

Effects of dose response and 5 weeks of exercise on abdominal circumference and BMI in obese women

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ABSTRACT

Being overweight, which results in a large belly circumference, is often overlooked, despite the fact that belly fat accumulation can endanger health. The purpose of this study was to determine the effect of changes in abdominal circumference and BMI after giving tabata training for 16 meetings. This study is a quasi-experiment that employs a one-group pre-test post-test group design with a population of all Powerfit Daru members and a total sample of 15 using a purposive sampling technique with sample criteria of having an abdominal circumference > 80 cm, being 25-40 years old, and being obese. The obtained data were processed using IBM SPSS version 26 and the paired T-test. The results showed that the average decrease in pre-test and post-test abdominal circumference was (94.86 8.79; 90.46 8.85) with a P value of 0.005 0.05. The results showed that the average change in BMI was 30.51 2.18; 29.96 2.65, with a P value of 0.418 > 0.05. The average decrease in abdominal circumference was -4.4 cm, and the BMI was -0.54 kg/m². The conclusion of this study was that there was a significant decrease in changes in abdominal circumference with tabata exercise for 5 weeks of treatment but no significant decrease in BMI.

Keywords: Bodyweight training; fat burning; abdominal circumference; obesity

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INTRODUCTION

Obesity is now often encountered in the community, especially in the circumference of the stomach. The pathogenesis of obesity includes two things, namely, that energy intake exceeds energy expenditure, and the second is the main barrier to obesity (Mannino et al., 2022). Beyond that, there are factors of high caloric intake, environmental influences, as well as genetic and epigenetic factors. Obesity is also common among teenagers and mothers, many of whom find it difficult to lose weight even though their desire is very high. This phenomenon has several public complaints, including the fact that it is very easy to become obese for those who do not maintain their weight on a regular basis. Obesity is referred to as a collection of excess

fat that can interfere with health (Umeh, 2021). The BMI itself is a simple index of weight and height that can be used to measure the classification of overweight and obesity risk in adults. Sumanty et al. (2018) argue that a lack of physical activity can cause food substances that enter the body to be unprocessed, which will cause fat accumulation in the body. This condition has a significant impact on the occurrence of various diseases, including diabetes, which is directly related to obesity. According to Rikesdas Kemenkes RI (2018), the 2018 data on overweight was 13.6% and obesity (BMI > 27.0) was 21.8%. The lowest was in East Nusa Tenggara Province at 10.3%, and the highest was in North Sulawesi Province at 30.2%. while central obesity in 2018 was 31.0% with an indicator of abdominal circumference for women > 80 cm and men > 90 cm (Kemenkes RI, 2018).

Opinion of Paulina and Yuniar (2022) that dissatisfaction with the body is a subjective negative evaluation of the individual against his body parts, which at present is a problem that is very much considered by society. Santoso (2019) also explains that in carrying out life in society, sometimes the demand to have an ideal body shape is one of the factors of dissatisfaction that greatly affects the person's condition. As a result, many adult women blame the situation and refuse to engage in activities that benefit the body. Physical appearance is one of the first things seen when interacting with other people; therefore, it is not surprising that everyone pays attention to their physical appearance (Sumanty, 2018). The abdominal circumference can be used as an important reference to determine body fat. Assessing levels with body mass and fat distribution is an option for meeting several needs, including clinical needs, because the measurement of a disease is not only determined by measuring body weight (Romanholo et al., 2018). The measurement of the waist and abdomen is marked by the size that lies between the last rib and the iliac crest at its smallest limit (Chaves & Reis, 2018). Abdominal circumference was measured from the midpoint of the lower rib margin and the right and left iliac crest bones and then measured horizontally using a measuring tape. According to IDF (International Diabetes Federation) criteria, the cutoff point for abdominal circumference as a determinant of central obesity is Europe > 94 cm male > 80 cm female, Japan > 85 cm (male and female), Asia and China > 90 cm male > 80 cm female (Siahaan et al., 2017).

