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# Determinants of Energy Intake from Ultra-Processed Food Consumption among Adolescent Girls in Tasikmalaya City, Indonesia

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## Abstract

Adolescence is a critical period characterized by significant physical, cognitive, psychosocial, and emotional changes that influence dietary behaviors, including increased consumption of ultra-processed foods (UPFs), which may contribute to chronic disease risk. This study aimed to analyze the determinants of energy intake from UPFs among adolescent girls in Tasikmalaya City. This observational study employed a cross-sectional design, involving 514 adolescent girls from 10 public junior high schools in Tasikmalaya, selected through proportional random sampling. The energy intake from UPFs was collected using 2×24-hour food recalls, then separated using Nova 4. Information on potential determinants, including individual and interpersonal factors, was obtained through a structured questionnaire. Data were analyzed using the chi-square test and logistic regression. The results showed that one-fifth (21%) of participants had energy intake dominated by UPFs. Significant individual factors associated with the dominance of energy intake from UPFs included screen time duration ($p$ = 0.001; OR = 2.424 [95% CI = 1.420-4.140]) and main meals ($p$ = 0.019; OR = 1.996 [95% CI = 1.121-3.554]). Interpersonal factors related to the dominance of energy intake from UPFs were family status ($p$ = 0.006; OR = 2.336 [95% CI = 1.275-4.282]). Screen time duration emerged as the strongest contributing factor. In conclusion, dominant energy intake from UPFs among adolescent girls is influenced by screen time duration, main meals, and family status. Parents need to pay attention to adolescent girls' nutritional intake, especially limiting UPFs consumption. Policies regarding healthy snacks sold in school cafeterias also need to be implemented.

**Keywords:** adolescent girls; dietary patterns; energy intake; screen time; ultra-processed foods

## INTRODUCTION

Adolescence is a phase of life characterized by significant changes in physical, cognitive, psychosocial, and emotional development, as well as health problems distinct from those of childhood and adulthood (Singh et al., 2019). Worldwide, in 2019, there were 1.2 billion teenagers aged 10 to 19 years, and 90% of them lived in low- and middle-income countries (LMICs) (United Nations, 2019). Therefore, improving the health and well-being of adolescents, especially adolescent girls in developing countries, is a global health priority (Sparrow et al., 2021; Shinde et al., 2023). Unfortunately, adolescent girls in developing countries tend to have poor eating habits (UNICEF Indonesia, 2021).

The habit of eating outside is common among young people (Wellard-Cole et al., 2021). The high frequency of eating outside increases energy, fat, sugar, and sodium intake (Putri and Anwar,

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2024), as the food usually consumed outside is ultra-processed foods (UPFs) (Andrade et al., 2020; Souza et al., 2022). Consumption of UPFs contributes to 50% of total energy intake in some Northern European countries and 25% in some developing countries (Sandoval-Insausti et al., 2020). From 2007 to 2022, there was an increase in UPFs consumption, marked by higher sales in South Asian, Southeast Asian, and Sub-Saharan African countries (Monteiro et al., 2025). Indonesia, one of the developing countries in Southeast Asia, is also experiencing an increase in UPFs consumption (Colozza et al., 2023), with one-third of the Indonesian population exceeding the recommended intake of sugar, salt, and fat (Dewanti et al., 2022).

UPFs are typically high in sugar, salt, and fat (Monteiro et al., 2025) and are major contributors to adolescents' energy intake (Muraro et al., 2023). Young people (ages 12 to 19) consume more energy from UPFs than children (ages 2 to 11) (CDC, 2020). The World Health Organisation (WHO) stated in 2020 that 80% of young people worldwide often consume UPFs, including 50% at lunch, 15% at dinner, and 15% at breakfast (Yetmi et al., 2021). Increased UPFs consumption correlated with increased intake of free sugars, total fat, and saturated fat, and decreased fiber, protein, potassium, zinc, and magnesium, as well as vitamins A, C, D, E, B12, and niacin (Martini et al., 2021).

