

The Relationship Between Fat Intake and Physical Activity and Nutritional Status in Students of SMPN 22 Surakarta

Istianah Nur Adila¹, Nur Lathifah Mardiyati^{2*}, Dwi Sarbini³

Universitas Muhammadiyah Surakarta, Indonesia

Email: nlm233@ums.ac.id

Keywords	Abstract
Fat Intake, Physical Activity, Nutritional Status, Students	Adolescents are an age group that is vulnerable to nutritional problems due to physiological changes and modern lifestyles. This study aims to determine the relationship between fat intake and physical activity and nutritional status in SMPN 22 Surakarta students. This study uses an analytical observational design with <i>a cross-sectional approach</i> . The sample amounted to 141 students who were selected using a simple random sampling technique. Fat intake data was collected through <i>the 24-Hour Food Recall</i> method for three non-consecutive days and analyzed using Nutrisurvey 2007, while physical activity was measured using <i>the PAQ-A questionnaire</i> . Nutritional status is determined based on the body mass index by age (BMI/U) based on <i>z-score</i> using WHO standards. The results of statistical analysis showed that there was no relationship between fat intake and nutritional status ($p = 0.997$) or between physical activity and nutritional status ($p = 0.070$) in SMPN 22 Surakarta students. This study indicates that other factors beyond fat intake and physical activity may play a role in determining adolescent nutritional status.



INTRODUCTION

Adolescence is a transition period between childhood and adulthood characterized by rapid physical, psychological, and social growth and development (Del Ciampo & Del Ciampo, 2020; Mastorci et al., 2024; Uktamovna, 2025). According to the Child Protection Act, adolescents are defined as individuals aged 10–18 years. In this phase, the need for nutrients increases as growth accelerates. Imbalance in nutritional intake can interfere with development and cause health problems, such as undernutrition, overnutrition, and obesity (Ministry of Health of the Republic of Indonesia, 2018).

Data from the Ministry of Health shows that in the city of Surakarta, the prevalence of adolescents aged 13–15 years with poor nutritional status reached 6.52%, obesity 11.65%, and obesity 4.31%. Meanwhile, in the age group of 16–18 years, the prevalence of adolescents is very thin and thin reaching 9.61%, obese 9.98%, and obese 11.47%. This shows that the problem of nutritional status is still a concern among adolescents, including in the Surakarta area (Aksari & Nugroho, 2024; Susanti et al., 2016; Veronika et al., 2021).

The habit of consuming high-fat foods such as junk food and processed foods is one of the causes of the increasing prevalence of overnutrition and obesity in adolescents (Dewi, 2013). These foods generally contain high fat and calories but are low in fiber and vitamins. Studies by Praditasari and Sumarmik (2018) show that excess fat intake is associated with an increased risk of overnutrition, while lack of fat intake can lead to undernutrition.

In addition to consumption factors, low physical activity also plays a role in increasing the prevalence of obesity. Physical activity plays a role in fat metabolism, and its deficiency can lead to the accumulation of body fat. Research shows that adolescents with very light physical activity have a 9.5 times higher risk of obesity compared to those who are active (Praditasari & Sumarmik, 2018). Modern lifestyles that tend to be passive or sedentary, such as playing gadgets or watching television, also reduce the intensity of physical activity among adolescents (Hamalding et al., 2019).

Previous studies have explored the relationship between dietary fat intake, physical activity, and nutritional status among adolescents. For instance, Dwivedi et al. (2020) found that excessive consumption of high-fat foods significantly correlates with increased obesity risk in adolescents, while insufficient physical activity further exacerbates this condition. Similarly, Kim and Lee (2021) demonstrated that sedentary behaviors, such as prolonged screen time, negatively affect fat metabolism and contribute to overweight and obesity among teenagers. However, these studies often focus on broad populations without addressing specific regional or cultural contexts. This research fills the gap by focusing on adolescents in Surakarta, Indonesia, where unique dietary patterns and lifestyle factors may influence nutritional outcomes differently. By integrating both fat intake and physical activity variables, this study offers a comprehensive understanding of their combined impact on adolescent nutritional status in this locale, providing localized data that can inform targeted interventions.

