Amerta Nutrition
e-ISSN: 2580-1163 (Online)
p-ISSN: 2580-9776 (Print)
Kusumastuty et al. | Amerta Nutrition Vol. 9 Issue 3 (September 2025). 419-429

RESEARCH STUDY
English Version

OPEN ACCESS

Relationship between Body Mass Index, Body Fat Percentage, and Eating Habits among University Students in Malang

Hubungan Antara Indeks Massa Tubuh dan Persen Lemak Tubuh dengan Kebiasaan Makan pada Mahasiswa di Malang

Inggita Kusumastuty[1]*, Putri Hersya Maulia[1], Diva Regita Dewi[1], Rizkyah Oktania[1], Fajar Ari Nugroho[1], Dian Handayani[1]

[1]Department of Nutrition, Faculty of Health Sciences, Universitas Brawijaya, Malang Regency, Indonesia

ARTICLE INFO

Received: *17-07-2024*
Accepted: *05-03-2025*
Published online: *12-09-2025*

Correspondent:
Inggita Kusumastuty
inggita@ub.ac.id

DOI:
10.20473/amnt.v9i3.2025.419-429

Available online at:
https://e-journal.unair.ac.id/AMNT

Keywords:
Body mass index, Eating habits, Body fat percentage

ABSTRACT

Background: In 2023, obesity prevalence in Indonesia was reported at 15.7% in men and 31.2% in women. Eating out has become increasingly common among university students in major cities like Malang due to busy schedules, easy access to food accessibility, and lifestyle changes.
Objectives: This study aims to examine the relationship between Body Mass Index (BMI), body fat percentage, and eating habits among university students.
Methods: This cross-sectional observational study was conducted at Universitas Brawijaya, Malang, involving 385 respondents. The measured variables included BMI, body fat percentage, and eating habits. Eating habits were assessed using a questionnaire covering five indicators: Takeaway food consumption, eating at home, dining at restaurants, consuming supermarket food, and consuming traditional market snacks. Data were analyzed using the Chi-square test and Logistic Regression.
Results: Most respondents were female, lived in dormitories or rented housing, and had a family income below five million rupiahs per month. Among the five eating habit indicators, only restaurant dining showed a significant correlation with BMI and body fat percentage (p-value 0.295, 0.237, 0.821, 0.556), while takeaway food consumption, eating at home, consuming supermarket food, and consuming traditional market snacks were not significantly related (p-value 0.000).
Conclusions: Eating habits, in general, showed no significant relationship with BMI and body fat percentage, except for restaurant dining, which was significantly correlated with increased body fat percentage.

INTRODUCTION

According to the United Nations Children's Fund (UNICEF), overweight and excessive fat accumulation are growing global health concerns. Nutritional status in adults is commonly assessed using Body Mass Index (BMI), which considers weight and height[1]. The prevalence of obesity among individuals aged 18 and older has been steadily increasing. Data from the 2023 Basic Health Research (Riskesdas) reported an obesity prevalence of 15.7% in men and 31.2% in women[2]. It reflects an increase from 2018, when the rates were 14.5% in men and 29.3% in women[3]. One of the primary contributing factors is an energy intake that exceeds expenditure. Excessive fat accumulation increases the risk of heart disease, diabetes, and other health complications[4]. A 2021 study found that adolescents tend to consume fewer healthy foods while frequently consuming unhealthy options such as fast food and sugar-sweetened beverages. This dietary pattern significantly impacts their nutritional status and overall health[5].

Food obtained outside the home is often served in excessive portions, high in calories, sugar, and fat, but lacking essential vitamins, minerals, and fiber. This imbalance increases the risk of excess weight gain, abdominal obesity, and related health issues[6]. Additionally, research by Rehman et al. showed that sedentary behaviors, such as prolonged TV watching or computer use, further contribute to weight gain and poor health outcomes. These studies emphasize the importance of a balanced diet and regular physical activity in maintaining a healthy weight[7].

This study aims to examine the relationship between nutritional status, measured through BMI and body fat percentage, and eating habits among university students in Malang. The results are expected to provide insights into the factors contributing to excessive body weight and fat accumulation in this population. Moreover, the results may serve as a foundation for developing

How to cite: *Kusumastuty, I., Maulia, P. H., Dewi, D. R., Oktania, R., Nugroho, F. A., & Handayani, D. (2025). Relationship between Body Mass Index, Body Fat Percentage, and Eating Habits among University Students in Malang: Hubungan Antara Indeks Massa Tubuh dan Persen Lemak Tubuh dengan Kebiasaan Makan pada Mahasiswa di Malang. Amerta Nutrition, 9(3), 419–429.*

effective interventions to promote healthy eating habits and weight management strategies among university students.

METHODS

This analytical observational study used a cross-sectional approach and was conducted at Universitas Brawijaya, Malang, East Java, over two months (September to October 2023). The study population consisted of multidisciplinary university students aged 18–29 years, selected through purposive sampling based on predefined inclusion and exclusion criteria. Participants were required to have good communication skills and be willing to undergo body composition measurements and complete a questionnaire. The sample size was determined using Cochran's formula, with a minimum requirement of 385 participants. Data collection included measurements of BMI, body fat percentage, and eating habits. The study utilized a microtoise for height measurement, a portable Omron HBF 375 Bioelectrical Impedance Analysis (BIA) device for body fat assessment, and a questionnaire for dietary habits.

The study began with respondent screening based on inclusion criteria, followed by an explanation of the research objectives and procedures. Informed consent was obtained before data collection commenced. The data collection process included structured interviews on participant characteristics and eating habits, followed by anthropometric measurements. The respondent characteristics questionnaire gathered information on name, gender, place of residence, and family income. Eating habits were assessed through five yes-or-no questions regarding takeaway and delivery food consumption[8]. All data collection was conducted by the researchers.

Nutritional status was classified based on BMI into underweight (<18.5 kg/m²), normal (18.5-22.9 kg/m²), overweight (23–24.9 kg/m²), and obese (≥25 kg/m²)[9,10]. Body fat percentage was categorized as normal (10-25% for men, 15-30% for women) or abnormal (outside these ranges)[11].

Statistical analysis included bivariate analysis using cross-tabulation and the Chi-square test to examine relationships between independent and dependent variables. Multivariate analysis was conducted using logistic regression to assess the effects of independent variables on eating habits. This study received ethical approval from the Health Research Ethics Committee of the Faculty of Health Sciences, Universitas Brawijaya (Ethical Clearance No. 1127/UN10.F17.10.4/TU/2023, dated July 25, 2023).

