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Urban vs. Rural: food choice analysis and its association with nutritional status and academic achievement among adolescents

Urban vs. Rural: analisis food choice (pemilihan makanan) dan hubungannya dengan status gizi dan prestasi akademik pada remaja

Fakhiratunnisa Putri Oceani[1], Ikeu Tanziha[2*], Drajat Martianto[3]

[1] Department of Community Nutrition, Faculty of Human Ecology, IPB University, West Java, Indonesia.
E-mail: fakhiratunnisa.oceani@apps.ipb.ac.id
[2] Department of Community Nutrition, Faculty of Human Ecology, IPB University, West Java, Indonesia.
E-mail: ikeu_jamilah@apps.ipb.ac.id
[3] Department of Community Nutrition, Faculty of Human Ecology, IPB University, West Java, Indonesia.
E-mail: dmartianto@apps.ipb.ac.id

***Correspondence Author:**
Department Community Nutrition, Faculty of Human Ecology, IPB University, Bogor, West Java, 16680, Indonesia.
E-mail: ikeu_jamilah@apps.ipb.ac.id

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Abstract

Long-term food choices play a critical role in shaping adolescents' nutritional status and have implications for their cognitive function and academic achievement. However, comprehensive studies comparing food choice patterns between urban and rural areas in Indonesia are limited. This study aimed to analyze the association between food choices, nutritional status, and academic performance among adolescents in urban and rural settings in the Philippines. Methods: A cross-sectional design was conducted in November–December among 377 students at Senior High School 1 Dramaga as an urban area and Senior High School 1 Nanggung as a rural area. Nutritional status was assessed using anthropometric measurements, food choices were evaluated using the *Food Choice Questionnaire* (FCQ), and academic performance was measured using final examination scores. Data were analyzed using univariate and bivariate approaches with Spearman's rank correlation and the Mann–Whitney U test. Results: Significant associations were observed between food choice dimensions and nutritional status in both urban (health r=0.732; mood r=–0.592; weight control r=0.708) and rural areas (health r=0.610; natural content r=0.577; weight control r=0.690) (p<0.001). Furthermore, nutritional status was positively correlated with academic performance in the urban (r=0.741) and rural (r=0.525) groups (p<0.001). In conclusion, food choices significantly influenced the nutritional status and academic achievement of adolescents in urban and rural areas. Targeted nutrition education is essential for promoting healthy food selection as a long-term strategy for improving nutritional outcomes and academic success.

Keywords: Academic performance, food preferences, nutritional status

Abstrak

Pemilihan makanan jangka panjang berperan penting dalam pembentukan status gizi remaja dan berdampak pada fungsi kognitif serta prestasi akademik. Namun, kajian komprehensif mengenai perbedaan pemilihan makanan antara wilayah urban dan rural di Indonesia masih terbatas. Penelitian ini bertujuan menganalisis hubungan antara pemilihan makanan, status gizi, dan prestasi akademik remaja di wilayah urban dan rural. Metode penelitian menggunakan desain potong lintang pada November–Desember di SMAN 1 Dramaga (urban) dan SMAN 1 Nanggung (rural) dengan 377 responden. Status gizi diukur melalui antropometri, pemilihan makanan dinilai menggunakan *Food Choice Questionnaire* (FCQ), sedangkan prestasi akademik diukur berdasarkan nilai ujian akhir. Analisis data dilakukan secara univariat dan bivariat dengan uji korelasi *Spearman's rank* dan uji *Mann–Whitney U*. Hasil, terdapat hubungan signifikan antara dimensi pemilihan makanan dengan status gizi, baik di urban (health r=0,732; mood r=–0,592; weight control r=0,708) maupun rural (health r=0,610; natural content r=0,577; weight control r=0,690) (p<0,001). Status gizi juga berkorelasi positif dengan prestasi akademik di urban (r=0,741) dan rural (r=0,525) (p<0,001). Kesimpulan, pemilihan makanan berpengaruh signifikan terhadap status gizi dan prestasi akademik remaja di kedua

wilayah. Pendidikan gizi terarah diperlukan untuk meningkatkan kesadaran memilih makanan sehat sebagai upaya peningkatan status gizi dan prestasi akademik jangka panjang.