Based on a preliminary study conducted in July 2024 at SMPN 22 Surakarta on 186 grade VIII students, it was found that 4.30% of students had undernourished status, 11.29% were overnourished, and 8.60% were obese. Based on this background, the researcher is interested in conducting research on the relationship between fat intake and physical activity and nutritional status in students of SMPN 22 Surakarta. The purpose of this research is to investigate the relationship between fat intake, physical activity levels, and nutritional status among grade VIII students at SMPN 22 Surakarta. The study's findings are expected to benefit school health programs, nutrition policymakers, and community health practitioners by offering evidence-based recommendations to improve adolescent health through balanced nutrition and increased physical activity.

METHOD

This study is an observational study with a design *cross-sectional* which aims to analyze the relationship between fat intake and physical activity on the nutritional status of SMPN 22 Surakarta students. The research was conducted in June 2024–May 2025 at SMPN 22 Surakarta with a population of all students in grades VIII and IX, using the *simple random sampling* and produced 141 samples after calculation of the Slovin formula and anticipation of sample loss. Sampling based on inclusion and exclusion criteria. The inclusion criteria in this study are 1) willing to be a respondent and 2) able to communicate well, while the exclusion criteria are 1) sick and 2) not present during the study. This research already has ethical feasibility given by KEPK FK UMS with code of ethics No. 5546/B.1/KEPK-FKUMS/II/2025.

The study-free variables were fat intake and physical activity, while the bound variable was nutritional status. Data were collected through interviews, *24-hour* recall, *PAQ-A* questionnaires, and anthropometric measurements, then analyzed using *Nutrisurvey 2007* and *SPSS version 25*. The research process includes instrument preparation, data collection, *editing*, *coding*, *entry*, and *cleaning* before univariate and bivariate analysis. The relationship between free and bound variables was analyzed using the *Spearman Rank* test with significance interpretation at $p\text{-value} < 0.05$.

The criteria for classification fat intake are divided into three categories, namely 1) less intake if $<80\%$ AKG), 2) sufficient intake if it is in the range of $80\text{--}100\%$ AKG, and 3) more

intake if $>100\%$ AKG. At the level of physical activity, there are five categories based on *the PAQ-A score*, namely very low (score 1), low (score 2), medium (score 3), high (score 4), and very high (score 5). Meanwhile, nutritional status is categorized into 4 categories based on BMI/U, namely undernutrition (-3 elementary school < -2 elementary school), good nutrition (-2 elementary school to $+1$ elementary school), overnutrition ($+1$ elementary school to $+2$ elementary school), and obesity ($> +2$ elementary school).

RESULTS AND DISCUSSION

Respondent Characteristics

The respondents in this study were 141 students in grade IX of SMP Negeri 22 Surakarta. The distribution of respondent characteristics can be seen in Table 1:

Table 1. Distribution of Respondent Characteristics

Category	Frequency (n=141)	Percentage (%)
Gender		
Man	68	48,2
Woman	73	51,8
Age		
14 years	48	34
15 years	78	55,3
16 years old	12	8,5
17 years	3	2,1
Fat Intake		
Less	110	78
Enough	31	22
Physical Activity		
Very low	23	16,3
Low	90	63,8
Keep	24	17
Tall	4	2,8
Nutritional Status		
Malnutrition	16	11,3
Good nutrition	100	70,9
More nutrition	12	8,5
Obesity	13	9,2

Table 1 shows that the respondents in this study consisted of 73 female students (51.8%) and 68 male students (48.2%). Most respondents were 15 years old (78%), followed by 14-year-olds (34%), 12-year-olds (8.5%), and 17-year-olds (2.1%). The majority of students were recorded to have low fat intake, namely as many as 110 people (78%), while only 31 students (22%) had fat intake in the sufficient category. In the physical activity variable, as many as 63.8% of students were in the low physical activity category, 16.3% in the very low category, 17% in the medium category, and only 2.8% were classified as having high physical activity. Based on nutritional status, as many as 11.3% of students are in the undernutrition category, 70.9% are classified as good nutrition, 8.5% have overnutrition status, and 9.2% are included in the obesity category.

The gender and age characteristics of the respondents in this study showed that most were 15-year-old adolescent girls. According to Sari and Nugraheni (2021), age and gender play an important role in influencing the nutritional status of adolescents, due to differences in food consumption patterns, body energy needs, and physical activity levels between men and women. This is supported by research conducted by Hidayati et al (2023) which states that the

age range of 14 to 15 years is a very important period for growth, because during this time the body experiences accelerated development and increased nutritional needs, both macro and micro, which can have a long-term impact on nutritional status.

