

Health Behaviors Associated with Overweight among University Students: The Roles of Ultra-Processed Food Consumption and Physical Activity

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ABSTRACT

Background: Overweight and obesity among university students are influenced by dietary behavior, physical activity, socioeconomic characteristics, and family predisposition. This study aimed to analyze factors associated with overweight/obesity among university students, focusing on ultra-processed food consumption and physical activity while controlling for potential confounders.

Subjects and Method: This case-control study involving 201 active university students, comprising 77 overweight/obesity cases and 124 normal controls. Participants were selected using purposive sampling with matching by sex and age. Data were collected using a semi-quantitative food frequency questionnaire (SQ-FFQ), International Physical Activity Questionnaire-Short Form (IPAQ-SF), Pittsburgh Sleep Quality Index (PSQI), and anthropometric measurements. Data were analyzed using multiple logistic regression with SPSS version 29.

Results: family history of obesity was significantly associated with higher odds of overweight/obesity. Students with a family history of obesity had approximately three times higher odds of being overweight/obese than those without a family history (aOR= 2.96; 95% CI=1.10 to 7.93; p= 0.031). Students enrolled in the Nutrition study program had lower odds of overweight/obesity than those in the Hospital Administration program (aOR=0.35; 95% CI=0.13 to 0.95; p= 0.040). Weekly allowance >IDR 700,000 showed a borderline association with higher odds of overweight/obesity (aOR= 6.59; 95% CI=0.89 to 48.95; p=0.065). Vigorous physical activity ≤10 minutes also showed a borderline association with lower odds (aOR=0.33; 95% CI=0.11 to 1.01; p=0.053), whereas vigorous physical activity of 11–20 minutes was not significantly associated with overweight/obesity (aOR= 0.89; 95% CI=0.32 to 2.45; p=0.820). Frequent snack and soft drink consumption were not significantly associated with overweight/obesity after adjustment.

Conclusion: Family history of obesity and study program were significantly associated with overweight/obesity, whereas ultra-processed food consumption and physical activity were not independently associated after adjustment. These findings highlight the importance of familia predisposition and nutrition-related educational environments in campus-based prevention strategies.

Keywords: healthy behavior, ultra-processed foods, overweight, physical activity

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BACKGROUND

Changes in dietary and lifestyle patterns in the modern era have substantially influenced the health of young adults. University students are particularly exposed to changes in dietary behavior as they gain greater independence in food selection and daily routines. One important concern is the increasing consumption of ultra-processed foods (UPFs), which are industrially formulated products that commonly contain high levels of added sugars, salt, and fats and various food additives, while generally providing lower nutritional quality than minimally processed foods (Shim, 2025). Commonly consumed UPFs include instant noodles, processed meat products, packaged snacks, sugar-sweetened beverages, sweet biscuits or wafers, chocolate, and ice cream (Rachmi et al., 2021; Shim, 2025).

Higher consumption of UPFs has been associated with greater energy intake, weight gain, and obesity. Several mechanisms have been proposed, including high energy density, poor dietary quality, excessive intake of added sugars and fats, altered appetite regulation, and potential disturbances in metabolic processes and the gut microbiota (Elizabeth et al., 2020; Dicken & Batterham, 2024; Monda et al., 2024; Shim, 2025). These concerns are particularly relevant among young adults because dietary and lifestyle behaviors established during university years may persist into adulthood and contribute to long-term obesity risk.

The global burden of overweight and obesity among children and young people has increased substantially. The World Health Organization reported that more

than 390 million children and adolescents aged 5–19 years were overweight in 2022, with the prevalence increasing from 8% in 1990 to 20% in 2022 (WHO, 2024). In Indonesia, the 2023 Indonesian Health Survey reported an overweight prevalence of 12.1% among adolescents aged 13–15 years (Health Development Policy Agency, 2023). Although these data primarily concern younger age groups, the continuing increase in excess weight highlights the importance of identifying modifiable risk factors before unhealthy patterns become established in adulthood.