Kata Kunci: Preferensi makanan, prestasi akademik, status gizi

Introduction

Adolescence is the transitional phase between childhood and adulthood. Numerous psychological and physiological changes take place (Musmiah, 2019). Physiological changes in adolescents primarily focus on physical development in males and females, including bone growth, skeletal and muscle development, pelvic widening, muscle and fat distribution changes, reproductive system maturation, secondary sexual characteristics, and internal organ development. These changes lead to increased nutritional demand compared to earlier stages of life. Therefore, at this age, it is crucial to pay attention to and choose an adequate intake of both macronutrients and micronutrients for the body (Hafiza et al., 2020; Al Rahmad et al., 2020). This increased nutritional demand is closely linked to food choices in terms of daily needs, preferences, and eating patterns among adolescents as they seek to meet the requirements of these physiological changes.

On the other hand, adolescence is also a period of dietary transition. One of the developments during adolescence is decision-making, including determining what food to consume and preferences regarding food. Initially controlled by parents, eating patterns shift towards independent choices adolescents make based on personal considerations, a concept commonly referred to as *food choice* (Ziegler et al., 2021). Several factors influence an individual's *food choice*, including place of residence, whether in urban or rural areas, which differ in terms of population density, administrative systems, economic conditions, infrastructure, and access to public facilities, including access to specific food options (Heriyana et al., 2020). Additionally, food availability at home, parental control, peer influence, taste, cost, food preparation processes, self-efficacy, and the influence of idols or "influencers" on various social media platforms also play a role. These factors lead adolescents in urban areas to have greater access to fast food than those in rural areas, who are more likely to consume local foods. This disparity is influenced by infrastructure availability, presence of shopping centers or fast-food outlets, and ease of transportation in urban regions. In addition, external factors such as peer influence and social media exposure are particularly important as they can significantly influence adolescents' food preferences and consumption decisions. When these preferences are repeated and sustained over time, they contribute to the formation of specific eating patterns, which can have long-term implications for adolescents' nutritional status.

Food choice shapes eating habits and can have long-term effects on nutritional status. Meanwhile, adolescents are vulnerable to nutritional problems, both overnutrition and undernutrition (Rachmayani et al., 2018). Malnutrition in adolescents remains an unresolved issue. The data from the 2023 Indonesia Health Survey (*SKI*) indicated that 18,1% of adolescents aged 16-18 in West Java were categorized as stunted (Kementerian Kesehatan, 2023). The 2022 WHO report stated that among the global population aged 5–19 years, approximately 390 million children and adolescents were overweight, and around 190 million experienced thinness (underweight) (World Health Organization, 2024).

Adolescents with a poor nutritional status may experience a 30% reduction in their physical and intellectual development. This can result in decreased concentration, difficulty in effective communication, lack of responsiveness, and ultimately, lower IQ scores, which can affect academic performance (Anwar & Isatirradiyah, 2018). Meanwhile, the 2022 *Program for International Student Assessment* (*PISA*) found that Indonesia had a high level of equitable access to education but also exhibited low academic performance. Indonesia experienced a decline in scores in all three categories, mathematics, reading and science from 2018 to 2022 (OECD, 2022).

Based on the background information provided regarding various aspects of food choice and its impact on adolescents' nutritional status and academic achievement, this study aimed to analyze *food choices* among adolescents in urban and rural areas and its effects on their

nutritional status and academic performance. Although numerous studies have explored food choices and their influencing factors, most have focused solely on food choice variables, without examining their holistic relationship with nutritional status and academic performance. Moreover, most of these studies have been conducted in other countries with social, cultural, and economic contexts that differ significantly from those in Indonesia. This study provides field-based empirical evidence that can serve as a reference for developing policies related to food choices and their impact on adolescents' academic achievement in the Indonesian context.

Methods

This study was a quantitative study using a cross-sectional design. This study was conducted from November to December 2024 at two schools: one representing an urban area (Dramaga Sub-district) and one representing a rural area (Nanggung Sub-district). The classification of urban and rural areas was based on criteria set by the Central Bureau of Statistics (*Badan Pusat Statistik*, BPS). Schools in each area were purposefully selected, considering specific criteria and factors. This study was approved by the Research Ethics Committee of the IPB University (approval number 1489/IT3).KEPMSM-IPB/SK/2024 on November 8, 2024.

