ANALYSIS OF DETERMINANTS OF OBESITY AND OVERWEIGHT RISK FACTORS AMONG ADOLESCENTS IN CENTRAL JAVA PROVINCE BASED ON THE 2023 INDONESIAN HEALTH SURVEY DATA

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ABSTRACT
Background: Overweight and obesity among adolescents have become a growing public health issue in Indonesia, contributing to the risk of non-communicable diseases in adulthood. Risky dietary behaviors and low physical activity levels are suspected to play a role in the increasing prevalence of obesity in the adolescent age group. This study provides valuable insights into the risk factors of adolescent obesity in Central Java, contributing to the development of targeted prevention strategies. Objective: This study aimed to identify the risk factors associated with overweight and obesity in adolescents aged 11–18 years in Central Java Province. Methods: A cross-sectional design with a quantitative approach was employed, utilizing secondary data from the 2023 Indonesian Health Survey (SKI). The study analyzed data from 4,439 adolescents aged 11–18 years who met the inclusion criteria. Nutritional status was determined based on the Body Mass Index for Age (BMI/A). Data analysis included univariate, bivariate (chi-square), and multivariate (multiple logistic regression) analyses. Results: The multivariate analysis revealed that soft drink consumption ≥1 time per day was an independent determinant that significantly increased the risk of overweight and obesity (aOR = 3.742; 95% CI: 1.440–9.723). Instant noodle consumption was associated with overweight and obesity at certain levels. Although educational level and consumption of sweet foods, sweet beverages, and fatty foods were linked to obesity in the bivariate analysis, they were not significant after controlling for other variables. Conclusion: Daily soft drink consumption is a major risk factor for overweight and obesity among adolescents in Central Java. Preventing adolescent obesity requires a comprehensive approach, including improved dietary patterns, increased physical activity, and support from families and public policies.

INTRODUCTIONS

Obesity and overweight are complex chronic diseases characterized by excessive fat accumulation that can interfere with health. These conditions have become global issues, no longer limited to high-income and developed countries (WHO, 2025). The prevalence of obesity and overweight has increased most rapidly in low- and middle-income countries, particularly among the poor. In children and adolescents, the surge in obesity and overweight has been notable in recent decades (Popkin et al., 2012). From 1990 to 2022, cases of overweight and obesity in the 5–19 age group rose from 8% to 20%. WHO data indicates that, out of 1.2 billion children and adolescents globally, 390 million are overweight, and 160 million are obese (Abazbekova et al., 2025; WHO, 2025). In Indonesia, the prevalence of obesity and overweight in children has steadily increased from 2013 to 2023. The 2023 Indonesian Health Survey (SKI) reported that 13% of children aged 5–12 years in Central Java are overweight, and 8.3% are obese (Kementerian Kesehatan RI, n.d.).

Obesity and overweight are key contributors to the emergence of non-communicable diseases (NCDs) such as diabetes, hypertension, heart disease, and respiratory diseases. NCDs are responsible for 74% of global deaths, with more than three-quarters of these deaths occurring in low- and middle-income countries (Organization, 2025). The impact of obesity in children and adolescents extends beyond physical health, leading to hypertension, metabolic disorders, musculoskeletal issues, sleep apnea, and psychosocial problems, including low self-esteem and academic challenges (WHO, 2025). Economically, obesity imposes a significant burden, with global costs reaching USD 2 trillion annually, and projections suggest this may rise to USD 3 trillion by 2030 (WHO, 2025). The rapid growth of obesity, especially among adolescents, underscores the need for urgent public health interventions.

Research has shown that individual behaviors, such as poor dietary habits and low physical activity, contribute significantly to obesity (Organization, 2018). In Indonesia, many adolescents have unhealthy eating habits, including high consumption of sugar-sweetened beverages, salty foods, and fatty foods. According to (Unicef, 2022), about 66.7% of children and adolescents aged 5–19 years consume sugary drinks daily, reflecting broader patterns of poor eating behaviors. Data from the 2014 Individual Food Consumption Survey (SKMI) also show that adolescents aged 13–18 years consume 44% of their sodium intake from salt, with more than half of the respondents exceeding the recommended sodium intake (Prihatini & Permaesih, n.d.; Rachmi et al., 2021).

The region of Central Java is particularly significant for this study due to its rising rates of overweight and obesity among adolescents. A study by (Lowe et al., 2021) indicated that unhealthy dietary patterns, including high-fat snacks and sugary drinks, are prevalent in rural Central Java, with children and adolescents being the most affected group. Furthermore, research by (Oktaviani et al., 2023) highlights that residents in Central Java consume a higher variety of sweet foods compared to other provinces. This study aims to identify the risk factors associated with obesity and overweight in adolescents aged 11–18 years in Central Java Province, based on the 2023 SKI data.

