

## Obesity Affects Physical Fitness in Elementary School Children Aged 10-12 Years

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**Abstract:** Finding the disparities in fitness between pupils aged 10 to 12 who had normal body mass index and those who were obese was the aim of this study. **Methods:** This quantitative descriptive study sought to identify the variations in fitness, particularly in cardiorespiratory fitness, among students aged 10 to 12. Using a Volume Oxygen Maximum (VO<sub>2</sub>max) prediction algorithm, cardiorespiratory fitness was assessed indirectly. The Shapiro-Wilk test is used in the normalcy test. Thirty students, split into two groups, made up the sample. Fifteen students in the first group had a normal body mass index, while fifteen students in the second group were obese. **Outcome:** Shapiro-Wilk tested the normalcy test. The results of the test indicated that the data had an anomalous distribution, with  $p=0,012$  ( $p<0,05$ ). The Mann-Whitney test is used in hypothesis testing. With a result of  $p=0.000$  ( $p<0.05$ ), the U test revealed a difference in fitness between 10-12-year-old kids who were obese and those with a normal body mass index. This study demonstrated that students aged 10 to 12 who were obese and those with a normal body mass index differed in terms of fitness.

**Keywords:** Obesity; Fitness; VO<sub>2</sub>max

### 1. Introduction

The prevalence of childhood obesity is rising everywhere, including in Indonesia (1). The most recent statistics indicates that a concerning percentage of youngsters between the ages of 10 and 12 suffer from obesity (2). This results from an unbalanced calorie intake and expenditure (3). An poor diet and a lack of physical activity are major contributors to this issue (4). Obesity affects a child's social development on both a psychological and social level in addition to their physical health (5). A number of interrelated risk factors impact childhood obesity in children aged 10 to 12 (6)

The susceptibility to obesity is significantly influenced by genetic factors (7). Children from families with a history of obesity have a higher likelihood of experiencing similar problems (8). Research shows that genetic factors can contribute up to 33% to a person's body weight (9). Consumption of high-calorie foods, such as fast food, sugary snacks, and fizzy drinks, contributes significantly to obesity. Children tend to like foods that have an attractive taste and appearance, which is often unhealthy. Poor eating habits, such as frequent snacking and skipping breakfast, also increase the possibility of getting these ailments. Low physical activity is another key factor.

Children today spend more time with electronic games or watching television, which reduces the time for active play. Lack of exercise causes the calories that come in not to be burned properly, thus contributing to fat accumulation. Psychological aspects such as stress and emotional disorders can

affect a child's eating habits. Some children may use food as a way to cope with negative emotions, which can lead to overeating. The family environment also plays a role in the formation of children's eating habits and physical activity. Parenting that doesn't support a healthy lifestyle, such as providing easy access to unhealthy foods and a lack of encouragement to exercise, can increase the risk of obesity. Children from families with low socioeconomic backgrounds may be more susceptible to obesity due to limited access to healthy food and sports facilities. However, children from high-income families can also become obese if their diet and lifestyle are unhealthy. Several additional factors, such as gender, birth weight, length of breastfeeding, and knowledge of nutrition, can also affect the risk of obesity in children. Understanding these factors is essential for designing effective preventive interventions in addressing the problem of obesity among children.

Children's physical fitness is an important indicator of overall health. Research shows that children with obesity tend to have lower fitness levels compared to their peers who have a normal Body Mass Index (BMI). This is due to the sedentary lifestyle that is often experienced by obese children, where they spend more time sitting and less physical activity. Poor physical fitness can result in faster fatigue during physical activity, as well as potentially decreasing academic achievement and overall life quality. The long-term impact of obesity on children is not only limited to physical health problems such as diabetes and heart disease, but can also affect cognitive and emotional development. Obese children often experience social stigma, bullying, and self-confidence issues, which can hinder their social and emotional development. Therefore, It's critical to comprehend the connection between obesity and physical fitness in order to design effective interventions to improve children's health.

This study aims to examine the relationship between obesity and elementary school pupils' fitness levels, ages 10 to 12. By understanding this relationship, it is hoped that better insights can be obtained about strategies for preventing and managing obesity in children, as well as improving their physical fitness. The study will also provide important information for educators and parents in supporting their children's health through increased physical activity and a healthy diet.

Obese youngsters store less energy in the form of glycogen in their muscles and store more energy in the form of fat. When the body's energy supplies diminish, it becomes unable to continue engaging in physical activity. Muscle glycogen depletion is typically the cause of fatigue during exercise. Obese youngsters are unable to participate in activities that require a lot of time.

## 2. Materials and methods

In this research, a cross-sectional methodology in which independent variables (predictors) and dependent variables (criteria) are measured simultaneously. In Tanjung Duren, West Jakarta, at Tanjung Duren Utara State Elementary School 01, the study was carried out. All students in classes 4–6 of Alkhairiyah 1 Elementary School in Surabaya, aged 10–12, make up the study's population. The sampling approach uses the purposive sampling technique to obtain a sample that properly reflects the group being sampled. The number of samples is calculated in this study using a 2012 study by Esmaeilzadeh and Ebadollahzadeh. The Pocock formula was then used to determine the number of samples per group, which came out to be 15 persons. The following are the requirements for inclusion: Students between the ages of 10 and 12 are enrolled in the school. Obese people who are willing to participate in the study must have a body mass index (BMI) of  $>21.4$  for men and  $>22.6$  for women, which is the threshold number based on age. In the meanwhile, the following are the exclusion criteria: heart problems, musculoskeletal deformities, or having been ill for the previous week. In this study, fitness was the dependent variable while obesity was the independent variable. Body Mass Index was used to calculate obesity measurement data, and the Ministry of Health 2011 was consulted for categorization. Meanwhile, The One Mile Walking Test was used to test fitness by calculating Maximum

Oxygen Volume. The collected data is presented in the form of frequency distribution tables and cross-tabulation, and then narrated by comparing with existing theories. To find out the effect of obesity on fitness by comparing fitness between the obese group and the group with a normal BMI.