Several epidemiological studies have provided evidence of an association between UPF consumption and adiposity. In the European Prospective Investigation into Cancer and Nutrition (EPIC) cohort, participants in the highest quintile of UPF consumption had a 15% higher risk of becoming overweight or obese among those with normal weight at baseline and a 16% higher risk of becoming obese among those who were overweight at baseline, compared with participants in the lowest quintile (Cordova et al., 2021). Similarly, a prospective cohort study among young people in the United States found that greater UPF intake was associated with a greater annual increase in body mass index (BMI), supporting a potential longitudinal relationship between UPF exposure and weight gain (Du et al., 2024). Among Jordanian children and adolescents, UPFs contributed approximately 40% of daily energy intake and were associated with waist circumference, further suggesting a potential relationship between UPF exposure and adiposity (Al-Hourani et al., 2025).

Setyaningsih et al. (2024) found that higher ultra-processed food consumption was associated with overweight status and poorer diet quality among university students aged 18–25 years. The study also showed that greater ultra-processed food intake was associated with higher total energy and macronutrient intake. However, a study among elementary school students in Surabaya found no significant association between UPF consumption and BMI-for-age, although physical activity was significantly associated with BMI-for-age in multivariable analysis (Pratiwi et al., 2022). Hanifa et al. (2024) also mentioned that ultra-processed food (UPF) consumption and physical activity were not significantly associated with with overnutrition. These inconsistent findings indicate that the relationship between UPF consumption and excess weight may be influenced by differences in population characteristics, dietary assessment methods, physical activity, and other behavioral or socioeconomic factors.

Physical activity is another important modifiable factor in the development and prevention of overweight and obesity. Regular physical activity increases energy expenditure and contributes to the maintenance of healthy body composition, while insufficient activity may contribute to positive energy balance and adiposity (Atakan et al., 2021; Strasser, 2013). Among young adults, physical activity may also interact with dietary behaviors and other lifestyle factors, making it important to consider physical activity when examining the relationship between UPF consumption and overweight/obesity.

However, evidence regarding factors associated with overweight/obesity among Indonesian university students remains limited. Previous Indonesian studies have frequently used cross-sectional designs,

relatively small samples, or different approaches to assessing UPF consumption. In addition, potential confounding factors such as physical activity, sleep quality, socioeconomic characteristics, family history of obesity, parental education, and other dietary behaviors have not consistently been considered within the same analytical model. Furthermore, the relationship between individual UPF food and beverage items and overweight/obesity may differ according to consumption patterns and population characteristics. Therefore, an analytical study that simultaneously considers these potential confounding factors is needed to provide a more comprehensive understanding of the factors associated with overweight/obesity among university students.

Based on this background, this study aimed to identify factors associated with overweight/obesity among university students, with particular emphasis on selected UPF consumption and physical activity, after adjusting for potential confounding factors, including sleep quality, family history of obesity, sociodemographic characteristics, parental education, and other dietary behaviors. The findings are expected to contribute to the development of evidence-based strategies for preventing overweight and obesity among university students through appropriate lifestyle and dietary interventions.

SUBJECTS AND METHOD

1. Study Design

This study was an analytical observational study with a case-control design was conducted at School of Health Sciences of Muhammadiyah Bojonegoro, East Java, Indonesia, from November 2025 to April 2026.

2. Population and Sample

The population in this study consisted of 357 active students at STIKes Muhammadiyah Bojonegoro during the 2025/2026 academic year. The minimum sample size was calculated using the case–control sample size formula with a 95% confidence level ($Z\alpha = 1.96$), 80% statistical power ($Z\beta = 0.84$), a case-to-control ratio of 1:2, an assumed overweight prevalence of 20%, and a minimum detectable odds ratio of 2. The calculation yielded a minimum sample of 108 participants (36 cases and 72 controls). To account for possible non-response, an additional 10% was added, resulting in a final sample size of 120 participants. However, a total of 201 eligible students were recruited and included in the final analysis, comprising 77 cases (overweight/obesity) and 124 controls (normal weight).

The sampling technique used was purposive sampling with matching based on sex and age group (18–24 years). The inclusion criteria were active students at STIKes Muhammadiyah Bojonegoro, aged 18–24 years, willing to participate, and able to complete the questionnaire. The exclusion criteria were students who were undergoing a special diet, had a history of chronic diseases (e.g., diabetes mellitus, cardiovascular disease, or endocrine disorders), or were unwilling to undergo anthropometric measurements.

3. Study Variables

The dependent variable was overweight/obesity status. The main independent variables included dietary behavior, particularly consumption of selected ultra-processed food (UPF) items, and physical activity. Other independent variables included sex, age, study program, semester, residence, weekly allowance, family history of obesity, parental education, sleep quality, and selected dietary behavior, including instant noodle, nugget/sausage/meatball,

canned corned beef/sardine, snack, packaged sweet tea, instant coffee, soft drink, sweet biscuit/wafer, chocolate, and ice cream consumption. Physical activity was assessed separately according to vigorous- and moderate-intensity activity.

