

A Cross-Sectional Study on the Risk Factors of Overnutrition Status among Junior High School Students

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Abstract

Background: Overweight status in adolescents is known to have a high prevalence and continues to grow every year. This trend increased by 5.2% among adolescents aged 13-15 in Indonesia, and the Bekasi Regency has the fourth highest prevalence in West Java Province. Over time, changes in the quality and quantity of diet and lifestyle can be a factor in the occurrence of overweight status in adolescents. This study aims to determine the relationship between ultra-processed food consumption habits, physical activity, and sleep duration with overweight status in adolescents at Junior High School 1 South Tambun.

Method: This study used an analytic observational method with a cross-sectional design. The study population comprised 160 students in grades 7 and 8 at State Junior High School 1 South Tambun, and a sample of 113 respondents using a stratified random sampling technique. Research data were obtained directly through anthropometric measurements and filling out questionnaires. Data were analysed using univariate and bivariate analysis with the Chi-Square statistical test.

Result: The percentage of overnutrition status in adolescents was 28.3%. Based on data analysis through the Chi Square test, the relationship between ultra-processed food consumption habits and overweight status ($p=0.270$), physical activity and overweight status ($p=0.306$), and sleep duration with overweight status ($p=0.771$).

Conclusion: Consumption habits of ultra-processed foods, physical activity, and sleep duration are not associated with overweight among Junior High School 1 South Tambun adolescents. The high percentage of overnutrition status in this study suggests that adolescents should adopt a healthy diet and lifestyle to prevent an increase in the prevalence of overnutrition status.

Keywords: Adolescents, Overnutrition, Physical activity, Sleep duration, Ultra-processed foods consumption

INTRODUCTION

Adolescence is a transitional phase from childhood to adulthood, marked by various biological, cognitive, and socio-emotional changes.¹ This stage typically begins between the ages of 12 and 16, coinciding with junior high school years, and is commonly referred to as early adolescence.^{2,3} During this period, adolescents require adequate energy and nutrient intake to support optimal growth and development.

An imbalance between nutrient intake and adolescent energy expenditure may lead to nutritional problems.⁴ One of the nutritional problems commonly occurring in adolescents is overnutrition, a condition characterized by excessive fat accumulation in the body.⁵ Overnutrition is classified into two categories: overweight and obesity, typically identified by a Body Mass Index-for-Age (BMI-for-age) z-score greater than +1 SD.⁶ Overnutrition during adolescence can result in various developmental issues, such as impaired cognitive function and altered timing of puberty.⁷ Furthermore, adolescents who experience overnutrition are more likely to continue this condition into adulthood, increasing the risk of non-communicable diseases such as hypertension, type 2 diabetes, cardiovascular diseases, stroke, musculoskeletal disorders, respiratory issues, osteoarthritis, and several types of cancer including endometrial, breast, ovarian, prostate, liver, gallbladder, kidney, and colorectal cancer.^{7,8}

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Globally, the World Health Organization (WHO) reported that in 2016, more than 340 million children and adolescents aged 5–19 years were overweight or obese.⁹ The prevalence of overweight in this age group has increased significantly, from 4% in 1975 to 18% in 2016. Similarly, the proportion of obese children and adolescents rose from 1% in 1975 to 14% in 2016. In Indonesia, data from the 2013 National Basic Health Research (Riskesdas) showed that the prevalence of overnutrition among adolescents aged 13–15 years was 10.8% and 7.3% for those aged 16–18 years, based on BMI-for-age. This number rose in the 2018 Riskesdas report to 16.0% and 13.5%, respectively.¹⁰ In West Java Province, overnutrition among adolescents aged 13–15 was 16.9%. In Bekasi Regency specifically, the prevalence of overweight and obesity among adolescents aged 13–15 years was 9.09% and 11.61%, respectively, resulting in a combined prevalence of 20.7%.¹¹ This places Bekasi Regency as the fourth highest in terms of adolescent overnutrition prevalence in West Java, following Bekasi City, Karawang Regency, and Subang Regency.¹¹

The increased risk of overnutrition in adolescents is attributed to genetic (10–30%) and environmental and behavioral (70%) factors.¹² Changes in societal behavior and lifestyle, influenced by economic development, globalization, and urbanization, also affect adolescents, who are naturally curious and inclined to adopt new habits. According to the Indonesian Ministry of Health, lifestyle factors influencing nutritional status include smoking, dietary patterns, and physical activity.¹³