The study population consisted of adolescents and students from representative schools in both urban and rural areas. Total sampling was employed to accurately represent the characteristics of the urban and rural areas. The sampling method used in this study was total sampling to ensure that the sample could adequately represent the characteristics of each area, as represented by the students in each respective school. In this study, matching was conducted based on the learning methods and curriculum. However, socioeconomic characteristics differed because of the inherent differences between the two regions. As a result, 172 students from Senior High School 1 Nanggung and 212 from Senior High School 1 Dramaga brought the total number of participants to 384. However, by the end of the study, four subjects from Senior High School 1 Dramaga and three from Senior High School 1 Nanggung had declared dropouts, reducing the total number of subjects to 377. This study applied the following inclusion criteria: a) High school students in grade XI (aged 15–18 years); b) Not currently suffering from acute or chronic infections, nor undergoing intensive medical treatment; c) Not following any special diets (such as weight-loss diets or disease-specific diets); d) Willing to participate in the study by signing an informed consent (and informed assent, if applicable)."

Food choice analysis was conducted using the Food Choice Questionnaire (FCQ), which was initially developed by Steptoe, Pollard, and Wardle (1995) to assess key aspects of individual food selection. The FCQ has been applied worldwide; however, its implementation in Indonesia requires adjustments, particularly concerning the cultural and religious aspects. Therefore, (Tanziha, 2023) adapted and modified the questionnaire by incorporating additional dimensions related to religion and dietary taboos. The Food Choice Questionnaire (FCQ) consists of ten dimensions: health (6 items) refers to reasons for choosing food related to health aspects such as nutritional value, high fiber, presence of vitamins and minerals, high protein, and maintaining overall health; mood (3 items) relates to emotional factors such as relaxation, stress relief, and pleasure; convenience (5 items) addresses ease of preparation, time efficiency, and accessibility; sensory appeal (4 items) focuses on appearance, taste, texture, and aroma; natural content (3 items) concerns the presence of natural ingredients; price (3 items) reflects considerations of food affordability; weight control (3 items) relates to managing or controlling body weight; familiarity (3 items) refers to the preference for familiar or frequently consumed foods; ethical concern (3 items) involves food packaging, political acceptability of the food source, and production regulations; and religion and taboo (5 items) addresses food choices based on halal certification, ingredient content, labeling, social acceptance, and avoidance of taboo elements.

Scoring for each item was conducted using a 5-point Likert scale as follows: Not at all important, not important, oderately important, important, and very important. Based on this scoring system, food choice was assessed by analyzing the average scores for each dimension, which allowed for the identification of the most important factors influencing respondents' food choices. The questionnaire underwent a validity

test, which showed p-values < 0,05 across all dimensions, indicating that the instrument was valid for measuring food choice. Furthermore, a reliability test was conducted, yielding the following Cronbach's alpha values: health (0,88), mood (0,88), convenience (0,82), sensory appeal (0,81), natural content (0,86), price (0,74), weight control (0,82), familiarity (0,75), ethical concern (0,64), and religion and taboos (0,66). These results indicate that the questionnaire demonstrated reliability, ranging from acceptable to very good (Tanziha, 2023). Academic performance data were obtained from secondary data, specifically the results of students' final semester exams. These data were collected from the scores recorded by the teachers using the latest assessment standards under the *Merdeka Belajar* system by the Ministry of Education, Culture, Research, and Technology (*Kemendikbudristek*). Nutritional status was measured using Z-scores based on subjects' height and weight measurements. Nutritional status categories were adjusted according to the anthropometric standards outlined by Kemenkes.

Data were processed using Microsoft Excel 2016 for Windows and analyzed using the Statistical Package for the Social Sciences (SPSS) version 32. Nutritional status was determined using WHO Health Organization AnthroPlus software. Data processing involves several stages including editing, coding, entry, and analysis. The manuscript was edited to ensure the accuracy and completeness of the data.

Univariate analysis was conducted to describe the characteristics of the respondents, including age, gender, pocket money, parental occupation, parental income, and family size. The results were presented as frequency distributions and percentages. Bivariate analysis examined the relationship between the independent variable (food choice) and the dependent variables (nutritional status, quality of life, and academic performance).

Spearman's Rank correlation test was used to assess the correlations and to evaluate the strength and direction of the associations between food choice and nutritional status, and between nutritional status and academic achievement, while the Mann–Whitney U test was used to compare variables between the two independent groups (urban vs. rural) was conducted using ordinal data that were not normally distributed.

Result and Discussion

The subjects of this study were adolescents aged 15–18 years, both in urban and rural areas, with the majority being 16 years old. The percentage of females in urban areas was higher than in rural areas, whereas.