Despite the increasing prevalence of adolescent obesity in Central Java, there is a lack of in-depth studies focusing on specific dietary habits and behaviors that contribute to obesity in this region. While national surveys provide general trends, regional studies are crucial for identifying targeted interventions. This research will fill this gap by focusing on specific risk factors such as the consumption of soft drinks, instant noodles, and other dietary patterns, contributing to the understanding of adolescent obesity in Central Java.

METHOD

This study uses a cross-sectional design with a quantitative approach. The data utilized are secondary data from the 2023 Indonesian Health Survey (SKI). The population in this study consists of adolescents aged 11–18 years in Central Java Province, with a total of 8,119 subjects. Study participants were selected based on inclusion and

exclusion criteria. The inclusion criteria included adolescents aged 11–18 years with complete data (100%). Adolescents classified as underweight were excluded from the study to avoid potential bias related to the dual burden of malnutrition (underweight and overweight), which could confound the analysis of obesity risk factors. After screening, a total of 4,439 subjects were included.

The independent variables include age group, gender, education level, physical activity habits, and the consumption of risky foods, such as sweet foods and drinks, salty foods, fatty foods, soft drinks, energy drinks, and instant noodles. The age variable is classified into the following groups: 11, 12, 13, 14, 15, 16, 17, and 18 years. The gender variable is categorized into male and female. The education variable is divided into two categories: low education (not attending school up to graduating from junior high school or its equivalent) and high education (graduating from senior high school or its equivalent up to higher education). Nutritional status is calculated using BMI-for-age (Body Mass Index/Age) and is classified into normal, overweight, and obese categories. The risky food consumption variable is divided into four categories: never, less than three times per month, 1–6 times per week, and more than once per day. The physical activity variable is classified into moderate and heavy physical activity, according to guidelines from the World Health Organization (WHO) and the International Physical Activity Questionnaire (IPAQ), where moderate physical activity refers to activities such as brisk walking or cycling, and heavy physical activity refers to activities such as running or vigorous sports.

Ethical approval for this study was obtained from the ethical review board of the Islamic University of Indonesia (UII). The data used in this study were publicly available secondary data, and no direct interaction with the participants was involved.The data in this study were analyzed in several stages. First, univariate analysis was performed to describe the characteristics of the respondents, including age, gender, education, risky food consumption patterns, and physical activity. Next, bivariate analysis using the chi-square test was applied to assess the relationships between these variables. Finally, multivariate analysis using multiple logistic regression was used to determine the factors that significantly influence and predict the probability of an event occurring.

RESULTS AND DISCUSSION
Data Analysis

Table 1. Frequency Distribution

Variable	Number (n)	Percentage (%)
Age (years)		
11	466	10.5
12	417	9.4
13	504	11.4
14	585	13.2
15	664	15.0
16	647	14.6
17	586	13.2
18	570	12.8
Gender		
Male	2,193	49.4
Female	2,246	50.6
Education		
Low	4,110	92.6
High	329	7.4
Nutritional Status		

Normal	3,755	84.6
Overweight	527	11.9
Obese	157	3.5
Sweet Food Consumption		
Never	50	1.1
≤3 times per month	186	4.2
1-6 times per week	3,346	75.4
≥1 time per day	857	19.3
Sweet Drink Consumption		
Never	56	1.3
≤3 times per month	148	3.3
1-6 times per week	1,669	37.6
≥1 time per day	2,566	57.8
Salty Food Consumption		
Never	144	3.2
≤3 times per month	320	7.2
1-6 times per week	2,095	47.2
≥1 time per day	1,880	42.4
Fatty Food Consumption		
Never	37	0.8
≤3 times per month	138	3.1
1-6 times per week	1,831	41.2
≥1 time per day	2,433	54.8
Soft Drink Consumption		
Never	2,815	63.4
≤3 times per month	986	22.2
1-6 times per week	555	12.5
≥1 time per day	83	1.9
Energy Drink Consumption		
Never	3,931	88.6
≤3 times per month	303	6.8
1-6 times per week	162	3.6
≥1 time per day	43	1.0
Instant Noodle Consumption		
Never	151	3.4
≤3 times per month	899	20.3
1-6 times per week	3,203	72.2
≥1 time per day	186	4.2
Physical Activity		
Heavy	1,465	33.0
Moderate	3,287	74.0

The study sample consisted of adolescents aged 11–18 years with a relatively even distribution across age groups. The largest proportion was found among those aged 15 years (15.0%), followed by those aged 16 years (14.6%). The gender distribution was nearly balanced, with males comprising 49.4% and females 50.6%. Most respondents had normal nutritional status (84.6%), while 11.9% were classified as overweight and 3.5% as obese.

