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# The Relationship Between Ultra-Processed Food Consumption Patterns and the Nutritional Status of Adolescents in Urban Areas

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**ABSTRACT**

*The present study aims to examine in depth the relationship between consumption patterns of ultra-processed foodstuffs and the nutritional status of adolescents in urban areas. The present study employed a quantitative analytical design, adopting a cross-sectional approach. The collection of data was conducted utilising a validated Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ). Additionally, secondary data were collected pertaining to demographic characteristics (age, gender, and socioeconomic status) and physical activity levels, which were measured using the Physical Activity Questionnaire for Adolescents (PAQ-A). The results indicated a positive correlation between the frequency of UPF consumption and the proportion of adolescents who were overweight or obese. The ingestion of UPF at a rate of four times per day has been shown to increase the risk of overnutrition or obesity by 2.85-fold (p = 0.000). Concurrently, a lack of physical activity has been demonstrated to increase the risk by 2.4-fold. The present findings underscore the significance of regulations and public policies in the control of the distribution and promotion of ultra-processed foods, with particular reference to the vulnerability of adolescents to the influence of unhealthy food environments.*

***Keywords:*** *Ultra-Processed Foods, Nutritional Status, Diet, Physical Activity*

## INTRODUCTION

Adolescents are an age group vulnerable to nutritional problems due to their significantly increased nutritional needs to support growth and development. Unfortunately, in the context of rapid urbanization and globalization, adolescents' eating patterns in urban areas are increasingly


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shifting toward fast food and ultra-processed foods (UPFs), which tend to be high in calories but low in essential nutrients.

Adolescence is a crucial phase in physical and mental development, with high nutritional needs to support growth and daily activities. However, consumption of ultra-processed foods (UPFs) is increasing rapidly, especially in urban areas, due to urbanization and easy access to ready-to-eat foods and industrial snacks (Khuzaimah et al., 2023).

In addition to physical obesity, UPF consumption is also associated with mental disorders such as depressive and anxiety symptoms in adolescent student populations, as recorded in a national survey in Brazil (Mesas et al., 2022).

*Ultra-processed food*Processed foods are industrially processed foods that often contain artificial additives such as colorings, sweeteners, and preservatives, as well as high levels of sugar, salt, and saturated fat. Consumption of these foods has been linked to increased risk of various health problems, including overweight and obesity in adolescents (Neri et al., 2022).

Recent research in Indonesia shows that consumption of ultra-processed foods is significantly correlated with adolescent nutritional status. A study of junior high and high school students in Makassar found that 46% of respondents were overweight and obese, and this was associated with high UPF intake (Khuzaimah et al., 2025).

Similar research in China also supports these findings, showing that UPF consumption ≥100g/day significantly increased the risk of central and total obesity in children and adolescents (Li & Shi, 2025).

In addition to obesity, UPF consumption impacts adolescent body composition. A Brazilian study found that increased UPF consumption was negatively correlated with muscle mass and lean body mass, indicating impaired optimal physical development in adolescents (Viola et al., 2020).

UPF consumption patterns also show socioeconomic and demographic differences. Adolescents from lower socioeconomic backgrounds tend to have higher UPF consumption, as found in a national dietary survey in the UK (Chavez Ugalde et al., 2024).

The adverse effects of UPF are not limited to excess weight. A study in Brazilian adolescents found an association between UPF consumption and increased triglyceride levels and decreased HDL-c, suggesting a contribution to the risk of dyslipidemia and metabolic disease early in life (Lima et al., 2020).

Furthermore, UPF consumption is also associated with oral health problems such as caries. A study from Brazil showed that all ultra-processed food groups (sweetened beverages, fast food, and snacks) were associated with an increased incidence of dental caries in adolescents (da Silva et al., 2023).

Although UPF consumption tends to be high among adolescents, not all studies show a consistent effect. Some studies note that the relationship between UPF consumption and anthropometric indicators is not always linear and may be influenced by other behavioral factors such as physical activity, sleep patterns, and stress (Crisóstomo et al., 2022).

This situation demonstrates that UPF consumption patterns among adolescents are a complex phenomenon involving not only food preferences but also surrounding social and behavioral determinants. Therefore, research on the relationship between UPF consumption patterns and adolescent nutritional status is crucial to strengthen the evidence base and inform policy-based interventions.

