

Association Between Total Energy Intake, Ultra-Processed Food Consumption, and Nutritional Status Among Adolescents

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ABSTRACT

Introduction: The increasing prevalence of overweight and obesity among adolescents has been linked to dietary transitions characterized by excessive energy intake and high consumption of ultra-processed foods (UPFs). However, evidence regarding the association between total energy intake, UPF consumption frequency, and nutritional status among Indonesian adolescents remains limited.

Objective: This study aimed to analyze the relationship between total energy intake and frequency of UPF consumption with the nutritional status of adolescents at SMP PGRI Cibaribis, Bandung Regency.

Methods: The research design used a quantitative observational analytic approach with a cross-sectional design. A sample of 71 students was selected using proportional random sampling technique. Data were collected through the Semi Quantitative Food Frequency Questionnaire (SQ-FFQ) and anthropometric measurements. Bivariate analysis using Chi-square test.

Results: Results showed the majority of respondents had high energy intake (36.6%) and frequently consumed UPF (76.1%). However, there was no significant relationship between energy intake and nutritional status ($p=0.312$) nor between frequency of UPF consumption and nutritional status ($p=0.644$).

Conclusion: These findings indicate that neither variable directly influences the nutritional status of adolescents. As for the limitations of this study, they are likely influenced by limitations in research design and methods, as well as confounding factors that could potentially affect the nutritional status of adolescents, such as physical activity, socioeconomic status, sleep patterns, and diet quality. Future research is recommended to consider using a longitudinal design with the addition of more complex variables that could potentially influence the nutritional status of adolescents.

KEYWORD

*Energy Intake
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INTRODUCTION

Nutritional status is a key indicator for evaluating adolescent health. It is strongly influenced by dietary practices, particularly imbalances between nutrient intake and nutritional requirements. Adolescents represent a population at high risk for nutritional problems, including both undernutrition and overweight/obesity (Khuzaimah et al., 2025). Adequate energy intake is essential to support rapid growth and development during adolescence. However, the shift toward modern lifestyle patterns, characterized by increased consumption of fast foods and ultra-processed foods (UPFs), poses a significant challenge to maintaining balanced dietary habits among adolescents.

The rising consumption of ultra-processed foods has been associated with worsening metabolic health outcomes globally, reflecting major dietary transitions. Ultra-processed foods are typically industrially formulated products characterized by excessive caloric density, high levels of added sugars, sodium, and trans fats, and low micronutrient content. Juul and Bere (2024) reported that in industrialized countries such as the United States, ultra-processed foods contribute nearly 60% of total daily energy intake (Juul & Bere, 2024). This phenomenon is not limited to high-income countries; developing countries, including Indonesia, have also experienced substantial increases in ultra-processed food consumption in parallel with lifestyle transitions.

Indonesia has become an important target market for ultra-processed food products, particularly among adolescents. In 2020, ultra-processed foods accounted for approximately 45% of total daily caloric intake in Indonesia, with adolescents representing a disproportionately high consumer group. (Diba, 2025). Data from the Indonesian Basic Health Research (Riskesdas) 2018 reported that the prevalence of overweight among adolescents aged 13–18 years was 16%, while obesity reached 8% (Riskesdas, 2018). A study by Fauziyyah et al. (2022) identified excessive consumption of ultra-processed foods as a major contributor to the rising prevalence of obesity, reporting that 45.6% of respondents were obese and 43.4% had high levels of UPF intake (Fauziyyah et al., 2022). These patterns are influenced by changing family dietary behaviors and the increasing impact of digital media marketing.

Given these concerns, this study aimed to analyze the association between total energy intake, frequency of ultra-processed food consumption, and nutritional status among adolescents at SMP PGRI Cibaribis, Bandung Regency.

