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Original Research Paper

The Relationship Between Physical Activity and Fiber Intake with The Incidence of Overweight in Teenagers at SMA Negeri 1 Toroh

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ABSTRACT

Background: Overweight is a common issue among adolescents, with 9.5% of Indonesian teenagers classified as overweight in 2018. Low physical activity and inadequate fiber intake are significant contributing factors. **Objective:** This study aimed to analyze the relationship between physical activity and fiber intake with overweight incidence among students at SMA Negeri 1 Toroh. **Methods:** This descriptive quantitative study used a cross-sectional design involving 90 students from grades X, XI, and XII, selected through proportionate stratified random sampling. Physical activity was measured using a 7x24 hour activity form, fiber intake was assessed with the Sq-FFQ, and overweight status was determined based on BMI calculations. Data were analyzed using the Spearman rank correlation test. **Results:** Most respondents had low physical activity (81.1%) and inadequate fiber intake (88.9%). A total of 41.1% were classified as overweight. The analysis showed no significant relationship between physical activity and overweight status ($p = 0.543$; $rs = -0.065$). However, fiber intake was significantly associated with overweight status ($p = 0.033$; $rs = 0.225$). **Conclusion:** There is no significant association between physical activity and overweight status, but fiber intake is significantly related to overweight status among students at SMA Negeri 1 Toroh.

Introduction

Biologically, adolescence is a period that requires a balance between nutritional intake and physical activity. Adolescence is a transitional developmental phase between childhood and adulthood[1]. Adolescents commonly face nutritional problems, one of which is overweight, resulting from an imbalance between dietary intake and physical activity[2].

In 2018, 9.5% of adolescents in Indonesia were reported to be overweight, while the prevalence in Central Java Province was 7.9%[3], and in Grobogan Regency in 2017, it reached 9.98%[4]. According to UNICEF, obesity rates have steadily increased across all age groups in recent years. Among individuals aged 5–19 years, the prevalence reached 66.7%, which is linked to poor eating habits and a preference for foods and beverages high in sugar, salt, and fat, often consumed in excess over long periods. At the same time, the consumption of fiber-rich foods such as fruits and vegetables among adolescents remains low, which has a significant impact on the prevalence of overweight and obesity[5].

Overweight is a condition where a person's body weight exceeds the normal range[6]. According to the Indonesian Ministry of Health, overweight is indicated by a Body Mass Index (BMI) of 23–24 kg/m². Weight gain can result from frequent consumption of high-fat, low-fiber foods over an extended period[7]. According to Millatashofi, low protein intake and high-fat consumption can also contribute to overweight[8]. Other contributing factors to

overweight in adolescents include genetics, low physical activity, unhealthy eating patterns, and nutrient intake[9].

Physical activity refers to body movements generated by skeletal muscles that result in energy expenditure[10]. The more frequent the activity, the more energy is expended. Adolescents who are physically inactive may experience fat and calorie accumulation without adequate energy burning, leading to overweight[11]. Preliminary studies at SMA Negeri 1 Toroh found that 65% of adolescents engaged in light physical activity, often preferring activities that require minimal energy, such as lounging, sitting, and exercising only during scheduled physical education classes. Besides physical activity, fiber intake also influences the occurrence of overweight.

In a study by Aziz et al. (2023), there was a significant relationship between physical activity and overweight among high school students at SMA N 1 Singkawang. This was attributed to the high prevalence of low physical activity among students, linked to sedentary lifestyles, such as spending excessive time on mobile phones, playing games, and prolonged television watching, which resulted in minimal energy expenditure[12]. Similarly, Hamalding et al. (2019) found a correlation between physical inactivity and overweight, noting that adolescents often preferred watching television, playing games, and snacking over engaging in energy-demanding activities[13].

In addition to physical inactivity, a diet high in carbohydrates, fats, and sugars but low in fiber can also contribute to overweight. High-fiber foods can promote satiety and help reduce hunger[14]. Preliminary interviews conducted by the researchers using the SQ-FFQ form to assess food consumption among adolescents at SMA Negeri 1 Toroh over the past month revealed that 95% of adolescents had a fiber intake deficit. This was likely due to adolescents' tendency to consume unhealthy snacks and foods that are low in fiber and high in fat. A study by Putri (2023) found a significant relationship (p=0.001) between fiber intake and overweight. Among adolescents with low fiber intake, 86.7% were classified as obese[15].