High UPFs consumption is associated with a higher risk of health deterioration, especially cardiometabolic disease, increased risk of mental disorders, and increased risk of death (Lane et al., 2024). Other findings suggest that high UPFs consumption is associated with a higher risk of diabetes, hypertension, dyslipidemia, and obesity (Vitale et al., 2024). According to a national health survey, the prevalence of non-communicable diseases in Indonesia has been increasing annually (Ministry of Health of Indonesia, 2023). Food consumption, suspected to be a risk factor for non-communicable diseases, includes increased intake of sugar, salt, and excess fat (Andarwulan et al., 2021; Thapsuwan et al., 2024), which are widely present in UPFs (Kesaite et al., 2024). Efforts to control UPFs consumption among adolescent girls can be achieved by identifying the determinants of high UPFs intake.

The social ecological model (SEM) approach, which includes individual, interpersonal, and environmental factors, is a valuable conceptual framework for understanding health behavior (McLeroy et al., 1988). Individual factors include knowledge, personal behavior and consumption; interpersonal factors include the influence of the social environment, such as family; and environmental factors include community and policy. The SEM approach has been widely used to describe the determinants of unhealthy food consumption practices, such as high-salt intake (Mensah et al., 2025). In UPF's consumption behavior, individual and interpersonal factors are essential drivers (Vashtianada et al., 2023), and these factors influence choice (Santos and Assunção, 2025).

This research was conducted in Tasikmalaya, an area in West Java Province that has the largest population in Indonesia (Provincial Government of West Java, 2024). The population of Tasikmalaya is dominated by the Sundanese ethnic group, known for their consumption of plant-based foods (Raihandhany and Purnomo, 2025). However, research shows that consumption of UPFs is increasing globally, not only in urban areas but also in rural areas (Choudhury et al., 2025). This study aims to analyze the determinants of UPFs using the SEM approach, with a focus on individual and interpersonal factors in Tasikmalaya City, an area with food consumption dominated by plant-based foods.

## MATERIALS AND METHOD

### Study design and participants

This study employed an observational, cross-sectional design. The population in this study was female junior high school students in Tasikmalaya City, Indonesia. Tasikmalaya City has 21 public junior high schools distributed across 10 sub-districts. Ten public junior high schools were selected as research sites, one from each sub-district. In Tasikmalaya City, there are 6 sub-districts with more than 1 public junior high school, so the sample will be selected randomly using a random picker. The calculation of the minimum sample size, with a 25% non-response rate, yielded 535 participants. The minimum sample size is calculated using Equation 1 (Mukti, 2025).

$$n = \frac{N}{1+Ne^2} \quad (1)$$

Where, n = Sample, N = Population, and e = Error (10%).

Participants were selected using proportional random sampling. At the end of the study, 21 respondents did not participate in the second food recall and were excluded, leaving 514 participants who could be analyzed. Before the study was conducted, the participants and their parents or legal guardians signed an informed consent form.

**Data collection**

Fifteen eighth-semester nutrition students participated in data collection for this study. The collected data included both dependent and independent variables. The dependent variable was energy intake from UPFs, obtained by comparing energy intake from UPFs with that from non-UPFs. The results were grouped into 2 categories: UPFs dominance and non-UPFs dominance. UPFs dominance occurred when energy from UPFs was greater than that from non-UPFs. UPF intake was obtained by subtracting foods included in the UPF group from total daily food intake. UPFs were industrial formulations made from inexpensive ingredients extracted from or derived from whole foods, combined with additives. Both local and commercial products were determined using the Nova 4 classification (Monteiro et al., 2019). Total daily food consumption was obtained from a non-consecutive 2×24-hour food recall (Huang et al., 2022) conducted on weekdays and holidays, using a food photo book to help participants estimate household size.

The independent variables were determinants of UPFs, based on a social ecological approach, including individual, interpersonal, environmental, and policy factors. Environmental and policy factors were assumed to be homogeneous because the research was conducted in public junior high schools within the same area (Tasikmalaya City). Therefore, the determinants of energy intake from UPFs in this study included individual factors and interpersonal factors. Individual factors included age, grade, pocket money, sleep duration, late-night sleep, screen time duration, physical activity, nutritional literacy, main eating habits, and breakfast habits. Meanwhile, interpersonal factors included parents' education and occupation, the number of family members, and family status.

