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Determinants of Obesity among University Students at UIN Alauddin Makassar

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ABSTRACT

Obesity remains a public health and nutritional problem in Indonesia. University students are a vulnerable group prone to unhealthy lifestyles that may increase the risk of obesity. Lifestyle factors associated with obesity among students include sleep duration, risky dietary patterns, and physical activity. This study aimed to analyze the association between sleep duration, risky dietary patterns, and physical activity with obesity among students at Universitas Islam Negeri Alauddin Makassar. A cross-sectional study design was conducted among all active students registered in the university database (n = 20,805). A total of 378 participants were selected using stratified random sampling. Anthropometric measurements, including height and weight, were performed to determine obesity status. Data were collected using questionnaires on respondent characteristics, risky food consumption, dietary patterns, physical activity, and sleep quality assessed using the Pittsburgh Sleep Quality Index (PSQI). Hypothesis testing was conducted using the chi-square test and Spearman correlation with a significance level of α = The results showed that the prevalence of obesity among respondents was 18.0%. The majority of respondents (88.4%) had a sleep duration of less than 8 hours. There was a significant association between sleep duration and obesity incidence ($p < 0.05$; $r = -0.192$), although the correlation was weak. In addition, risky dietary patterns were also significantly associated with obesity ($p < 0.05$; $r = 0.131$), with a very weak correlation. In contrast, no significant association was found between physical activity and obesity ($p = 0.743$). Improving determinant factors associated with obesity among students may serve as an alternative approach for implementing healthy lifestyle interventions in the university setting.

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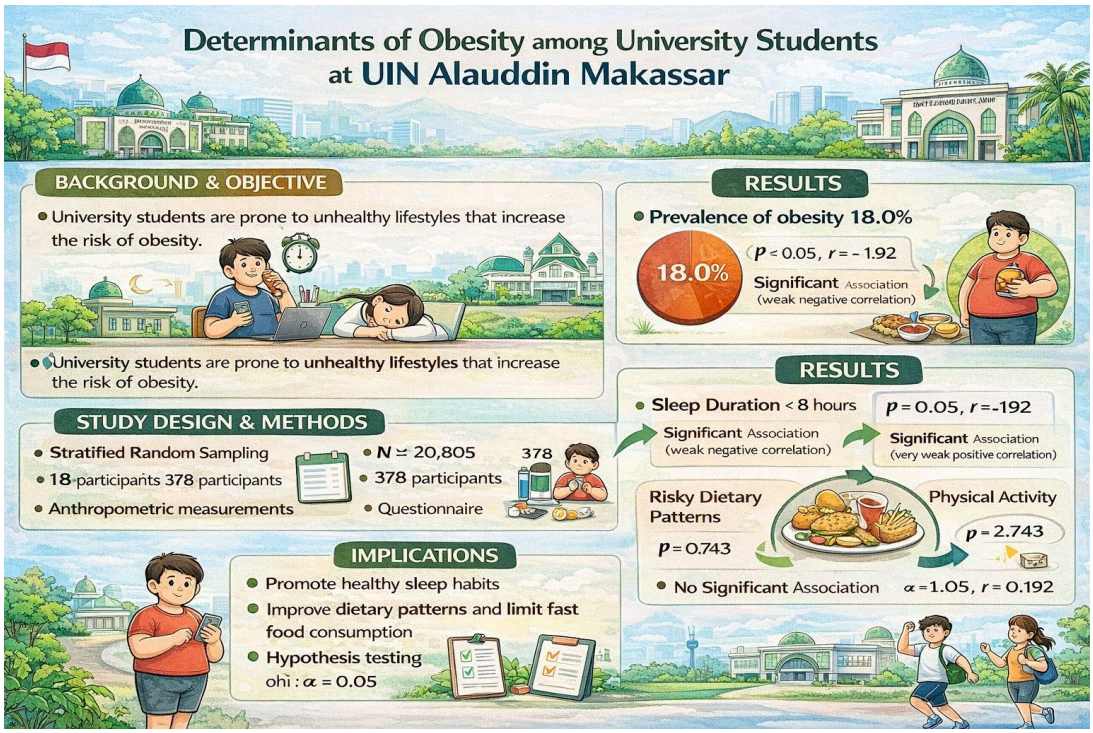
Key Messages:

- The identification of sleep duration and risky dietary patterns as determinants of obesity highlights the need for targeted prevention interventions in university settings, particularly those aimed at improving sleep quality and promoting healthy dietary practices.