High school adolescents are a vulnerable group at risk of becoming overweight. Contributing factors include infrequent physical activity and low consumption of fruits and vegetables. Based on this background, the research question is formulated as: "Is there a relationship between physical activity and fiber intake with overweight among adolescents at SMA Negeri 1 Toroh?" In response to this problem, it is necessary to conduct a study entitled "The Relationship Between Physical Activity and Fiber Intake with Overweight Among Adolescents at SMA Negeri 1 Toroh.

Materials and Methods

Research Design

This study employed a quantitative descriptive method with a cross-sectional design aimed at identifying the relationship between physical activity and fiber intake with the incidence of overweight among adolescents. The study was conducted at SMA Negeri 1 Toroh in September 2024.

Sample

The population in this study included all students from grades X, XI, and XII at SMA Negeri 1 Toroh, totaling 1,047 students. The sampling technique used was Proportionate Stratified Random Sampling to ensure representation from each grade level, resulting in a total sample of 90 students. Inclusion criteria included adolescents aged 16–18 years, able to stand upright, and not undergoing any specific diets such as a high-fiber diet, low-fiber diet, high-fat diet, or low-fat diet.

Data Collection Techniques

Data were collected through interviews using a 7x24 hour physical activity form to measure the respondents' activity levels and fiber intake interviews using the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ). Additionally, anthropometric measurements, including weight and height, were taken twice to ensure data accuracy.

Data Analysis Techniques

Data analysis in this study included univariate and bivariate analysis. The univariate analysis was used to describe the characteristics of the respondents, such as age, gender, class, physical activity level, fiber intake, and overweight status. Bivariate analysis was performed to test the relationship between variables using the Spearman Rank correlation test.

Ethical Consideration

This study obtained an ethical clearance certificate from the Health Research Ethics Committee of the Faculty of Health Sciences with certificate number 555/KEPK-FIK/IX/2024. All respondents who participated were provided with explanations regarding the objectives and procedures of the study and gave their consent after understanding their rights and obligations as participants. The researchers ensured the confidentiality and security of the respondents' personal data.

Results

This study involved 90 adolescents from grades X, XI, and XII at SMA Negeri 1 Toroh. The data analysis consisted of univariate and bivariate analyses. The univariate analysis covered variables such as age, gender, class, physical activity, fiber intake, and the incidence of overweight. Meanwhile, bivariate analysis used the Spearman rank correlation test to analyze the relationship between physical activity and fiber intake with the incidence of overweight.

Table 1. Distribution of Characteristics, Physical Activity, Fiber Intake, and Overweight Incidence

Characteristics	n	%
Age		
16 years	64	71.1
17 years	22	24.4
18 years	4	4.4
Gender		
Male	36	40.0
Female	54	60.0
Grade		
Grade X	30	33.33
Grade XI	30	33.33
Grade XII	30	33.33
Physical Activity		
Light	73	81.1
Moderate	14	15.6
Vigorous	3	3.3
Fiber Intake		
Deficit	80	88.9
Adequate	8	8.9
Excess	2	2.2
Overweight Incidence		
Overweight	37	41.1
Not Overweight	53	58.9

***Source**: Primary Data*

Based on Table 1, the majority of respondents were 16 years old, accounting for 71.1%, and more than 50% were female. Regarding physical activity data, most respondents engaged in light physical activity (81.1%), while 15.6% engaged in moderate activity. Performing physical activity daily is essential. According to research by Efendi (2021), respondents tend to perform light activities that do not expend much energy, especially among female respondents[17]. For fiber intake data, almost all respondents had a fiber deficit (88.9%), as they rarely consumed fiber sources and frequently consumed snacks and foods high in fat. Regarding the incidence of overweight, 41.1% of respondents were categorized as overweight, while the remaining 58.9% had a normal nutritional status.

Table 2. Distribution of Food Items, Consumption Frequency, and Average Consumption

Food Items	Frequency	Average Consumption (g/day)
Carbohydrates		
Rice	2–3 times/day	100–200 g
Instant Noodles	2–4 times/week	85–170 g
Animal-Based		
Chicken Eggs	1–4 times/week	50–100 g
Chicken Meat	2–3 times/month	40–80 g
Plant-Based		
Tofu	1–2 times/week	50–100 g
Tempeh	1–3 times/week	25–75 g
Vegetables		
Spinach	1–2 times/week	35–60 g
Carrots	1–2 times/week	30 g
Water Spinach	2–3 times/month	30–45 g
Fruits		
Oranges	1–2 times/week	55–110 g
Mangoes	Once a month	60–120 g
Apples	1–2 times/month	85 g
Papayas	1–2 times/month	110 g
Oils & Fats		
Cooking Oil	Once a day	5 g
Coconut Milk	1–2 times/week	15–30 g
Snacks		
Chiki	Once a day	15 g
Others		
Sugar	2–3 times/day	20–40 g
Sauce	Once a day	10–20 g