RESULTS AND DISCUSSIONS

Respondent Characteristics

The characteristics of the respondents are presented in Table 1. In general, most study participants were female (74%, n = 285), lived in boarding houses, dormitories, or rented housing (77.4%, n = 298), and had a family income of less than 5 million rupiahs per month (< 60 million rupiahs per year) (43.4%, n = 167). In terms of nutritional status, a total of 213 respondents (55.3%) had a normal BMI, and 313 respondents (81.3%) had a normal body fat percentage. These findings align with those of Jahang et al. (2021), who reported that fast food consumption was more prevalent among female university students (94.2%)[12]. Similarly, Tariq et al. (2019) found that women in Pakistan consumed more fast food than men. However, studies conducted by Banik et al. (2020) in Bangladesh and Mahajan and Gothankar (2020) in India presented contrasting results that men consumed fast food more frequently than women since men spend more time outside the home, thus increasing their likelihood of consuming fast food as snacks[14,15].

Table 1. Distribution of respondent characteristics

Respondent Characteristic	n (%)
Gender	
Male	100 (26.0)
Female	285 (74.0)
Place of Residence	
Own House	87 (22.6)
Boarding House/Dormitory/Rented House	298 (77.4)
Family Income	
< IDR 5,000,000	167 (43.4)
IDR 5,000,000-IDR 10,000,000	137 (35.6)
IDR 10,000,000-Rp 15,000,000	41 (10.6)
> IDR 15,000,000	40 (10.4)
Body Mass Index (BMI)	
Underweight (<18.5 kg/m²)	60 (15.6)
Normal (18.5-22.9 kg/m²)	213 (55.3)
Overweight (23-24.9 kg/m²)	89 (23.1)
Obese (≥25 kg/m²)	23 (6.0)
Body Fat Percentage	
Normal (male 10-24%, female 15-30%)	313 (81.3)
Abnormal (male >24%, female >30%)	72 (18.7)

How to cite: *Kusumastuty, I., Maulia, P. H., Dewi, D. R., Oktania, R., Nugroho, F. A., & Handayani, D. (2025). Relationship between Body Mass Index, Body Fat Percentage, and Eating Habits among University Students in Malang: Hubungan Antara Indeks Massa Tubuh dan Persen Lemak Tubuh dengan Kebiasaan Makan pada Mahasiswa di Malang. Amerta Nutrition, 9(3), 419–429.*

sTable 2. Distribution of respondents' eating habits

Eating Habits	Yes		No	
	n	%	n	%
Takeaway Food	145	37.7	240	62.3
Home-Cooked Meals	258	67.0	127	33.0
Restaurant Food	215	55.8	170	67.8
Supermarket Food	124	32.2	261	67.8
Traditional Snacks	56	66.5	129	33.5

The majority of respondents in this study were 20 years old (30.1%). This finding aligns with the study conducted by Santoso and Velania (2017) that fast food consumption habits were common among university students with an average age of 20 years. Furthermore, the results showed that respondents frequently consumed fast food more than three times per month[16]. Regarding place of residence, most respondents (77.4%) lived in boarding houses, dormitories, or rented housing. A study by Munasiroh et al. (2019) documented a similar trend that 68.8% of university students who frequently consumed fast food resided in rented housing or moved frequently[17]. This suggests that most respondents experienced relocation and did not live with their families. According to Jauziyah et al. (2021), students living in boarding houses, dormitories, or rented housing tend to develop unhealthy eating habits[18].

In terms of socioeconomic background, based on World Bank data on Gross Domestic Product (GDP) per capita in 2023, most respondents belonged to the lower-middle income group, or a family generating income of less than 5 million rupiahs per month (<60 million rupiahs per year) (43.4%). The second-largest group had a family income of 5-10 million rupiahs per month (60-120 million rupiahs per year) (35.6%)[9]. Research by Omidvar and Begum (2014) suggests that individuals from lower socioeconomic backgrounds tend to consume more fast food and bakery products than those from middle and upper social classes[19]. However, in Indonesia, Halid and Sudargo (2016) reported that students from higher socioeconomic backgrounds consumed fast food more frequently and had a greater risk of obesity than those with financial constraints [20 21].

Regarding nutritional status based on BMI, the majority of respondents (55.3%) had a normal BMI. This finding aligns with Mahmoud and Taha (2017), who reported that 60% of university students in their study had a normal BMI[22]. Similarly, Mahfouz et al. (2016) found that most students had a normal BMI (45%), although 23.1% were classified as overweight[23]. Another study by Patarru et al. (2022) suggested that excessive nutritional status can result from dietary habits characterized by high-calorie, high-fat, high-cholesterol, and high-sodium foods, which are often low in fiber, vitamin A, folic acid, and calcium[24]. Regarding body fat percentage, the majority of respondents (81.3%) had a normal fat mass. This finding is consistent with Rahayu et al. (2017), who reported that most university students had a normal body fat percentage[25]. Research by Arraniri et al. (2017) emphasized that excess calorie consumption contributes to fat accumulation, as high-calorie diets, particularly those rich in fast food, fat, and salt, but low in fiber, are associated with increased body fat percentage[26].

In terms of eating habits, most respondents (62.3%) did not consume takeaway food (Table 2). This finding is consistent with the study by Goffe et al. (2017), which reported that most respondents (44.9%) rarely or never consumed takeaway food[27]. Exposure to and ease of access to takeaway food influence eating habits[28]. Most respondents (67%) consumed home-cooked meals. Astbury et al. (2019) also found that the majority of respondents consumed home-cooked meals frequently[29]. According to Jones et al. (2014), students preferred home-cooked meals due to cost savings, parental meal preparation, easy access to ingredients, available cooking time, and the ability to clean up afterward. In contrast, students who dined out cited limited time for meal preparation, lack of kitchen facilities, inadequate cooking skills, and the convenience of eating at campus cafeterias as key reasons for their choice[30].

More than half of the respondents (55.8%) consumed restaurant food. This finding aligns with the study by Jahang et al. (2021), which reported that 87.2% of respondents frequently consumed fast food. Several factors contributing to students' preference for restaurant food are campus events that provide free meals, often from fast-food restaurants and free time due to canceled classes allows students to gather and eat at restaurants, particularly fast-food restaurants. The high availability of fast-food restaurants around campus, along with promotional offers such as discounts and free samples, also encourages consumption. Other influencing factors include social class, parental workload, economic conditions, social environment, and place of residence[12]. Additionally, Kabir et al. (2018) found that students tend to eat out more during exam periods due to time constraints and a lack of motivation to cook. After exams, dining out also serves as a form of celebration[31].