METHODS

This study employed a quantitative analytic observational design using a cross-sectional approach. The population consisted of 238 students enrolled in Grades VII and VIII at SMP PGRI Cibaribis, Bandung Regency, Indonesia. The sample size was calculated using the Slovin formula, as the total population was known. A proportional random sampling technique was applied based on predefined inclusion criteria, including students who were present during data collection and provided written informed consent. A total of 71 respondents met the inclusion criteria and were included in the analysis. Data collection involved assessing total daily energy intake and the frequency of ultra-processed food (UPF) consumption using a semi-quantitative food frequency questionnaire (SQ-FFQ). Energy intake was categorized as low (<80% of the Indonesian Recommended Dietary Allowance), adequate (80–110%), or high (>110%).

The frequency of UPF consumption was defined according to the level of industrial food processing and categorized as frequent (≥ 1 time/day or 2–6 times/week) and infrequent (≤ 1 time/week or never). Anthropometric measurements were conducted to determine nutritional status, which was classified as normal or abnormal based on standard growth references. Data were processed through editing, coding,

entry, tabulation, and cleaning procedures and subsequently analyzed using the Statistical Package for the Social Sciences (SPSS). Univariate analysis was performed to describe respondent characteristics, and bivariate analysis using the chi-square test was conducted to examine associations between total energy intake, frequency of UPF consumption, and nutritional status. Ethical approval for this study was obtained from the Health Research Ethics Committee of Institut Kesehatan Immanuel (Reference No. 113/KEPK/IKI/III/2024).

RESULTS

A total of 71 adolescents were included in the analysis. Nearly half of the participants were 14 years of age (49.0%), with a slight predominance of females (54.9%) compared with males (45.1%). Regarding dietary intake, 35.2% of respondents had high energy intake, while 36.6% had low energy intake relative to age-specific requirements. The majority of participants (76.1%) reported frequent consumption of ultra-processed foods, whereas 23.9% reported infrequent consumption. In terms of nutritional status, 69.0% of respondents were classified as having abnormal nutritional status, while 31.0% had normal nutritional status. Abnormal nutritional status included both overweight and obesity.

Table 1. Sociodemographic and nutritional characteristics of adolescent respondents (n = 71)

Characteristics	n	%
Age (years)		
12	8	11.3
13	28	39.4
14	35	49.3
Sex		
Male	32	45.1
Female	39	54.9
Energy intake		
Low	25	35.2
Adequate	20	28.2
High	26	36.6
Frequency of ultra-processed food consumption		
Frequent	54	76.1
Infrequent	17	23.9
Nutritional status		
Abnormal (overweight/obesity)	49	69.0
Normal	22	31.0

Association between energy intake and nutritional status

Table 2 presents the distribution of nutritional status according to total energy intake among 71 respondents. The majority of participants exhibited imbalanced energy intake. Among those with high energy intake, 28.2% were classified as having abnormal nutritional status. Similarly, 23.9% of respondents with low energy intake were categorized as having abnormal nutritional status. Among adolescents with adequate energy intake, 16.9% were classified as having abnormal nutritional status, while 11.3% had normal nutritional status. Chi-square analysis indicated that there was no statistically significant association between total energy intake and nutritional status ($p = 0.312$).

Table 2. Association between total energy intake and nutritional

Energy Intake	Abnormal Nutritional Status n (%)	Normal Nutritional Status n (%)	Total n (%)	p-value
Low	17 (23.9)	9 (12.7)	26 (36.6)	0.312
Adequate	12 (16.9)	8 (11.3)	20 (28.2)	
High	20 (28.2)	5 (7.0)	25 (35.2)	

Association between ultra-processed food consumption frequency and nutritional status

Table 3 presents the distribution of nutritional status according to the frequency of ultra-processed food (UPF) consumption among 71 respondents. The majority of adolescents who frequently consumed ultra-processed foods (50.7%) were classified as having abnormal nutritional status, while 25.4% were classified as having normal nutritional status. Among respondents who reported infrequent UPF consumption, 18.3% were categorized as having abnormal nutritional status and 5.6% as having normal nutritional status. Chi-square analysis indicated that there was no statistically significant association between the frequency of ultra-processed food consumption and nutritional status ($p = 0.644$).