The results showed that the majority of respondents had a low fat intake (78%), while the rest (22%) were classified as having sufficient intake. This indicates that most students have not met their daily fat needs according to the Nutritional Adequacy Rate (AKG). In fact, fat is an important macronutrient component for adolescents to support growth, hormone production, and absorption of fat-soluble vitamins. These results are in line with research by Fauzia and Haqqi (2022) conducted on students of SMPN 4 Purwokerto, which also showed that most of the respondents had low fat intake. They stated that adolescents' consumption patterns tend to be unbalanced, with low fat portions due to the influence of family economics and irregular eating habits.

Most of the respondents in this study had low physical activity (63.8%). This data shows a growing trend of sedentary lifestyles among adolescents. This is in line with research conducted by Sumilat & Fayasari (2018), which states that sedentary activities in adolescents are dominated by screen-based activities such as playing gadgets, watching television, or using computers, as well as other sedentary activities for a long time.

Most of the students in this study had good nutritional status (70.9%), but there were still 11.3% with undernutrition and 17.7% with overnutrition or obesity. This condition illustrates the phenomenon of *triple burden of malnutrition* in adolescent groups, namely the existence of malnutrition problems, overnutrition, and obesity simultaneously in one population. According to Rachman et al. (2025), the nutritional status of adolescents is greatly influenced by various factors, including diet, physical activity levels, socioeconomic conditions, and lifestyle in general. An imbalance in one or a combination of these factors can lead to impaired nutritional status, either towards deficiency or excess.

The following data presentation aims to describe the distribution of minimum, maximum, median, and standard deviation values of each variable, so as to provide an overview of the trends and variations of respondent data. The distribution of respondent variable values can be seen in the following Table 2.

Table 2. Variable Value Distribution of Respondents

Variabel	Minimal	Maximum:	Median	Standard Deviation
Fat Intake (grams)	33,94	109,90	65,13	15,63
Physical Activity	1,10	4,01	2,01	0,59
Nutritional Status (SD)	-4,00	3,84	-0,63	1,46

Table 2 on the variable fat intake of respondents had an average of 65.13 grams/day with a standard deviation of ± 15.63 grams/day. The minimum value of the respondent's fat intake recorded was 33.94 grams/day, while the maximum value was 109.90 grams/day. When compared to the Nutritional Adequacy Rate (AKG) based on age and gender, where fat needs range from 70-85 grams/day (Ministry of Health of the Republic of Indonesia, 2019), the average fat intake of respondents is still classified as not meeting their needs or is included in the category of insufficient fat intake. The lack of fat intake at this age is quite important to pay attention to, considering that fat plays a role in supporting cell growth, hormone production, and absorption of vitamins A, D, E, and K (Winarsih, 2018). When the body does not get adequate fat intake, the availability of energy becomes limited so that various physiological functions cannot run optimally (Mahatidanar, 2015).

The physical activity variable showed that the score obtained by the respondents was in the range of 1.10 to 4.01. The average physical activity score of all study respondents was 2.01 ± 0.59 . Based on the interpretation of the PAQ-A score, this value indicates that the

majority of adolescents are in the category of low activity. The low average score reflects that most respondents have not met the recommended physical activity of at least 60 minutes per day as recommended by the WHO (2020). Low physical activity can cause energy imbalances, increased body fat mass, and the risk of obesity and non-negable diseases in the future (Ovita et al., 2019).

Meanwhile, the respondents' nutritional status variables showed that the *z-score* value varied from -4.00 SD to +3.84 SD with an average of -0.63 SD $\pm$ 1.46 SD. The average is still in the range of the good nutrition category. The wide variation in the *z-score* value reflects that there are respondents who are undernourished to obese. In adolescence, nutritional status imbalances can have an impact on physical growth, cognitive development, and long-term health risks (WHO, 2020).

The Relationship of Fat Intake with Nutritional Status

Bivariate analysis was performed to determine the relationship between fat intake and nutritional status. The results of the test on the relationship between fat intake and nutritional status can be seen in Table 3.

Table 3. Test Results of the Relationship between Fat Intake and Nutritional Status

Fat Intake Rate	Nutritional Status										p
	Malnutrition		Good Nutrition		More Nutrition		Obesity		Total		
	N	%	N	%	N	%	N	%	N	%	
Less	13	81,3	78	78,0	8	66,7	11	84,6	110	78,0	0,997
Enough	3	18,8	22	22,0	4	33,3	2	15,4	31	22,0	
More	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0	
Total	16	100	100	100	12	100	13	100	141	100	

*Rank Spearman

Table 3 shows that the results of the *spearman rank* test show a significance value (p) of 0.997. The p value > 0.05 , then it can be concluded that there is no significant relationship between fat intake and nutritional status in students of SMP Negeri 22 Surakarta. Thus, the null hypothesis (H0) is accepted.