***Source**: Primary Data*

Based on Table 2, the eating patterns of the respondents tended to be unhealthy. The respondents frequently consumed high-carbohydrate foods, such as rice in amounts of 100–200g per meal, whereas according to the "Isi Piringku" dietary guidelines, the recommended portion per meal is only 150g of rice. Additionally, respondents often consumed instant noodles 2–4 times per week, whereas the recommended intake is only 1–2 times per week. Fiber-rich foods, such as vegetables and fruits, were rarely consumed by the respondents. Instead, they more frequently consumed foods high in fat and sugar, as supported by the interview results indicating that respondents consumed cooking oil once per day and sugar 2–3 times per day.

Table 3. Relationship Between Physical Activity and Fiber Intake with Overweight Incidence

Variable	Overweight		Not Overweight		p-value
	n	%	n	%	
Physical Activity					
Light	30	41.1	43	58.9	0.543
Moderate	7	50.0	7	50.0	
Vigorous	0	0	3	100.0	
Fiber Intake					
Deficit	36	45.0	44	55.0	0.033
Adequate	1	12.5	7	87.5	
Excess	0	0	2	100.0	

***Source:** Primary Data, 2024*

Based on Table 3, the majority of respondents who engaged in light physical activity were categorized as overweight at 41.09%, while more than 50% of the remaining respondents were not overweight. In the moderate physical activity category, the results were evenly split at 50%, and three respondents engaged in heavy physical activity. The results of the Spearman's rank correlation test for physical activity showed a p-value of 0.543, indicating no significant relationship between physical activity and the incidence of overweight among adolescents at SMA Negeri 1 Toroh, with a correlation coefficient (r) of -0.065. The negative sign indicates an inverse relationship, meaning that the risk of being overweight is lower when physical activity levels are low.

On average, the respondents had a fiber intake deficit. Among the overweight respondents, 45% had a fiber intake deficit, while more than 50% of the remaining respondents with a fiber deficit were not overweight. Among respondents with adequate fiber intake, 87.5% had a normal nutritional status (not overweight). Based on the Spearman's rank correlation test, a p-value of 0.033 was obtained, indicating that there is a significant relationship between fiber intake

and the incidence of overweight among adolescents at SMA Negeri 1 Toroh, with a correlation coefficient (rs) of 0.225. The positive sign indicates a direct relationship, meaning that the lower the fiber intake, the higher the incidence of overweight.

Discussion

Respondent Characteristics

Based on the univariate analysis, the majority of respondents were 16 years old (71.1%), 24.4% were 17 years old, and 4.4% were 18 years old. Most respondents in this study were female (60%), while 40% were male. Regarding the sample distribution by grade level, the 90 samples from grades X, XI, and XII were evenly distributed, each with a percentage of 33.33%. More than 50% of respondents had light physical activity levels, 15.6% had moderate physical activity, and 3.3% engaged in vigorous physical activity. The majority of respondents (88.9%) had a fiber intake categorized as deficient.

Based on the study results, most respondents (58.9%) had a normal nutritional status (not overweight), while 41.1% were categorized as overweight. Respondents categorized as overweight included those who were overweight and obese, while the non-overweight group consisted of respondents with normal and underweight nutritional status. There are several contributing factors to excessive body weight, including lack of physical activity, frequent consumption of fast food, low nutritional knowledge, parental income, and genetic factors such as gender, age, and heredity[18].

Distribution of Food Ingredients, Frequency and Average Consumption

Based on interviews conducted regarding food consumption over the past month using the SQ-FFQ form, the majority of respondents rarely consumed fruits and vegetables. Respondents more frequently consumed foods that were fried, such as fried chicken, omelets, mayonnaise risoles, *mendoan* (fried tempeh), fried dumplings, *seblak*, *baso aci* (meatball tapioca soup), and vegetables cooked in coconut milk. Most respondents rarely consumed fruits and vegetables as sources of fiber. The type of fiber that can induce satiety is soluble fiber, which can be found in foods such as broccoli, green beans, and apples, but only a few respondents reported consuming these.