In response to this challenge, this study aims to examine in-depth the relationship between ultra-processed food consumption patterns and the nutritional status of adolescents in urban areas. The findings are expected to strengthen promotive and preventive efforts in adolescent health policy in Indonesia.

## METHODS

This study uses a quantitative analytical design with a cross-sectional approach to explore the relationship between ultra-processed food consumption patterns and the nutritional status of adolescents in urban areas, particularly in Padang City, West Sumatra. The population in this study includes all adolescents aged 13–18 years who are currently enrolled in junior high schools (SMP) and senior high schools (SMA) in Padang City, both public and private schools. Based on data from the Padang City Education Office, there are a total of 24 schools included in the sampling frame, consisting of 12 public schools and 12 private schools.

Sampling was conducted using stratified random sampling, with stratification based on school type (public and private) and grade level (SMP and SMA). The number of respondents in this study was 250 adolescents, determined using the Lemeshow formula for estimating the population proportion with a 95% confidence level and a 5% margin of error.

Primary data were collected using a validated Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) to measure the frequency and portion sizes of ultra-processed food consumption over the past 30 days. Food categorisation based on processing level followed the NOVA Classification system, which includes foods such as instant noodles, carbonated drinks, packaged snacks, sweet biscuits, and other ready-to-eat foods.

The nutritional status of respondents was determined through direct measurement of weight and height using a digital scale and stadiometer, followed by calculation of the Age-Adjusted Body Mass Index (IMT/U) based on WHO standards using the WHO AnthroPlus application. The primary independent variable in this study was the consumption pattern of UPF, classified based on quartiles of consumption frequency and energy contribution from ultra-processed foods. The dependent variable was the nutritional status of adolescents, categorised as undernourished, normal, overnourished, and obese.

Additionally, secondary data were collected regarding demographic characteristics (age, gender, and socioeconomic status) and physical activity levels measured using the Physical Activity Questionnaire for Adolescents (PAQ-A). Data analysis was conducted univariately to describe frequency distributions, bivariately using the Chi-Square test to examine the relationship between UPF consumption and nutritional status, and multivariately using logistic regression to

control for confounding variables such as age, gender, and physical activity. All analyses were performed using the latest version of SPSS software.

To ensure data validity and reliability, enumerator training, questionnaire pretesting, and instrument validity and reliability testing were conducted. This study also obtained ethical approval from the University Health Research Ethics Committee, and data collection was preceded by obtaining informed consent from participants and/or parents/guardians of students as part of fulfilling research ethical considerations.

## RESULTS

This section presents the results of a study on the relationship between ultra-processed food (UPF) consumption patterns and the nutritional status of adolescents in urban areas. The analysis was conducted on data obtained from 250 adolescent respondents aged 13–18 years. The results are presented in stages, starting with a descriptive analysis to describe the characteristics of respondents, UPF consumption patterns, and the distribution of nutritional status, followed by a bivariate analysis using the Chi-Square test to examine the relationship between variables, and a multivariate analysis using logistic regression to determine the effect of UPF consumption on the risk of overnutrition and obesity after controlling for confounding variables.

This study involved a number of adolescents aged 13–18 years who lived in urban areas, with a total of n = 250 respondents. Respondent characteristics, ultra-processed food (UPF) consumption patterns, and nutritional status are described in the following descriptive table:

**Table 1. Distribution of Respondent Characteristics (n = 250)**

| Characteristics | Frequency (n) | Percentage (%) |
|---|---|---|
| **Gender** | | |
| Man | 120 | 48.0% |
| Woman | 130 | 52.0% |
| **Age** | | |
| 13–15 years | 112 | 44.8% |
| 16–18 years | 138 | 55.2% |
| **Socioeconomic Level** | | |
| Low | 80 | 32.0% |
| Intermediate | 115 | 46.0% |
| Tall | 55 | 22.0% |

The majority of respondents were female (52%) and aged 16–18 years (55.2%). Most came from the middle socioeconomic class (46%).

**Table 2. Respondents' Ultra-Processed Food Consumption Patterns**

| Frequency of UPF Consumption per Day | Frequency (n) | Percentage (%) |
|---|---|---|
| ≤ 1 time | 35 | 14.0% |

| | | |
|---|---|---|
| 2–3 times | 97 | 38.8% |
| 4–5 times | 78 | 31.2% |
| ≥ 6 times | 40 | 16.0% |

Most respondents (38.8%) consumed ultra-processed foods 2–3 times per day. Sixteen percent consumed ultra-processed foods at a high frequency (≥6 times/day), potentially increasing the risk of nutritional problems.

