



## The Impact of 12 Weeks of Moderate-Intensity Aerobic Exercise on Reducing Obesity in Older Adults

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### Abstract

**Objective.** Obesity is a significant health concern that can affect individuals of all ages, including children and adults. The purpose of this study is to evaluate the effectiveness of 12 weeks of moderate-intensity aerobic exercise in reducing complex obesity levels in older individuals. The research methodology used in this study is experimental, with a one-group pre-post test design. The study was conducted in June-July 2023 at the Jakarta State University Sports Hall, located in Rawamangun, East Jakarta. Following the participants' completion of 12 weeks of moderate-intensity aerobic exercise, a post-test was administered, which included measuring their BMI.

**Materials and Methods.** The study involved 30 elderly participants who were obese. The sampling technique used was purposive sampling, with several criteria such as being male, aged between 55-65 years, having a body mass index (BMI) between 27-32 kg/m<sup>2</sup>, coming from a large family from the Faculty of Sports Science, Jakarta State University, and being willing to participate in research on the effects of moderate-intensity aerobic exercise for 12 weeks. The research aimed to determine the effects of moderate-intensity aerobic exercise for 12 weeks on reducing the level of complex obesity in elderly people.

**Result.** The research findings indicate that the 12-week program of moderate-intensity aerobic exercise, designed by researchers, is an effective approach to significantly decrease complex obesity in the elderly population. The results of the study demonstrate the potential benefits of engaging in regular physical activity to improve the health and well-being of older adults.

**Conclusion.** The study results indicate that engaging in aerobic exercise of moderate intensity, such as running on a treadmill, for 12 weeks can lead to a significant decrease in body fat and weight, thus promoting effective obesity reduction.

**Keywords:** Exercise, Intensity, Aerobics, Obesity

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**Introduction**

Obesity is a prevalent health issue that has a significant impact on people of all ages, ranging from children to adults. The condition is primarily caused by an unhealthy lifestyle, which can include a sedentary routine, poor dietary habits, and lack of physical activity. The consequences of obesity can be severe, leading to various health complications such as diabetes, heart disease, and high blood pressure. It is crucial to promote a healthy lifestyle and raise awareness about the importance of maintaining a healthy weight to combat obesity (Zhu, W., et al., 2023). Various methods can be used to prevent obesity, both through natural approaches and medical procedures such as surgery, and the level of success depends on the strong commitment of the individual undergoing it.

An obese body condition will certainly affect a person's performance in carrying out physical activities. Because an obese body condition will certainly not be able to move freely, and it is susceptible to injury to the legs. In the context of physical training for obese sufferers, achievement and health can be achieved through a combination of talent, proper nutritional intake, and an appropriate training program. This has a significant positive impact, especially on the elderly population. Elderly people need a good level of physical fitness so they can do physical exercise without feeling tired quickly (Bompa, T., & Buzzichelli, 2015). For optimal results, it is recommended that you engage in moderate-intensity aerobic exercise to improve your physical health. Jogging or running on a treadmill are both great options to achieve this goal.

As people age, it becomes increasingly important to maintain good physical fitness through regular exercise. This is true for both those who are already physically active and those who are not. However, seniors who engage in vigorous exercise often face the challenge of muscle fatigue, which can prevent them from fully recovering between workouts. This can impact their endurance levels and overall physical appearance. Additionally, many elderly individuals experience fatigue quickly during exercise (Nala, 2015).

There is currently no research that has investigated the effect of moderate-intensity aerobic exercise for 12 weeks on the activation of complex obesity reduction in the elderly. Additionally, there has been no research that examines appropriate acute physical exercise methods for people who are obese. Therefore, this study aims to test and determine the impact of moderate-intensity aerobic exercise for 12 weeks on the activation of complex obesity reduction in the elderly. The hypothesis of this study is that moderate-intensity aerobic exercise for 12 weeks is effective in activating complex obesity reduction in the elderly. The purpose of

this research is to assist students and the general public in selecting the most effective physical exercise methods to combat obesity in the elderly, allowing them to lead healthier lives.