Consumption patterns revealed that 75.4% of respondents consumed sweet foods 1–6 times per week, and 57.8% consumed sweet beverages at least once per day. Consumption of salty and fatty foods was high, with 42.4% and 54.8% of respondents, respectively, consuming them daily. The majority (63.4%) reported never consuming soft drinks, with 88.6% never consuming energy drinks. Instant noodles were most commonly consumed 1–6 times per week (72.2%).

Table 2. Determinants of Overweight and Obesity

Variable	Nutritional Status				P value	OR	95% Confidence Interval		P value Model 1	aOR Model 1	95% Confidence Interval		P value Model 2	aOR Model 2	95% Confidence Interval	
	Overweight & Obesity		Normal													
	n	%	n	%			Lower	Upper			Lower	Upper			Lower	Upper
Age (years)					0,667											
11	67	1,5%	399	9,0%	Ref				Ref				Ref			
12	71	1,6%	346	7,8%	0,280	0,818	0,569	1,177	0,258	0,809	0,561	1,168	0,256	0,809	0,560	1,167
13	75	1,7%	429	9,7%	0,825	0,961	0,672	1,372	0,788	0,952	0,665	1,363	0,785	0,951	0,664	1,362
14	86	1,9%	499	11,2%	0,883	0,974	0,690	1,376	0,871	0,972	0,685	1,377	0,869	0,971	0,685	1,377
15	95	2,1%	569	12,8%	0,973	1,006	0,717	1,410	0,933	1,015	0,721	1,428	0,934	1,015	0,721	1,428
16	100	2,3%	547	12,3%	0,619	0,919	0,657	1,284	0,629	0,920	0,655	1,292	0,641	0,922	0,657	1,296
17	88	2,0%	498	11,2%	0,771	0,950	0,674	1,340	0,798	0,955	0,674	1,355	0,916	0,981	0,691	1,394
18	102	2,3%	468	10,5%	0,128	0,770	0,551	1,078	0,169	0,788	0,561	1,107	0,641	0,912	0,620	1,342
Gender					0,060	0,852	0,724	1,003	0,083	0,862	0,728	1,020	0,076	0,858	0,725	1,016
Male	361	8,1%	1.832	41,3%												
Female	323	7,3%	1.923	43,3%												
Education					0,028*	1,389	1,045	1,846					0,099	1,358	0,945	1,952
Low	619	13,9%	3.491	78,6%												
High	65	1,5%	264	5,9%												
Sweet Food					0,021*											
≥1 time per day	115	2,6%	742	16,7%	0,193	1,613	0,785	3,315	0,395	1,391	0,651	2,975	0,378	1,407	0,659	3,008
1–6 times per week	518	11,7%	2.828	63,7%	0,383	1,365	0,678	2,746	0,541	1,257	0,604	2,616	0,513	1,277	0,614	2,656
≤3 times per month	41	0,9%	145	3,3%	0,755	0,884	0,407	1,919	0,637	0,825	0,372	1,832	0,659	0,836	0,377	1,855
Never	10	0,2%	40	0,9%	Ref				Ref				Ref			