GRAPHICAL ABSTRACT



INTRODUCTION

Nutritional problems in Indonesia are characterized by the triple burden of malnutrition, one of which is obesity. According to the World Health Organization (WHO), approximately 1.9 billion adults worldwide are overweight and obesity, with 39% classified as overweight and 13% as obese. In Indonesia, the prevalence of obesity among individuals aged >18 years is 21.8%, with a higher prevalence observed among those with higher education (28.1%) compared to other educational levels. The prevalence is also higher in females (29.3%) than in males (14.5%) (1).

Obesity risk increases with age due to the accumulation of body fat, particularly abdominal fat. Individuals with obesity are at risk of various chronic diseases, including cardiovascular diseases (CVD), gastrointestinal disorders, type 2 diabetes (T2D), musculoskeletal disorders, sleep disturbances, respiratory problems, psychological issues, and cancer, as well as increased mortality risk. The causes of obesity are multifactorial, including dietary and lifestyle factors such as consumption of sugar-sweetened beverages, poor diet quality, physical inactivity, sedentary behavior, short sleep duration, and environmental influences (2). Previous studies have shown that individuals with overweight tend to have higher fat intake and lower vegetable consumption compared to those with normal weight, along with micronutrient deficiencies and systemic inflammation (3).

University students, as a group of young adults (20–30 years), are in a transitional phase that is vulnerable to changes in body composition, including a decrease in fat-free mass and an increase in body fat mass. In addition to biological factors, lifestyle changes among students also contribute to obesity risk. Academic demands, independent living, and changes in social environment can influence health behaviors, includingdietary patterns, physical activity, and sleep habits.

Theoretically, obesity results from a long-term imbalance between energy intake and energy expenditure (3). However, recent research indicates that the determinants of obesity extend beyond energy balance and involve more complex behavioral and lifestyle factors (4). Several variables consistently reported to be associated with obesity among university students include sleep duration, dietary patterns, and physical activity. Short sleep duration has been shown to affect the regulation of leptin and ghrelin, hormones involved in appetite control. Meanwhile, physical activity contributes to energy expenditure, whereas dietary patterns play a key role in determining both the quality and quantity of energy intake (4).

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In this study, dietary patterns are examined through the concept of risky foods, defined as foods that may increase the risk of degenerative diseases, including obesity. Risky foods are generally characterized by high levels of sugar, fat, and salt, and often include processed foods, fast foods, sugar-sweetened beverages, and foods containing additives. High consumption of such foods has been associated with excessive energy intake, metabolic alterations, and disruptions in gut microbiota balance, which contribute to the development of obesity.

Although numerous studies have examined the relationship between lifestyle factors and obesity, findings remain inconsistent, particularly regarding physical activity and dietary patterns among university students. Moreover, most studies have been conducted outside the local context, highlighting the need for research specific to university settings in Indonesia.

Alauddin State Islamic University is one of the first Islamic public universities in Eastern Indonesia and attracts a large number of students. The demanding academic schedule and campus activities may increase the likelihood of students consuming meals outside the home and relying on ready-to-eat foods, often accompanied by imbalanced dietary patterns and insufficient physical activity. Therefore, this study aims to analyze the determinant factors associated with obesity among university students.

METHOD

This study employed a quantitative approach using a cross-sectional design. The design was used to measure both independent and dependent variables simultaneously. The independent variables in this study included risky food consumption patterns, dietary patterns, sleep quality, and physical activity, while the dependent variable was the incidence of obesity among students at Alauddin State Islamic University Makassar. The study was conducted at Alauddin State Islamic University Makassar in October 2023. The population consisted of all active students registered in the Center for Technology and Data Management (Pustipad), totaling 20,805 students across eight faculties. The sample size was determined using the Lemeshow formula, resulting in a minimum sample of 378 students. Sampling was conducted using a stratified random sampling method. The distribution of the population and study sample by faculty is presented in Table 1.