From an epidemiological perspective, a person's level of obesity is measured using BMI (Body Mass Index), where the calculation involves a comparison of body weight (in kilograms) divided by height (in meters) squared. Women and men with a BMI between 18.5 and 22.9 are categorized as having a healthy weight. A BMI between 23 and 24.9 indicates overweight, while a BMI above 25 indicates obesity (this calculation does not apply to the elderly, pregnant women and children because BMI does not reflect the distribution of fat deposits in the body).

Biological factors that cause obesity involve genetic factors and inherited diseases (Klissouras, V., et.al, 2020), dysfunction of certain parts of the brain such as the hypothalamus and peripheral signal saturation, metabolic factors or the rate of calorie burning in the body, and the number of fat cells in the body (Kim et al., 2023). Psychological factors that play a role in obesity include emotional, behavioral, environmental and physical training/sport aspects (Saunders, L. A., et.al, 2023). The process of losing weight in obesity should not be done drastically, just 5-10% in 3-6 months (Peruzzaro, 2019), and the speed of weight loss in adults is around 1-4 kilograms per month (Al-Khelaifi, 2020). Losing weight can be done by eating healthier, working out more, taking medicine or trying acupuncture.

Obesity can be treated with a weight loss program that involves a nutritionist, endocrinologist, or psychiatrist. The program begins with a safe weight loss target of around 3% -5% of the total body weight. In this program, experts provide patients with advice on how to change their diet and physical exercise. However, these changes must be tailored to the patient's overall health condition and level of obesity (Shiraseb, F., et.al, 2023).

If dietary adjustments and increased physical activity do not lead to weight loss, doctors can prescribe weight loss medication to help patients. However, weight loss medication is only given to patients whose BMI (Body Mass Index) is above 30 or who have comorbidities such as diabetes, high blood pressure, or sleep apnea. Orlistat and liraglutide are two examples of weight loss drugs that can be prescribed. Before prescribing any medication, the doctor will review the patient's medical history and consider the potential side effects of the drug. The doctor will also monitor the patient's condition while taking the medication.

One of the actions given by doctors to treat people who are obese is to carry out surgery aimed at reducing weight, known as bariatric surgery. This operation will change the digestive system by limiting food intake to reduce calorie absorption. Patients undergo bariatric surgery if they have tried various weight loss methods without success, have a body mass index (BMI) above 40 or BMI above 35 and suffer from comorbidities such as hypertension or diabetes.

Physical exercise is an activity that individuals undertake to maintain good health and prevent various illnesses. According to data from the World Health Organization (WHO), individuals who do not exercise enough have a 20%-30% higher risk of death from various causes compared to those who engage in at least 150 minutes of moderate-intensity exercise per week. Unfortunately, in 2010, nearly 23% of adults aged 18 and over did not get sufficient exercise, with the highest prevalence occurring in America (32%) and the lowest in Southeast Asia (15%). However, a study found that increasing physical exercise by 10% could prevent the deaths of up to 533,000 people each year, and increasing it by 25% could control the deaths of 1,300,000 people (Hall, M. G., et.al, 2023).

Physical exercise can be classified into two categories based on oxygen uptake: aerobic exercise and anaerobic exercise. Aerobic exercise requires oxygen to produce energy, while anaerobic exercise does not. Physical exercise can also be categorized based on its duration: acute physical exercise and chronic physical exercise. Acute physical exercise refers to exercise carried out for a short duration, typically no more than 30 minutes. On the other hand, chronic physical exercise refers to exercise that lasts longer than 30 minutes.

When you engage in physical exercise, your body undergoes several changes, such as an increase in oxygen levels in the blood. Typically, there is a reserve of oxygen in the blood. However, during physical activity, the body requires a large amount of oxygen to meet energy needs. The blood carries oxygen through the lungs and binds it to hemoglobin. If the oxygen level in the blood falls below normal limits, it can harm the body by causing fainting or even death.