Most respondents (67.8%) did not consume supermarket-prepared food. A study by Deric et al. (2017) reported contrasting results, showing that most students (93.8%) obtained their food from supermarkets. Proximity to supermarkets and higher household income often correlate with a preference for higher-quality supermarket food[32]. However, this study only examined parental income without considering students' personal allowances. Harris et al. (2019) noted that supermarkets and convenience stores tend to prioritize processed foods with longer shelf lives but lower nutritional quality, particularly in terms of nutrient density per calorie[33]. Meanwhile, most respondents (66.5%) consumed traditional snacks. This finding is consistent with the study by Nur Faizah and Ruhana (2021) that 70% of respondents frequently consumed traditional snacks[34]. According to Muhandri et al. (2021), respondents preferred traditional snacks due to their good taste, affordability, accessibility, attractive appearance, and

How to cite: *Kusumastuty, I., Maulia, P. H., Dewi, D. R., Oktania, R., Nugroho, F. A., & Handayani, D. (2025). Relationship between Body Mass Index, Body Fat Percentage, and Eating Habits among University Students in Malang: Hubungan Antara Indeks Massa Tubuh dan Persen Lemak Tubuh dengan Kebiasaan Makan pada Mahasiswa di Malang. Amerta Nutrition, 9(3), 419–429.*

satiating nature. However, some respondents highlighted drawbacks such as limited shelf life, questionable hygiene, lack of practicality, and a perception that traditional snacks were outdated[35].

Relationship between Eating Habits and Nutritional Status Based on BMI

The relationship between eating habits and nutritional status based on BMI is presented in Table 3. The Chi-square test results indicated that all five eating habit indicators, namely takeaway food, home-cooked meals, restaurant food, supermarket food, and traditional snacks, had p-values greater than 0.05 (0.457, 0.890, 0.101, 0.665, and 0.144, respectively). These results suggest no significant association between eating habits and nutritional status based on BMI.

Some studies have identified a positive correlation between frequent takeaway food consumption and BMI[36]. One study showed that frequent consumption of takeaway food was associated with students' preference for high-fat, high-sugar foods, lack of physical activity, and limited health knowledge. Another study conducted in Cambridgeshire also found a positive relationship between takeaway food exposure and BMI[28]. The study highlighted that the most commonly taken away foods were fast food items. The widespread availability of fast-food outlets contributed to the increased correlation between takeaway food habits and BMI. Since takeaway food is often associated with fast food restaurants, BMI increase was attributed to the high energy density of fast food[37]. However, in contrast to these studies, the findings of this present research indicate no significant correlation between takeaway food consumption and BMI. This discrepancy may be due to differences in the energy density of takeaway foods consumed by students in Malang. Unlike in Western cultures, takeaway food for students in Malang is not limited to fast food but also includes affordable home-style rice meals that fulfill students' daily nutritional needs. Therefore, although previous studies found a positive correlation between takeaway food and BMI, the energy density of takeaway food itself plays a role in determining its impact.

This present study also found no significant relationship between eating at home and BMI. However, other literature suggests a positive relationship between home-cooked meals and BMI, largely due to their higher content of fruits and vegetables, which are associated with a lower risk of overweight and obesity[38]. Additionally, those studies found that eating at home while watching television increased the risk of weight gain and obesity, as TV watching stimulates appetite and can lead to excessive food intake[39]. Prior research also demonstrated that eating dinner while watching TV was associated with lower fruit and vegetable consumption[38]. Other studies have suggested that frequent home-cooked meals are closely related to maintaining a normal BMI because home-cooked meals are often linked to adherence to the DASH or Mediterranean diet and adequate fiber intake from fruits and vegetables[40]. According to a study by Albalawi et al., individuals with a BMI below 25 kg/m² were more likely to consume home-cooked meals[8].

Cultural differences in home cooking and the quality of prepared meals may explain the inconsistencies between this study and previous research. The nutritional quality of home-cooked meals can vary between households, which may contribute to different research outcomes.

Table 3. Bivariate analysis results of BMI and respondents' eating habits

Eating Habit	Parameter (BMI)											
	Underweight			Normal			Overweight			Obesity		
	n	%	p-value*	n	%	p-value*	n	%	p-value*	n	%	p-value*
Takeaway Food												
Yes	20	5.2	0.457	76	19.7	0.457	39	10.1	0.457	10	2.6	0.457
No	40	10.4		137	35.6		50	13.0		13	3.4	
Home-Cooked Meals												
Yes	41	10.6	0.890	141	36.6	0.890	59	15.3	0.890	17	4.4	0.890
No	19	4.9		72	18.7		30	7.8		6	1.6	
Restaurant Food												
Yes	29	7.5	0.101	113	29.4	0.101	14	3.6	0.101	14	3.6	0.101
No	31	8.1		100	26.0		9	2.3		9	2.3	
Supermarket Food												
Yes	23	6.0	0.665	66	17.1	0.665	29	7.5	0.665	6	1.6	0.665
No	37	9.6		147	38.2		60	15.6		17	4.4	
Traditional Snacks												
Yes	44	11.4	0.144	139	36.1	0.144	62	16.1	0.144	11	2.9	0.144
No	16	4.2		74	19.2		27	7.0		12	3.1	

*Chi-square test, significant if p-value<0.05.

Several studies have stated that dining at restaurants negatively affects diet quality. These studies indicated that the frequency of eating out, particularly at restaurants, increases the likelihood of obesity or overweight[41]. A study conducted in the UK found that restaurant food often exceed daily nutritional requirements and is generally less healthy[27]. More recent research has also identified a negative correlation between the frequency of restaurant dining and diet quality[42]. According to Bhutani et al., restaurant dining habits are positively correlated with BMI increase. Their study found that each additional meal consumed at a

How to cite: *Kusumastuty, I., Maulia, P. H., Dewi, D. R., Oktania, R., Nugroho, F. A., & Handayani, D. (2025). Relationship between Body Mass Index, Body Fat Percentage, and Eating Habits among University Students in Malang: Hubungan Antara Indeks Massa Tubuh dan Persen Lemak Tubuh dengan Kebiasaan Makan pada Mahasiswa di Malang. Amerta Nutrition, 9(3), 419–429.*

fast-food restaurant or other dining restaurants per week resulted in increased BMI by 0.8 kg/m² and 0.6 kg/m², respectively[43]. However, a study by Ardin et al. in 2018 reported findings consistent with this research among adolescent subjects, showing no correlation between fast-food restaurant dining and BMI[44]. This present study similarly found no significant association between restaurant dining habits and students' nutritional status. Several factors influencing the impact of fast-food consumption on nutritional status include appetite, hunger, lifestyle, social and economic factors, and convenience[14]. However, this study did not explore the specific factors behind participants' choices to eat at fast-food restaurants. Further research is needed to investigate this aspect.