Table 1. Sample distribution by Faculty at UIN Alauddin Makassar

No	Faculty	Population	Sample
1.	Sharia and Law	2867	53
2.	Tarbiyah and Teaching	2855	52
3.	Ushuluddin and Phylosophy	2755	49
4.	Adab and Humanities	2057	39
5.	Da'wah and Communication	2966	54
6.	Science and Technology	3118	59
7.	Medicine and Health Science	1613	29
8.	Islamic Economy and Bussiness	2574	42
	Total	20805	378

Data Collection

Data were collected through direct measurements and structured questionnaires. Obesity status was determined based on anthropometric measurements conducted directly by the researchers, including body weight and height. Body weight was measured using a digital scale with a precision of 0.1 kg, while height was measured using a microtoise with a precision of 0.1 cm. Body Mass Index (BMI) was calculated as weight (kg) divided by height squared (m^2) and subsequently classified according to established standards.

Sleep duration and sleep quality were assessed using the validated Pittsburgh Sleep Quality Index (PSQI) questionnaire. Risky dietary patterns were measured using a food frequency questionnaire that included the consumption of foods high in sugar, salt, and fat, such as fast foods, sugar-sweetened beverages, and processed foods. Risky dietary pattern scores were categorized into "at risk" and "not at risk" based on the median value.

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Physical activity was measured using a questionnaire adapted from the Global Physical Activity Questionnaire (GPAQ), which assesses physical activity based on duration and intensity over the past week. Physical activity levels were then categorized as sufficient or insufficient.

Inclusion and Exclusion Criteria

The inclusion criteria for this study were active students of Alauddin State Islamic University Makassar who were willing to participate and completed the questionnaire. The exclusion criteria included students who were experiencing health conditions that could affect nutritional status, such as chronic diseases or metabolic disorders, as well as respondents with incomplete data.

Data Analysis

The collected data were processed through editing, coding, entry, and cleaning using SPSS software. Univariate analysis was conducted to describe the frequency distribution of respondent characteristics and study variables. Bivariate analysis was performed to examine the association between independent variables (sleep duration, risky dietary patterns, and physical activity) and the dependent variable (obesity). Statistical tests included the chi-square test and Spearman's correlation, with a significance level (α) of 0.05.

Ethical Considerations

This study received ethical approval from the Health Research Ethics Committee of the Faculty of Medicine and Health Sciences, Alauddin State Islamic University Makassar (Reference No. B1.001c/KEPK/FKIK/XII/2023). All respondents were provided with information regarding the study objectives and were required to sign an informed consent form prior to data collection. The confidentiality of respondent data was strictly maintained and used solely for research purposes.

RESULTS

Association between Sleep Duration and Obesity

The results showed that, of the 378 respondents, all (100%) had poor sleep quality, with an obesity prevalence of 18.0%. Spearman's rank correlation test showed a p-value of 0.017 (<0.05) with a correlation coefficient of -0.192. These findings indicate a significant association between sleep duration and obesity status; however, the correlation was very weak. The positive coefficient suggests that lower sleep quality scores are associated with higher Body Mass Index (BMI), indicating a tendency toward obesity (Table 2).

Table 2. Association between sleep duration and obesity status among university students at UIN Alauddin Makassar

Sleep Duration	Obesity Status				Total		*p-value (Spearman's test)*	*Correlation Coefficient*
	Obese		Non-Obese					
	n	%	n	%	N	%		
<8 Hours	62	16,4	272	72,0	334	88,4	0,000	-0,192
≥8 Hours	6	1,6	38	10,0	44	11,6		
Total	68	18,0	310	82,0	378	100,0		

Association between Physical Activity and Obesity

Table 3 shows that, among 286 respondents with low physical activity, 18.5% were classified as obese. Meanwhile, among 92 respondents with adequate physical activity, 16.3% were classified as obese. The chi-square test showed a p-value of 0.743 (>0.05), indicating no significant association b2etween physical activity and obesity status.