The percentage of males was higher in rural areas than in urban areas. There was a significant difference in the occupation of fathers and mothers ($p<0,05$). In urban areas, the dominant professions were entrepreneurs, private employees, and civil servants, whereas in rural areas, most were entrepreneurs and farmers/fishers/laborers. No significant difference was found in fathers' income; however, a significant difference ($p<0,05$) was observed in mothers' income, with mothers in urban areas earning higher income than those in rural areas. This is consistent with a study conducted in Bangladesh, which stated that the income of mothers in urban and rural areas differs due to the variation in availability.

Mothers in urban areas are more likely to obtain employment in the formal sector or engage in income-generating activities that provide relatively higher and more stable earnings, compared to mothers in rural areas who often work as unpaid family laborers (Nahar & Zahangir, 2024). The same trend is observed for pocket money. Differences in parental occupation and income between urban and rural areas may help explain this phenomenon. In addition, adolescents living in urban settings tend to have greater needs, such as transportation costs and participation in social activities, which often leads parents to provide larger amounts of pocket money. Social influences, including exposure to social media and peer pressure, also contribute to urban parents' tendency to give more. This is consistent with a cross-sectional study conducted in Bogor, which found significant differences in adolescents' pocket money between urban and rural areas due to variations in socioeconomic status and environmental conditions (Ateye et al., 2019).

These patterns suggest that adolescents' financial autonomy is shaped not only by household economic capacity, but also by the broader social environment in which they live. There was no significant difference in family size between urban and rural areas. This can be explained by the current equal distribution of access to family planning services and

reproductive healthcare in both urban and rural areas. This finding is consistent with the study conducted by (Han et al., 2023), which reported no significant difference in family size between urban and rural regions (Han et al., 2023).

In summary, differences in socioeconomic conditions, employment opportunities, and social environments between urban and rural areas contribute to disparities in parental income and adolescents' pocket money, while family size appears to be increasingly similar because of improved access to reproductive health services across regions.

Table 1. Subject and family characteristics

Subject Characteristics	Urban (Dramaga), (n=208)		Rural (Nanggung), (n=169)		P-value
	n	%	n	%	
Age (years)					0,010*
Mean±SD	16,11±0,39		16,24±0,61		
Median	16 (15-17)		16 (15-18)		
15 years	6	2,9	14	8,3	
16 years	173	83,2	103	60,9	
17 years	29	13,9	50	29,6	
18 years	0	0	2	1,2	
Gender					0,021*
Male	74	35,6	80	47,3	
Female	134	64,6	89	52,7	
Father's Occupation					<0,001*
Unemployed	13	6,3	14	8,3	
Employed	134	64,6	155	91,7	
Mother's Occupation					0,004*
Unemployed	137	65,9	89	52,7	
Employed	71	34,1	80	47,3	
Father's Income					0,205
< IDR 2.100.000	107	51,4	98	58,0	
≥ IDR 2.100.000	101	48,6	71	42,0	
Mother's Income					0,025*
< IDR 2.100.000	174	83,7	155	91,7	
≥ IDR 2.100.000	34	16,3	14	8,3	
Family Size					0,515
Small (≤ 4 people)	96	46,2	80	47,3	
Medium (5–6 people)	98	47,1	85	50,3	
Large (≥ 7 people)	14	6,7	4	2,4	
Pocket Money (IDR)					<0,001*
Mean±SD	22,293±9,320		17,266±5,835		
Median	20.000(15.000-50.000)		15.000(7.000-50.000)		
IDR 5.000-15.000	58	27,9	90	53,3	
IDR 16.000-25.000	106	51,0	71	42,0	
> IDR 25.000	44	21,1	8	4,7	

The following table shows that the two dimensions do not significantly differ between urban and rural areas, namely, health and familiarity. Meanwhile, based on food choice analysis, the three dimensions with the highest average scores in urban areas were religion and taboo, convenience, and sensory appeal. In contrast, the three dimensions with the highest averages in rural areas were health, religion, taboos, and weight control. A significant difference was also found in nutritional status variables (p<0,05). Adolescents in urban areas have a higher percentage of overweight (14,9%) and obese (5,8%) categories than those in rural areas. Meanwhile, adolescents in rural areas showed a higher percentage in the severely underweight (1,8%) and underweight (3%) categories than in urban areas.

A significant difference was observed in the academic achievement variable (p<0,05), with adolescents in rural areas performing better—64,5% reach the goal), and none were categorized as fully remedial. In contrast, the highest percentage in urban

areas were found in the selective remedial category for the specific criteria.