According to the "Isi Piringku" (My Plate) guidelines for fulfilling nutritional needs, the variety of food sources should consist of carbohydrates, protein, vegetables, and fruits. However, the study results showed that respondents had low dietary variety. Respondents tended to consume more carbohydrate sources and high-fat foods compared to high-fiber foods. The recommended portion size for protein is 1/3 of ½ plate per meal. From the interviews, it was found that respondents consumed animal-based proteins only 1-4 times per week or 2-3 times per month, while plant-based protein was consumed 1-3 times per week, indicating that their protein intake did not meet the recommended guidelines of "Isi Piringku."

In addition to meeting carbohydrate and protein requirements, fiber intake also needs to be considered. Fiber is widely found in fruits and vegetables. The interviews revealed that respondents consumed fruits only 1-2 times per week or per month, whereas the recommended fruit intake per meal is 1/3 of ½ plate, indicating that respondents' fiber intake did not meet the recommended guidelines. Besides fruits, adequate vegetable consumption is also necessary. According to the "Isi Piringku" guidelines, vegetables should make up 2/3 of ½ plate per meal. However, the interviews revealed that most respondents rarely

consumed vegetables, typically 1-4 times per week or 2-3 times per month, which is far below the recommended intake.

From the interviews, it was also found that respondents frequently consumed high-carbohydrate foods, such as 100-200g of rice per meal, while the recommended portion according to "Isi Piringku" is 150g of rice per meal. Respondents also frequently consumed instant noodles 2-4 times per week and regularly consumed unhealthy snacks (high in fat and low in fiber), such as fried dumplings, fried sausages, *seblak*, and *baso aci*. Additionally, respondents frequently consumed foods and beverages high in sugar, as indicated by interview results showing that respondents consumed 20-40g of sugar per day. According to the Ministry of Health Regulation (Permenkes), the recommended sugar intake is approximately 50g per day[19]. Insufficient fiber intake can lead to constipation and increase the risk of obesity[20].

The Relationship Between Physical Activity and the Incidence of Overweight

Physical activity data collection was conducted using a physical activity form through interviews about activities over 7×24 hours, covering 5 weekdays and 2 weekend days. Each activity was matched with its PAR (Physical Activity Ratio) value and then converted into PAL (Physical Activity Level). There are three categories of physical activity based on FAO/WHO/UNU (2001), namely: light (1.40–1.69), moderate (1.70–1.99), and vigorous (2.00–2.40)[16]. To obtain the respondent's average activity level over seven days, the formula used was: $\sum PAL \div 7$.

Based on Table 3, the results showed that more than 50% of respondents engaged in light physical activity. The Spearman rank correlation test indicated no significant relationship between physical activity and overweight among adolescents at SMA Negeri 1 Toroh, with a correlation coefficient (rs) of -0.065. The negative correlation shows an inverse relationship, meaning that the risk of being overweight is lower when physical activity is light.

The majority of respondents performed light physical activities. This may be because respondents spent most of their weekdays at school, where they typically spent more time sitting in class rather than engaging in other activities. Meanwhile, respondents with vigorous physical activity levels generally spent less time on sedentary activities. These respondents commonly engaged in activities such as walking for about two hours per day, exercising not only during physical education classes but also outside school hours—for example, jogging in the afternoons and on weekends for 30–60 minutes, cycling, jogging, playing sports like soccer, basketball, volleyball, and doing sit-ups.

Another factor that may contribute to weight gain is gender. The incidence of overweight and the level of physical activity tend to differ between male and female adolescents. Male adolescents typically spend more time engaged in physical activities compared to females. Based on interview results, male respondents were more likely to engage in activities during recess, such as playing soccer or walking, while female respondents preferred activities such as grooming in class, chatting, sitting leisurely, snacking in the cafeteria, and using their phones.

According to Sari's (2017) study, there was no significant relationship between physical activity and overweight ($p=0.480$)[21]. This finding is supported by Wibisono's (2024) research, which also found no relationship between physical activity and overweight[22]. This may be influenced by other factors such as gender and excessive food consumption[23]. Similarly, Wati et al. (2023) reported a p-value

of 0.422, indicating no significant relationship between physical activity and overweight among adolescents[24]. This was attributed to differences in activity patterns between male and female adolescents. Male adolescents tended to engage in sports or walking for approximately two hours daily, while female adolescents mostly engaged in moderate-intensity activities such as grooming, sweeping, ironing, washing dishes, and doing laundry.