Table 3. Association between ultra-processed food consumption frequency and nutritional status among adolescents (n = 71)

Frequency of Ultra-Processed Food Consumption	Abnormal Nutritional Status n (%)	Normal Nutritional Status n (%)	Total n (%)	p-value
Frequent	36 (50.7)	18 (25.4)	54 (76.1)	0.644
Infrequent	13 (18.3)	4 (5.6)	17 (23.9)	

DISCUSSION

Characteristics of Respondents

The participants in this study were aged 12–14 years, corresponding to early adolescence. This developmental stage is characterized by increased energy requirements due to rapid linear growth, gains in muscle mass, and hormonal fluctuations (Story et al., 2002). The majority of participants were 14 years old (49.3%), indicating progression toward late puberty, a phase that may influence dietary behaviors and increase the risk of nutritional imbalance.

The sex distribution was predominantly female (54.9%), reflecting the higher proportion of female students at SMP PGRI Cibaribis. Most respondents demonstrated either high (36.6%) or low (35.2%) energy intake, indicating substantial variability in dietary energy consumption among adolescents. This pattern illustrates the dual burden of malnutrition, a phenomenon commonly observed in developing countries, where undernutrition and overnutrition coexist within the same population.

These findings support the theory of energy balance, which posits that nutritional status results from the interaction between energy intake and energy expenditure. The observed discrepancies suggest that energy adequacy levels do not consistently align with actual physiological requirements, potentially influencing long-term nutritional outcomes (Popkin et al., 2020).

A large proportion of respondents (76.1%) were identified as frequent consumers of ultra-processed foods (UPFs). This finding aligns with global data indicating that adolescents represent a primary consumer group for UPFs, largely due to affordability, palatability, and widespread availability (Monteiro et al., 2019). In Indonesia, this trend has grown substantially, driven by rapid expansion of the food industry and shifts in lifestyle patterns.

Association between energy intake and nutritional status

This study found no statistically significant association between total energy intake and nutritional status ($p = 0.312$), indicating that variations in reported energy intake did not significantly influence adolescents' nutritional status. These findings are consistent with Ramadhani et al. (2022), who reported no significant association between energy intake and adolescent nutritional status in Bone Bolango, Gorontalo (Ramadhani et al., 2022). Similarly, Yulyani (2024) found no significant relationship between energy intake and nutritional status ($p = 0.878$) (Yulyani, 2024). Although adequate energy intake is theoretically linked to nutritional status, the World Health Organization (WHO, 2012) states that both insufficient and excessive energy intake contribute substantially to suboptimal nutritional outcomes. However, energy intake does not exert an immediate effect on nutritional status; rather, its impact accumulates over time through sustained dietary patterns (Ramadhani et al., 2022).

The absence of a statistically significant correlation between total energy intake and nutritional status does not imply that energy intake is irrelevant. Current nutritional status reflects past dietary patterns, whereas present intake may predict future outcomes. Furthermore, recall bias and potential under-reporting associated with the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) may have influenced the findings. Importantly, energy intake alone is not the sole determinant of nutritional status (Limbotto et al., 2024). According to Peltzer and Pengpid (2011), adolescent body weight is influenced by multiple factors, including dietary behaviors, psychosocial determinants, and misperceptions related to nutrition (Peltzer & Pengpid, 2011).

Association between ultra-processed food consumption and nutritional status

The Chi-square analysis demonstrated no significant association between UPF consumption frequency and nutritional status ($p = 0.644$). However, descriptive data indicated that the proportion of abnormal nutritional status was higher among participants with more frequent UPF consumption.