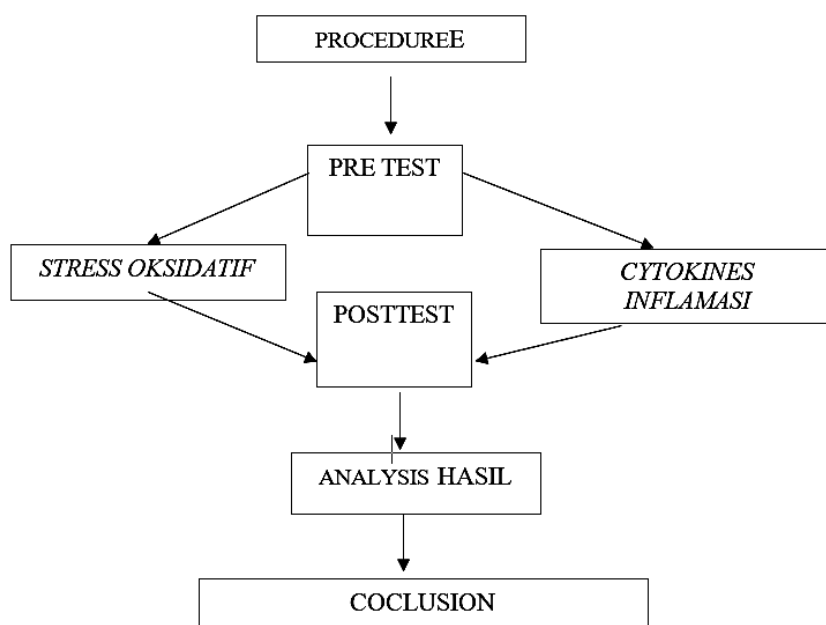
## **Materials and Methods**

### ***Study Participants.***

This study involved 30 older adults who were obese. The research used a purposive sample selection technique with several criteria. The criteria included: 1) adults who come from large families, Faculty of Sports Sciences, Jakarta State University, 2) aged between 55-65 years, 3) male, 4) their body mass index (BMI) between 27-32 kg/m<sup>2</sup>, 5) were willing to participate in this study regarding the impact of 12 weeks of moderate-intensity aerobic exercise on the activation of complex obesity reduction in older adults.

### ***Study organization.***

This study examined how moderate-intensity aerobic exercise impacts the obesity reduction complex in late adulthood. We used experimental methods, specifically the One Group Pre-Post Test Design. The research took place at the Jakarta State University Sports Hall, Rawamangun, East Jakarta, in June-July 2023. The research procedure had six stages. First, we collected the population and research sample. Second, we conducted a pre-test to measure Physical Fitness before moderate intensity aerobic exercise (initial test). Third, participants completed moderate intensity exercise treatment by running on a treadmill with an intensity of 60-70% HRmax for 40 minutes per training session. Fourth, we conducted a post-test to measure Physical Fitness after completing moderate-intensity aerobic exercise (final test). Fifth, we calculated, analyzed, and interpreted the data to obtain research results. Sixth, we made conclusions based on the results of the comparison between the initial and final tests.



**Figure 1.** Research Flow Diagram

### *Statistical analysis.*

During the data collection procedure, we followed a two-step process. Firstly, we measured the BMI (Body Mass Index) for each participant. Secondly, the participant took part in moderate intensity aerobic exercise by running on a treadmill with an intensity of 60%-70% HRmax for 40 minutes per training session. Once we had collected all the data from both the pre-test and post-test, we analyzed it using SPSS Version 21.

**Table 1.** Time line of data collection

Meetings	Activities
Meeting 1	1) Explanation to participants regarding the flow of activities. 2) Demonstration of acute physical exercise to the participants. 3) Measurement of body weight and height to determine the participant's BMI
Meeting 2	Data were collected on the levels of oxidative stress and inflammatory cytokines from each participant before carrying out physical exercise according to the protocol.
Meeting 3	Do light exercise for 12 weeks of physical training (running on a treadmill) according to the protocol.
Meeting 4	Take physical fitness data for each participant based on protocol

## Results

In this study, we investigated the effect of 12 weeks of moderate intensity aerobic exercise on complex obesity reduction in older adults. We analyzed the results using normality analysis and processed different tests using paired sample t-test to explore any differences.