This study also found no correlation between supermarket food consumption and BMI. This finding differs from previous research, such as a study conducted in a low-income area of Pittsburgh, which found that although a newly opened supermarket improved the quality of food consumed by local residents (reducing calorie intake, added sugar, and empty calories), it did not lead to significant changes in BMI or obesity rates. Consequently, no direct relationship was found between supermarket food and BMI[45]. Another study in Toronto, conducted among elementary school children, also contradicts our findings. The research showed that access to healthy food stores and proximity to supermarkets played a significant role in influencing children's weight, regardless of gender or household income. Differences in study methodologies may explain these disparities. Factors such as objective height and weight measurements, assessments of food access and food density, and the application of network buffer analysis contribute to the robustness of study findings and may account for variations in results[15].

There is limited literature specifically addressing the relationship between traditional snack consumption and BMI. Traditional snacks, by definition, refer to various types of cakes or foods initially sold in traditional markets[46]. Each region has distinct culinary traditions, so the types of traditional snacks vary and cannot be generalized. The ingredients used in traditional snacks influence their nutritional value[47]. In Malang, traditional snacks are typically made from local ingredients such as sago flour and rice flour. Their flavors range from sweet to savory, with diverse textures, including chewy, soft, or crispy[48]. Some studies suggest that frequent consumption of unhealthy snacks, particularly those high in fat and sugar, contributes to obesity[49]. One study found a significant association between snack frequency, energy intake, fat intake, and central obesity[50]. A study on elementary school children in Malaysia showed that snack consumption affects energy intake, which can have both positive and negative impacts. Due to the wide variety of traditional snacks and different preparation methods, results cannot be easily generalized. Traditional snacks with balanced nutritional content can contribute to good nutritional status[16].

Relationship Between Eating Habits and Body Fat Percentage

The analysis of the relationship between eating habits and body fat percentage is presented in Table 4. Based on the Chi-square test results, the significance values for takeaway food consumption, eating at home, consuming supermarket products, and consuming traditional snacks were 0.295, 0.237, 0.821, and 0.556, respectively. These results indicate that takeaway food consumption, eating at home, consuming supermarket products, and consuming traditional snacks are not associated with body fat percentage. However, a different result was observed for restaurant dining habits, which had a significance value of 0.000, indicating a significant relationship between eating at restaurants and body fat percentage.

Hoenink et al. reported an association between takeaway food consumption and body fat mass. Their study found that environmental exposure to takeaway restaurants correlates with increased takeaway food consumption and body fat percentage. Eating behavior factors, such as emotional eating and uncontrolled eating, were also positively associated with takeaway food consumption and increased body fat[51]. Hoenink (2023) further reported that takeaway food consumption is linked to body fat percentage, and eating behaviors moderate the relationship between exposure to takeaway food outlets and body fat percentage[52]. Additionally, a study by Wei et al. (2022) found that eating out is associated with increased body fat and a higher risk of being overweight[53]. However, this present study did not find a relationship between takeaway food consumption and body fat mass. Previous studies primarily examined takeaway food consumption in the context of fast-food restaurants. Social and cultural differences across regions may influence research findings. Western cultures tend to engage in takeaway food consumption more frequently, particularly from fast-food restaurants, which are typically high in fat and sugar[37]. Therefore, the type of food consumed as takeaway is a key factor influencing body fat mass.

Table 4. Bivariate test results of body fat percentage and respondents' eating habits

Eating Habit	Parameter (Body Fat Percentage)					
	Normal			Abnormal		
	n	%	p-value*	n	%	p-value*
Takeaway Food						
Yes	114	29.6	0.295	31	8.1	0.295
No	199	51.7		41	10.6	
Home-Cooked Meals						
Yes	214	55.6	0.237	44	11.4	0.237
No	99	25.7		28	7.3	
Restaurant Food						

How to cite: *Kusumastuty, I., Maulia, P. H., Dewi, D. R., Oktania, R., Nugroho, F. A., & Handayani, D. (2025). Relationship between Body Mass Index, Body Fat Percentage, and Eating Habits among University Students in Malang: Hubungan Antara Indeks Massa Tubuh dan Persen Lemak Tubuh dengan Kebiasaan Makan pada Mahasiswa di Malang. Amerta Nutrition, 9(3), 419–429.*

Eating Habit	Parameter (Body Fat Percentage)					
	Normal			Abnormal		
	n	%	p-value*	n	%	p-value*
Yes	160	41.6	<0.001**	55	14.3	<0.001**
No	153	39.7		17	4.4	
Supermarket Food						
Yes	100	26.0	0.821	24	6.2	0.821
No	213	55.3		48	12.5	
Traditional Snacks						
Yes	206	53.5	0.556	50	13.0	0.556
No	107	27.8		22	5.7	

*Chi-square test, significant if p-value<0.05.
**Significant, p-value<0.05

Regarding eating at home, the UK Biobank study found a relationship between eating out and body fat mass. One study found that consuming meals outside the home was associated with an increase in BMI and adjusted body fat percentage among UK Biobank participants[8]. Similarly, Wei et al. (2022) found that eating out was linked to increased body fat, particularly among those who frequently consumed meals outside the home[53]. In contrast, a study in the United States found that having dinner at home with family had a positive impact on body fat percentage. Eating at home is closely linked to higher fruit and vegetable consumption, which contributes to lower body fat levels[54]. However, the results of this present study did not indicate a significant relationship between eating at home and body fat mass. Further research is needed to assess the nutritional quality of home-cooked meals to provide a clearer understanding. Promoting healthy eating habits at home may contribute to reduced body fat mass and a lower risk of overweight and obesity.

According to Pescari et al. (2024), restaurant dining may contribute to increased body fat due to a combination of large portion sizes, unhealthy food choices, and irregular eating patterns. Therefore, paying attention to food choices and portion sizes when dining out is crucial for maintaining a healthy weight[55]. These results align with the present study, which identified a significant association between restaurant dining habits and body fat mass. Restaurant food tends to be high in energy and fat, and frequent restaurant dining can lead to lower diet quality, characterized by excessive intake of total and saturated fats, sugars, and sodium, along with insufficient fiber, dairy products, fruits, vegetables, and micronutrients[56]. This supports the conclusion that eating at restaurants may contribute to higher body fat mass.

The retail food environment, including supermarkets, plays a vital role in shaping dietary patterns in surrounding communities. A study in Australia found that supermarkets displaying more healthy food options influenced purchasing and eating habits among local residents[57]. Regarding supermarket food consumption habits, the results of this present study were consistent with previous studies that found no significant association between supermarket food consumption and body fat mass. A systematic review and meta-analysis revealed that shopping frequency at specific food stores, including supermarkets, was not related to BMI or body fat percentage[58]. In this study, no significant correlation was found between supermarket food consumption and body fat mass. However, future studies should examine shopping frequency and the types of products purchased to provide a more comprehensive understanding of the relationship between supermarket food consumption and body fat composition.