There are several obesity terms today, such as abdominal obesity, percentage body fat, abdominal adiposity, and predictor of obesity (Ahmad et al., 2016). There are two types of obesity that are often encountered, namely generalized obesity and abdominal or central obesity. Sari (2016) mentions that obesity, especially abdominal obesity, is a risk factor for cardiovascular disease. Castro et al. (2017) Obesity also causes serious health consequences and triggers degenerative diseases that can lead to morbidity and mortality due to the accumulation of excess fat in adipose tissue. There are two types of abdominal fat, namely subcutaneous fat and visceral fat (Haryati, 2013). Fat that is above the abdominal muscles is called subcutaneous fat, which serves to bind the skin tissue with the organs below. While fat that is close to internal organs such as the kidneys, liver, and intestines is called visceral fat, Visceral fat is fat stored in adipose tissue in the abdomen (abdominal cavity area), often referred to as organ fat or intra-abdominal fat (Nurmalasari & Hayatuddini, 2018).

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One of the efforts of sports efforts that can be done among the community is light exercise, especially to maintain body fitness. Tabata is currently one of the most popular exercises Shilenko et al. (2020). This type of high-intensity exercise with 20-second intervals alternating with 10-second rest intervals. This is repeated

8 times for 4 minutes. The advantage of the tabata workout is that it is more efficient and takes no more than 45 minutes (Rosdiana & Imanudin, 2020). This exercise is important and needed for people who have a solid time. Strength training has various types of exercises such as weight training, this weight training can improve body composition, strength development, muscle hypertrophy, and motor performance (Caminha et al., 2017). According to studies, aerobic exercise can increase metabolic, endocrine, and hormone-binding processes (Kiani et al., 2020). The amount of work undertaken is sometimes not balanced with the rest period, and this causes people to rarely set aside time to exercise because they are tired of carrying out their work roles in society (Widiantini & Tafal, 2014). When the body lacks physical activity, the calories contained in the food that enters the body accumulate into fat deposits, this happens when there is no burning through sports activities (Puspitasari, 2017). These impacts can trigger the emergence of degenerative diseases. The decrease in the level of physical activity that occurs in the community is related to the level of economic loss due to high health costs due to obesity and overweight (Kuswari et al., 2022).

Doing a lot of exercises has a direct impact on good fitness compared to a sedentary person who just sits still all day (Juliansyah et al., 2021). Improving physical ability can provide maximum fitness achievement by going through a proper training process. Exercise has three meanings: practice, exercise, and training (Ismadraga & Lumintuarso, 2015). practice that aims to improve skills by using tools. Exercise aims to improve the quality of the body's organ systems so that it is easier to perfect the movement. Training aimed at ensuring that the exercise is carried out in accordance with the material, method, and intended target. The FITT concept can be used by the community to train one's fitness (Adi, 2021). Frequency is defined as the number of times a week a person does sports, the intensity of how hard a person's physical training activities are, the length of time the activity is carried out at one time, and the type of sport chosen. The amount of intensity depends on the type and purpose of the exercise; the more work that is done in a unit of time, the higher the intensity of the exercise (Ismadraga & Lumintuarso, 2015); time is the calculation of the duration needed each time to do the exercise; and type is the type of exercise.

Tabata training is a high-intensity interval training (HIIT) concept that is performed quickly (Tabata, 2019). A similar study from Shah and Purohit (2020) revealed that tabata training can reduce weight in middle-aged women. However, in the study of Shah and Purohit (2020), no comparison group was given, namely the control group. The existence of this group will serve as a clear comparison between the treatment group and the group without treatment. Therefore, this is one of the gaps that can be developed, as well as the reason why this research is important to do.

The main purpose of this study was to determine the effect of tabata exercises on women aged 25–40 years. This is done so that people, especially women in the Daru Powerfit Club, have an ideal abdominal circumference and avoid the accumulation of abdominal fat, which can endanger health and invite degenerative diseases.