Tabel 2. Analysis of food choice, nutritional status and academic achievement

Variable	Urban (Dramaga) (n=208)		Rural (Nanggung) (n=169)		p-value
	Mean ± SD	Median (Min-Max)	Mean ± SD	Median (Min-Max)	
Food Choice					
Health	3,92 ± 0,9	4,17 (1,33-4,00)	4,11 ± 0,6	4,17 (2,00-5,00)	0,143
Mood	3,98 ± 0,8	4,00 (1,67-5,00)	3,42 ± 0,4	4,00 (1,67-5,00)	<0,001*
Convenience	4,03 ± 0,8	4,20 (1,60-5,00)	3,84 ± 0,6	4,00 (1,60-5,00)	0,001*
Sensory appeal	3,99 ± 0,5	4,00 (2,25-5,00)	3,54 ± 0,4	4,25 (2,00-5,00)	<0,001*
Natural content	3,87 ± 1,0	4,00 (1,00-5,00)	3,81 ± 0,9	4,00 (2,00-5,00)	<0,001*
Price	3,96 ± 1,0	4,33 (1,00-5,00)	3,82 ± 0,9	4,00 (2,33-5,00)	<0,001*
Weight control	3,79 ± 0,9	4,00 (1,00-5,00)	3,92 ± 0,6	3,67 (1,67-5,00)	<0,001*
Familiarity	3,90 ± 0,8	4,00 (1,00-5,00)	3,67 ± 0,9	4,00 (2,00-5,00)	0,054
Ethical concern	3,90 ± 0,8	4,00 (1,00-5,00)	3,60 ± 0,7	4,20 (1,40-5,00)	<0,001*
Religion and taboo	4,10 ± 1,0	4,40 (2,00-5,00)	4,02 ± 0,6	4,20 (1,40-5,00)	<0,001*
Nutritional Status (BAZ)					<0,001*
Mean±SD	0,021 ± 1,2		-0,40 ± 1,05		
Median (Min-Max)	0,005 (-3,68-3,54)		-0,48 (-3,64-2,81)		
Severely underweight	2	1,0	3	1,8	
Undeweight	4	1,9	5	3	
Normal	159	76,4	150	88,8	
Overweight	31	14,9	8	4,7	
Obesity	12	5,8	3	1,8	
Academic Achievement					<0,001*
Mean±SD	57,40 ± 14,84		59,65 ± 9,55		
Median (Min-Max)	57,82 (20,27-88,18)		61,83 (33,00-82,67)		
Full remedial	1	0,5	0	0	
Majority remedial	46	22,1	16	9,5	
Selective remedial	73	35,1	43	25,4	
Reach the goal	71	34,1	109	64,5	
Reach the goal and embrace challenges	17	8,2	1	0,6	

Adolescents in urban areas tend to choose food based on convenience and moods. As shown in Table 2, the convenience dimension in food choices received the second-highest score in urban areas, with an average value of 4,03. This indicates that adolescents in urban areas prioritize ease and convenience when selecting food. This aligns with the study by (Septiani et al., 2017), which found that comfort food can influence adolescent stress levels, making them feel satisfied and at ease (Septiani et al., 2017) In the research location within an urban area, adolescents tend to choose fast food for lunch at school. The main reasons for this choice were easy access, appealing taste, and attractive presentations. Although some adolescents bring home-prepared meals, most bring pocket money and independently choose the food they want to consume at school. The preference for convenience-based food choices in urban areas may increase the risk of excessive intake of sugar, salt, and fat, which can negatively impact the long-term nutritional status if not properly managed through nutrition education and school environmental supervision.

Meanwhile, in rural areas, the food choice dimensions with the highest average scores were health, religion, taboos, and weight control. In rural areas, aside from limited access to modern processed foods, people tend to choose

foods based on health considerations and long-standing dietary habits. The geographical conditions in the rural areas involved in this study, with an abundance of gardens producing various types of food, further support the community, especially adolescents, in consuming a diverse range of foods prepared in more natural forms. In rural areas, traditional practices are still prioritized for food consumption, including the use of natural food processing methods and the selection of specific food types. These practices aim to preserve local customs, which in turn contributes to public health and weight control. This is consistent with a qualitative study conducted in Tanzania, which found that food taboos remain strong in rural communities (Lekey et al., 2024). This research highlights that environmental conditions and local culture in rural areas should serve as a strong foundation for maintaining healthy eating patterns through the diversification of local food sources.