In other words, high or low fat intake does not always go hand in hand with changes in the nutritional status of students. These results show that students' nutritional status is influenced by many other factors beyond fat intake, such as the total amount of energy consumed, the overall diet, the type and quality of fat consumed, the frequency of meals, and the level of physical activity. Although respondents often consumed fried or fatty foods, small portions of consumption, the use of used cooking oil, and family economic limitations also caused insufficient daily fat intake. In addition, the 3 x 24 hour food recall measurement method used in this study only describes short-term consumption patterns, so it does not necessarily reflect overall eating habits.

Interestingly, although most of the respondents were recorded to have a low fat intake, the results of observations and interviews showed that they still ate fatty foods at almost every meal. These foods are usually in the form of fried foods or types of fast food (*junk food*) that are easily accessible and can be used as a side dish. In addition, the most common food processing method used by respondents' families is fried, which technically does contain fat. The list of foods or food ingredients that respondents consumed most often can be seen in Table 4:

Table 4. List of Food/Ingredients of Research Respondents

No	Food/Ingredients
1.	Oil
2.	Bread
3.	Instant noodles
4.	Ayam goreng
5.	Fried Rice
6.	Fried tempeh
7.	Chicken eggs
8.	Milk
9.	Basreng (fried meatballs)
10.	Intestinal chips

Table 4 shows that there were quite a few types of high-fat foods consumed by grade 9 respondents during the 3-day period of non-consecutive recording. Some of them are even classified as very often consumed, such as oil, bread, fried chicken, instant noodles, and fried rice. These foods generally contain moderate to high amounts of fat, depending on how they are processed and the portions consumed.

This study shows that the overall fat intake of the respondents is still relatively low based on the results of nutritional estimates from the recorded food data. There are several possible main causes, including:

First, a small portion of consumption. Although the type of food consumed contains high fat, if consumed in small amounts, the total contribution of fat to energy intake also remains low (Fayasari et al., 2018). Many teens tend to consume fatty foods only as a snack or in limited frequency, so their impact on weight gain is insignificant.

Second, not all respondents have the same high-fat food consumption pattern. Variations in food preferences are the main cause of this imbalance. Some adolescents may prefer low-fat foods such as fruits, vegetables, or healthier traditional foods, rather than fast food or processed foods that are high in fat (Fayasari et al., 2018). This shows that behavioral factors and food choices greatly determine how fat is consumed by each individual.

Third, the habit of skipping meals. A number of students admitted that they did not eat breakfast or eat lunch regularly, which had an impact on not meeting their energy and macronutrient needs, including fat. This irregular diet usually occurs among adolescents and risks causing unbalanced nutrient intake (Kasenda et al., 2024). If respondents often skip meals or do not eat regularly, their fat intake may also decrease, as there is not enough food intake to meet the body's energy and fat needs. The results of this study are also strengthened by other studies that show that food preferences, food habits, and frequency of food consumption are the dominant factors that determine the nutritional status of adolescents, not solely the type of food available around them (Mokoginta et al., 2016).

The results of this study reinforce the importance of evaluation not only based on the frequency of consumption of certain foods, but also considering portions and daily diet as a whole (Putri et al., 2022). These results are in line with previous findings by Pratama et al. (2021) which stated that although adolescents often consume fast food, the intake of macronutrients does not always exceed the safe limit due to the frequency and portion of consumption that is not too large. The results of this study are also in line with the research conducted by Fauzia and Haqqi (2022) which stated that there was no significant relationship between fat intake and nutritional status in SMPN 4 Purwokerto students with a p value of 0.682. However, this study is not in line with the research conducted by Febytia and Dainy (2022) which stated that there was no significant relationship between fat intake and nutritional status in nutrition students at the University of Muhammadiyah Jember with a p value of 0.412.

Research conducted by Khoerunisa and Istianah (2021) also showed a significant relationship between fat intake and nutritional status in adolescents with a p value of 0.003.

The Relationship of Physical Activity with Nutritional Status

Based on the results of the study using the PAQ-A physical activity questionnaire, it was found that most of the respondents spent more of their time with light activities such as standing around the location and sitting around while reading, chatting, or doing assignments. In addition, in the question section about the frequency of exercising and playing games over the past week, the majority of respondents answered "never" or only "1–2 times".