4. Operational Definition of Variables

Overweight/obesity is a nutritional status was assessed using Body Mass Index (BMI), calculated as body weight in kilograms divided by height in meters squared (kg/m^2).

Ultra-processed food consumption was assessed using a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ), which recorded the frequency of consumption of selected food and beverage items.

Physical activity: Physical activity was assessed using the International Physical Activity Questionnaire-Short Form (IPAQ-SF) and classified according to duration and intensity.

Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI). Participants with a global PSQI score of ≤ 5 were categorized as having good sleep quality, whereas those with a score of > 5 were categorized as having poor sleep quality.

Age was recorded in years and categorized into 18–20 years and 21–24 years.

Sex was categorized as male and female, with male used as the reference category.

Study program was categorized as Hospital Administration, Nutrition, and Medical Records. Hospital Administration was used as the reference category.

Semester was current academic semester was categorized as Semester 1, Semester 3, Semester 5, and Semester 7. Semester 1 was used as the reference category.

Residence was categorized as rural and urban, with rural residence used as the reference category.

Parental education: The educational attainment of the father and mother was categorized as higher education or lower education. Higher education was used as the reference category for both variables.

Weekly allowance was defined as the amount of money received by participants for their weekly living expenses. It was categorized as <IDR 100,000, IDR 100,000– <300,000, IDR 300,000–700,000, and >IDR 700,000, with <IDR 100,000 as the reference category.

Family history of obesity: Family history of obesity was assessed based on participants' self-reported history of obesity among family members and categorized as yes or no, with no family history as the reference category.

5. Study Instruments

Sleep quality, physical activity, and dietary consumption were assessed using standardized instruments. Sleep quality was assessed using the Pittsburgh Sleep Quality Index (PSQI), which evaluates seven components of sleep during the previous month, with global scores ranging from 0 to 21; higher scores indicate poorer sleep quality. Physical activity was assessed using the International Physical Activity Questionnaire–Short Form (IPAQ-SF), which evaluates vigorous- and moderate-intensity activities, walking, and sitting during the previous seven days based on frequency and duration. Dietary consumption was assessed using a Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) to determine the frequency and portion size of food and beverage consumption during the previous month. The analysis focused on selected ultra-processed foods (UPFs), including instant noodles, processed meat products, canned corned beef/sardines, packaged snacks, packaged sweet tea, instant coffee, soft drinks, sweet biscuits/wafers, chocolate, and ice cream. Consump-

tion frequency was categorized according to the study criteria for statistical analysis.

6. Data analysis

Data were analyzed using SPSS version 29. Univariate analysis was performed to describe the distribution of participant characteristics using frequencies and percentages. Bivariate analysis was conducted using simple logistic regression to examine the association between each independent variable and overweight/obesity, with crude odds ratios (ORs), 95% confidence intervals (CIs), and p-values reported. Multivariable analysis was performed using multiple logistic regression with the Enter method to obtain adjusted odds ratios (AORs), 95% CIs, and p-values. Statistical significance was determined at $p < 0.05$.

7. Research Ethics

Research ethical issues, including informed consent, anonymity, and confidentiality, were addressed carefully throughout the study. Ethical approval for this study was granted by the Research Ethics Committee of School of Health Sciences of Muhammadiyah Ciamis, West Java, Indonesia, on 6 January 2025, under approval number 006/KEPK-MUCIS/I/2026.

RESULTS

1. Sample Characteristics

A total of 201 students participated in this study, comprising 77 participants classified as overweight/obesity and 124 participants classified as normal weight. The demographic and anthropometric characteristics of the participants are presented in Table 1. Most participants were aged 18–20 years (62.7%), female (80.1%), and lived in rural areas (80.6%). The most represented study program was Hospital Administration (40.8%). Regarding parental education, the largest proportion of fathers (44.8%) and mothers (33.3%) had completed senior high school. Nearly half of the participants

(46.3%) reported a weekly allowance of less than IDR 100,000. A family history of obesity was reported by 20.4% of parti-

cipants. Based on BMI, 61.7% of participants had normal weight, 15.9% were overweight, and 22.4% were obese.