**Table 2.** Test data normality

	Statistic	Shapiro-wilk Df	Sig.	Results
Pre-test	0.365	30	0.000	Normal
Pos-test	0.390	340	0.001	Normal

The calculations performed in SPSS generated Table 2 shown above. The table indicates that the data in both pre-test and post-test have a normal distribution, as evidenced by the normality values of 0.000 and 0.001, respectively. These values are greater than the significance level of  $\alpha$  0.05, thus indicating normality of the population data.

**Table 3.** Paired Sample Statistics Results from Pre-test and Post-test

	Mean	N	Std. Deviation	Std. Error Deviation
Pre-test	15.5667	30	4.22377	0.77115
Pos-test	22.4000	30	3.27583	0.59808

The average score on the pre-test was 15.5. After receiving treatment in the form of moderate-intensity aerobic exercise to reduce complex obesity for 12 weeks, the average score

on the post-test for the older adult participants increased significantly to 22.4. This indicates a significant improvement from pre-test to post-test.

**Table 4.** Connecting test samples

	Paired Differences					t	df	Sig. (2-tailed)	
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference					
				Lower	Upper				
Pair 1	pretest - posttest	-6.8333	3.39455	.61976	-8.10088	-5.56579	-11.02	29	0.000

When it comes to decision making, there are two key concepts to consider. Firstly, if  $\text{Sig} > 0.05$ , then it indicates that there is no significant effect. Secondly, if  $\text{Sig} < 0.05$ , specifically  $-6.8333$ , then it indicates a significant impact in the mean difference test using SPSS on the mean, which indicates the difference between pre-test and post-test. The results of the t-count were  $-11.02$ , the degrees of freedom (df) were  $29$ , and the p-value was  $0.000 < 0.05$ . This means that there is a significant difference between before and after being given moderate intensity aerobic exercise treatment on the activation of complex obesity reduction in older adults. Based on these results, it can be concluded that moderate intensity aerobic exercise has a significant impact on the activation of the obesity reduction complex in the older adults studied by the researchers. This means that 12 weeks of moderate-intensity aerobic exercise can significantly increase the activation of the obesity reduction complex in older adults.

## Discussion

Physical exercise triggers metabolic changes in the body, activating adaptation mechanisms to establish a new dynamic balance (Damaso, Ê. et.all, 2023). One of the most significant changes in this regard occurs in muscle tissue, where the increased energy demand after exercise results in greater oxygen use by mitochondria (Martini, D., et.all, 2023). In addition, skeletal muscle is an important source of oxygen free radicals because during muscle contraction, increased transfer of unpaired electrons from complexes I and III in the electron transport chain produces superoxide radicals ( $\text{O}_2^-$ ), an important member of the reactive oxygen species (ROS) (Cáceres, A., et.all, 2023).

The toxic products of this activity are then converted to hydrogen peroxide ( $\text{H}_2\text{O}_2$ ) by superoxide dismutase (SOD). This is the first line of defense against free radicals and is then neutralized by other enzymes such as catalase, glutathione peroxidase (GPX), and glutathione

reductase (GR) (Kamla, J. I., et.all , 2023). Referring to this concept, 12 weeks of moderate intensity aerobic exercise developed by the researchers can increase the activation of the obesity reduction complex in late adults.