Bivariate analysis was performed to determine the relationship between physical activity and nutritional status. The results of the test on the relationship between physical activity and nutritional status can be seen in Table 5.

Table 5. Test Results of the Relationship between Physical Activity and Nutritional Status

Physical Activity Level	Nutritional Status										p
	Malnutrition		Good Nutrition		More Nutrition		Obesity		Total		
	N	%	N	%	N	%	N	%	N	%	
Very low	0	0,0	20	20,0	0	0,0	3	23,1	23	16,3	0,070
Low	12	75,0	60	60,0	8	66,7	10	76,9	90	63,8	
Keep	4	25,0	16	16,0	4	33,3	0	0,0	24	17,0	
Tall	0	0,0	4	4,0	0	0,0	0	0,0	4	2,8	
Very high	0	0,0	0	0,0	0	0,0	0	0,0	0	0,0	
Total	16	100	100	100	12	100	13	100	141	100	

*Rank Spearman

Table 5 shows that the results of the *spearman rank* test show a significance value (p) of 0.070. The p value > 0.05, then it can be concluded that there is no significant relationship between physical activity and nutritional status in SMP Negeri 22 Surakarta students. Thus, the null hypothesis (H0) is accepted.

The results of this study show that the low intensity of physical activity among adolescents is more influenced by the use of gadgets and the lack of an environment that supports outdoor activities. Light and irregular physical activity in the short term tends not to have a direct impact on changes in nutritional status, especially if energy intake from food remains balanced or excessive (Putri et al., 2022). In addition, in adolescence, nutritional status is also greatly influenced by diet, puberty growth, and other life habits, which may be more dominant than physical activity in influencing body mass index (BMI) (Sari & Nugraheni, 2021).

This study also shows that although physical activity is an important factor in maintaining nutritional status, its effect is more visible in the long term and when activities are carried out intensely and regularly (Kusumawardani et al., 2023). Therefore, it is important to foster structured physical activity habits early on to prevent future health problems.

This study shows that the majority of adolescent respondents have a low level of physical activity, but are still classified as good nutritional status. This shows that low physical activity is not always directly related to nutritional status problems, especially in a short period of time. The results of this study are in line with research conducted by Nabawiyah et al (2021) which found that there was no meaningful relationship between physical activity and nutritional status in students with a p value of 0.411, because nutritional status is also greatly influenced by various other factors, such as the adequacy of energy intake, eating frequency patterns, and the consumption of ready-to-eat or processed foods. However, this study is not in

line with the research conducted by Harahap et al (2020) which stated that there is a relationship between physical activity and nutritional status in adolescents in Labuhan Batu district with a p value of 0.030. Research conducted by Febytia and Dainy (2022) also showed a significant relationship between physical activity and nutritional status in nutrition students at the University of Muhammadiyah Jember with a p value of 0.001.

Although the level of physical activity of the respondents is relatively low, it is likely that they still have daily energy intake that can meet or even exceed the body's needs, which are sourced from staple foods, snacks, and foods high in sugar and fat. In a study conducted by Putri et al. (2022), it was stated that in the adolescent group, energy balance was more influenced by food consumption patterns than physical activity, especially when these activities were light, unstructured, and not carried out regularly. Therefore, even if daily physical activity is low, an individual's nutritional status or Body Mass Index (BMI) can still be in the normal category as long as there is a balance between the energy coming in and the energy expended. This condition suggests that nutritional status does not only depend on activity level, but is also strongly influenced by the quantity and quality of daily food intake.

CONCLUSION

Based on the research findings, it can be concluded that there is no significant relationship between fat intake and nutritional status, nor between physical activity and nutritional status among students at SMP Negeri 22 Surakarta. Despite the fact that the majority of students had low fat intake and low physical activity levels, these factors did not appear to significantly affect their nutritional status. The lack of a relationship could be attributed to other contributing factors, such as the overall diet, genetics, socio-economic conditions, or perhaps other lifestyle factors that were not explored in this study. This suggests that fat intake and physical activity alone may not be sufficient to determine nutritional status in this specific population.

For future research, it is recommended to explore a broader range of factors that could affect the nutritional status of adolescents, such as the overall quality of the diet, sleep patterns, or mental health conditions. Further studies could also investigate other possible mediators such as parental influence, peer pressure, or environmental factors like the availability of healthy food and recreational spaces. A longitudinal study may provide more insight into how these variables influence the nutritional status over time, and if there is a delayed effect of fat intake or physical activity on the health outcomes of adolescents.

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