Age is the time span in years from the participant's birth until the research was conducted, grouped into 12 to 13 and 14 to 15. Grade is the educational level at which the research was conducted, divided into VII, VIII, and IX. Pocket money is the participant's answer to the question of how much money (IDR) they receive in one day, divided into > 20,000 and ≤ 20,000 IDR per day (Hidayanti et al., 2023). Sleep duration is the time span in hours from when the participants went to sleep until they woke up yesterday, divided into < 8 and ≥ 8 hours (Cortes et al., 2023; Grasaas et al., 2024). Late-night sleeping is the time at which the participant begins to fall asleep at night, grouped as "yes" if the participant went to sleep ≥ 11.00 PM and "no" if they went to sleep < 11.00 PM (Zhong et al., 2025). Screen time duration is the length of time (hours) the participant spends in front of the gadget in one day, divided into < 4 and ≥ 4 hours (Zablotsky et al., 2025).

Physical activity is the participant's answer to the question of how many times they exercise in one week, with a minimum duration of 30 minutes, divided into < 3 and ≥ 3 times per week (James et al., 2023). Nutritional literacy is the participant's answer score on questions based on the Diet and Health Knowledge Survey (DHKS) questionnaire (Bahramfard et al., 2020), grouped into "bad" (< 50% correct answers) and "good" (≥ 50% correct answers). The main meals are the frequency (times per day) of consuming complete meals consisting of staple foods and side dishes at the main times of the day (morning, noon, and evening) (Ishikawa-Takata et al., 2021). Main meals were categorized into < 3 and ≥ 3 times per day. Breakfast habits are the frequency (times per week) of food consumption from 05.00 AM to 09.00 AM, which was categorized as "frequent" (3 times per week) or "rare" (< 3 times per week) (Gutkowska et al., 2025).

Parental education is the formal education completed by the father and mother, divided into elementary school, junior high school, senior high school, and university. Parental occupation refers to the activities carried out by parents to earn money, divided into working and non-working activities. The number of family members is the number of people living in the same household as the participant, grouped into > 4 and ≤ 4 (Laksono and Wulandari, 2021). Family status is the

condition of the participant's family at the time the research was conducted, grouped as "complete" if the participant lives with a complete family (father and mother), and "incomplete" if the participant lives only with the father or mother, or neither.

**Statistical analysis**

Data analysis included univariate, bivariate, and multivariate analyses. In the univariate analysis, data were presented in a frequency distribution table, along with mean, SD, minimum, and maximum values. The relationship between determinant factors and energy intake from UPFs was tested using the chi-square test, with significance set at $p < 0.05$. To fulfil the 2×2 table in the chi-square test, variables with more than 2 categories were changed into 2 categories. The variable of parental education level was grouped into 2 categories based on the 9-year compulsory education program (elementary-junior high school and senior high school-university) (Republic of Indonesia, 2003). The grouping of grade variables was changed to grades VII and VIII-IX. In the bivariate analysis, variables with $p < 0.25$ were further tested using logistic regression modelling.

**Ethical consideration**

This study has received ethical approval under No. 004616/UNIVERSITAS DIAN NUSWANTORO/2025, dated September 1, 2025.