METHOD

This study employs quantitative research in the form of a quasi-experimental research design with one group pre-test post-test to determine the change in values between before and after a group's treatment. The population in this study was all members of Powerfit Daru, totaling 60 people, and the subjects in this study were 15 people with obesity criteria. Powerfit Daru is an aerobics community where all members are female. The technique used in this study was a purposive sampling technique with criteria determined by the researcher, including inclusion criteria. in the form of a member of Powerfit Daru who is female, has a stomach width of more than 80 cm, is aged between 25 and 40 years old, has no history of injury, and is willing to be a subject.

The treatment carried out in this study used Tabata exercises to strengthen the abdominal circumference, which were carried out for 20 seconds of treatment and 10 seconds of rest for 4 minutes, which were carried out in 2 sets of exercises. The instrument used by researchers to determine abdominal circumference is a measuring tape, and they determine BMI using weight and height measurements.

The research procedure stage was carried out for 16 meetings, which took place at the Powerfit Daru studio with the concept of a day of treatment and a day of rest. In the initial stage, the researcher records the

identity of the prospective subject and gives an agreement sheet to be signed, provides direction for the activities to be carried out, prepares some research aids, and tries to maintain the confidentiality of the subject's identity, which will be shown to the person concerned at the end of the study. Implementation stage: the researcher measured the pre-test abdominal circumference and BMI of 15 subjects and explained the tabata movement that would be carried out for 16 meetings. The final stage: after carrying out the treatment, the researcher re-measured the post-test for abdominal circumference and BMI in the form of numbers and ended the study.

The results of the research obtained by the data will be processed with several prerequisite tests before determining the hypothesis. Testing the data makes it easier for researchers to obtain the desired results; therefore, the researchers tested the data with normality and homogeneity tests and paired T-Test correlation tests with the help of the IBM SPSS version 26 application.

RESULTS AND DISCUSSION

The data obtained in this study were tested by pre-analysis and hypothesis testing. The normality test was used to determine whether the obtained data were normally distributed or not, and the normality test was to determine whether the obtained data came from a homogeneous population. Subsequent testing uses hypothesis testing using the Paired T-Test, which is used to determine the effect of treatment before and after based on the results that exist in the members of Powerfit Daru. The following are the results of the pre-analysis and hypothesis testing:

Table 1. Normality Test

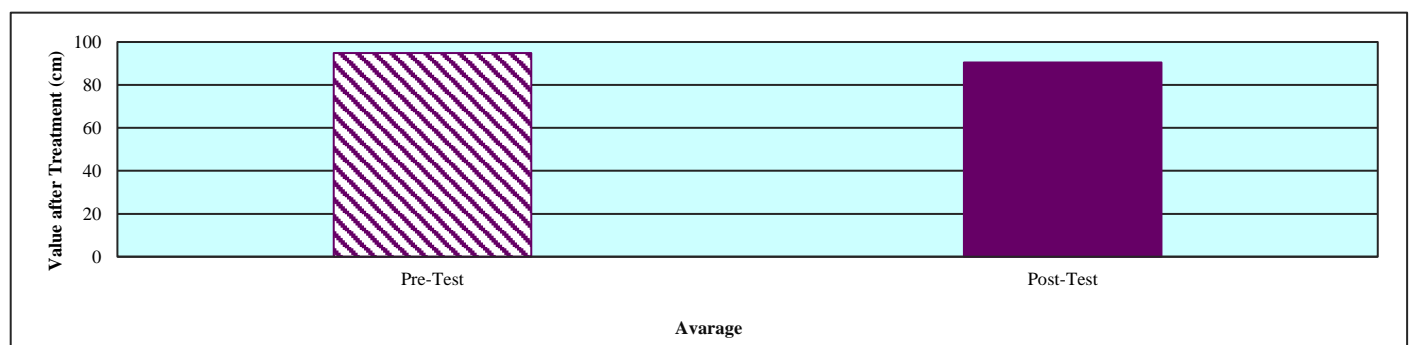
Variabel	n	P	
		Pre-test	Post-test
Abdominal Circumference	15	0,252	0,458
BMI	15	0,364	0,408

Table 1 shows the results of the data pre-analysis using Shapiro-Wilk, comparing the pre-test and post-test abdominal circumference and BMI. The results of the LP pre-test were $P = 0.458 > 0.05$. The results of the pre-test BMI were $P = 0.408 > 0.05$. These results can be concluded for the pre-test and post-test abdominal circumference, and the BMI normality test data is normally distributed.