Common dietary patterns among adolescents include low consumption of fruits and vegetables and frequent intake of high-risk foods such as sugary drinks, fried foods, fast food, and processed products.¹ According to the NOVA classification system developed by Monteiro and endorsed by the Food and Agriculture Organization (FAO), processed foods are categorized into four groups: minimally processed foods (MPF), processed culinary ingredients (PCI), processed foods (PF), and ultra-processed foods (UPFs).¹⁴ Ultra-processed foods are industrially manufactured, energy-dense foods high in sugar, fat, and sodium.¹⁵ Their refined carbohydrate content can lead to overconsumption, fat accumulation, and overnutrition.¹⁶ A study by Nardocci involving individuals over 18 years old in Canada found that consumption of UPFs was associated with a 32% higher risk of obesity.¹⁷ Similar to a cross-sectional study by Fauziyyah *et al.*, this study also reported a significant association between UPF consumption and obesity incidence.¹⁵

Another contributing factor to weight gain is low physical activity.¹⁸ Nationally, the prevalence of insufficient physical activity among individuals over 10 years increased from 26.1% in 2013 to 33.5% in 2018.¹⁹ Lack of physical activity leads to suboptimal energy expenditure. When this persists without being balanced by a healthy diet, it increases the risk of overnutrition and obesity. A study by Nisa *et al.* found that physically inactive adolescents had a 1.937 times higher risk of being overweight or obese compared to those with sufficient physical activity.²⁰ Similarly, Destiani *et al.* previously found a significant relationship between physical activity and overnutrition among junior high school students.²¹

Adequate sleep, one of the basic human needs, is vital in restoring and optimizing the body's condition after physical activity. Sleep deprivation is associated with an increased appetite and BMI due to hormonal imbalances, specifically a decrease in leptin, which suppresses hunger, and an increase in ghrelin, which stimulates appetite.^{22,23} Research by Amrynia and Galuh indicated a relationship between adolescent sleep duration and overnutrition.¹² Manja also found a significant association between sleep duration and obesity, with those sleeping less than 6 hours per day having a 3.104 times higher risk of becoming obese.²⁴

Given the rising prevalence of overnutrition, which remains above the national average, and the absence of prior studies addressing these specific variables, combined with the availability of ultra-processed food products at nearby school canteens and outlets—this study aims to analyze the relationship between ultra-processed food consumption habits, physical activity, and sleep duration with overnutrition status among adolescents at State Junior High School 1 of South Tambun.

METHOD

Participants and Study Design

A quantitative study was performed using a cross-sectional approach. The independent variables were ultra-processed food consumption habits, physical activity, and sleep duration, while the dependent variable was overnutrition status. Data was collected from May to June 2023, targeting 160 seventh—and eighth-grade students at State Junior High School 1 of South Tambun. One hundred and

thirteen participants, 51 seventh-grade and 62 eighth-grade students, were selected as samples using stratified random sampling by predetermined inclusion and exclusion criteria.

Measurements and Procedure

Students of State Junior High School 1 of South Tambun aged 13–16 years were included in this study, were physically and mentally healthy, and were willing to complete the questionnaire and participate. The exclusion criteria included students who were ill or had medical conditions affecting body weight (such as diabetes mellitus, thyroid disorders, heart disease, or tuberculosis), athletes, and individuals taking specific medications. Data on ultra-processed food consumption habits were collected using a Food Frequency Questionnaire (FFQ), physical activity data were obtained through the Physical Activity Level (PAL) questionnaire, and sleep duration data were assessed using the Pittsburgh Sleep Quality Index (PSQI).

Statistical Analysis and Ethical Clearance

Moreover, besides the distribution of the study variables, a Chi-Square test was also conducted to test the relationship between the independent and dependent variables. Data collection was carried out directly at State Junior High School 1 of South Tambun, with approval from the school administration and the Health Research Ethics Committee of Universitas Pembangunan Nasional “Veteran” Jakarta (Approval No.: 286/VI/2023/KEPK). The process began by distributing informed consent forms to potential participants. Students who agreed to participate and signed the consent form were asked to undergo anthropometric measurements and complete research questionnaires.

RESULT

Table 1 showed that most of the State Junior High School 1 of South Tambun students were not classified as overnourished. Most respondents were female and 13 years old. The proportion of students who frequently consumed ultra-processed foods was nearly equal to that of those who consumed them rarely. More than half of the students reported engaging in light physical activity. Additionally, the number of students with inadequate sleep duration (less than 8 hours) was significantly higher than those with adequate sleep.