## RESULTS AND DISCUSSION

The total daily nutritional intake of the participants showed that the mean total energy intake was 1,363.3±459.3 kcal, total fat intake was 49.2±25.5 g, total carbohydrate intake was 189.6±90.08 g, and total sodium intake was 1,052.2±737.6 mg (Table 1). For UPFs consumption, the mean energy, fat, and carbohydrate intake derived from UPFs was lower than from non-UPFs (493.4±286.8 vs 869.3±375.7 kcal; 17.8±12.4 vs 30.6±16.2 g; and 67.0±42.6 vs 122.5±81.5 g, respectively). In contrast, the mean sodium consumption from UPFs (829.2±650.9 mg) was higher than from non-UPFs (222.9±368.2 mg) (Table 1). Of the 514 participants, one-fifth had energy (21.6%), fat (25.7%), and carbohydrate (23.0%) intake from UPFs that dominated daily intake. Meanwhile, more than two-thirds of the participants (84.2%) obtained the majority of their daily sodium intake from UPFs (Table 1). The use of a 2×24-hour recall may not fully reflect daily food intake, but this research attempted to increase data validity by conducting the recall on non-consecutive school days and holidays. Potential recall bias and challenges in estimating portion sizes were addressed by using a food photo booklet to assist participants in estimating household measures.

Globally, UPFs consumption is increasing, especially among children and adolescents. This increase occurs not only in high-income countries but also in middle-income countries, such as Indonesia (Mescoloto et al., 2024). In this study, one-fifth of participants (21.6%) consumed more energy from UPFs than non-UPFs sources. Consumption of UPFs contributes to significant increases in energy (Shim et al., 2022), fat (Costa et al., 2024), carbohydrates (Bestari et al., 2023), and sodium (Cortes et al., 2023). Therefore, higher consumption of UPFs also increases the risk of chronic diseases (Matos et al., 2021), such as coronary heart disease (Li et al., 2023), diabetes mellitus (Moradi et al., 2021), and hypertension (Wang et al., 2022).

In this study, participants' sodium intake was primarily from UPFs. UPFs have become a popular snack in developing countries (Moodie et al., 2021), including Indonesia (Nurhasan et al., 2024). Rapidly, high consumption of UPF has become a public health concern due to the high sodium content (Islam et al., 2022). The average salt consumption among Indonesians is 6.6 g, equivalent to 2,674 mg of sodium per day, and the highest sodium content is in snack chips (1,394.4 mg per 100 g) (Pradana et al., 2025). In Tasikmalaya, there are local spices such as *atom bulan*, *atom bintang*, *aida*, and a unique onion sauce that has a salty taste (Zahra, 2023). These spices are often added to schoolchildren's snacks, such as sausages, nuggets, fried macaroni, *seblak*, *basreng*, *baso aci*, etc.

Table 2 presents individual and interpersonal factors of adolescent girls in Tasikmalaya City. Regarding individual factors, the mean age of participants was 13±0.8 years, and most were in eighth grade. The majority (81.3%) had pocket money of ≤ 20,000 IDR per day. More than half (51.0%) had nutritional literacy levels in the bad category. Furthermore, more than half of the participants had a sleep duration of < 8 hours per day (59.5%) and started sleeping after 11.00 PM (12.1%). In addition, most participants spent

Table 1. Nutrient intake from UPF in adolescent girls in Tasikmalaya City

| Nutrition content in UPF | n (%) | Mean±SD | Min-max |
|---|---|---|---|
| Energy (kcal) | | | |
| Energy total | | 1,363.3±459.3 | 364.0-3,976.7 |
| Energy from UPF | | 493.4±286.8 | 0-2,162.2 |
| Energy from non-UPF | | 869.3±375.7 | 0-2,359.4 |
| Energy domination | | | |
| UPF | 111 (21.6) | | |
| Non-UPF | 403 (78.4) | | |
| Fat (g) | | | |
| Fat total | | 49.2±25.5 | 5.8-402.4 |
| Fat from UPF | | 17.8±12.4 | 0-117.3 |
| Fat from non-UPF | | 30.6±16.2 | 0-113.0 |
| Fat domination | | | |
| UPF | 132 (25.7) | | |
| Non-UPF | 382 (74.3) | | |
| Carbohydrates (g) | | | |
| Carbohydrates total | | 189.6±90.08 | 48.1-1,444.1 |
| Carbohydrates from UPF | | 67.0±42.6 | 0-326.5 |
| Carbohydrates from non-UPF | | 122.5±81.5 | 0-1,348.7 |
| Carbohydrates domination | | | |
| UPF | 118 (23.0) | | |
| Non-UPF | 396 (77.0) | | |
| Sodium (mg) | | | |
| Sodium total | | 1,052.2±737.6 | 12.9-7,043.6 |
| Sodium from UPF | | 829.2±650.9 | 0-3,828.6 |
| Sodium from non-UPF | | 222.9±368.2 | 0-6,442.1 |
| Sodium domination | | | |
| UPF | 433 (84.2) | | |
| Non-UPF | 81 (15.8) | | |

