# RISK FACTORS OF OBESITY IN ADOLESCENCE: A CASE CONTROL STUDY

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**Abstract**

Obesity in adolescents needs attention because it can persist into adulthood and increase the risk of degenerative diseases. In Tasikmalaya district, there has not been much research related to obesity risk factors, including with case control study. This research aims to analyze the risk factors associated with obesity in adolescents. The research sample consists of teenagers from a private school in Tasikmalaya Regency. This study uses a case-control design, with a total of 32 cases (total sampling) and 64 controls, resulting in a total sample of 96 students. The independent variables are junk food consumption, soft drink consumption, vegetable and fruit consumption, physical activity, screen time, and sleep duration. Data collection techniques were conducted through interviews and food recalls, as well as measuring obesity using the BMI indicator. Data analysis employed the chi-square test at a 95% confidence level. The research results indicate that the variables of junk food consumption (p-value=0.025; OR=3.1), soft drink consumption (p-value=0.017; OR=3.3), vegetable consumption (p-value=0.012; OR=3.4), fruit consumption (p-value=0.017; OR=3.2), physical activity (p-value=0.002; OR=4.5), screen time (p-value=0.017; OR=3.2), and sleep duration (p-value=0.035; OR=2.8) have a significant relationship with the incidence of obesity in adolescents. Thus, the factors of food consumption, physical activity, screen time, and sleep duration are variables that increase the risk of obesity in adolescents.

**Keywords: Adolescence; Obesity; Risk factors.**

## INTRODUCTION

Obesity is a chronic disease characterized by the accumulation of excess fat, which can have a negative impact on body health. The World Health Organization (WHO) states that in 2022, the prevalence of children and adolescents aged 5–19 years living with obesity will reach 8%, or around 160 million adolescents (1)(2). This condition can continue into adulthood and can even increase the risk of dangerous non-communicable diseases including dyslipidaemia, hypertension, cardiovascular

disease, insulin resistance or diabetes, fatty liver disease and psychosocial (3)(4).

According to data from the latest basic health research in Indonesia, 1 in 5 school-age children (20%, or 7.6 million) and 1 in 7 adolescents (14.8%) in Indonesia are obese (3.3 million against 3.3 million). Due to the potential negative effects of obesity on children's physical and mental health, this poses a serious threat to the welfare of Indonesian children. Furthermore, childhood obesity raises the risk of a number of serious non-communicable diseases as well as long-term consequences as type 2 diabetes, COPD, and other cancers (5).

Based on basic health research in Indonesia, 1 in 5 school-age children (20%, or 7.6 million) and 1 in 7 adolescents (14.8%, or 3.3 million) live with obesity. Based on that data, West Java is ranked 13th with a prevalence of obesity in adolescents aged 13–15 years of 4.89%. Meanwhile, in the 16-18 age group, West Java is the 8th province with the highest prevalence of obesity, with a prevalence of 4.51% above the national prevalence average of 4.0%. Tasikmalaya Regency is ranked 5th with the highest prevalence of obesity in adolescents aged 13–15 in West Java, namely 6.26%. Meanwhile, the prevalence of obesity in adolescents aged 16-18 years in Tasikmalaya Regency is 2.22%, almost three times the increase in cases of obesity findings in Tasikmalaya Regency in 2023 from 2022.

The results of health screening throughout 2023 showed that obesity cases in Tasikmalaya Regency were dominated by adolescents at the SMA/MA/SMK levels, with 225 cases of obese adolescents. Based on the distribution of obesity cases, the Leuwisari Health Center area ranks first with the highest obesity cases at the SMA/MA/SMK level, with 52 cases (6).