Table 2. Homogeneity Test

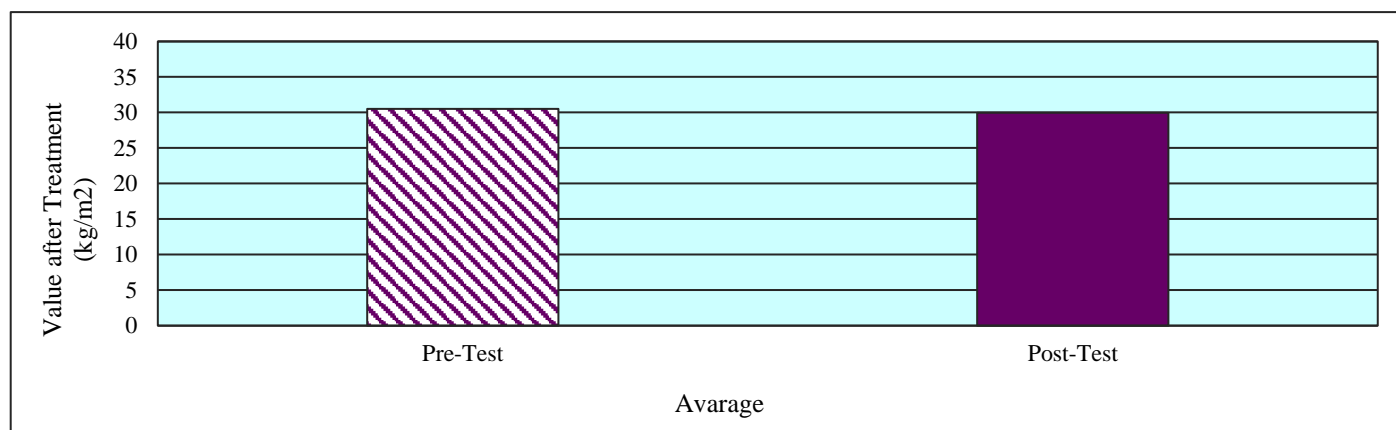
Variabel	n	P
Abdominal Circumference	15	0,874
BMI	15	0,955

Table 2 shows the results of the pre-analysis of data from the homogeneity test for abdominal circumference and BMI. Abdominal circumference got a value of $P = 0.955 > 0.05$. These findings show that the two variables of abdominal circumference and BMI have P values greater than or equal to 0.05, implying that the two data sets above are homogeneous.



Graph 1. Paired T-Test Abdominal Circumference

Graph 1 shows the results of the analysis test using the paired T-test to find out the comparison of the results before and after the measurement of abdominal circumference after treatment. The results of the pre-test abdominal circumference were 94.85 8.79 cm, and the post-test abdominal circumference was 90.46 8.85 cm (P value = 0.005 0.05), giving a difference between the pre-test and post-test average abdominal circumference of -4.4 cm. These results indicate that there is a significant difference between the pre-test and post-test measurements of abdominal circumference in the Powerfit Daru treatment group. This result is consistent with the hypothesis that there is an effect of tabata training on decreasing abdominal circumference in Powerfit Daru members.



Graph 2. Paired T-Test BMI

Graph 2 shows the results of the analysis test using the paired T-test to find out the comparison of results before and after measuring BMI after treatment. BMI pre-test results Producing an average BMI of 30.51 2.18 kg/m² and a post-test of 29.96 2.65 kg/m², with a P value of 0.418 > 0.05, the difference between the pre-test and post-test was 0.54 kg/m². These results indicate that there is no significant difference between the pre-test and post-test measurements of BMI in the Powerfit Daru treatment group.