Table 1. Distribution of Research Subject Characteristics (n=201)

Characteristics	Category	Frequency	Percentage
Age	18-20 years old	126	62.7
	21-24 years old	75	37.3
Sex	Male	40	19.9
	Female	161	80.1
Study Program	Hospital Administration	82	40.8
	Nutrition	45	22.4
	Medical Records	74	36.8
Semester	1 st	50	24.9
	3 rd	63	31.3
	5 th	55	27.4
	7 th	33	16.4
Residence	Rural	162	80.6
	Urban	39	19.4
	No schooling	4	2.0
Father's Education	Elementary school	50	24.9
	Junior high school	38	18.9
	Senior high school	90	44.8
	Higher education	19	9.5
Mother's Education	No schooling	4	2.0
	Elementary school	47	23.4
	Junior high school	53	26.4
	Senior high school	67	33.3
Weekly Allowance	Higher education	30	14.9
	< IDR 100,000	93	46.3
	IDR 100,000 – <300,000	92	45.8
	IDR 300,000 – 700,000	9	4.5
Family History of Obesity	> IDR 700,000	7	3.5
	No history	160	79.6
	History present	41	20.4
Body Mass Index	Normal	124	61.7
	Overweight	32	15.9
	Obesity	45	22.4

2. Bivariate Analysis

Simple binary logistic regression was performed to examine the associations between the independent variables and overweight/obesity. Low vigorous physical activity (≤ 10 minutes) was significantly associated with lower odds of overweight/obesity compared with high vigorous physical activity (> 20 minutes). Participants reporting low vigorous physical activity had approximately 67% lower odds of being

overweight/obese, and the association was statistically significant (OR=0.33; 95% CI=0.13 to 0.82; $p=0.017$).

Participants receiving a weekly allowance of $> \text{IDR } 700,000$ had approximately five times higher odds of overweight/obesity compared with those receiving $< \text{IDR } 100,000$, although the association was not statistically significant (OR= 5.00; 95% CI=0.92 to 27.25; $p=0.063$). Participants with a family history of obesity had

approximately twice the odds of overweight/ obesity compared with those without a family history, although the association was not statistically significant (OR= 1.95; 95% CI=0.97 to 3.90; p=0.059). Participants reporting 31–60 minutes of moderate physical activity had approximately 3.6-fold higher odds of overweight/ obesity compared with those reporting >60 minutes, although the association was not statistically significant (OR=3.56; 95% CI= 0.82 to 15.46; p= 0.091). Good sleep quality

was associated with lower odds of overweight/obesity compared with poor sleep quality, but the association was not statistically significant (OR=0.26; 95% CI=0.03 to 2.19; p=0.215). Frequent soft drink consumption was associated with approximately 2.8-fold higher odds of overweight/ obesity compared with rare consumption, although the association was not statistically significant (OR=2.80; 95% CI=0.65 to 12.07; p=0.167.)

Table 2. Bivariate Analysis of Factors Associated with Overweight/Obesity

Variable Group	Overweight/Obesity				OR	95% CI		p
	No		Yes			Lower limit	Upper limit	
	n	%	n	%				
Sex								
Male (Ref)	22	55.0	18	45.0	1.00	-	-	-
Female	102	63.4	59	36.6	0.71	0.35	1.42	0.332
Study Program								
Hospital Administration (Ref)	47	57.3	35	42.7	1.0	-	-	-
Nutrition	29	64.4	16	35.6	0.74	0.35	1.57	0.434
Medical Records	48	64.9	26	35.1	0.73	0.38	1.39	0.335
Semester								
Semester 1 (Ref)	28	56.0	22	44.0	1.00	-	-	-
Semester 3	44	69.8	19	30.2	0.55	0.25	1.19	0.130
Semester 5	34	61.8	21	38.2	0.79	0.36	1.71	0.545
Semester 7	18	54.5	15	45.5	1.06	0.44	2.57	0.896
Residence								
Rural (Ref)	103	63.6	59	36.4	1.00	-	-	-
Urban	21	53.8	18	46.2	1.49	0.74	3.03	0.263
Weekly Allowance								
< IDR 100,000 (Ref)	62	66.7	31	33.3	1.00	-	-	-
IDR 100,000 – <300,000	55	59.8	37	40.2	1.35	0.74	2.45	0.332
IDR 300,000 – 700,000	5	55.6	4	44.4	1.60	0.40	6.38	0.506
> IDR 700,000	2	28.6	5	71.4	5.00	0.92	27.25	0.063
Family History of Obesity								
No (Ref)	104	65.0	56	35.0	1.00	-	-	-
Yes	20	48.8	21	51.2	1.95	0.97	3.90	0.059
Father's Education								
Higher Education (Ref)	70	64.2	39	35.8	1.00	-	-	-
Lower Education	54	58.7	38	41.3	1.26	0.71	2.23	0.422
Mother's Education								
Higher Education (Ref)	60	61.9	37	38.1	1.00	-	-	-
Lower Education	64	61.5	40	38.5	1.01	0.57	1.79	0.963
Vigorous Physical Activity								
Never	18	58.1	13	41.9	0.91	0.40	2.06	0.815
Low (≤10 minutes)	27	79.4	7	20.6	0.33	0.13	0.82	0.017