There are 3 domains related to obesity, namely habits (behavior), socio-economic, and obesogenic environment. Other factors also contribute such as genetic factors, sleep patterns, and hormones (7). Consumption patterns and environments are increasingly obesogenic, thus failing to encourage the adoption of healthy eating patterns and active lifestyles. The presence of junk food that has developed over the past few decades has caused foods and drinks high in sugar, salt, and fat (GGL) to be widely distributed

and easily accessible. The availability of drinking water is still a major concern; exposure to advertisements for foods and drinks high in GGL, especially in children and adolescents, is also very high, such as screen time, internet use, and excessive use of social media. The quality of active mobility infrastructure is poor, limiting outdoor physical activity (5)(8).

Magriplis' study (2021) showed that children and adolescents with energy intake from added sugar ≥10% of total energy intake had a 1.77 times greater risk of obesity (9). Another study showed that consuming fast food >3 times per week increased the risk of obesity (OR 4.4) (10). Children and adolescents who lack fiber intake are 3 times more at risk of obesity (11). Multiple epidemiological studies havedemonstrated statistically significant reductions in risks of obesity (12).

Research on children in Nepal indicates that sedentary behavior such as screen time that does not meet the recommendation of <2 hours per day increases three times with the risk of obesity (13). Children and adolescents who have a sleep duration of <7 hours per day can increase the risk of obesity by 3 times compared to those who have sufficient or long sleep duration (14).

This research combines a number of variables in previous research, to obtain a complete picture of the risk factors for obesity in adolescents. Singaparna Vocational School was the highest obesity rate among other equivalent high schools in the Leuwisari Health Center in previous two years. The results of a preliminary survey conducted in February 2024 at Singaparna Vocational School, Tasikmalaya Regency showed that the proportion of soft drink consumption with frequent frequency in the obese adolescent group was 40%, while the non-obese adolescent group did not consume soft drinks with frequent frequency. The proportion of screen time duration >2 hours in obese and non-obese adolescents was 90% and 60%. Then the proportion of sleep duration <7 hours/day in obese and non-obese adolescents was 80% and 50%, respectively. A number of studies on risk factors for adolescent obesity in rural areas, especially in Tasikmalaya district, have not been carried out very much.

Based on the background above, the study aims to find out the relationship between junk food consumption, soft drink consumption, fruit and vegetable consumption, physical activity, screen time, and sleep duration with the incidence of obesity in students at Singaparna Vocational School.

**METHOD**

This research is an analytical survey study with a case-control design. The study conducted in Vocacional Student (SMK Singaparna) in Tasikmalaya district, who has the highest obesity rate in Puskesmas Leuwisari, on May-August 2024. The target population is 126 students. The cases are the obese students of Vocational Student in Singaparna (32 students) as the total samples, and the control population is non-obese students. Cases group matched by sex and age with the controls group with a ratio of 1:2. Obesity measurement is carried out using data from case screening by community health centers, by using BMI per Age.

In this study, the instruments used were questionnaires, FFQ (Food Frequency Questionnaire), Physical Activity Level (PAL), and Pittburgh Sleep Quality Index (PSQI). Data collection was carried out by interviews using questionnaires and observation to measure food frequency, physical activity and sleep quality.

Data analysis used in this study is univariate and bivariate analysis using the chi-square test with confident interval 95% and alpha 0.05. The hypotesis significant if p value $< 0.05$. Analysis data using SPSS IBM Unsil lisence. This research has been approved by the Health Research Commite Ethic of the Universitas Muhammadiyah Purwokerto, Indonesia with numbers: KEPK/UMP/125/VI/2024.