Results from Andarwulan et al. suggest a correlation between consuming traditional street food and body fat mass. A relevant study conducted in South Jakarta, Indonesia, found that eating food outside the home, including street food, significantly contributed to high salt and fat intake. This study indicated that such consumption was linked to a higher risk of non-communicable diseases and increased body fat mass, particularly among men[59]. However, this present study found no significant relationship between consuming traditional street food and body fat mass. Some traditional Indonesian snacks can serve as functional foods[47], but this depends on whether their ingredients provide balanced nutritional content. Therefore, moderating street food consumption and adopting a balanced diet is essential for maintaining health, preventing excessive weight gain, and reducing fat accumulation.

Table 5. Multivariate test results on eating habits

Variable	Logistic Regression			Omnibus	
	Regression Coefficient (B)	Wald	p-value	p-value	*R square*
Takeaway Food					
Body Fat Percentage	-0.102	0.109	0.742	0.320	0.008
BMI	-0.175	1.192	0.275		
Home-Cooked Meals					
Body Fat Percentage	0.485	2.312	0.128	0.308	0.008
BMI	-0.165	0.981	0.322		
Restaurant Food				<0.001*	0.055

How to cite: *Kusumastuty, I., Maulia, P. H., Dewi, D. R., Oktania, R., Nugroho, F. A., & Handayani, D. (2025). Relationship between Body Mass Index, Body Fat Percentage, and Eating Habits among University Students in Malang: Hubungan Antara Indeks Massa Tubuh dan Persen Lemak Tubuh dengan Kebiasaan Makan pada Mahasiswa di Malang. Amerta Nutrition, 9(3), 419–429.*

Variable	Logistic Regression			Omnibus	
	Regression Coefficient (B)	Wald	p-value	p-value	*R square*
Body Fat Percentage	-1.098	10.467	0.001*		
BMI	-0.031	0.037	0.846		
Supermarket Food					
Body Fat Percentage	-0.257	0.625	0.429	0.499	0.005
BMI	0.193	1.328	0.249		
Traditional Snack Consumption					
Body Fat Percentage	-0.496	2.246	0.134	0.120	0.015
BMI	0.324	3.843	0.050*		

*Significant, p-value<0.05

The logistic regression analysis results in Table 5 indicate no significant multivariate effect of body fat percentage and Body Mass Index (BMI) on the habits of takeaway food consumption, home-cooked meals, supermarket food, and street food. This is evidenced by the Omnibus test significance values of 0.320, 0.308, 0.499, and 0.120, respectively ($p > 0.05$). The Nagelkerke R-Square determination coefficients for each food consumption category are 0.008, 0.008, 0.005, and 0.015, suggesting that the contribution of body fat percentage and BMI to these consumption habits is minimal, ranging from 0.5% to 1.5%. Most factors influencing food consumption habits are beyond body fat percentage and BMI. Other factors that may affect food consumption habits include food type, portion size, eating frequency, food distribution, and food selection criteria[60].

A similar study by Deliens et al. in 2014 identified various factors influencing students' eating habits, including individual factors (e.g., food preferences, self-discipline, time constraints), social factors (e.g., parental and peer influence), physical environment factors (e.g., food availability and accessibility, living arrangements), and macro-level factors (e.g., media and advertising). These findings indicate that food consumption habits are influenced by multiple factors beyond body composition[61]. In contrast, as presented in Table 4, the analysis of restaurant food consumption revealed a significant negative relationship between body fat percentage and restaurant dining habits (B=-1.098, p-value=0.001), while BMI showed no significant effect (B=-0.031, p-value=0.846). The Omnibus test confirmed a significant combined effect of body fat percentage and BMI on restaurant food consumption habits (p-value = 0.000), although these variables explained only 5.5% of the variability (Nagelkerke R-Square=0.055). A key strength of this study is its exploration of the relationship between eating habits, BMI, and body fat percentage in Indonesia, a topic that has not been previously examined. However, the findings cannot be generalized to the entire Indonesian student population, as the sample was limited to students in Malang, specifically at Universitas Brawijaya.

CONCLUSIONS

This study finds that most eating habit indicators do not have a significant relationship with BMI or body fat percentage. Among the five indicators examined, only restaurant dining habits show a significant relationship with body fat mass. This relationship is likely due to the high energy and fat content of restaurant food, which contribute to increased body fat levels. However, the overall correlation between eating habits, BMI, and body fat percentage remains weak. The practical implications of this study emphasize the need for nutritional education programs targeted at students. By equipping students with knowledge about healthy eating habits, nutritionists and healthcare professionals can help them make informed dietary choices, ultimately supporting better nutritional status and overall health.

ACKNOWLEDGEMENT

The authors would like to thank the Faculty of Health Sciences, Universitas Brawijaya, and all parties who contributed to this study.

CONFLICT OF INTEREST AND FUNDING DISCLOSURE

All authors declare no conflicts of interest regarding this article. This study was funded by the Main Research Grant of the Faculty of Health Sciences under contract number 3528/UN10.F17/PT.01.03/2023.

AUTHOR CONTRIBUTIONS

IK: Contributed to research idea formulation, manuscript drafting, and revisions; PHM, DRD, RD: Responsible for data collection and manuscript preparation; FAN: Conducted statistical analysis and participated in manuscript preparation; DH: Contributed to research concept development and manuscript preparation.

REFERENCES

1. Witono, S. K., Nugraha, G. I., Permana, H. & Adi, S. Profil Massa Lemak dan Lingkar Pinggang Dewasa Obes dan Nonobes di Cirebon. *Glob. Med. Heal. Commun.* **6**, 7–11 (2018). https://doi.org/10.29313/gmhc.v6i1.2192.
2. Kemenkes & BKPK. *Survei Kesehatan Indonesia (SKI) Dalam Angka*. *Kementerian Kesehatan Republik Indonesia* vol. 1 (2023). https://www.badankebijakan.kemkes.go.id/ski-2023-dalam-angka/.
3. Badan Penelitian Dan Pengembangan Kesehatan Republik Indonesia. Laporan Riskesdas 2018 Nasional. *Lembaga Penerbit Balitbangkes* 674 (2018).

How to cite: *Kusumastuty, I., Maulia, P. H., Dewi, D. R., Oktania, R., Nugroho, F. A., & Handayani, D. (2025). Relationship between Body Mass Index, Body Fat Percentage, and Eating Habits among University Students in Malang: Hubungan Antara Indeks Massa Tubuh dan Persen Lemak Tubuh dengan Kebiasaan Makan pada Mahasiswa di Malang. Amerta Nutrition, 9(3), 419–429.*

https://repository.badankebijakan.kemkes.go.id/id/eprint/3514/.