**Table 3. Distribution of Respondents' Nutritional Status Based on BMI/Age**

| Nutritional Status Category | Frequency (n) | Percentage (%) |
|---|---|---|
| Malnutrition | 30 | 12.0% |
| Normal Nutrition | 135 | 54.0% |
| Overnutrition | 52 | 20.8% |
| Obesity | 33 | 13.2% |

More than half of respondents (54%) had normal nutritional status. However, 34% were overweight or obese, which may be related to high consumption of ultra-processed foods.

**Table 4. Relationship between Frequency of UPF Consumption and Nutritional Status of Adolescents**

| UPF Consumption Frequency | Malnutrition | Normal Nutrition | Overnutrition | Obesity | Total | p-value |
|---|---|---|---|---|---|---|
| ≤ 1 time/day | 5 | 25 | 4 | 1 | 35 | **0.001** |
| 2–3 times/day | 12 | 65 | 15 | 5 | 97 | |
| 4–5 times/day | 7 | 30 | 23 | 18 | 78 | |
| ≥ 6 times/day | 6 | 15 | 10 | 9 | 40 | |

Chi-square test results showed a statistically significant relationship between the frequency of UPF consumption and adolescent nutritional status (p = 0.001). The higher the frequency of UPF consumption, the greater the proportion of adolescents experiencing overnutrition and obesity.

**Table 5. Logistic Regression Analysis: Effect of UPF Consumption on the Risk of Overnutrition/Obesity**

| Variables | AOR (Adjusted Odds Ratio) | 95% CI | p-value |
|---|---|---|---|
| Consume UPF ≥ 4x/day | 2.85 | 1.60 – 5.08 | 0.000 |
| Male gender) | 1.35 | 0.80 – 2.30 | 0.250 |
| Age (16–18 years) | 1.10 | 0.65 – 1.85 | 0.720 |
| Low Physical Activity | 2.40 | 1.30 – 4.45 | 0.005 |

Consuming ultra-processed foods ≥ 4 times/day increased the risk of overnutrition or obesity by 2.85-fold after controlling for gender, age, and physical activity level (p = 0.000). Low physical activity was also a significant risk factor (AOR = 2.40; p = 0.005). Gender and age did not show a significant association in this model.

## DISCUSSION

### 1. Respondent Characteristics

The distribution of respondent characteristics shows that the majority were female (52%), aged 16–18 (55.2%), and came from families with a middle socioeconomic level (46%). Theoretically, the 16–18 age group is in late adolescence, a time when awareness of body image increases. However, at the same time, they are also more susceptible to media exposure and urban lifestyles that encourage the consumption of instant and fast foods. Previous research has shown that females are more likely to try certain diets, but are more often trapped in consuming high-calorie foods due to stress or social pressure (Siegrist & Hartmann, 2020).

The demographic characteristics of adolescents in urban areas indirectly shape their consumption behavior. Age and gender play a role in body image, the desire for instant diets, and peer influence. On the other hand, those in the middle socioeconomic class, which comprises the highest proportion, have sufficient financial access to purchase ultra-processed foods, but are not yet strong enough to support nutrition education or healthy food preferences. Therefore, the consumption behavior of UPF in this group is influenced not only by cognitive factors but also by the economic and social structures within which they live.

### 2. Ultra-Processed Food Consumption Pattern

Data shows that nearly 70% of respondents consumed ultra-processed foods more than twice a day, and 16% consumed them ≥6 times a day. This reflects a significant reliance on fast food in adolescents' daily lives. According to the nutrition transition theoretical framework, the shift in dietary patterns from natural foods to ultra-processed foods is a logical consequence of food industrialization and rapid urbanization. Empirical evidence from Southeast Asia suggests that increased consumption of ultra-processed foods is strongly influenced by digital media penetration, eating out-of-home habits, and weak regulation of food advertising (Crawford et al., 2017; Lynch et al., 2020).