Variable Group	Overweight/Obesity				OR	95% CI		p
	No		Yes			Lower limit	Upper limit	
	n	%	n	%				
Moderate (11–20 minutes)	25	64.1	14	35.9	0.70	0.33	1.51	0.368
High (>20 minutes) (Ref)	54	55.7	43	44.3	1.00	-	-	-
Moderate Physical Activity								
Never	3	75.0	1	25.0	1.11	0.08	15.04	0.937
Low (10–30 minutes)	96	62.7	57	37.3	1.98	0.52	7.49	0.315
Moderate (31–60 minutes)	15	48.4	16	51.6	3.56	0.82	15.46	0.091
High (>60 minutes) (Ref)	10	76.9	3	23.1	1.00	-	-	-
Sleep Quality								
Good sleep quality	6	85.7	1	14.3	0.26	0.03	2.19	0.215
Poor sleep quality (Ref)	118	60.8	76	39.2	1.00	-	-	-
Dietary variables								
Instant Noodles								
Rare (Ref)	111	62.0	68	38.0	1.00	-	-	-
Frequent	13	59.1	9	40.9	1.13	0.46	2.78	0.790
Nugget/Sausage/Meatball								
Rare (Ref)	106	61.3	67	38.7	1.00	-	-	-
Frequent	18	64.3	10	35.7	0.87	0.38	2.01	0.761
Canned Corned Beef/Sardines								
Rare (Ref)	121	61.4	76	38.6	1.00	-	-	-
Frequent	3	75.0	1	25.0	0.53	0.05	5.20	0.586
Snacks								
Rare (Ref)	80	63.0	47	37.0	1.00	-	-	-
Frequent	44	59.5	30	40.5	1.16	0.64	2.09	0.619
Packaged Sweet Tea								
Rare (Ref)	106	62.4	64	37.6	1.00	-	-	-
Frequent	18	58.1	13	41.9	1.19	0.55	2.60	0.652
Instant Coffee								
Rare (Ref)	111	62.0	68	38.0	1.00	-	-	-
Frequent	13	59.1	9	40.9	1.13	0.46	2.78	0.790
Soft Drink								
Rare (Ref)	121	62.7	72	37.3	1.00	-	-	-
Frequent	3	37.5	5	62.5	2.80	0.65	12.07	0.167
Sweet Biscuits/Wafers								
Rare (Ref)	99	60.0	66	40.0	1.00	-	-	-
Frequent	25	69.4	11	30.6	0.66	0.30	1.43	0.293
Chocolate								
Rare (Ref)	120	62.5	72	37.5	1.00	-	-	-
Frequent	4	44.4	5	55.6	2.08	0.54	8.01	0.285
Ice Cream								
Rare (Ref)	108	61.4	68	38.6	1.00	-	-	-
Frequent	16	64.0	9	36.0	0.89	0.37	2.14	0.800

3. Multivariate Analysis

A multivariable binary logistic regression using the Enter method was performed to examine the independent associations between the study variables and over-

weight/ obesity. The analysis included 201 participants and simultaneously adjusted for sociodemographic characteristics, family history, physical activity, sleep quality, and dietary factors.

After adjustment for the variables included in the model, participants with a family history of obesity had approximately three times higher odds of being overweight/obese compared with those without a family history, and this association was statistically significant (aOR=2.96; 95% CI= 1.10 to 7.93; p=0.031). Students in the Nutrition program had approximately 65% lower odds of overweight/obesity compared with students in the Hospital Administration program (aOR=0.35; 95% CI=0.13 to 0.95; p=0.040).