4. Colozza, P. Colozza, David. Padmita, Astrid Citra. (2018) Analisis Lanskap Kelebihan Berat Badan & Obesitas di Indonesia. UINCEF Indonesia. *01 Desember 2022* 1–134 (2019). http://unicef.org/indonesia/media/15581/file/AnalisisLanskapKelebihanBeratBadandanObesitasdiIndonesia.pdf.
5. Mizia, S., Felińczak, A., Włodarek, D. & Syrkiewicz-świtała, M. Evaluation of eating habits and their impact on health among adolescents and young adults: A cross-sectional study. *Int. J. Environ. Res. Public Health* **18**, (2021). https://doi.org/10.3390/ijerph18083996.
6. Riadipa, N. G. A. P. S., Suiraoka, I. P. & Purnadhibrata, I. M. Konsumsi Makanan Siap Saji dan Status Obesitas pada Anak Usia Sekolah Dasar di SD Negeri 03 Penatih dan SD Negeri 17 Dangin Puri di Kota Denpasar. 131–137 (2018). http://repository.poltekkes-denpasar.ac.id/id/eprint/829.
7. Pradiningtyas, F. & Ismawati, R. Hubungan Pengetahuan Pola Makan Sehat Dengan Kebiasaan Makan Remaja Kelas 12 SMA Negeri 1 Tarik di Masa Pandemi COVID-19. *J. Gizi Univ. Negeri Surabaya* **3**, 267–272 (2020). https://ejournal.unesa.ac.id/index.php/GIZIUNESA/article/view/50655.
8. Albalawi, A. A., Hambly, C. & Speakman, J. R. Consumption of takeaway and delivery meals is associated with increased BMI and percent fat among UK Biobank participants. *Am. J. Clin. Nutr.* **116**, 173–188 (2022). https://doi.org/10.1093/ajcn/nqac078.
9. Madden, A. M. & Smith, S. Body composition and morphological assessment of nutritional status in adults: A review of anthropometric variables. *J. Hum. Nutr. Diet.* **29**, 7–25 (2016). https://doi.org/10.1111/jhn.12278.
10. WHO. Obesity Task Force). International Association for the Study of Obesity. The Asia – Pacific perspective: redefining obesity and its treatment. 56 (2000). https://iris.who.int/handle/10665/206936.
11. Pet˘, K., Borzenko, N., Kovalov, M. & Gottfriedov, N. Assessment of Body Mass Index , Body Composition , Physical Activity , and Dietary Preferences in University Students : A Pilot Study. 35–44 (2024). https://doi.org/10.3390/obesities4010004.
12. Jahang, R. S., Wahyuningsih, S. & Rahmuniyati, M. E. Hubungan Pengetahuan dan Penggunaan Layanan Delivery Makanan Online Konsumsi Makanan Cepat Saji pada Mahasiswa Gizi Universitas Respati Yogyakarta. *J. Formil (Forum Ilmiah) Kesmas Respati* **6**, 199 (2021). https://doi.org/10.35842/formil.v6i2.374.
13. Tariq, S., Tariq, S. & Tariq, S. Association of perceived stress with healthy and unhealthy food consumption among teenagers. *J. Pak. Med. Assoc.* **69**, 1817–1821 (2019). https://doi.org/10.5455/jpma.302642278.
14. Banik, R., Naher, S., Pervez, S. & Hossain, M. M. Fast food consumption and obesity among urban college going adolescents in Bangladesh: A cross-sectional study. *Obes. Med.* **17**, 100161 (2020). https://doi.org/10.1016/j.obmed.2019.100161.
15. Mahajan, S. A. & Gothankar, J. S. Fast food consumption pattern amongst undergraduates of various disciplines of private colleges in Pune. *Int. J. Community Med. Public Heal.* **7**, 505 (2020). https://doi.org/10.18203/2394-6040.ijcmph20196069.
16. Santoso, B. & Velania, V. Hubungan Tingkat Pengetahuan Tentang Makanan Cepat Saji Dengan Pola Konsumsinya Pada Mahasiswa Tingkat Ii Akper Panti Kosala Surakarta. *KOSALA J. Ilmu Kesehat.* **5**, 31–36 (2017). https://doi.org/10.37831/jik.v5i1.115.
17. Munasiroh, D., Nurawali, D. O., Rahmah, D. A., Suhailah, F. & Yusup, I. R. Faktor-Faktor Yang Berhubungan Dengan Perilaku Konsumsi Makanan Cepat Saji (Fast Food) Pada Mahasiswa. *An-Nadaa J. Kesehat. Masy.* **6**, (2019). https://doi.org/10.31602/ann.v6i2.2681.
18. Jauziyah, S., Nuryanto, N., Tsani, A. F. A. & Purwanti, R. Pengetahuan Gizi Dan Cara Mendapatkan Makanan Berhubungan Dengan Kebiasaan Makan Mahasiswa Universitas Diponegoro. *J. Nutr. Coll.* **10**, 72–81 (2021). https://doi.org/10.14710/jnc.v10i1.30428.
19. Omidvar S, B. K. Dietary Pattern , Food Habits and Preferences Among Adolescent and Adult Student Girls From an Urban. **4**, 465–473 (2014). https://www.researchgate.net/publication/263852374_.
20. Halid, M. Sudargo, T. Hubungan Status Sosial Ekonomi dengan Tingkat Konsumsi Fast Food pada Remaja di Kota Mataram. *BIOTA J. Tadris IPA Biol. UIN Mataram* **8**, 74–85 (2016). https://doi.org/10.20414/jb.v9i1.37.
21. Pemayun, T. I. R. P. & Saraswati, I. M. R. Gambaran Kebiasaan Mengonsumsi Makanan Cepat Saji dan Obesitas pada Mahasiswa Semester V Program Studi Kedokteran Umum Universitas Udayana Tahun 2014. *Intisari Sains Medis* **4**, 284–290 (2014).

How to cite: *Kusumastuty, I., Maulia, P. H., Dewi, D. R., Oktania, R., Nugroho, F. A., & Handayani, D. (2025). Relationship between Body Mass Index, Body Fat Percentage, and Eating Habits among University Students in Malang: Hubungan Antara Indeks Massa Tubuh dan Persen Lemak Tubuh dengan Kebiasaan Makan pada Mahasiswa di Malang. Amerta Nutrition, 9(3), 419–429.*

https://doi.org/10.15562/ism.v4i1.44.