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Table 3. Association between physical activity and obesity status among university students at UIN Alauddin Makassar

Physical Activity	Obesity Status				Total		*p-value (Chi-square)*	*OR_{crude} (95% CI)*
	Obese		Non-Obese					
	n	%	n	%	N	%		
Low	53	18,5	233	81,5	286	100,0	0,743	1,168 (0,623-2,189)
Adequate	15	16,3	77	83,7	92	100,0		
Total	68	18,0	310	82,0	378	100,0		

Association between Risky Dietary Patterns and Obesity

Table 4 shows that, among 205 respondents with risky dietary patterns, 18.0% were classified as obese. Meanwhile, among 173 respondents with non-risky dietary patterns, 17.9% were classified as obese. The nonparametric statistical test using Spearman's rank correlation showed a p-value of 0.010 (<0.05) with a correlation coefficient of 0.131. These results indicate a significant association between risky dietary patterns and obesity status; however, the strength of the correlation was very weak. The positive coefficient suggests that higher risky dietary pattern scores are associated with higher Body Mass Index (BMI), indicating a tendency toward obesity.

Table 4. Association between risky dietary patterns and obesity status among university students at UIN Alauddin Makassar

Risky Dietery Patterns	Obesity Status				Total		*p-value (Spearman's test)*	*Correlation Coefficient*
	Obese		Non-Obese					
	n	%	n	%	N	%		
Risky	37	18,0	168	82,0	205	100,0	0,010	0,131
Non-Risky	31	17,9	142	82,1	173	100,0		
Total	68	18,0	310	82,0	378	100,0		

DISCUSSION

Sleep is a state of altered consciousness in which an individual's perception of and response to the environment are reduced. Sleep deprivation negatively affects both physical and mental performance. It is influenced by social, biological, environmental, and lifestyle factors, and is associated with impaired motor function and performance. Individuals with insufficient sleep tend to have difficulty focusing, concentrating, and making decisions, and are more prone to confusion and risk-taking behaviors (5).

This study found that the average sleep duration among students at Alauddin State Islamic University Makassar was 6 hours, with the Faculty of Tarbiyah contributing the highest proportion of students with short sleep duration (96.2%). Statistical analysis showed a significant association between sleep duration and obesity status, although the correlation was very weak. The negative correlation coefficient indicates that shorter sleep duration is associated with higher Body Mass Index (BMI), increasing the likelihood of obesity. Previous studies among university students have also reported a significant relationship between sleep duration and BMI ($p < 0.05$, Spearman's rank correlation), which may be explained by the role of leptin and ghrelin hormones (6).

Other studies have similarly demonstrated an association between sleep duration and obesity. Individuals with poor sleep quality tend to experience greater fatigue during the day, which may reduce their ability and motivation to engage in physical activity. Poor sleep quality is also associated with increased energy intake, particularly from energy-dense foods, and has adverse effects on metabolism (7).

Short sleep duration among students may be attributed to habits such as staying up late to complete academic assignments. A study by Putri (2022) found that respondents in the obese group had shorter sleep duration compared to those in the non-obese group (8). Sleep influences body weight through various biological and behavioral mechanisms. Short sleep duration can increase hunger, provide more opportunities to eat, increase fatigue, and alter thermoregulation. Increased hunger and eating opportunities ultimately lead to higher energy intake (9).

Sleep plays an important role in regulating body weight and metabolism. Insufficient sleep disrupts hormonal regulation, particularly the secretion of leptin and ghrelin, which are involved in appetite control and

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food intake. Individuals who do not obtain adequate sleep may experience increased caloric intake and excessive appetite, partly due to elevated plasma ghrelin levels associated with short sleep duration (10).