**RESULTS AND DISCUSSION**

**Results**

Table 1. Characteristics and Bivariate Analysis of Risk Factors of Obesity in Adolescence in Vocational School Singaparna Tasikmalaya Regency 2024

| Variables | Obesity | | | | Total | | P-value | OR (95% CI) |
|---|---|---|---|---|---|---|---|---|
| | Yes | | No | | | | | |
| | n | % | n | % | n | % | | |
| **Sex** | | | | | | | | |
| - Male | 7 | 21.9 | 14 | 21.9 | 21 | 100.0 | - | - |
| - Female | 25 | 78.1 | 50 | 78.1 | 75 | 100.0 | | |
| **Body Mass Indeks** | | | | | | | | |
| - Mean | | 29.71 | | 20.38 | | | | |
| - Median | | 28.16 | | 20.17 | | | | |
| - St. Dev | | 3.19 | | 3.04 | | | | |
| - Min | | 27.18 | | 14.87 | | | | |
| - Max | | 40.17 | | 26.91 | | | | |
| **Soft drink consumpt** | | | | | | | | |
| - Often | 23 | 71.9 | 28 | 43.8 | 51 | 100.0 | 0.017 | 3.26 (1.316-8.206) |
| - Rarely | 9 | 28.1 | 36 | 56.2 | 45 | 100.0 | | |
| **Junk food consumpt** | | | | | | | | |
| - Often | 29 | 71.9 | 29 | 45.3 | 58 | 100.0 | 0.025 | 3.08 (1.236-7.696) |
| - Rarely | 9 | 28.1 | 35 | 54.7 | 34 | 100.0 | | |
| **Vegetable comsump** | | | | | | | | |
| - Often | 22 | 68.8 | 25 | 39.1 | 47 | 100.0 | 0.012 | 3.43 (1.395-8.446) |
| - Rarely | 10 | 31.2 | 39 | 60.9 | 49 | 100.0 | | |
| **Fruit comsumption** | | | | | | | | |
| - Often | 22 | 68.8 | 26 | 40.6 | 48 | 100.0 | 0.017 | 3.21 (1.236-7.696) |
| - Rarely | 10 | 31.2 | 38 | 59.4 | 48 | 100.0 | | |
| **Physical activity** | | | | | | | | |
| - Low | 21 | 65.6 | 19 | 29.7 | 40 | 100.0 | 0.002 | 4.52 (1.828-11.181) |
| - Moderate and High | 11 | 34.4 | 45 | 70.3 | 56 | 100.0 | | |
| **Screen time** | | | | | | | | |
| - High | 22 | 68.8 | 26 | 40.6 | 48 | 100.0 | 0.017 | 3.21 (1.309-7.898) |
| - Less | 10 | 31.2 | 38 | 59.4 | 48 | 100.0 | | |
| **Sleep duration** | | | | | | | | |
| - <8.5 hours | 23 | 71.9 | 30 | 46.9 | 53 | 100.0 | 0.035 | 2.89 (1.162-7.222) |
| - ≥8.5 hours | 9 | 28.1 | 34 | 53.1 | 43 | 100.0 | | |

*Sumber: Primary Data, 2024*

Based on table 1, it is known that the number of male respondents in the case group is 7 respondents and female respondents are 25 respondents. The number

of male respondents in the control group is 14 respondents and female respondents are 50 respondents. It is known that the average BMI of respondents in the case group was 29.71 and in the control group was 20.38. The lowest BMI of respondents in the case and control groups were 27.18 and 14.87 respectively.

**Discussion**

1. Soft drink consumption and risk of obesity

   Based on the results of this study, it is known that consuming soft drinks in the frequent category is known to increase the risk of obesity by 3.286 times compared to adolescents who rarely consume soft drinks. Sugar-sweetened beverages, commonly called soft drinks, contain high calories and sugar, which can cause fat accumulation in the body if consumed excessively (7). It is proven that sugar is a primary factor that not only causes obesity but also chronic and fatal diseases in later life such as diabetes and non-alcoholic liver. This study is in line with other research, which shows that who drank 1-2 bottles of soft drinks per day increase the risk of obesity (15).