Several variables showed non-significant trends. Participants receiving a

weekly allowance of >IDR 700,000 had higher odds of overweight/obesity compared with those receiving <IDR 100,000, although the association did not reach statistical significance (aOR=6.59; 95% CI= 0.89 to 48.95; p=0.065). Similarly, participants reporting low vigorous physical activity (≤ 10 minutes) had lower odds of overweight/obesity compared with those reporting high vigorous physical activity (> 20 minutes), although the association was borderline and did not reach statistical significance (aOR=0.33; 95% CI= 0.11 to 1.01; p=0.053).

Table 3. Multivariate Analysis of Factors Associated with Overweight/Obesity

Independent variables	aOR	95% CI		p
		Lower limit	Upper limit	
Sex				
Male (Ref)	1.00	-	-	-
Female	0.90	0.35	2.34	0.826
Study Program				
Hospital Administration (Ref)	1.00	-	-	-
Nutrition	0.35	0.13	0.95	0.040
Medical Records	0.78	0.34	1.77	0.552
Semester				
Semester 1 (Ref)	1.00	-	-	-
Semester 3	0.40	0.16	1.02	0.055
Semester 5	0.71	0.29	1.74	0.451
Semester 7	0.90	0.29	2.78	0.858
Residence				
Rural (Ref)	1.00	-	-	-
Urban	1.33	0.53	3.33	0.547
Weekly Allowance				
< IDR 100,000 (Ref)	1.00	-	-	-
IDR 100,000 – <300,000	1.29	0.61	2.74	0.508
IDR 300,000 – 700,000	0.59	0.10	3.52	0.562
> IDR 700,000	6.59	0.89	48.95	0.065
Family History of Obesity				
No (Ref)	1.00	-	-	-
Yes	2.96	1.10	7.93	0.031
Father's Education				
Higher Education (Ref)	1.00	-	-	-
Lower Education	2.16	0.88	5.29	0.094
Mother's Education				
Higher Education (Ref)	1.00	-	-	-
Lower Education	0.60	0.25	1.47	0.266
Vigorous Physical Activity				
Never	0.83	0.30	2.30	0.725

Independent variables	aOR	95% CI		p
		Lower limit	Upper limit	
Low (≤ 10 minutes)	0.33	0.11	1.01	0.053
Moderate (11–20 minutes)	0.89	0.32	2.45	0.820
High (> 20 minutes) (Ref)	1.00	-	-	-
Moderate Physical Activity				
Never	2.14	0.11	41.00	0.614
Low (10–30 minutes)	1.85	0.41	8.47	0.426
Moderate (31–60 minutes)	2.90	0.54	15.49	0.214
High (> 60 minutes) (Ref)	1.00	-	-	-
Sleep Quality				
Good sleep quality	0.26	0.03	2.76	0.266
Poor sleep quality (Ref)	1.00	-	-	-
Dietary variables				
Instant Noodles				
Rare (Ref)	1.00	-	-	-
Frequent	0.97	0.30	3.11	0.952
Nugget/Sausage/Meatball				
Rare (Ref)	1.00	-	-	-
Frequent	0.45	0.14	1.42	0.172
Canned Corned Beef/Sardines				
Rare (Ref)	1.00	-	-	-
Frequent	0.08	0.003	2.49	0.152
Snacks				
Rare (Ref)	1.00	-	-	-
Frequent	1.83	0.81	4.12	0.145
Packaged Sweet Tea				
Rare (Ref)	1.00	-	-	-
Frequent	1.02	0.38	2.75	0.965
Instant Coffee				
Rare (Ref)	1.00	-	-	-
Frequent	0.94	0.27	3.24	0.925
Soft Drink				
Rare (Ref)	1.00	-	-	-
Frequent	5.36	0.69	41.46	0.108
Sweet Biscuits/Wafers				
Rare (Ref)	1.00	-	-	-
Frequent	0.44	0.15	1.27	0.128
Chocolate				
Rare (Ref)	1.00	-	-	-
Frequent	4.81	0.52	44.66	0.168
Ice Cream				
Rare (Ref)	1.00	-	-	-
Frequent	0.72	0.24	2.19	0.562

DISCUSSION

The increasing prevalence of overweight and obesity among university students is a multifactorial problem involving the interaction of sociodemographic characteristics, lifestyle behaviors, dietary patterns, socioeconomic circumstances, and familial

predisposition. This study examined factors associated with overweight/obesity among university students, with particular attention to modifiable behavioral factors. In the fully adjusted multivariable model, family history of obesity and study program were significantly associated with overweight/

obesity. Weekly allowance and vigorous physical activity showed borderline associations, whereas dietary consumption variables, moderate physical activity, sleep quality, sex, residence, semester, and parental education were not statistically significant.