Previous research suggests that a balance between ROS production and antioxidant enzyme activity is critical for maintaining muscle redox homeostasis, keeping ROS below threshold, and preserving their function as signaling molecules while reducing their toxic effects. (Ďásková, N., et.all, 2023). On the other hand, the activity and capacity of ROS and antioxidants are correlated so they can be used as surrogate markers (Åsberg et al., 2023). In addition, the antioxidant status in the blood reflects the increased oxygen demand in muscle tissue during physical exercise (Bouça-Machado, 2020). Therefore, circulating levels as a marker of oxidative stress increase after acute and routine physical exercise (Bouça-Machado, R., et.all 2020). However, the influence of different exercise protocols on antioxidant balance is not fully understood. Meanwhile, several studies reported that obese patients experienced more significant increases in oxidative biomarkers after acute physical exercise compared with normal weight individuals (PW and Murphy, 2005). Other studies show contradictory results (Cheng, S., & Mao, 2016), So the issue of the effect of acute physical exercise on reducing oxidative stress is still being debated.

In sports, achievement and fitness can be achieved through talent or nutritional intake as well as appropriate exercise programs that have a positive effect on older adults. Older adults need good physical fitness to stay energetic during exercise (Ravi Kumar, 2017). Prolonged muscle contractions can result in a condition known as muscle fatigue. Research in older adults shows that muscle fatigue increases almost in line with the rate of decline in muscle glycogen. Therefore, most fatigue is caused by the inability of the muscle contraction process and muscle fiber metabolism to continue to provide the same work results (Haible, 2020).

Poor physical condition and lack of exercise can affect the condition of later adults. When participating in physical activity for a long period of time, the results will not be optimal. The main problem often faced by late adults who exercise vigorously is fatigue, or the inability to recover from fatigue, from one workout to the next. Fatigue is a factor related to stamina and appearance. Many older adults easily experience physical fatigue during games or practice (Hansen, 2020).

Fatigue during exercise is a problem that can result in decreased performance. This condition is often faced by late adults when competing due to lack of energy reserves and high levels of lactic acid in the blood. Late adults require the availability of energy as fuel that activates muscle contraction processes and improves their performance. Anaerobic energy



refers to energy that can be produced from food without oxygen, while aerobic energy means energy that can only be produced through oxidative metabolism.

Lactic acid is the final product produced from pyruvic acid during anaerobic glycolysis. Lactate is an intermediate product of glucose metabolism. Lactate is the result of anaerobic metabolism which is waste. This process takes place without oxygen. The accumulation of lactic acid will inhibit glycolysis, resulting in muscle fatigue. High levels of lactic acid will cause acidosis around muscle cells, hinder coordination, increase the risk of injury, and disrupt the energy system of Creatine Phosphate.

High levels of lactic acid in late adults will be detrimental to the performance of the elderly (Murphy, K., et.al, 2023). To address the aforementioned issues, it's important to establish a suitable exercise routine and ensure proper nutrition, as well as a supportive emotional and physical environment. According to research conducted by Gusbakti, participants who consumed carbohydrate drinks with electrolytes experienced a significant increase in fatigue while pedaling a bicycle ergometer, compared to those who took a placebo. This highlights the significant impact of nutrition on the performance of older adults. To maintain consistent levels of fitness throughout the trial, participants were instructed to engage in aerobic exercise for 2-3 weeks prior to the next test.

The goal of aerobic training is to increase the number of mitochondria in the body. Mitochondria are responsible for producing high-energy ATP to help the body meet its energy needs. Physical activity focuses on improving the performance of cells and organs, especially mitochondria. Aerobic exercises done three to five times per week, for 20-60 minutes each time, with an intensity of 60-80% of maximum heart rate, can boost blood flow and help remove metabolic waste from the body, leading to faster recovery. This can also help reduce fatigue after exercising (Schamarek, I., et.al, 2023).

## **Conclusions**

The study conducted on the impact of 12 weeks of moderate-intensity aerobic exercise on older adults revealed some interesting findings. The research indicated that the activation of the obesity reduction complex in late adulthood can be increased through the effect of 12 weeks of moderate-intensity aerobic exercise. This means that the obesity reduction complex plays a crucial role in weight loss, especially in older adults. The results of this study are significant as they suggest that incorporating moderate-intensity aerobic exercise in the daily routine of older adults can help activate the obesity reduction complex and reduce the risk of obesity-related health issues.

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## Conflict of interest

*No potential conflict of interest was reported by the authors.*

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