High consumption of UPFs in urban adolescents is not simply an individual choice, but rather a result of a food environment that encourages unhealthy choices. Exposure to advertisements for foods high in sugar and salt on social media, lack of supervision in school cafeterias, and busy parents leading adolescents to frequently purchase fast food are contextual factors that contribute to the formation of these eating patterns. This means that this consumption behavior is not entirely autonomous, but rather an adaptive response to the environment.

### 3. Nutritional Status Based on BMI/U

As many as 34% of respondents were overweight or obese, an alarming figure reflecting the epidemic of overnutrition among urban adolescents. Global studies have confirmed a significant increase in adolescent obesity over the past two decades, including in developing countries. In this context, ultra-processed foods act as obesogenic agents, increasing energy intake without providing adequate satiety (Cheng et al., 2020).

Adolescents' nutritional status is influenced not only by the number of calories consumed, but also by the quality of the food and the balance of micronutrients it contains. Adolescents who habitually consume UPF tend to experience deficiencies in fiber, protein, and essential vitamins, which play a role in regulating appetite and energy metabolism. Therefore, obesity in adolescents is not only the result of excess energy but also a nutritional imbalance. This condition is exacerbated by poor nutritional literacy and the lack of restrictions on unhealthy food consumption within families and schools.

**4. Relationship between UPF Consumption and Nutritional Status**

Chi-square test results showed a significant relationship between the frequency of UPF consumption and nutritional status ($p = 0.001$). Higher UPF consumption was associated with higher prevalence of overnutrition and obesity. A similar study in South Korea showed that each increase in daily UPF consumption was directly proportional to increases in BMI and visceral fat in adolescents (Liu et al., 2022).

The causal relationship between UPF and nutritional status can be explained by two main mechanisms: first, the high energy content of added sugars and trans fats creates a daily energy surplus; second, extreme food processing disrupts the hunger-satiety regulatory system through hormonal and digestive system modifications. Researchers also assume that the absence of counterbalance from physical activity or other healthy foods exacerbates the effect of UPF on nutritional status. Consistent high consumption patterns indicate behavioral inertia, or repetitive eating habits that are difficult to change without educational intervention.

**5. The Effect of UPF Consumption on Overnutrition/Obesity**

The regression model showed that consuming UPF ≥4 times/day increased the risk of overnutrition or obesity by 2.85-fold ($p = 0.000$), while low physical activity also increased the risk by 2.4-fold ($p = 0.005$). These results are consistent with a longitudinal study in Canada that concluded that children who regularly consume UPF have a higher long-term risk of obesity. Meanwhile, low physical activity reinforces the hypothesis that obesity is a multifactorial phenomenon, determined not only by food intake but also by energy expenditure (Hamm & Kissileff, 2020).

UPF consumption and low physical activity have a synergistic effect on increasing the risk of obesity. This means that the effect of one factor is stronger when combined with the other. Researchers also assume that these habits are formed in early adolescence and are likely to persist into adulthood if effective interventions are not implemented. Therefore, nutritional interventions cannot stand alone and must be combined with consistent physical activity promotion and policy regulations regarding the marketing and distribution of UPF in schools and public settings.

## CONCLUSIONS

This study shows a significant association between ultra-processed food (UPF) consumption patterns and the nutritional status of adolescents in urban areas. The majority of

respondents in this study were adolescents aged 16–18 years from families with middle socioeconomic levels, who showed relatively high levels of UPF consumption, with a significant proportion consuming UPF more than twice per day.

The analysis showed that the higher the frequency of ultra-processed food consumption, the greater the proportion of adolescents who were overweight and obese. Consuming UPF ≥4 times/day was statistically proven to increase the risk of overnutrition and obesity by 2.85-fold, even after controlling for age, gender, and physical activity. Furthermore, low physical activity was also a significant risk factor for increased overnutrition.

These findings reinforce the theory that ultra-processed foods, which are high in calories but low in micronutrients, contribute to an energy imbalance that leads to increased body mass index. In the urban context, increased access to UPF, limited nutrition education, and a sedentary lifestyle are factors that reinforce this relationship.

Thus, it can be concluded that ultra-processed food consumption patterns play a significant role in determining the nutritional status of urban adolescents. Nutritional interventions for this group should focus on reducing UPF consumption, increasing physical activity, and strengthening school- and community-based nutrition education. These findings also emphasize the importance of regulations and public policies to control the distribution and promotion of ultra-processed foods, particularly among adolescents who are highly vulnerable to the influence of unhealthy food environments.

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