Table 1. Univariate Analysis of Respondent Characteristics at State Junior High School 1 of South Tambun

Variable	n	%
Nutritional Status		
Non-overnutrition	81	71.1
Overnutrition	32	28.3
Age		
13 years	67	59.3
14 years	43	38.1
15 years	2	1.8
16 years	1	0.9
Sex		
Male	49	43.4
Female	64	56.6
Ultra-Processed Food Consumption		
Frequent	57	50.4
Rare	56	49.6
Physical Activity Level		
Light	72	63.7
Moderate	23	20.4
Heavy	18	15.9
Sleep Duration		
Inadequate	88	77.9
Adequate	25	22.1

Table 2. The Relationship Between Ultra-Processed Food Consumption and Overnutrition Status

Ultra-Processed Food Consumption	Nutritional Status						p-value
	Overnutrition		Non-overnutrition		Total		
	n	%	n	%	n	%	
Frequent	13	22.8	44	77.2	57	100	0.270
Rare	19	33.9	37	66.1	56	100	

Table 3. The Relationship Between Physical Activity and Overnutrition Status

Physical Activity	Nutritional Status						p-value
	Overnutrition		Non-overnutrition		Total		
	n	%	n	%	n	%	
Light	21	29.2	51	70.8	72	100	0.306
Moderate	4	17.4	19	82.6	23	100	
Heavy	7	38.9	11	61.1	18	100	

In Table 2, among students who frequently consumed ultra-processed foods, 22.8% were overnourished. The p-value of 0.270 ($p > 0.05$) indicates no statistically significant association between ultra-processed food consumption habits and overnutrition among adolescents at State Junior High School 1 of South Tambun. Table 3 indicates that most students engaged in light physical activity regardless of their nutritional status. Statistical test suggests no statistically significant relationship between this population's physical activity level and overnutrition status ($p=0.306$). As shown in Table 4, most students found inadequate sleep durations. Moreover, the statistical test indicates no significant association between sleep duration and overnutrition status among adolescents in this study ($p=0.771$).

Table 4. The Relationship Between Sleep Duration and Overnutrition Status

Sleep Duration	Nutritional Status						p-value
	Overnutrition		Non-overnutrition		Total		
	n	%	n	%	n	%	
Inadequate	26	29.5	62	70.5	88	100	0.771
Adequate	6	24.0	19	76.0	25	100	

DISCUSSION

The prevalence of overnutrition among students at State Junior High School 1 of South Tambun (28.3%) was found to be higher than the reported prevalence among adolescents in Bekasi Regency (20.7%) according to the 2018 Basic Health Research (Riskesdas) data. Overnutrition during adolescence not only increases the risk of obesity in adulthood but also contributes to a greater likelihood of developing degenerative diseases such as coronary heart disease, diabetes mellitus, hypertension, stroke, and cancer.¹² Factors contributing include genetics, dietary intake, physical activity, and sociocultural influences.²⁵

Ultra-Processed Food Consumption and Overnutrition Status

The findings of this study indicate no statistically significant association between the consumption of ultra-processed foods and overnutrition among adolescents at State Junior High School 1 of South Tambun. Based on brief interviews with respondents, many preferred bringing home-prepared meals to school rather than purchasing ultra-processed food products, primarily due to financial considerations. Furthermore, it is important to note that not all ultra-processed foods are high

in energy or low in micronutrients, key factors contributing to the risk of overnutrition.¹⁶ This finding aligns with research by Enes et al., which found no significant association between ultra-processed food consumption and nutritional status among adolescents aged 10–18 in Campinas, São Paulo ($p = 0.383$).²⁶ Similarly, a study by Ali et al. in Kuala Nerus, Terengganu, Malaysia, reported no significant association ($p = 0.954$), as most respondents consumed predominantly unprocessed or minimally processed foods. Although the frequency of home cooking was not particularly high, participants preferred traditional food options when eating outside the home.²⁷ Pratiwi et al. found no significant association between ultra-processed food intake and nutritional status, attributing the result to the relatively higher intake of unprocessed or minimally processed foods, with respondents relying more on fresh ingredients for daily consumption. Respondents in the current study largely came from middle-income socioeconomic backgrounds, which may influence food choices and access to healthier meals.¹⁶