> 4 hours per day on screens (68.9%) and engaged in physical activity or exercise < 3 times per week (84.8%). In terms of eating habits, most participants consumed main meals < 3 times per day (52.1%) and rarely (73.7%) ate breakfast (Table 2).

In interpersonal factors, the majority of fathers (47.9%) and mothers (47.1%) had a senior high school education, the majority of fathers (96.1%) were employed, and the majority of mothers (73.9%) were unemployed. The average number of family members was 4±1, with the majority (53.3%) having fewer than 4 members, and 88.9% having complete families (father and mother still together) (Table 2).

The result of statistical analysis in Table 3 showed that the individual factors, including age, grade, pocket money, sleep duration, late-night sleep, physical activity, and nutritional literacy, were not related to the dominance of energy intake from UPFs. Meanwhile, the screen time, main meals, and breakfast habits were associated with the dominance of energy intake from UPFs ($p$ = 0.001, 0.005, and 0.003, respectively).

In the interpersonal factors, variables for parents' education and occupation, and family members were not related to the dominance of energy intake from UPFs ($p > 0.05$). Only family status showed a significant relationship with the dominance of energy intake from UPFs ($p$ = 0.035; OR = 1.984; 95% CI = 1.093-3.601).

At the beginning of the modelling, 7 variables met the inclusion criteria ($p < 0.25$). These consisted of 4 individual factors (screen time duration, nutritional literacy, main meals, and breakfast habits) and 3 interpersonal factors (maternal education, maternal occupation, and family status). Furthermore, logistic regression modelling was carried out by removing, one by one, variables with $p > 0.05$, starting with the

Table 2. Individual and interpersonal factors of adolescent girls in Tasikmalaya City

| Variable | n (%) | mean±SD | Min | Max |
|---|---|---|---|---|
| Individual factors | | | | |
| Age (years) | | 13±0.8 | 12 | 15 |
| 12-13 | 227 (44.2) | | | |
| 14-15 | 287 (55.8) | | | |
| Grade | | | | |
| Complete category | | | | |
| VII | 179 (34.8) | | | |
| VIII | 217 (42.2) | | | |
| IX | 118 (23.0) | | | |
| Two categories | | | | |
| VII | 179 (34.8) | | | |
| VIII-IX | 335 (65.2) | | | |
| Pocket money (IDR per day) | | 18,800±7,700 | 2,000 | 50,000 |
| > 20,000 | 96 (18.7) | | | |
| ≤ 20,000 | 418 (81.3) | | | |
| Sleep duration (hours per day) | | | | |
| < 8 | 306 (59.5) | 7±1 | 3 | 9.5 |
| ≥ 8 | 208 (40.5) | | | |
| Late-night sleeping | | | | |
| Yes | 62 (12.1) | | | |
| No | 452 (87.9) | | | |
| Screen time duration (hours per day) | | | 2 | 18 |
| > 4 | 354 (68.9) | 7.6±4.3 | | |
| ≤ 4 | 160 (31.1) | | | |
| Physical activity (times per week) | | 1.7±1.2 | 0 | 6 |
| < 3 | 436 (84.8) | | | |
| ≥ 3 | 78 (15.2) | | | |
| Nutrition literation | | 13.2±3.4 | 3 | 22 |
| Bad | 262 (51.0) | | | |
| Good | 252 (49.0) | | | |
| Main meals (times per day) | | 2±1 | 0 | 5 |
| < 3 | 379 (73.7) | | | |
| ≥ 3 | 135 (26.3) | | | |
| Breakfast habits (times per week) | | 3±2 | 0 | 7 |
| Rare | 268 (52.1) | | | |
| Frequent | 246 (47.9) | | | |
| Interpersonal factors | | | | |
| Father’s education | | | | |
| Complete category | | | | |
| Elementary | 101 (19.6) | | | |
| Junior high school | 88 (17.1) | | | |
| Senior high school | 246 (47.9) | | | |
| University | 79 (15.3) | | | |
| Two categories | | | | |
| Elementary-Junior high school | 189 (36.8) | | | |
| Senior high school-university | 325 (63.2) | | | |
| Mother’s education | | | | |
| Complete category | | | | |
| Elementary | 99 (19.3) | | | |