Theoretically, UPF consumption is commonly associated with increased body mass index (BMI) due to its high caloric density, elevated sugar content, and low fiber composition (Ganesrau et al., 2023). The NOVA classification system defines UPFs as industrial formulations subjected to extensive processing and containing multiple additives; long-term consumption may disrupt energy balance mechanisms (Monteiro et al., 2019). Conceptually, therefore, higher UPF consumption frequency would be expected to correlate with changes in nutritional status.

Nevertheless, the present findings are consistent with Mutawakillah et al. (2025), who reported no significant association between UPF consumption and nutritional status ($p = 0.160$) (Mutawakillah et al., 2025), as well as Pratiwi et al. (2022), who found no correlation between UPF intake and nutritional status among adolescents in Surabaya ($p = 0.217$) (Pratiwi et al., 2022). One possible explanation for the non-significant findings is that nutritional status represents the cumulative result of complex interactions among multiple factors, including imbalanced dietary patterns, metabolic differences, and individual characteristics (Chang & Mao, n.d.). Variability in metabolic response may also play a role. Adolescents with higher basal metabolic rates and greater physical activity levels may exhibit increased caloric expenditure capacity, potentially mitigating the effects of high UPF intake, and vice versa (Hanifa et al., 2024). Notably, this study did not assess energy expenditure as a potential confounding variable, despite its central role in energy balance theory.

CONCLUSION

This study demonstrated no statistically significant association between total energy intake, frequency of ultra-processed food (UPF) consumption, and adolescents' nutritional status. These findings suggest that although energy intake is essential to meet physiological requirements, its

relationship with nutritional status is not immediate and likely reflects long-term cumulative dietary exposure. Similarly, the frequency of UPF consumption cannot be conclusively interpreted as having a direct impact on adolescents' nutritional status within the school setting studied. This study has several limitations, including potential constraints related to study design and methodology, as well as unmeasured confounding variables such as physical activity, socioeconomic status, sleep patterns, and overall diet quality, all of which may influence adolescent nutritional status. Future research should consider longitudinal study designs and incorporate more comprehensive variables to better elucidate the multifactorial determinants of adolescent nutritional status.