On the other hand, Aziz et al. (2023) found a significant relationship between physical activity and overweight among students at SMA N 1 Singkawang. Most adolescents had low physical activity levels, often spending their time playing on their phones, gaming, and watching movies[12]. Meanwhile, Aharid and Nadhiroh (2024) reported that 50.6% of adolescents engaged in light physical activities, with sitting being the most frequently reported activity[25].

Relationship between Fiber Intake and Overweight Incidents

Fiber intake was assessed using the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ), which includes food items that are sources of dietary fiber. Data were collected through interviews with respondents regarding their food consumption over the past month, including frequency, portion size (grams), and preparation methods. After obtaining food consumption data from the respondents, the average daily frequency, average daily intake (grams/day), and total fiber nutrient intake (grams/day) were calculated and compared to the recommended daily fiber intake according to the 2019 Recommended Dietary Allowance (RDA). Fiber intake was then classified based on the percentage of adequacy obtained. There are three fiber intake categories according to the Ministry of Health (Depkes, 2003): deficient (<90%), adequate (90–119%), and excessive (≥120%).

Table 3 shows that most respondents had low fiber intake with overweight nutritional status at 45%. On the other hand, respondents with adequate fiber intake had a normal nutritional status at 87.5%, and there were two respondents with excessive fiber intake. Statistical analysis using the Spearman rank correlation test indicated a significant relationship between fiber intake and the incidence of overweight among adolescents at SMA Negeri 1 Toroh, with a p-value of 0.033 and an rs value of 0.225. The positive correlation indicates a direct relationship, meaning that the lower the fiber intake, the higher the incidence of overweight. Based on the food consumption interviews using the SQ-FFQ over the past month, it can be concluded that the majority of respondents had unhealthy eating patterns (high in carbohydrates, sugar, fat, and low in fiber), as evidenced by interview results showing that most respondents rarely consumed fiber sources. Respondents frequently consumed foods that were deep-fried, such as fried chicken, omelets, risol mayo, mendoan (fried tempeh), fried dumplings, seblak, baso aci (spicy meatballs), and vegetables cooked in coconut milk. Additionally, respondents often consumed excessive portions of carbohydrate sources. For example, most respondents reported eating instant noodles 2–4 times per week, whereas the recommendation is to limit instant noodle consumption to no more than two servings per week to avoid forming unhealthy habits that could lead to overweight. Interviews also revealed that respondents frequently consumed sugar in amounts of 2–4 tablespoons per meal, while the recommended daily sugar intake is around 5 tablespoons. If this pattern continues over a long period, it may contribute to weight gain.

This finding is in line with Ayu's (2023) research, which found a significant relationship between fiber intake and overweight among

adolescents. Her study indicated that most overweight adolescents had low fiber intake[26]. This is supported by the research of Asyura & Yanti (2019), which found a significant relationship (p=0.001) between fiber intake and overweight. Their study also reported that most adolescents consumed fast food more than five times per week[27].

According to the Indonesian Ministry of Health Regulation No. 28 of 2019 concerning the Recommended Dietary Allowance, adolescents aged 16–18 years have different fiber requirements based on gender. Female adolescents require 29 grams of fiber per day, while male adolescents require 37 grams per day[28]. However, the results of this study showed that most respondents only consumed 10–20 grams of fiber per day, which means that their fiber intake did not meet the recommended requirements.

Conclusion

Based on the results of this study, the majority of respondents had low physical activity levels, accounting for 81.1%, while most respondents (88.9%) had a fiber intake deficit. The Spearman rank correlation test between physical activity and the incidence of overweight yielded a p-value of 0.543, indicating no significant relationship between physical activity and overweight among adolescents at SMA Negeri 1 Toroh. The correlation strength was very weak, with an rs value of -0.065, indicating a negative relationship, meaning that lower physical activity is associated with a lower risk of overweight in this study.

Meanwhile, the analysis of fiber intake showed a p-value of 0.033, indicating a significant relationship between fiber intake and the incidence of overweight among adolescents at SMA Negeri 1 Toroh. The rs value of 0.225 indicates a positive correlation, meaning that the lower the fiber intake, the higher the incidence of overweight. Based on these findings, it is recommended that respondents engage in more physical activity, maintain a healthy diet, and regularly monitor their weight through periodic measurements to keep track of their nutritional status.

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