The results of this study showed no significant association between physical activity and obesity. This may be explained by the dominant influence of energy intake compared to energy expenditure through physical activity. Individuals who regularly engage in physical activity may still develop obesity if high-energy food intake is not controlled (11). Previous studies reported that approximately 26.9% of students engaged in less than 2 hours of physical activity per week, while 33.9% exceeded 2 hours (12). In Thailand, around 49.5% of students were reported to have adequate physical activity levels (13). A study among students of the Faculty of Health Sciences at UHAMKA found that 47.8% had low physical activity, 39.6% moderate, and 12.6% high physical activity levels (14). Globally, declining physical activity has been observed among adolescents in nearly all countries. According to a report published in *The Lancet*, based on 1.9 million respondents from 358 surveys across 168 countries, insufficient physical activity was found in 27.5% of the global population (15).

Physical activity among university students is influenced by both intrinsic and extrinsic factors, such as gender, intensity, and internal motivation (16). Significant associations have been found between gender, employment status, availability of sports facilities, lecturer support, and perceptions of physical activity. Higher levels of physical activity are more commonly observed among male students, those who are employed, those with easy access to sports facilities (at home or on campus), and those with positive perceptions of physical activity (14).

The World Health Organization (WHO) has highlighted the global issue of insufficient physical activity. In university settings, increasing physical activity can be facilitated by providing accessible public spaces, such as jogging tracks and sports facilities. Dietary patterns are a key determinant of obesity, particularly the consumption of sugar-sweetened beverages and poor diet quality. Risky foods are defined as foods that increase the risk of degenerative diseases, including those high in sugar, salt, fat, additives, and preservatives. Increased consumption of fast food has been associated with central obesity (17). Other contributing factors include unhealthy lifestyles (such as physical inactivity, excessive screen time, short sleep duration, or shift work) and environmental factors (18).

This study also found a significant association between risky dietary patterns and obesity. This finding is consistent with previous studies showing that increased intake of added sugars contributes to obesity, regardless of other macronutrient intake (19). Other studies have reported that skipping breakfast and frequent snacking are strongly associated with obesity among students (20). Additionally, frequent fast-food consumption has been linked to obesity risk, with individuals consuming fast food two or more times per week having a 2.2-fold higher risk of obesity (21). A systematic review further reported that excessive consumption of sugary foods and fast food was associated with increased obesity risk (relative risk <1.20 and 1.17, respectively) (22).

Previous clinical studies have shown that diets high in fat and glucose or fructose can alter gut microbiota, characterized by reduced proportions of *Bacteroidetes* and increased *Proteobacteria*. These changes may increase intestinal permeability due to alterations in tight junction proteins caused by intestinal inflammation, leading to metabolic endotoxemia, inflammation, lipid accumulation, hepatic steatosis, and ultimately obesity (23). Nutritional sources and diet quality are increasingly emphasized over quantity in obesity prevention and control efforts (24). A better dietary pattern is characterized by greater variety and diversity of foods, with a higher proportion of healthy food choices and improved overall diet quality (25).

However, some studies have reported inconsistent findings, indicating no association between risky food consumption and obesity, possibly due to other influencing factors such as genetics and physical activity (26). Other studies have also found no significant difference in obesity risk among individuals consuming risky foods after controlling for variables such as age and marital status, potentially due to metabolic changes in individuals who have given birth or differences in body image concerns among married individuals (27).

It is important to note that the cross-sectional design of this study does not allow for causal inferences. Additionally, there is potential for recall bias in self-reported dietary intake (FFQ/recall) and physical activity data. This limitation can be minimized through proper enumerator training and the use of supporting tools such as food photographs or food models to improve accuracy (28).

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CONCLUSION

This study found that sleep duration and risky dietary patterns were significantly associated with obesity among students at Alauddin State Islamic University Makassar ($p < 0.05$), although of the correlation was weak. Sleep duration of less than 8 hours was associated with an increased risk of obesity. The consumption of foods high in sugar and fat, as well as fast food, was positively associated with a higher prevalence of obesity. In contrast, physical activity was not significantly associated with obesity in this study. Obesity prevention interventions in university settings should prioritize improving sleep duration and promoting healthy dietary patterns.

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CONFLICTS OF INTEREST

All authors declare no conflict of interest regarding this article.

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