This study sought to ascertain the effect of tabata training on abdominal circumference reduction in Powerfit Daru members. Giving tabata training to Powefit Daru members uses a tabata count with 20 seconds of treatment and 10 seconds of rest. Tabata movements vary, especially in the abdomen, such as sit-ups, knee touches, crunches, and planks, which are repeated in two sets. The number of subjects in this study was 15 women, and they had an abdominal circumference of more than 80 cm. The subject was given the tabata exercise treatment for 16 meetings with the one-day exercise, one-day rest method. Measurements were carried out in two stages, namely the beginning before doing the tabata exercise and the end after the last meeting.

The results of the correlation test for abdominal circumference reduction seen from the pre-test and post-test measurements using the tabata exercise found the results of the significance of Sig. 2 tailed $P = 0.005$, which means that there is a significant difference in the effect between the pre-test and post-test of the abdominal circumference measurement of Powerfit Daru members. This result has an average reduction in abdominal circumference of 4.4 cm. The results of the correlation test for the decrease in BMI seen from the pre-test and post-test measurements using scales and height found a significant tail P value of 0.418, which means that there is no significant effect between the pre-test and post-test BMI measurements of Powerfit Daru members. This result has a difference of 0.54 kg/m² in the average decrease in BMI. The results of measuring the width of the abdominal circumference are adjusted to the average size of women > 80 cm and men > 90 cm (Ross et al., 2020).

The treatment group received tabata sit-ups, knee touch crunches, and planks 16 times in one month: four times in the first week, three times in the second week, four times in the third week, three times in the fourth week, and two times in the fifth week. The exercise has an impact on decreasing abdominal circumference for research subjects that have been determined by researchers. The results of the tabata exercise treatment have a positive impact because they lead to a decrease in the average abdominal circumference of 4.4 cm,

strengthen abdominal muscle endurance, and decrease BMI classification. According to [Meiriawati \(2013\)](#)'s research on abdominal muscle strengthening, sit-up exercises at 45, 90, and 120 degrees have a significant effect with a P value of 0.000, which means it is less than 0.05.

Excess fat levels in a person's body cause issues that must be addressed; many diseases will be suffered as a result of excess fat deposits in the body, which must be removed by burning fat. Fat burning can be used in a variety of sports, including taking advantage of body weight and maintaining a healthy diet and daily activity. One example of body-weight exercise is tabata sit-ups, knee touches, crunches, and plank exercises. Obesity is not far from several influencing factors such as age, gender, genetics, and physical activity ([Hendra, 2016](#)). Age is a central obesity factor that cannot be changed; increasing age will increase total body fat, especially the distribution of central fat ([Puspitasari, 2017](#)). Gender, central obesity is common in both men and women, but excess central fat is more common in women, and women control excess energy over stored fat. Women have estrogen, whereas men have testosterone, which explains why women have more body fat. According to [Barbosa et al. \(2022\)](#), understanding the interaction of different anthropometric systems and respiratory systems allows estimates for the development of physical exercise intensity. For men, excess fat energy is used in a protein metabolism machine. In women, energy storage as a result of the fat will contribute to a low ratio of fat-free tissue, which will decrease at the same rate as body mass.

Genetics is heredity in a family; a person's posture and body shape tend to be inherited. This is a real thing that genetic factors have interfered with in determining the number of fat cells in the body. Parents who have a fat body tend to have children who are fat too. Genes certainly affect the amount of fat stored in the body and where the body will process the extra fat ([Kurdanti, 2015](#)). A family often shares almost the same food and habits; therefore, the relationship between genes and the environment is mutually supportive. Physical activity and stress levels are factors that influence obesity other than fatty and excess foods, stress factors, smoking, alcohol, and nervous system disorders ([Sudikno et al., 2020](#)). [Allsabab et al. \(2022\)](#) Improved health and mood can also be achieved by doing physical activities that last approximately 30 minutes every day. Physical activity prevents a person from gaining excess weight and contributes to weight loss. Lack of activity can increase the risk of chronic disease. The decrease in abdominal circumference occurs due to the redistribution of adipose tissue, and the amount decreases according to the duration of exercise. Stress occurs because of the pressures of life that cause mental and physical conditions to be disturbed ([Hendra et al., 2016](#)). Some studies say that people experiencing stress can develop central obesity. This can happen because someone who is stressed tends to have an unhealthy lifestyle, such as eating and drinking irregularly, consuming sweet and high-fat foods, and ignoring exercise.