### 3. Results

#### 3.1. Data Description

Weight, height, and body mass index were measured by age in order to sample, and samples with normal and obese categories were then collected. A physical activity questionnaire created by the researcher is completed by prospective samples in order to validate the information on inclusion and exclusion criteria. When a sample satisfies the requirements, the researcher explains the goal and objective to them. The sample then signs an informed consent form acknowledging that they have comprehended the explanation and agree to participate in the study.

The sample size for this study was thirty individuals. It is separated into two groups: 15 individuals in the normal BMI/U category and 15 individuals in the obese category. In the normal group, the age distribution of samples was as follows: 10 individuals (67%) were 10 years old, 4 individuals (27%), and 1 individual (6%), who was 11 years old. There were three individuals (20%), eight individuals (53%), and four individuals (27%), respectively, in the obese group who were 10 years old, 11 years old, and 12 years old.

In the typical group of seven individuals (27%) and eight (53%) female samples, the gender distribution of the samples was determined. In contrast, there were 8 individuals (53%), and 7 individuals (47%), in the obesity group who were male and female, respectively. The results of the physical activity-based sample distribution, which involved having children complete a physical activity questionnaire, showed that 8 out of the normal groups had good physical activity (53%) and 7 out of the normal groups had less physical activity (37%).

In contrast, six individuals (40%) and nine individuals (60%) in the obesity group were in the sample with good physical activity and reduced physical activity, respectively. According to the findings of the 1-mile walking test for VO<sub>2</sub>max measurement and BMI/U assessment, the normal group, which consisted of 15 individuals, had a mean VO<sub>2</sub>max of 58.42 and a mean body mass index of 17.05. A sample of 15 individuals in the obese group had a mean body mass index of 27.13 and a mean VO<sub>2</sub>max of 41.26. A graph showing the VO<sub>2</sub>max and body mass index data for both groups is shown below: 2

#### 3.1 Hypothesis Testing

Data from the Shapiro-Wilk test, which evaluates for normality, showed an uneven distribution. Furthermore, because the distributed data is not normal, the hypothesis test employs the Mann-Whitney U Test. The hypothesis is accepted if the p-value is higher than 0.05 and rejected if it is lower than 0.05. The following theories have been validated:

Ho: The fitness levels of primary school students in the Normal BMI and Obesity categories, ages 10 to 12, are identical.

Ha: Children in elementary school, ages 10 to 12, differ in their level of fitness. years in both the obese and normal BMI categories.

The Mann-Whitney U Test findings for the hypothesis test yielded a value of  $p=0.000$ , where  $p<0.05$ . Given that Ho was turned down, it can be said that primary school students between the ages of 10 and 12 who fall into the normal BMI group and those who fall into the obese category differ in terms of their level of fitness.

#### 4. Discussion

This research shows a significant difference in the physical fitness levels of children with normal BMI categories and those with obesity. Obese children have lower  $VO_2$ max values, indicating a lower aerobic capacity compared to children with normal weight. This is in line with research by (10,11) which shows that increased body mass hinders cardiovascular performance in children due to the increased workload on the body during physical activity. Obese children require greater effort even for light activities, potentially leading to fatigue and reducing participation in daily physical activities(12,13).

The decrease in  $VO_2$ max in the obese group can be explained by several factors. First, a larger body mass requires more energy to move, thereby increasing the workload of the heart and lungs during physical activity (14). Second, the accumulation of fat in the body can hinder energy metabolism efficiency and reduce the oxidative capacity of muscles, which accelerates fatigue during physical activity (15,16).

Poor habits, as demonstrated by many obese children in this study, contribute to low aerobic capacity (17). Research by (18) also supports this finding by stating that excessive screen time is negatively correlated with children's  $VO_2$ max. A lack of daily physical stimulation leads to a decrease in the body's physiological adaptation to aerobic exercise (19). In addition, psychological factors such as low self-esteem and lack of social support can cause obese children to be reluctant to participate in physical activities, exacerbating their low fitness levels (20). The family environment also plays an important role. Parents who do not provide a healthy lifestyle model or who easily provide access to high-calorie foods further increase the risk of obesity and low physical fitness in children (21).

This research highlights the importance of developing school and family-based interventions that emphasize increasing physical activity and establishing healthy eating patterns from an early age (22). The implementation of structured, fun, and participatory sports programs can improve cardiovascular fitness and help gradually reduce weight in obese children (23–25).

#### 5. Conclusions

According to the study's findings, elementary school students between the ages of 10 and 12 who fall into the normal BMI group and those who fall into the obese category have different levels of fitness. The recommendations derived from this study's findings are: When measuring  $VO_2$ max in a single person, the researcher concentrates on a single sample to ensure that the results are correct. In order to prevent queue development during the pulse count, the samples were trained to determine their respective pulse rates. It is anticipated that future studies would focus on the variables influencing childhood obesity.

**Conflicts of Interest:** The authors declare no conflict of interest.

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