The nutritional status of adolescents in urban areas was higher in the overweight and obese categories. In contrast, the underweight and severely underweight categories are more prevalent in rural areas. This aligns with the different food choices in each location. Long-term food choices accumulate to shape the different nutritional status categories. Easier access to various food outlets, including main meals and snacks, in urban areas increases the risk of overweight and obesity compared to adolescents in rural areas. Urban adolescents have greater ease in accessing and selecting various types of food they desire (Losada-Rojas et al., 2021). The differences in nutritional status between the two regions highlight the importance of developing strategies tailored to the specific needs of each region. In this case, urban areas need to address excessive consumption among adolescents, whereas rural areas should focus on balancing dietary intake to prevent undernutrition.

Adolescents in rural areas showed better academic performance than those in urban areas. This is because of the strong support provided by the school, including both teachers and available facilities, as well as peer support among students during the learning process. In addition, adolescents in this area are still minimally exposed to external influences or current trends that may hinder the learning process, both at school and home. However, further research is required to obtain more detailed results. This finding differs from those of most studies, which indicate that academic achievement in urban areas is generally higher than that in rural areas. This finding differs from those of most studies, which indicate that academic achievement in urban areas is generally higher than that in rural areas. Adolescents in rural areas are relatively less exposed to social media, peer pressure, and lifestyle-related stressors. A calmer environment, along with support from teachers and families, enables them to focus on their academics. This is supported by a study conducted by (Siebers et al., 2022), which found that excessive use of social media can disrupt adolescents' attention and negatively impact their academic performance. This is in line with the study by (Hernandez-Toranno, 2018), which states that this is due to the superior and more comprehensive quality of learning facilities and infrastructure in urban areas (Hernandez-Toranno, 2018). However, school facilities are adequate in the rural research location. This aligns with the study by (Khusaini & Muvera, 2020).

Which states that the government has made efforts to equalize educational facilities, making it possible for rural adolescents to achieve better academic performance (Khusaini & Muvera, 2020). Other factors influence adolescent academic achievement, such as social support from parents, teachers, and peers (Khusaini & Muvera, 2020). Based on the findings of this study, differences in food choices, nutritional status, and academic performance indicate that future interventions or policy approaches must be designed with strategies tailored to the specific needs of each region. As this study did not include follow-up qualitative research, further qualitative studies are needed to inform the development of more detailed and context-specific strategies in each area.

Based on Table 3, in urban areas, the dimensions of food choices that were not significant included natural content, price, ethical concerns, and religion. The mood, convenience, and sensory appeal dimensions show a negative correlation, meaning that the less important these aspects are, the better the nutritional status categoryMeanwhile, in rural areas, the dimensions that do not significantly affect adolescents' nutritional status are convenience, ethical concern, religion, and taboo. The other dimensions showed a

significant positive correlation, with a moderate to strong relationship. A negative correlation was found in the mood and sensory appeal dimensions.

Table 3. Correlation between food choice and nutritional status

Variabel	Nutritional Status (Urban)		Nutritional Status (Rural)	
	r	p-value	r	p-value
Food Choice				
Health	0,732	0,001*	0,610	0,001*
Mood	-0,592	0,001*	-0,473	0,001*
Convenience	-0,509	0,001*	-0,101	0,193
Sensory appeal	-0,223	0,001*	-0,409	0,001*
Natural content	-0,058	0,407	0,577	0,001*
Price	0,030	0,671	0,571	0,001*
Weight control	0,708	0,001*	0,690	0,001*
Familiarity	0,570	0,001*	0,582	0,001*
Ethical concern	0,060	0,388	-0,110	0,155
Religion and taboo	-0,070	0,317	-0,133	0,086

In analyzing the correlation between food choice and nutritional status, six food choice dimensions in urban areas were found to be significantly related to nutritional status: health, mood, convenience, sensory appeal, weight control, and familiarity. In urban areas, adolescents are more exposed to peer influence and social media (Aqilah et al., 2023; Samaha & Hawi, 2016). Adolescents have food selection preferences, especially those living in different regions (Faradila et al., 2019). Over time, these food choices develop into patterns that eventually lead to differences in adolescents' nutritional status. A study by (Wulandari et al., 2021) found that adolescents choose food based on environmental factors, including peer influence, accessibility, and price (Birkenhead & Slater, 2015). Among adolescents, food that is quickly prepared, flavorful, and visually appealing is a top priority. This tendency affects long-term eating habits and ultimately impacts adolescents' nutritional status (Rahayu & Fitriana, 2020).