Variable	Nutritional Status				P value	OR	95% Confidence Interval		P value Model 1	aOR Model 1	95% Confidence Interval		P value Model 2	aOR Model 2	95% Confidence Interval	
	Overweight & Obesity		Normal													
	n	%	n	%			Lower	Upper			Lower	Upper			Lower	Upper
Sweet Drinks					0,049*											
≥1 time per day	364	8,2%	2.202	49,6%	0,130	1,650	0,863	3,154	0,271	1,464	0,742	2,890	0,285	1,450	0,734	2,862
1–6 times per week	282	6,4%	1.387	31,2%	0,377	1,341	0,700	2,572	0,522	1,249	0,632	2,467	0,535	1,240	0,628	2,451
≤3 times per month	26	0,6%	122	2,7%	0,528	1,280	0,595	2,753	0,576	1,252	0,570	2,751	0,608	1,229	0,559	2,703
Never	12	0,3%	44	1,0%	Ref				Ref				Ref			
Salty Food					0,447											
≥1 time per day	272	6,1%	1.608	36,2%	0,243	1,303	0,836	2,030	0,511	1,169	0,734	1,861	0,505	1,171	0,735	1,866
1–6 times per week	335	7,5%	1.760	39,6%	0,515	1,158	0,745	1,798	0,576	1,141	0,720	1,808	0,565	1,145	0,722	1,815
≤3 times per month	51	1,1%	269	6,1%	0,571	1,162	0,691	1,954	0,581	1,163	0,681	1,985	0,556	1,174	0,688	2,005
Never	26	0,6%	118	2,7%	Ref				Ref				Ref			
Fatty Food					0,035*											
≥1 time per day	346	7,8%	2.087	47,0%	0,557	0,731	0,257	2,077	0,411	0,642	0,223	1,850	0,388	0,627	0,217	1,809
1–6 times per week	316	7,1%	1.515	34,1%	0,309	0,581	0,204	1,652	0,252	0,539	0,187	1,552	0,235	0,526	0,182	1,518
≤3 times per month	18	0,4%	120	2,7%	0,716	0,808	0,256	2,552	0,685	0,786	0,245	2,516	0,648	0,762	0,238	2,444
Never	4	0,1%	33	0,7%	Ref				Ref				Ref			
Soft Drink					0,052											
≥1 time per day	6	0,1%	77	1,7%	0,059	2,238	0,969	5,169	0,007**	3,742	1,440	9,723	0,006**	3,795	1,461	9,856
1–6 times per week	97	2,2%	458	10,3%	0,116	0,823	0,646	1,049	0,055	0,773	0,594	1,006	0,054	0,772	0,593	1,004
≤3 times per month	163	3,7%	823	18,5%	0,207	0,880	0,723	1,073	0,140	0,853	0,691	1,054	0,138	0,852	0,690	1,053

Variable	Overweight & Obesity n	%	Normal n	%	P value	OR	95% CI Lower	Upper	P value Model 1	aOR Model 1	95% CI Lower	Upper	P value Model 2	aOR Model 2	95% CI Lower	Upper
Never	418	9,4%	2.397	54,0%	Ref				Ref				Ref			
Energy Drink					0,427											
≥1 time per day	10	0,2%	33	0,7%	0,162	0,601	0,295	1,227	0,016*	0,357	0,154	0,823	0,014*	0,352	0,152	0,812
1–6 times per week	21	0,5%	141	3,2%	0,396	1,224	0,767	1,951	0,193	1,393	0,846	2,293	0,196	1,390	0,844	2,289
≤3 times per month	47	1,1%	256	5,8%	0,965	0,993	0,719	1,371	0,583	1,101	0,781	1,553	0,568	1,105	0,783	1,559
Never	606	13,7%	3.325	74,9%	Ref				Ref				Ref			
Instant Noodle					0,054											
≥1 time per day	39	0,9%	147	3,3%	0,803	0,935	0,548	1,593	0,801	0,932	0,540	1,608	0,832	0,943	0,546	1,627
1–6 times per week	486	10,9%	2.717	61,2%	0,120	1,386	0,919	2,091	0,067	1,482	0,973	2,257	0,060	1,497	0,983	2,281
≤3 times per month	129	2,9%	770	17,3%	0,082	1,480	0,952	2,300	0,036*	1,620	1,033	2,541	0,032*	1,636	1,043	2,567
Never	30	0,7%	121	2,7%	Ref				Ref				Ref			
Physical Activity																
Heavy					0,983	1,006	0,846	1,196	0,702	1,035	0,867	1,236	0,694	1,036	0,868	1,238
Yes	225	5,1%	1.240	27,9%												
No	459	10,3%	2.515	56,7%												
Moderate					0,775	0,969	0,804	1,168	0,644	0,956	0,791	1,156	0,628	0,954	0,789	1,154
Yes	510	11,5%	2.777	62,6%												
No	174	3,9%	978	22,0%												

Bivariate analysis showed that low education was significantly associated with overweight and obesity (p = 0.028), but after controlling for other variables in the multivariate analysis, this association was no longer significant (p = 0.099). Similarly, while sweet food consumption showed a significant association in the bivariate analysis (p = 0.021), it was not an independent determinant in the multivariate analysis (p = 0.378). Sweet beverage consumption also exhibited a significant relationship in bivariate analysis (p = 0.049), but the effect diminished in the multivariate model (p = 0.285), suggesting that sweet beverages were not an independent risk factor for obesity.

Among the most important findings, daily soft drink consumption remained a significant independent determinant of overweight and obesity (aOR = 3.742; 95% CI: 1.440–9.723; p = 0.007). This demonstrates that consuming soft drinks ≥1 time per day significantly increases the risk of obesity among adolescents in Central Java. On the other hand, instant noodle consumption showed a significant association in the multivariate analysis (p = 0.032), with those consuming them ≤3 times per month being more likely to be overweight or obese (aOR = 1.636; 95% CI: 1.043–2.567; p = 0.032).