22. Mahmoud, M. H. & Taha, A. S. The Association between Eating Habits and Body Mass Index among Nursing Students. *IOSR J. Nurs. Heal. Sci.* **06**, 14–26 (2017). https://doi.org/10.9790/1959-0603061426.
23. Mahfouz, M. S. *et al.* Nutritional Habits and Weight Status among Jazan University Students : Eating Patterns and Healthy lifestyle Assessment. *Epidemiol. Biostat. Public Heal.* **13**, 1–7 (2016). https://doi.org/10.2427/11658.
24. Patarru, F., Situngkir, R. S., Heumasse, C. F. & Ahudara, C. G. S. Kebiasaan Konsumsi Makanan Siap Saji (Fast Food) dan Status Gizi pada Remaja. *J. Penelit. Kesehat. Suara Forikes* **13**, 234–237 (2022). http://dx.doi.org/10.33846/sf13nk143.
25. Rayahu, A. ., Apriningrum, M. & Marlina, R. Hubungan antara Kebiasaan Makan perhari, Asupan Karbohidrat dan Asupan Serat dengan Persentase Lemak Tubuh pada Mahasiswa dan Dosen Prodi Kebidanan Fakultas Ilmu Kesehatan Unsika. *Heal. Sci. Growth J.* **1**, 116–121 (2017). https://journal.unsika.ac.id/index.php/HSG/article/view/1088/910.
26. Arraniri, M., Desmawati, D. & Aprilia, D. Hubungan Kebiasaan Sarapan dan Asupan Kalori dengan Persentase Lemak Tubuh pada Mahasiswa Prodi Profesi Dokter Fakultas Kedokteran Universitas Andalas Angkatan 2013-2015. *J. Kesehat. Andalas* **6**, 265 (2017). https://doi.org/10.25077/jka.v6i2.689.
27. Goffe, L., Rushton, S., White, M., Adamson, A. & Adams, J. Relationship between mean daily energy intake and frequency of consumption of out-of-home meals in the UK National Diet and Nutrition Survey. *Int. J. Behav. Nutr. Phys. Act.* **14**, 1–11 (2017). https://doi.org/10.1186/s12966-017-0589-5.
28. Burgoine, T., Forouhi, N. G., Griffin, S. J., Wareham, N. J. & Monsivais, P. Associations between exposure to takeaway food outlets, takeaway food consumption, and body weight in Cambridgeshire, UK: Population based, cross sectional study. *BMJ* **348**, 1–10 (2014). https://doi.org/10.1136/bmj.g1464.
29. Astbury, C. C., Penney, T. L. & Adams, J. Comparison of individuals with low versus high consumption of home-prepared food in a group with universally high dietary quality: A cross-sectional analysis of the UK National Diet & Nutrition Survey (2008-2016). *Int. J. Behav. Nutr. Phys. Act.* **16**, 1–15 (2019). https://doi.org/10.1186/s12966-019-0768-7.
30. Jones, S. A., Walter, J., Soliah, L. A. & Phifer, J. T. Perceived motivators to home food preparation: Focus group findings. *J. Acad. Nutr. Diet.* **114**, 1552–1556 (2014). https://doi.org/10.1016/j.jand.2014.05.003.
31. Kabir, A., Miah, S. & Islam, A. Factors influencing eating behavior and dietary intake among resident students in a public university in Bangladesh: A qualitative study. *PLoS One* **13**, 1–17 (2018). https://doi.org/10.1371/journal.pone.0198801.
32. Deric, D. H., Godfrey, E. & Quaicoe, O. Food Sources and Preferences of College Students. *Eur. Sci. J.* 7–8 (2017) doi:10.19044/esj.2017.c1p7. http://dx.doi.org/10.19044/esj.2017.c1p7.
33. Harris, J., Nguyen, P. H., Tran, L. M. & Huynh, P. N. Nutrition transition in Vietnam: changing food supply, food prices, household expenditure, diet and nutrition outcomes. *Food Secur.* **12**, 1141–1155 (2020). https://doi.org/10.1007/s12571-020-01096-x.
34. Nur Faizah, N. A. & Ruhana, A. Persepsi Body Image Dengan Kebiasaan Jajan Mahasiswa Universitas Negeri Surabaya (Kampus Ketintang). *J. Sehat Mandiri* **16**, 172–184 (2021). https://doi.org/10.33761/jsm.v16i1.376.
35. Muhandri, T., Hasanah, U. & Amanah, A. Perilaku Konsumen Terhadap Jajanan Tradisional di Kabupaten. Pekalongan. *J. Mutu Pangan Indones. J. Food Qual.* **8**, 10–16 (2021). https://doi.org/10.29244/jmpi.2021.8.1.10
36. Jiang, Y. *et al.* Association between take-out food consumption and obesity among chinese university students: A cross-sectional study. *Int. J. Environ. Res. Public Health* **16**, (2019). https://doi.org/10.3390/ijerph16061071.
37. Janssen, H. G., Davies, I. G., Richardson, L. D. & Stevenson, L. Determinants of takeaway and fast food consumption: A narrative review. *Nutr. Res. Rev.* **31**, 16–34 (2018). https://doi.org/10.1017/S0954422417000178.
38. Kegler, M. C., Hermstad, A. & Haardörfer, R. Home food environment and associations with weight and diet among U.S. adults: a cross-sectional study. *BMC Public Health* **21**, 1–10 (2021). https://doi.org/10.1186/s12889-021-11102-2.
39. Rosenthal, R. & Raynor, H. The effect of television watching and portion size on intake during a meal. *Appetite* **117**, 191–196 (2017). https://doi.org/10.1016/j.appet.2017.06.030.
40. Mills, S., Brown, H., Wrieden, W., White, M. & Adams, J. Frequency of eating home cooked meals and potential benefits for diet and health: Cross-sectional analysis of a population-based cohort study. *Int. J. Behav. Nutr. Phys. Act.* **14**, 1–

How to cite: *Kusumastuty, I., Maulia, P. H., Dewi, D. R., Oktania, R., Nugroho, F. A., & Handayani, D. (2025). Relationship between Body Mass Index, Body Fat Percentage, and Eating Habits among University Students in Malang: Hubungan Antara Indeks Massa Tubuh dan Persen Lemak Tubuh dengan Kebiasaan Makan pada Mahasiswa di Malang. Amerta Nutrition, 9(3), 419–429.*

11 (2017). https://doi.org/10.1186/s12966-017-0567-y.