2. Junk food consumption and risk of obesity

   As a result of this study, adolescents who regularly consume junk food are found to be 3.084 times more likely to be obese than adolescents who do not consume junk food. Insulin resistance can result from consuming a lot of "junk" food, often known as junk food, which has a high sugar and calorie content, little fiber, and little nutritious value. a higher chance of developing insulin resistance, which can increase appetite and cause the brain's hunger signals to be distorted, making it difficult for them to manage their body weight. This study is consistent with previous studies that eating fast food increases the risk of obesity (16)(17).

3. Consuming vegetables and fruits with risk of obesity

   Consuming vegetables that are rarely known can increase the risk of obesity 3.432 times greater than adolescents who often consume vegetables. Consuming fruits that are rarely known has a 3.215 times greater risk of obesity compared to adolescents who often consume fruit.

In obese children and adolescents, there is an imbalance (dysbiosis) of microbes or microbial imbalances, which is a condition that can affect health. Dysbiosis of the gut microbiota can possibly increase metabolic complications through immune dysregulation, affect energy metabolism, disrupt hormonal balance, and increase pro-inflammation. Therefore, a balanced diet rich in fiber from vegetables and fruits can lead to microbial balance (eubiosis) where fiber is very good for the bacterial community in the intestine and can control weight gain through various mechanisms, including controlling appetite (18). A study shows that consuming fruits and vegetables more than 3 servings per day can protect children from obesity (19). Vegetables and fruits have mineral and vitamin content that is good for digestion, absorption of nutrients more effectively and efficiently, and helps the body's metabolism.

4. Physical activity and risk of obesity

Based on the results of this study, light physical activity is known to increase a person's risk of obesity by 4.522 times greater than adolescents with moderate to heavy physical activity. Adolescents with less physical activity or more light physical activity are at greater risk of obesity due to insufficient energy expenditure. When the energy intake is greater than the energy expended (expenditure), it is called a positive net energy balance which causes energy not to be used so that it is converted into energy reserves and then stored in fat cells. Prior study indicating that engaging in physical activity can mitigate genetic obesity risk and highlight the importance of genetic background for individual health and wellness. The higher daily step counts can mitigate genetic risk for obesity (20).

5. Screen time and risk of obesity

Based on the results of this study, high screen time is known to increase a person's risk of obesity 3.215 times higher compared to adolescents with low screen time. Screen time contributes to fat accumulation in 2 ways; less movement so that energy expenditure is low and increasing the risk of excessive energy intake because of the opportunity to snack while watching or playing games. In addition, children or adolescents who spend more time watching will potentially be exposed to unhealthy

food advertisements, because of which eating patterns can change.

A study in Yogyakarta showed that children who watch television in 2 hours per day are at risk of becoming obese twice, while watching 4 hours increases to 4.5 times greater to being obesity. However, not only for watching television but all sedentary activities. Based on the theory of energy balance, sedentary activities increase the risk of fat accumulation which causes weight gain (21). This means that for those who are not obese, sooner or later they will experience weight gain because they are currently doing things that are at risk of obesity, named sedentary behavior.

6. Duration of sleep and risk of obesity

Based on the results of this study, the duration of sleep that is not known can increase a person's risk of developing obesity 2.896 times greater than adolescents with sufficient sleep duration. In determining nutritional status, sleep duration plays an important role. Short sleep duration is related to changes in hormones and metabolism which are also related to weight gain and obesity. The hormones in question are an increase in the hormone ghrelin and a

decrease in the hormone leptin which causes increased hunger and appetite (22)(23).

This result of the research in line with other study by Suraya et al., (2020) which shows that there is a relationship between sleep duration and adolescent obesity. In this study, sleep duration was 7.954 times higher (14).

## CONCLUSION

Obesity in adolescence is influenced by multi factors. In this study, food consumption, lack of physical activity, screen time and sleep duration were significantly related to obesity. Youth eating habits are influenced by biological, cultural, and environmental variables, including easily accessible high-density food options. For kids and teenagers, media gadgets and related screen time make physical activity a less desirable option. Interventions needed to improve the obesogenic environment include political policies, as well as policies at the school level.

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