Energy drink consumption did not show a significant association with overweight and obesity in the bivariate analysis (p = 0.427). However, in the multivariate analysis, daily energy drink consumption was associated with a reduced risk of obesity (aOR = 0.357; 95% CI: 0.154–0.823; p = 0.016). This protective effect may be due to confounding factors like higher levels of physical activity, and thus, this result should be interpreted cautiously.

Overall, these findings underscore that daily soft drink consumption has the strongest association with obesity risk, while the impact of other dietary factors, such as instant noodles, varies depending on consumption frequency.

Discussion

Indonesia is undergoing a nutrition transition, evidenced by rising obesity and overweight rates in both urban and rural areas. Over the past two decades, the prevalence of overweight and obesity has increased significantly, with the consumption of fast food, instant noodles, and fried foods becoming more common. This trend is accompanied by declining physical activity levels (Oddo et al., 2019). According to the 2014 Individual Food Consumption Survey (SKMI), only a small percentage of adolescents consume a balanced diet of carbohydrates, proteins, and fats (Safitri et al., 2017). This dietary shift is contributing to increased obesity rates in the country.

While education level was not found to be a statistically significant independent determinant of overweight and obesity, studies suggest that educational attainment influences dietary habits, with adolescents from lower socio-economic backgrounds often consuming fewer nutritious foods and more processed, sweetened, and fast foods (Carrillo-Alvarez et al., 2025; Mekonnen et al., 2020). These adolescents face barriers in accessing nutritious food and learning about healthy eating, which is further exacerbated by their socio-economic status.

In this study, the consumption of sweet foods, sweetened beverages, and fatty foods was not independently associated with overweight and obesity in the multivariate analysis, despite showing an association in the bivariate analysis. This suggests that these foods may be interrelated in consumption patterns that contribute to obesity, but their individual effects were not strong enough after adjusting for other variables. Previous studies have shown that sweetened beverages, sweet foods, and fatty foods are common risk factors for adolescent obesity (Weihrauch-Blüher et al., 2018). Specifically, the consumption of sweetened beverages has been identified as a significant contributor to obesity, as liquid sugar does not promote satiety, leading to excess calorie intake (Yu et al., 2023). The growing accessibility of sweetened beverages in developing countries has further fueled their consumption among children and adolescents, contributing to the rise in obesity and related chronic diseases like metabolic syndrome and dental decay (Calcaterra et al., 2023; Khan et al., 2021).

Energy drink consumption was not significantly associated with overweight and obesity in the bivariate analysis, but a protective effect was observed in the multivariate analysis. However, this effect is likely a statistical

artifact, possibly influenced by confounding factors such as physical activity levels. This finding suggests that energy drinks do not reduce obesity risk and should be interpreted with caution.

The most significant finding in this study was the strong association between soft drink consumption and obesity. Daily soft drink consumption was a major independent risk factor for overweight and obesity (aOR = 3.742; 95% CI: 1.440–9.723; p = 0.007). This supports the conclusion that reducing soft drink intake could play a key role in preventing adolescent obesity. Additionally, instant noodle consumption was significantly associated with obesity at certain levels, with those consuming noodles ≤3 times per month showing a higher likelihood of being overweight or obese (aOR = 1.636; 95% CI: 1.043–2.567; p = 0.032).

Limitations of the Study

This study has several limitations. First, its cross-sectional design limits the ability to draw causal conclusions. Second, the reliance on food recall data introduces the potential for recall bias, as participants may not accurately report their dietary habits. Lastly, this study did not measure total energy intake, which could provide a more comprehensive understanding of the factors contributing to obesity.

CONCLUSION

Most of the variables studied were not found to be independent determinants of overweight and obesity in adolescents. Education level, consumption of sweet foods, sweetened beverages, and fatty foods showed associations in the bivariate analysis but were not significant after controlling for other variables. Consumption of soft drinks ≥1 time per day was the only factor that consistently increased the risk of overweight and obesity. Instant noodle consumption was associated with overweight and obesity at certain levels of consumption, although no clear dose-response pattern was observed. These findings emphasize that adolescent obesity is multifactorial and requires a comprehensive prevention approach.

To address this issue, it is recommended that policymakers implement measures to limit soft drink consumption among adolescents, such as regulating marketing strategies, taxing sugary drinks, and promoting healthier beverage alternatives. Additionally, school- and family-based interventions should be prioritized to educate and encourage healthier eating habits and increased physical activity, particularly by involving parents and teachers in fostering a supportive environment for healthy lifestyles.

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