

## ARTICLE INFORMATION

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## Soda consumption and overweight in high school students in Surakarta, Indonesia

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### Abstract

**Background:** Adolescence is an age that is vulnerable to facing various nutritional problems, both malnutrition and excess nutrition. Excessive nutrition is a body condition where food intake exceeds the recommended daily requirements, causing fat accumulation. Overnutrition in adolescents can be seen through the Body Mass Index (BMI) according to age, where assessment results that exceed  $\geq +1$  SD are included in the overnutrition category. Consumption of soft drinks is a risk factor that causes overnutrition due to excess sugar intake from these soda drinks. High intake of sweet drinks can increase overweight and can be a risk of metabolic disease. The recorded number of children and teenagers in Indonesia who were overweight or obese in 2018 was 20% or 7.6 million school children and 14.8% or 3.3 million teenagers.

**Purpose:** To determine the relationship between soda drink consumption and overweight.

**Method:** Observational research with a cross sectional approach. This research analyzes the relationship between the independent variable (frequency of soda consumption) and the dependent variable (more nutrients) which was carried out by collecting data at the same time. The population in this study were all tenth and eleventh grade students at SHS 1 Muhammadiyah, SHS 2 Muhammadiyah and Muhammadiyah Surakarta Special Program High School, with a sample of 104 respondents. The research was conducted at 3 Muhammadiyah High Schools in Surakarta on November 2022 – February 2024. Soda consumption data was collected using the Food Frequency Questionnaire (FFQ). Meanwhile, nutritional status data is carried out by anthropometric measurements such as height, weight and calculation of Body Mass Index (BMI) based on age (BMI/U).

**Results:** It was found that there was no significant relationship between soda drink consumption and the incidence of overnutrition with a p-value of 0.794.

**Conclusion:** There is no relationship between soda drink consumption and overnutrition.

**Keywords:** Adolescent; Overweight; Soda Consumption.

### INTRODUCTION

Adolescence is the period of development of children towards adulthood. The adolescent phase is characterized by the occurrence of sexual maturity, both physical, biological, and psychological. The environmental and social development of adolescents is very influential on adolescents in terms of biological and psychological (Moehji, 2003). Conceptually defines adolescents to include three things, including psychological, biological, and socioeconomic. The age range of adolescents has

been set by WHO, which is between the ages of 10-20 years. Adolescence is divided into two phases, namely the early adolescent phase with an age range of 10-14 years and the late adolescent phase with an age range of 15-20 years. The prevalence of people aged 10-19 years in Indonesia is 17% or 46 million of the total population in 2020 (Central Bureau of Statistics, 2020).

Adolescence is an age that is vulnerable to facing various nutritional problems, both malnutrition and

excess nutrition. Adolescents' nutritional knowledge greatly influences adolescents' attitudes and behavior in deciding what food and drinks to consume. Low nutritional knowledge can be seen from frequently consuming the wrong food or drink. Nutritional problems that occur in adolescents are very important to pay attention to because they can interfere with the body's growth and development and will have an impact on nutritional problems in adulthood. Factors that trigger adolescent nutritional problems include poor eating habits, wrong understanding of nutrition, excessive preferences for certain foods causing nutritional needs to not be met, the free entry of new food products from other countries which has an influence on the eating habits of teenagers, screen time current technological developments are contributing to the occurrence of nutritional problems in teenagers (Washi & Ageib, 2010; Nababan, Silitonga & Siagian, 2022; Aulia, 2021). It was recorded that the number of children and teenagers in Indonesia who were overweight or obese in 2018 was 20% or 7.6 million school children and 14.8% or 3.3 million teenagers (Central Bureau of Statistics, 2021).