A study by Fadila reported a significant association between frequent consumption of ultra-processed foods and overweight status among students at State Junior High School 3 of Makassar ($p=0.000$).²⁸ Elevated intake of ultra-processed foods may be driven by biological, behavioral, and socioeconomic factors.²⁹ These foods are considered obesogenic due to their high energy density, excessive sugar, salt, saturated fat content, low micronutrients, fiber, and protein.^{16,17} Additionally, their industrial processing techniques often suppress satiety signals, increasing appetite and overall energy intake, thereby contributing to overnutrition.³⁰ The most frequently consumed ultra-processed foods among respondents in this study included instant noodles, syrup, ice cream, packaged chocolate, smoked beef, biscuits, cassava snacks, extruded snacks, and chicken nuggets.

Physical Activity and Overnutrition Status

This study found no significant association between adolescents' physical activity levels and overnutrition status. However, the number of overnutrition respondents engaged in light physical activity was higher than those performing moderate or vigorous activity. This may be explained by the nature of most students' daily routines, which primarily involve sedentary behaviors such as sitting, studying, doing homework, or resting. More physically engaging activities like sports, running, or cycling were generally limited to weekends or holidays. These findings are consistent with those of Novianty et al., who reported no significant association between physical activity and adolescent nutritional status ($p=0.772$). Mufidah also found no such association, suggesting that while physical activity is an indirect factor, nutritional status is more directly influenced by dietary intake and infectious disease.^{23,31} Ganis et al. found no significant relationship ($p=0.212$) in their study of Catholic Junior High School St. Ignatius Loyola Labuan Bajo students, noting that most daily activities were sedentary.³² However, other studies have reported different results. For instance, Yanti et al. found a significant relationship between physical activity and overnutrition among senior high school students ($p=0.017$).³³

The World Health Organization recommends that children and adolescents aged 5–17 engage in at least 60 minutes of moderate to vigorous physical activity daily. Insufficient physical activity can lead to decreased muscle mass and increased fat accumulation, lowering basal metabolic rate. Combined with a high-calorie diet, this imbalance can significantly increase the risk of overnutrition.²⁰

Sleep Duration and Overnutrition Status

No significant association was found between sleep duration and overnutrition status among adolescents in this study. This may be attributed to typical lifestyle changes during adolescence, such as a tendency to stay up late, often not for eating but to complete academic assignments or use electronic devices. Additionally, other factors may play a more direct role in determining nutritional status. This result is consistent with research by Saputri at State Junior High School 2 of Klego Boyolali, which also reported no significant relationship between sleep duration and nutritional status ($p=0.452$).³⁴ Similar findings were observed in a study by Rachmadiani and Puspita, where sleep duration did not correlate with nutritional status ($p=1.000$). These findings suggest that short sleep duration does not necessarily lead to overnutrition. One possible explanation is that some individuals can maintain alertness despite sleep deprivation due to motivational or lifestyle factors.³⁵ Putri et al. also found no significant association between sleep duration and nutritional status among adolescents aged 11–14 in Babelan, Bekasi City ($p=0.313$).³⁶ However, a contrasting result was reported by

Amrynia & Prameswari, where a significant relationship was found ($p=0.04$), indicating that shorter sleep duration was associated with an increased risk of overnutrition.¹²

Individuals with insufficient sleep duration lose only about 26% of fat mass, whereas those with adequate sleep can lose up to 56%. Shorter sleep duration has been linked to reduced leptin, a hormone regulating fat storage, and increased ghrelin. This hunger-stimulating hormone can increase appetite and reduce fat metabolism. Beyond promoting increased appetite, these hormonal imbalances can also slow metabolism and reduce the body's capacity to burn fat. Additionally, daytime fatigue resulting from insufficient sleep may lower an individual's physical activity level, creating an energy imbalance, especially if accompanied by increased caloric intake and contributing to the risk of overnutrition and obesity.^{37, 38}

CONCLUSION

Statistically, no significant associations were found between ultra-processed food consumption, physical activity, sleep duration, and overnutrition among adolescents at State Junior High School 1 Tambun Selatan. This outcome may be influenced by certain limitations in the study, such as potential information bias. Despite these findings, adolescents are encouraged to maintain a balanced diet and adopt a healthy lifestyle, notably by limiting the intake of foods high in sugar, salt, and fat. Future researchers are advised to include additional variables that may influence nutritional status but were not examined in this study, such as parental history of overnutrition, nutrient intake, and eating patterns, habits, and behaviors.

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