation in the individual's fat tissue. Body weight, BMI, waist circumference, body fat, viscelar fat have a significant relationship with insulin resistance (Aydın et al. ., 2020) According to Paley et.al, exercise can reduce visceral fat accumulation and increase liver metabolism. (Paley & Johnson, 2018)

Conclusion

Physical exercise for 12 weeks can reduce BMI and waist circumference in FK Uhamka students

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