With the increasing nutritional needs of teenagers, healthy living habits and good and regular eating behavior must be given to secondary school students. Activities outside the home that teenagers often do are often the reason they prefer to consume snacks or fast food which are high in calories and fat. One of the nutritional problems in adolescents that needs attention is excess nutrition. Children and adolescents who experience excess nutrition will increase the risk of becoming overweight when they reach adulthood, even though excess nutrition is a risk factor that can cause metabolic syndrome which can lead to cardiovascular disease (Rafiony, Purba & Pramantara, 2015; Febrihartanty, Ermayani, Rachman, Dianawati & Harsian, 2019; Purnama, 2019). An imbalance between food intake and recommended needs is the cause of nutritional problems in adolescents. Excessive nutrition is a body condition where food intake exceeds the recommended daily requirements, causing fat accumulation. Overnutrition in adolescents can be seen through the Body Mass Index (BMI) according to age, where assessment results that exceed  $\geq +1$  SD are categorized as overnutrition (Ministry of Health of the Republic of Indonesia, 2019).

Many teenagers experience excess nutrition due to wrong eating patterns, such as low fiber intake, high fat, fast food and fizzy drinks. Apart from that, excess nutrition in teenagers is also caused by low physical activity and sedentary lifestyle habits or unhealthy lifestyles which are characterized by little movement and low energy expenditure. People with a sedentary lifestyle tend to spend a lot of time sitting or lying down, and little or no exercise. These two unhealthy lifestyles are factors that increase the risk of overweight in teenagers. Nutritional problems in adolescents have an impact on nutritional status and cause health problems. Unbalanced nutrition can have an impact on the reproductive system and excess nutrition can pose a risk of degenerative diseases, for example hypertension, diabetes mellitus, heart disease and several other types of diseases (Rafiony et al., 2015; Muchtar, Sabrin, Effendy, Lestari & Bahar, 2022).

Research on the relationship between soft drinks and nutritional events in 188 respondents with an age range of 20-45 years, found that consumption of soft drinks is a risk factor that causes overnutrition due to excess sugar intake from these soda drinks. Consuming soft drinks for a long time can cause deficiencies in protein, magnesium, calcium, phosphorus and vitamin A. The content of soft drinks can also cause erosion of teeth because of their high acid content. The caffeine in soda can disrupt the central nervous system and cause osteoporosis. Consumption of soft drinks can also cause overweight, hypertriglyceridemia, hypertension, increase low-density lipoprotein cholesterol (Limarda & Santoso, 2022; Liwanto & Santoso, 2021). High intake of sweet drinks can increase the risk of being overweight and can lead to metabolic disease. Consumers of sugary drinks also have a higher risk of experiencing ischemic stroke, especially in women. The increase in soda consumption is influenced by changes in the lifestyles of today's teenagers who are more following the lifestyles of foreigners and also because of the rise in supermarkets that sell various types of soda drinks. Another thing that causes the high prevalence of teenagers consuming soda drinks is the large number of advertisements displayed about soda drinks, so that teenagers will be very interested in trying them (Fatmala & Rohmah, 2022).

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Soda consumption and overweight in high school students in Surakarta, Indonesia

The results of preliminary research in October 2022, showed that students at SHS Muhammadiyah Surakarta who were overweight had a fairly high prevalence of 22.2% and 35.6% of 45 students often consumed soda drinks during the last 1 month. Soda drinks are widely sold at vendors around the school and in the canteen of Muhammadiyah Surakarta High School. SHS Muhammadiyah Surakarta is located in the middle of Surakarta so students can easily access soda drinks at minimarkets.

## RESEARCH METHOD

Observational research with a cross sectional approach. Using stratified random sampling technique using proportional random sampling. The population in this study were all tenth and eleventh grade students at SHS 1 Muhammadiyah, SHS 2 Muhammadiyah, and Muhammadiyah Surakarta Special Program High School, all respondents are Muslim. The number of respondents was 104 people, with inclusion criteria including students who were entering or leaving at the time of data collection, students who were willing to be research subjects and students who were following a certain diet. Meanwhile, exclusion criteria include students who are sick (infectious and chronic) so they cannot fill out the questionnaire and students who change schools. The research was conducted at 3 Muhammadiyah Surakarta high schools in November 2022 – February 2024.