Family history of obesity was significantly associated with overweight/obesity after adjustment for the other variables included in the model. Students with a family history of obesity had approximately three times higher odds of being overweight/ obese than those without a family history (aOR=2.96; 95% CI=1.10 to 7.93; $p=0.031$). This finding is consistent with previous evidence among Indonesian university students. Vidiawati et al. (2025), in a study of 1,552 first-year health sciences university students in Indonesia, also found that having a family history of obesity was independently associated with excess body weight (aOR=2.91; 95% CI=2.09 to 4.06). In addition, Widyastuti et al. (2025), using longitudinal data from the Indonesian Family Life Survey, demonstrated that body-weight trajectories among Indonesian children and adolescents were influenced by the interaction of host, behavioral, and environmental factors, with participants having caregivers living with obesity being more represented in the trajectory characterized by progression toward obesity. These findings support the interpretation that familial clustering of overweight/obesity may reflect both inherited susceptibility and shared family environments, including dietary and physical activity patterns. However, because the present study assessed family history rather than genetic markers, the observed association should be interpreted as an association with familial predisposition rather than direct evidence of genetic causation.

Study program was also associated with overweight/obesity at the category

level. Students enrolled in the Nutrition program had approximately 65% lower odds of overweight/obesity than students enrolled in the Hospital Administration program (aOR=0.35; 95% CI=0.13 to 0.95; $p=0.040$). This finding may reflect differences in exposure to nutrition-related knowledge and health-promoting behaviors. Rachmi et al. (2021), in a systematic review of Indonesian adolescents, highlighted the complex relationship between nutrition knowledge, eating behavior, and the broader social environment. Similarly, exposure to nutrition education may improve awareness of dietary quality and healthy weight management. However, the overall study-program variable was not statistically significant in the multivariable model ($p=0.119$), indicating that the significant result was specific to the Nutrition category compared with Hospital Administration. Therefore, the finding should not be interpreted as evidence that study program itself determines overweight/obesity.

Weekly allowance showed a borderline association with overweight/obesity. Students receiving more than IDR 700,000 per week had higher odds of overweight/obesity than those receiving less than IDR 100,000, although the association did not reach statistical significance (aOR= 6.59; 95% CI=0.89 to 48.95; $p=0.065$). The relatively large point estimate should be interpreted cautiously because the confidence interval was wide and included the null value, and only a small number of participants were in the highest allowance category. Greater purchasing power may increase access to fast food, energy-dense foods, and sugar-sweetened beverages. This interpretation is supported by Zogara et al. (2022), who reported that socioeconomic characteristics and pocket money were associated with fast-food consumption

among adolescent girls in Indonesia. A meta-analysis reported that there was a significant positive association between fast food consumption and obesity or overweight among individuals aged ten years and above (Khalfan et al., 2025).

Vigorous physical activity did not remain statistically significant after adjustment for the other variables. Compared with students reporting more than 20 minutes of vigorous physical activity, those reporting ≤ 10 minutes had lower odds of overweight/obesity, but the association was borderline and did not reach conventional statistical significance (aOR= 0.33; 95% CI= 0.11 to 1.01; $p=0.053$). Students reporting 11–20 minutes of vigorous physical activity also did not differ significantly from the reference group (AOR=0.89; 95% CI=0.32 to 2.45; $p=0.820$). Thus, the present study does not provide sufficient evidence that a specific duration of vigorous physical activity independently protects against overweight/obesity. Exercise is nevertheless an important component of weight regulation because physical activity increases energy expenditure and contributes to the maintenance of metabolic health and body composition (Atakan et al., 2021; Strasser, 2013). The absence of a significant association in the present analysis may reflect differences in total activity volume, sedentary behavior, energy intake, or the cross-sectional nature of the study. Pegington et al. (2020) similarly emphasized that weight gain among young adults is influenced by multiple interacting behavioral and environmental factors rather than physical activity alone.