Burning fat with exercise is best when done using an existing exercise program. Fat burning is a dietary supplement that can help you burn fat. Fat loss is a process in which the body loses fat by burning it through sports activities ([Refat, 2019](#)). According to [Westerterp \(2019\)](#), weight loss is a loss of body weight that can be measured with a scale. Weight loss or overall weight loss refers to the loss of muscle, fat, and water. in contrast to fat loss, which is one way to lose weight by eliminating fat. Obesity is a serious problem in many developing countries, with a negative impact on economic growth ([Novitasary, 2014](#)). Similarly, general and central obesity has become a health issue in Indonesia due to the double burden of disease that has befallen Indonesian society ([Harbuwono et al., 2018](#)). The increasing prevalence of obesity in several cities in Indonesia has greatly influenced the development of the welfare of the Indonesian people, especially in the health sector. Along with the increasing years, such as now, which can be considered the millennial year, many new habits have emerged, such as methods of consuming instant food and different lifestyles that disregard health, making it easy for people to become obese. The body will accumulate fat, especially in women who do not exercise but eat more food. This is what really affects a person's health condition.

A similar study from [Shah and Purohit \(2020\)](#) used the method of tabata exercise for weight loss in middle-aged women in Ahmedabad. The result is a significant change in waist circumference and BMI. The initial waist averaged 35 inches and was reduced to 32.5 inches. while the average BMI is 28.2 kg/m² to 27.3 kg/m². The fundamental difference from the research above is the treatment movements that use sit-ups, knee touches, crunches, and planks. Almost the same number of samples were collected from 15-16 people aged 20-45 years, regardless of obesity status. The drawback of these two studies is the absence of a

comparison group, namely the control group. The existence of this group will allow a clear comparison between the treatment and no-treatment groups.

Research from Dondokambey et al. (2020) says muscles will not be the same over time; muscles develop best in the age range of 20 to 30 years, and over time the muscles will adapt to what we do and are likely to decrease if not trained. Training muscle strength does not have to be with weights and going to the gym (a fitness place), but there are many things that can be done, such as weight training exercises. BMI: weight in kilos divided by height in meters squared. an anthropometric method used to classify body weight and obesity (Chandrasekaran, 2018). BMI is directly related to total body fat, which can represent body fat levels (Pranata, 2019). In contrast, central obesity only uses the width of the abdominal circumference measured in centimeters. Central obesity occurs due to unhealthy lifestyles such as consuming alcohol, smoking, eating fatty foods, and having low consumption of vegetables and fruit. None of the members who became respondents did these activities, except for the low consumption of vegetables and fruit and the lack of a well-designed exercise program. This study refers to the BMI value and the width of the abdominal circumference of Powerfit Daru members to determine the difference after giving tabata training. In this study, Powerfit Daru members were still in the obese stage and had not been able to reduce the classification below. However, in reducing the average abdominal circumference, Powerfit Daru members experienced a good decrease after being given tabata training for 16 meetings.

According to Asil et al. (2014), there are several other factors that influence the increase in a person's BMI in the form of problems they are experiencing, such as divorce, which breaks the focus on body health, the loss of someone who can change roles in society, and it is also mentioned that housewives have a higher BMI than working women. The body will accumulate fat, especially in women who do not exercise but eat more food. This is what really affects a person's health condition.

CONCLUSION

The conclusion from the discussion above is that there is a decrease in abdominal circumference for Powerfit Daru members after being treated with Tabata exercises. There is a change in the BMI value of Powerfit Daru members after comparing the results of the pre-test and post-test after being given the Tabata exercise treatment, but the classification does not change. The limitation of this study is that it only knows the effect of Tabata exercise on reducing abdominal circumference and BMI. It is hoped that further researchers will add variables for abdominal circumference reduction and measure food recall during the study period so that the data obtained can be used by the public for additional references to abdominal circumference reduction, and there should be a comparison group that was not given the treatment.

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CONFLICT OF INTEREST

The author declared that there were no conflicts of interest in writing this article.

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