This research analyzes the relationship between variables. The independent variable in this study is the frequency of soda consumption and the dependent variable is overweight. The variable frequency of soda consumption is measured by the frequency of consumption of soda drinks consumed in the last 1 month by the respondent. Frequency of soda drink consumption was measured using the Semi Quantitative Food Frequency Questionnaire (SQ-FFQ) method with a low category if the score was  $< \text{mean/median}$  and high if the score was  $\geq \text{mean/median}$ . The overweight variable is measured by BMI/U based on body weight (BB) divided by the square of height (TB) and minus the z-score with the category of not over-nutrition if (z-score  $< +1$  SD) and over-nutrition if (z-score  $\geq +1$  SD). Respondents are said to be overweight if they have a BMI of 23-24.9 and are not said to be overweight if their BMI is below 25, but above 18.5. The frequency of drinking soda is said to be frequent if you consume 1 – 3 medium sized bottles/cans (250-550 ml) in 3 days and rarely if you consume 1 – 3 medium sized bottles/cans (250-550 ml) 2 weeks.

Data analysis techniques include univariate and bivariate analysis. Using the chi-square method because the variables used are categorical. This research has received recommendation permission from the Health Research Ethics Committee of RSUD Dr. Moewardi with number: 130//HREC/2024.

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## RESEARCH RESULTS

Table 1. Characteristic Respondent (N= 104)

Variables	Results
<b>Age (n/%)</b> (Mean+SD)(Range)(Year)	(16.0+0.740)(15-18)
15	28/26.9
16	50/48.1
17	25/24
18	1/1
<b>Gender (n/%)</b>	
Male	12/11.5
Female	92/88.5
<b>Name of School (n/%)</b>	
SHS 1 Muhammadiyah	36/34.6
SHS 2 Muhammadiyah	33/31.7
Muhammadiyah Surakarta Special Program High School	35/33.7
<b>Amount of Daily Pocket Money received (Rupiah) (n/%)</b>	
≥ 10.000	92/88.5
< 10.000	12/11.5
<b>Overweight (n/%)</b>	
Yes	27/26
No	77/74
<b>Soda Consumption (n/%)</b>	
Often	60/57.7
Rare	44/42.3

Based on table 1, it is known that the majority of respondents were 16 years old, 50 people (48.1). All respondents were Muslim as many as 104 respondents (100%). There were 36 respondents from SHS 1 Muhammadiyah (34.6%), 33 respondents from SHS 2 Muhammadiyah (31.7%), and 35 respondents from Muhammadiyah Special Program High School (33.7%). Respondents who took part in the research were mostly female, 92 respondents (88.5%) and 12 male respondents (11.5%). There were 92 respondents who had allowances ≥10.000 (88.5%) while respondents who had allowances <10.000 were 12 respondents (11.5%).

Based on the table, it is known that respondents with overweight status have a smaller proportion, namely 27 respondents (26%) compared to respondents who are not overweight, namely 77 respondents (74%). There were 60 respondents who frequently consumed soda drinks (57.7%) compared to 44 respondents who rarely consumed soda drinks (42.3%).

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**Table 2. Analysis of the Relationship between the Frequency of Soda Consumption and Overweight**

Variable	Overweight		p- value
	Yes (n=27)	No (n=77)	
<b>Frequency of Soda Consumption (n/%)</b>			
<b>Often</b>	15/55.6	45/58.4	0.794
<b>Rare</b>	12/44.4	32/41.6	

Based on table 2, it is known that the majority of respondents who are not overweight are 74% (77 respondents) and the proportion of respondents who frequently consume soda drinks is 57.7% (60 respondents). The results of the analysis show that respondents who are not overweight are more likely to frequently consume soda drinks, namely 45 respondents (58.4%) in the frequent category and 32 respondents (46.1%) in the rarely category. Meanwhile, respondents who were overweight were found to consume fewer soda drinks, namely 15 respondents (55.6%) in the frequent category and 12 respondents (44.4%) in the rarely category. The chi-square test carried out produced a p-value of 0.794 > p-value 0.05, which means there is no significant relationship between the frequency of soda consumption and overweight status.