Additionally, their easy access to food outlets offering menus high in sugar, salt, and fat affect their nutritional status (Aqilah et al., 2023). A negative correlation was found in mood, convenience, and sensory appeal, indicating that the more adolescents prioritize these aspects, the more likely they are to have abnormal nutritional status. In contrast, in rural areas, seven food choice dimensions were significantly associated with nutritional status: health, mood, sensory appeal, natural content, price, weight control, and familiarity. A negative correlation was found in the dimensions of mood and sensory appeal, meaning that the more adolescents prioritize these aspects in their food choices, the more likely they are to have abnormal nutritional status.

Meanwhile, other dimensions showed a positive correlation, indicating that prioritizing these aspects was associated with good or normal nutritional status. Some food-choice dimensions related to nutritional status in rural areas differ from those in urban areas. That is influenced by environmental conditions, regional characteristics, local habits, ethnic and ease of access to food, all of which shape adolescents' food choices and consequently affect their nutritional status (Losada-Rojas et al., 2021).

Table 4 shows a strong correlation (in urban r=0,741 and in rural r=0,525) between nutritional status and adolescents' academic achievement in urban and rural areas (p=<0,001).

Table 4. Correlation between nutritional status and academic achievement

Variable	Academic Achievement	
	r	p-value
Nutritional Status		
Urban	0,741	<0,001*
Rural	0,525	<0,001*

Food choice does not directly affect academic achievement; rather, repeated and long-term food selection shapes dietary habits that eventually lead to different nutritional status categories among adolescents, which serve as key determinants of academic

performance. This explanation aligns with the findings of (Doustmohammadian et al., 2022), which indicate that nutrition literacy influences academic outcomes through its impact on healthy eating behaviors and subsequent body weight status. Furthermore, studies such as those conducted by (Asmare et al., 2018) in Ethiopia and (Cahyanto et al., 2021) have shown that adolescents with normal nutritional status consistently demonstrate better academic performance compared to those with poor nutritional status. This suggests that an adequate intake of macro- and micronutrients supports brain metabolism and cognitive function. Therefore, although food choice is an initiating factor in this causal chain, nutritional status serves as a mediating factor that links dietary behavior to academic achievement in adolescents. In both urban and rural areas, nutritional status is significantly related to academic achievement among adolescents. Adequate food intake, both in quantity and quality, fulfills the nutritional needs of adolescents and affects metabolism in the body, including brain metabolism.

The results indicate that adolescents with a good nutritional status exhibit high enthusiasm and concentration, enabling them to effectively engage in the learning process and achieve superior academic performance. Conversely, adolescents experiencing undernutrition may undergo structural and functional changes in the brain, which can reduce their ability to concentrate while studying (Cahyanto et al., 2021). This finding is consistent with (Soe et al., 2023) study, which identified that adolescents with normal nutritional status have better academic performance than those with undernutrition or overnutrition (Soe et al., 2023). Normal categories of nutritional status reflects a long-term balanced nutrient intake, which enhances information reception and processing in academic settings (Anwar & Isatirradiyah, 2018).

Nonetheless, academic achievement may also be affected by various other factors, including parental support or family income (Chandra & Aisah, 2023), peer influence, teacher, and additional psychosocial elements (Efriza et al., 2020).

Conclusion

There are significant differences in adolescent characteristics, family socioeconomic characteristics, food choices, nutritional status, and academic achievement between adolescents in urban and rural areas. Although access to food in urban areas is generally better, this study found that adolescents in rural areas demonstrated overall better outcomes in terms of food choices, nutritional status, and academic achievement. This may be attributed to several factors, including a tendency toward healthier food choices, parental support, and a supportive school environment. Food choice significantly affects adolescents' nutritional status and academic achievement in urban and rural areas. Health-oriented food choices, both in general and specifically related to body weight and nutritional status, can influence learning quality and academic achievement at school.

Therefore, increasing awareness about selecting food based on its nutritional value and health benefits is essential and should be promoted through nutrition education in schools that focus on balanced nutrition and healthy eating patterns. In addition, policies that support healthy eating habits should be developed. Further qualitative studies are required to improve dietary patterns through better food choices.

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