Moderate physical activity was also not significantly associated with overweight/ obesity. Students reporting 31–60 minutes of moderate physical activity had higher odds of overweight/obesity than those reporting more than 60 minutes,

although the association was not statistically significant (aOR=2.90; 95% CI=0.54 to 15.49; $p=0.214$). The wide confidence interval indicates substantial uncertainty in the estimate. This finding may reflect differences in overall daily energy expenditure, sedentary time, dietary intake, and other lifestyle behaviors. Therefore, the observed direction should not be interpreted as evidence that moderate physical activity increases the risk of overweight/obesity. Previous literature has emphasized that the relationship between physical activity and body weight is complex and depends on the overall energy balance and behavioral context (Strasser, 2013; Atakan et al., 2021).

Dietary variables were not independently associated with overweight/obesity after adjustment. Frequent snack consumption was associated with higher estimated odds of overweight/ obesity, but the association was not statistically significant (aOR= 1.83; 95% CI=0.81 to 4.12; $p=0.145$). Frequent soft drink consumption showed a similar direction, with more than fivefold higher estimated odds, but the confidence interval was wide and included the null value (aOR=5.36; 95% CI=0.69 to 41.46; $p=0.108$). Although these associations were not statistically significant, their direction is consistent with evidence linking ultra-processed foods and sugar-sweetened beverages to excess weight. Cordova et al. (2021) reported that higher consumption of ultra-processed foods was associated with weight gain and obesity in adults across multiple European cohorts. Similarly, prospective evidence among young people has shown an association between ultra-processed food intake and changes in body mass index (Du et al., 2024). Recent reviews have also highlighted the potential contribution of ultra-processed foods to obesity through high energy density, palat-

tability, and alterations in eating behavior (Dicken & Batterham, 2024; Monda et al., 2024; Shim, 2025).

In the present study, frequent snack and soft drink consumption were not independently associated with overweight/obesity after adjustment for potential confounders. This finding differs from the results of Setyaningsih et al. (2024), who reported an association between higher ultra-processed food consumption and overweight status among young adults. Their study also found that greater ultra-processed food intake was associated with higher energy and macronutrient intake. The difference may partly reflect methodological differences, including the cross-sectional design and the assessment of overall UPF intake in the previous study, whereas the present study used a case-control design and analyzed selected UPF food groups after adjustment for multiple potential confounders.

The lack of statistical significance for dietary variables in the present study should therefore not be interpreted as evidence that these foods have no relationship with obesity. The relatively small number of participants classified as frequent consumers of some dietary items may have reduced statistical power. In addition, the use of dichotomized dietary-frequency variables may have reduced variability in exposure and limited the ability to detect dose-response relationships. Previous research among Indonesian adolescents has also demonstrated the importance of dietary behaviors within the broader social and environmental context (Rachmi et al., 2021). Therefore, future studies should consider more detailed measures of dietary intake, portion size, total energy intake, and overall ultra-processed food consumption.

The association between soft drink

consumption also warrants cautious interpretation. Sugar-sweetened beverages provide substantial amounts of readily available energy and may contribute to positive energy balance when consumed frequently. Bray and Popkin (2013) highlighted the potential role of calorie-sweetened beverages and fructose in weight gain, while Elizabeth et al. (2020) emphasized the broader health implications of ultra-processed foods.

More recent evidence has continued to support a potential relationship between ultra-processed food consumption and obesity, although the strength of the association varies across populations and study designs (Al Hourani et al., 2025; Dicken & Batterham, 2024). The present study's non-significant finding may therefore reflect sample size, exposure distribution, or measurement limitations rather than the absence of a potential relationship.

Our findings indicate that overweight and obesity among university students cannot be attributed to a single behavioral factor. Familial predisposition and the educational context represented by study program may be important correlates, while socioeconomic and lifestyle factors may contribute in more complex ways. Campus-based prevention strategies should therefore combine early identification of students with a family history of obesity, nutrition education, and broader promotion of healthy dietary and physical activity behaviors. Future longitudinal studies with larger samples and more comprehensive measurements of energy intake, ultra-processed food consumption, physical activity, sedentary behavior, sleep, and family-level factors are needed to clarify the temporal and causal pathways underlying overweight/obesity among Indonesian university students.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this article. The funding agency had no role in the study design, data collection, data analysis, interpretation of the findings, manuscript preparation, or the decision to submit the manuscript for publication.

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