## DISCUSSION

In this study involving 104 respondents, it was found that respondents who were overweight were more likely not to frequently consume fizzy drinks (27.3%). Meanwhile, respondents who were not overweight actually consumed carbonated drinks more often (75%). The results of the analysis carried out using the chi square test showed that the p-value was 0.794, which was greater than the p-value of 0.05, which means there was no significant relationship between the frequency of soda consumption and being overweight.

The frequency of consumption of soda drinks and the incidence of overweight are not related because consumption of soda drinks containing sweeteners only helps meet energy intake but does not exceed the limits required by the body. Based on research conducted on 606 teenagers, the total intake of calorie drinks was 420 kcal and contributed 21.2% to energy intake (Cahyaningtyas, Soviana, Gz, & Gizi, 2018). This figure is still below the Nutritional Adequacy Rate (AKG) for teenage boys and girls who need energy of around 2650 kcal and 2100 kcal

per day. Frequently consuming soda drinks but not exceeding the adequate daily sugar and calorie intake limits will not have much of an effect on weight gain. In this study, respondents did not have overweight status even though they tended to frequently consume soda drinks, namely 45 respondents (75%).

Frequent consumption of soda is because most respondents have pocket money  $\geq 10.000$  (88.5%). The amount of this pocket money can increase respondents' purchasing power for the drinks they like, especially with the emergence of various variants of soft drinks, soda and other sweetened, increasingly making teenagers interested in trying them. In addition, affordable prices and easy to find sellers of soda and sweetened drinks are also factors in increasing soda consumption in adolescents. This condition is in accordance with research that states that there is a relationship between pocket money and accessibility with the frequency of consumption of soft drinks (Meiriasari & Mulyani, 2013).

The results of this study are in line with research conducted on teenagers at the Palu Salvation Army Vocational School which showed that the incidence of overweight was not related to the frequency and level of consumption of soft drinks (Faisal & Anayanti, 2021). This is in line with other research which shows that the frequency of drinking soda consumption is not significantly related to the incidence of obesity in adolescents (Amelia & Nugroho, 2021). This is because overweight is not only caused by excessive consumption of soda drinks, but there are several other factors that influence overweight.

Several factors that can cause overweight include direct factors which include the level of consumption of fat, protein and carbohydrates, genetics and physical activity. Meanwhile, indirect factors that can cause overweight include individual factors (negative body image), economic factors and diet related to

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good nutritional knowledge (Febriani, 2018). Basically, nutrition occurs due to an imbalance between daily energy intake and energy adequacy needs and expenses incurred. Modern developments have resulted in changes in lifestyle among teenagers, where they tend to live a sedentary lifestyle such as playing with gadgets and watching TV. The emergence of various types of fast food has also caused changes in food consumption patterns where teenagers tend to like fast food so that this lifestyle without physical activity will increase the risk of overweight and obesity in teenagers (Rafiony et al., 2015). Nutritional problems can have a lasting impact into adulthood and are a risk factor that can cause degenerative and metabolic diseases such as diabetes mellitus, coronary heart disease, cancer, dental caries and hypertension. Poor quality of life can cause health problems such as respiratory problems, stopping breathing during sleep (sleep apnea), and sleep disorders (Syifa & Djuwita, 2023).

## CONCLUSION

There was no significant relationship between soda consumption and the incidence of overweight in respondents. It is known that most respondents who frequently consume soda are not overweight. This is because soda drinks are not the only cause of overweight. Please note that consuming soda drinks that contain sweeteners only helps meet energy intake but does not exceed the limits required by the body. However, you still have to pay attention to the frequency of drinking soda so that it is not excessive, which can increase the risk of various diseases.

The suggestion in this study is for schools to select various foods and drinks that are traded in the school cafeteria environment. As for students, they should limit their consumption of soda drinks and spend more on their pocket money.

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