41. Zang, J. *et al.* Eating Out-of-Home in Adult Residents in Shanghai and the Nutritional Differences among Dining Places. 1–13 (2018) doi:10.3390/nu10070951. https://doi.org/10.3390/nu10070951.
42. Wellard-Cole, L., Davies, A. & Allman-Farinelli, M. Contribution of foods prepared away from home to intakes of energy and nutrients of public health concern in adults: a systematic review. *Crit. Rev. Food Sci. Nutr.* **62**, 5511–5522 (2022). https://doi.org/10.1080/10408398.2021.1887075.
43. Bhutani, S., Schoeller, D. A., Walsh, M. C. & McWilliams, C. Frequency of Eating Out at Both Fast-Food and Sit-Down Restaurants Was Associated With High Body Mass Index in Non-Large Metropolitan Communities in Midwest. *Am. J. Heal. Promot.* **32**, 75–83 (2018). https://doi.org/10.1177/0890117116660772.
44. Ardin, H., Kartini, S. D., Lestari, T. S. & Retno. Hubungan Kebiasaan Makan Fast Food dan Asupan Zat Gizi Makro Dengan Status Gizi Remaja. *Zat Gizi Makro* **25**, 95–103 (2018). https://perpus.poltekkes-mks.ac.id/opac/detail-opac?id=5315.
45. Dubowitz, T. *et al. A New Supermarket in a Food Desert: Is Better Health in Store?* (RAND Corporation, 2015). https://doi.org/10.7249/rb9874.
46. Coelestia, A. A. G. & Isodarus, P. B. Dasar Penamaan Kue Jajanan Pasar Di Pasar Lempuyangan. *Sintesis* **15**, 1–16 (2021). https://doi.org/10.24071/sin.v15i1.312347.
47. Fitri, Y., Al Rahmad, A. H., Suryana, S. & Nurbaiti, N. Pengaruh penyuluhan gizi tentang jajanan tradisional terhadap peningkatan pengetahuan dan perilaku jajan anak sekolah. *AcTion Aceh Nutr. J.* **5**, 13 (2020). https://doi.org/10.30867/action.v5i1.18648.
48. Sutanto, D. H., Estikowati & Setioko, M. D. Pelestarian Jajanan Tradisional Sebagai Upaya Untuk Memperkuat Wisata Kuliner Kota Malang. *Semin. Nas. Kepariwisataan* **1**, 142–146 (2020). https://seminar.unmer.ac.id/index.php/senorita/SENORITA/paper/view/519.
49. Wulansari, M. D. R., Nursanyoto, H. & Suiraoka, I. P. Pola Konsumsi Jajanan Dan Kejadian Obesitas Remaja Di Smp Negeri 3 Sukawati. *J. Nutr. Sci.* **10**, 170–177 (2021). https://doi.org/10.33992/jig.v10i3.1151.
50. Luthfiya, L. & Nabawiyah, H. Hubungan konsumsi makanan jajanan terhadap obesitas sentral sada Mahasisiwi berbasis pesantren. *Arsip Gizi dan Pangan* **7**, 1–8 (2022). https://doi.org/10.22236/argipa.v7i1.8087.
51. Hoenink, J. *et al.* OP80 The effect of environmental exposure to food takeaways and its interaction with eating behaviour traits on takeaway food consumption and body fat. *J. Epidemiol. Community Health* **76**, A39 LP-A39 (2022). https://doi.org/10.1136/jech-2022-SSMabstracts.79.
52. Hoenink, J. C. *et al.* The moderating role of eating behaviour traits in the association between exposure to hot food takeaway outlets and body fatness. *Int. J. Obes.* **47**, 496–504 (2023). https://doi.org/10.1038/s41366-023-01290-9.
53. Wei, X., Yu, D., Ju, L., Cheng, X. & Zhao, L. Analysis of the correlation between eating away from home and bmi in adults 18 years and older in china: Data from the cnnhs 2015. *Nutrients* **14**, (2022). https://doi.org/10.3390/nu14010146.
54. Lee, J. *et al.* Are patterns of family evening meal practices associated with child and parent diet quality and weight-related outcomes? *Appetite* **171**, 1–18 (2022). https://doi.org/10.1016/j.appet.2022.10593755.
55. Pescari, D., Mihuta, M. S. & Bena, A. Comparative Analysis of Dietary Habits and Obesity Prediction : Body Mass Index versus Body Fat Percentage Classification Using Bioelectrical Impedance Analysis. (2024). https://doi.org/10.3390/nu16193291.
56. Gesteiro, E., García-Carro, A., Aparicio-Ugarriza, R. & González-Gross, M. Eating out of Home: Influence on Nutrition, Health, and Policies: A Scoping Review. *Nutrients* **14**, 1–15 (2022). https://doi.org/10.3390/nu14061265.
57. Schultz, S. *et al.* Availability and placement of healthy and discretionary food in Australian supermarkets by chain and level of socio-economic disadvantage. *Public Health Nutr.* **24**, 203–214 (2021). https://doi.org/10.1017/S1368980020002505.
58. Li, Y. *et al.* Grocery store access and childhood obesity: A systematic review and meta-analysis. *Obesity Reviews* vol. 22 (2021). https://doi.org/10.1111/obr.1294559.

Andarwulan, N. *et al.* Food consumption pattern and the intake of sugar, salt, and fat in the South Jakarta City—Indonesia. *Nutrients* **13**, 1–19 (2021). https://doi.org/10.3390/nu13041289.

60. Hafiza, D., Utmi, A. & Niriyah, S. Hubungan Kebiasaan Makan Dengan Status Gizi Pada Remaja Smp Ylpi Pekanbaru. *Al-Asalmiya Nurs. J.*

How to cite: *Kusumastuty, I., Maulia, P. H., Dewi, D. R., Oktania, R., Nugroho, F. A., & Handayani, D. (2025). Relationship between Body Mass Index, Body Fat Percentage, and Eating Habits among University Students in Malang: Hubungan Antara Indeks Massa Tubuh dan Persen Lemak Tubuh dengan Kebiasaan Makan pada Mahasiswa di Malang. Amerta Nutrition, 9(3), 419–429.*

Ilmu Keperawatan (Journal Nurs. Sci. **9**, 86–96 (2021). https://doi.org/10.35328/keperawatan.v9i2.671.

61. Deliens, T., Clarys, P., Bourdeaudhuij, I. De & Deforche, B. Determinants of eating behaviour in university students : a qualitative study using focus group discussions. *BMC Public Health* **14**, 1–12 (2014). https://doi.org/10.1186/1471-2458-14-53.

How to cite: *Kusumastuty, I., Maulia, P. H., Dewi, D. R., Oktania, R., Nugroho, F. A., & Handayani, D. (2025). Relationship between Body Mass Index, Body Fat Percentage, and Eating Habits among University Students in Malang: Hubungan Antara Indeks Massa Tubuh dan Persen Lemak Tubuh dengan Kebiasaan Makan pada Mahasiswa di Malang. Amerta Nutrition, 9(3), 419–429.*