REFERENCES

- Chang, Z., & Mao, C. (n.d.). *Examining the relationship between ultra-processed food consumption and obesity : A comprehensive review*. 0, 1–8. <https://doi.org/10.54254/2753-8818/63/20241532>
- Diba, F. (2025). makanan ultra-proses, inovasi dalam industri makanan modern. *Ibnu Sina: Jurnal Kedokteran dan Kesehatan - Fakultas Kedokteran Universitas Islam Sumatera Utara*, 24(1), 191–201. <https://doi.org/10.30743/ibnusina.v24i1.798>
- Fauziyyah, H., Diana, F. M., & Femelia, W. (2022). Relationship of Ultraprocessed Food Consumption, Sleep Habits, and Online Food Ordering Practices With Obesity in Adults. *JGMI : The Journal of Indonesian Community Nutrition*, 11(2).
- Ganesrau, G., Ali, A., Mohamed, H. J. J., Zainuddin, A. A., Yusof, H. M., & Jean, S. W. (2023). Ultra-Processed Food Consumption About Body Mass Index (BMI) of Public University Students in Malaysia. *Malaysian Applied Biology*, 52(2 SE-Research Articles), 119–127. <https://doi.org/10.55230/mabjournal.v52i2.2663>
- Hanifa, R. A., Arini, F. A., & Wahyuningsih, U. (2024). *Sindrom Makan Malam , Konsumsi Ultra-processed Foods , dan Aktivitas Fisik sebagai Faktor Risiko Gizi Lebih pada Mahasiswa Fakultas Ilmu Kesehatan UPN “ Veteran ” Jakarta Night Eating Syndrome , Ultra-processed Foods Consumption , and Physical Activity as Risk Factors for Overnutrition in Students of Faculty of Health Science UPN “ Veteran ” Jakarta*. 8(3), 43–50. <https://doi.org/10.20473/amnt.v8i3SP.2024.43-50>
- Juul, F., & Bere, E. (2024). Ultra-processed foods – a scoping review for Nordic Nutrition Recommendations 2023. *Food & Nutrition Research*, 68(SE-Nordic Nutrition Recommendations). <https://doi.org/10.29219/fnr.v68.10616>
- Khuzaimah, A., Ruttu, I. P., & Jafar, N. (2025). *Correlation of Ultra-processed Food Consumption with Nutritional Status and Blood Pressure in Adolescents*. 8(1), 92–105.
- Limboto, D. J., Punuh, M. I., Malonda, N. S. H., Masyarakat, F. K., Ratulangi, U. S., Utara, S., & Gizi, S. (2024). *JURNAL*. 14(1), 1–8.
- Monteiro, C. A., Cannon, G., Levy, R. B., Moubarac, J.-C., Louzada, M. L. C., Rauber, F., Khandpur, N., Cediel, G., Neri, D., Martinez-Steele, E., Baraldi, L. G., & Jaime, P. C. (2019). Ultra-processed foods: what they are and how to identify them. *Public Health Nutrition*, 22(5), 936–941. <https://doi.org/DOI: 10.1017/S1368980018003762>
- Mutawakillah, H., Sari, R., Afiva, N., Thahara, A. R., Nurchalizah, R. Z., & Rosidati, C. (2025). *Hubungan antara Konsumsi Ultra-Processed Food dengan Status Gizi : Studi Potong Lintang pada Mahasiswa Kesehatan Masyarakat UIN Jakarta*. 4(1), 9–14.
- Peltzer, K., & Pengpid, S. (2011). Overweight and obesity and associated factors among school-aged adolescents in Ghana and Uganda. *International Journal of Environmental Research and Public Health*, 8(10), 3859–3870. <https://doi.org/10.3390/ijerph8103859>

- Popkin, B. M., Corvalan, C., & Grummer-Strawn, L. M. (2020). Dynamics of the double burden of malnutrition and the changing nutrition reality. *The Lancet*, 395(10217), 65–74. [https://doi.org/10.1016/S0140-6736\(19\)32497-3](https://doi.org/10.1016/S0140-6736(19)32497-3)
- Pratiwi, A. A., Chandra, D. N., & Khusun, H. (2022). Association of Ultra Processed Food Consumption and Body Mass Index for Age among Elementary Students in Surabaya. *Amerta Nutrition*, 6(2), 140–147. <https://doi.org/10.20473/amnt.v6i2.2022.140-147>
- Ramadhani, F., Nugroho, H. S. W., Sillehu, S., Maesarah, M., Adam, D., Nuryani, N., & Hatta, H. (2022). Correlation of Energy, Protein, Carbohydrate, and Physical Activity Intake with Nutritional Status of Adolescents. *Open Access Macedonian Journal of Medical Sciences*. <https://doi.org/10.3889/oamjms.2022.8110>
- Riskesdas. (2018). Laporan Riskesdas 2018 Nasional.pdf. In *Lembaga Penerbit Balitbangkes* (hal. hal 156).
- story, m., neumark-sztainer, d., & french, s. (2002). Individual and Environmental Influences on Adolescent Eating Behaviors. *Journal of the American Dietetic Association*, 102(3), S40–S51. [https://doi.org/10.1016/S0002-8223\(02\)90421-9](https://doi.org/10.1016/S0002-8223(02)90421-9)
- WHO. (2012). Childhood, obesity. *Bulletin de l'Academie Nationale de Medecine*, 187(7). [https://doi.org/10.1016/s0001-4079\(19\)33924-x](https://doi.org/10.1016/s0001-4079(19)33924-x)
- Yulyani, W. (2024). *Nutritional status, energy intake and calorie drinks among indonesia adolescents: a cross-sectional study*. 7(2), 121–128.