Table 2. *Continued*

| Variable | n (%) | mean±SD | Min | Max |
|---|---|---|---|---|
| Junior high school | 101 (19.6) | | | |
| Senior high school | 242 (47.1) | | | |
| University | 72 (14.0) | | | |
| Two categories | | | | |
| Elementary-Junior high school | 200 (38.9) | | | |
| Senior high school-university | 314 (61.1) | | | |
| Father's occupation | | | | |
| Not working | 20 (3.9) | | | |
| Working | 494 (96.1) | | | |
| Mother's occupation | | | | |
| Working | 134 (26.1) | | | |
| Not working | 380 (73.9) | | | |
| Family members (persons) | | 4±1 | 2 | 9 |
| > 4 | 235 (47.5) | | | |
| ≤ 4 | 279 (54.3) | | | |
| Family status | | | | |
| Incomplete | 57 (11.1) | | | |
| Complete | 457 (88.9) | | | |

variable that had the most significant *p*-value (mother's education). When the mother's education, occupation, and nutritional literacy variables were removed, none of the OR values changed by > 10%. However, when the breakfast habit variable was removed, the ORs changed by > 10% for all variables. Therefore, the variables of maternal education, maternal occupation, and nutritional literacy remain excluded from the model, while breakfast habits were re-entered. In the final model, 3 variables (screen time duration, main meals, and family status) were associated with the dominance of energy intake from UPFs, and screen time duration was the most influential factor (Table 4). However, this study has not considered the influence of peer groups and the presence of street food around schools.

Consumption of UPFs is increasing among adolescents across various countries and demographics (Gonçalves et al., 2023). In this study, participants who spent ≥ 4 hours per day in front of screens had higher energy consumption from UPFs than those who did not, with statistical tests indicating a relationship between screen time duration and energy intake from UPFs. Research involving Brazilian adolescents also showed that adolescents who spent more time in front of screens had a higher percentage of total energy intake from UPFs (Rocha et al., 2021).

Adolescents' screen time is primarily spent accessing social media for various purposes, including maintaining social connections, seeking information, and expressing themselves (Ouvrein et al., 2019). The majority of adolescents use social media daily, and many report being online almost constantly (Pereira et al., 2024). While using various social media applications, they are also likely to be exposed to UPF's advertising. This is because UPFs advertising is on the rise globally, especially on digital media. Digital advertising and social media engagement are increasingly being used to promote UPFs. These platforms enable targeted advertising that can significantly influence consumer behavior (Al-Ababneh et al., 2025). In addition, many people, especially children and adolescents, tend to snack while watching a screen. Snacks consumed while using screens are frequently UPF, which are convenient and tasty, but unhealthy (Rodríguez-Barniol et al., 2024).

Parental attitudes and control over food choices also play an essential role in shaping this behavior (Rodríguez-Barniol et al., 2024). Parental behavior and the home environment play a significant role in shaping adolescents' eating habits. In this study, participants who lived with only one parent (father or mother) or did not live with both parents had higher energy intake from UPFs. Adolescents living with both parents are less likely to consume UPFs compared to those living with a single parent or without any parents (Souza et al., 2023). Parents play a significant

Table 3. Determining factors of the domination of energy intake in adolescent girls in Tasikmalaya City

| Determinant of UPF | Domination of energy intake | | | | *p*; cOR (95% CI) |
|---|---|---|---|---|---|
| | UPF | | Non-UPF | | |
| | n | % | n | % | |
| Individual factors | | | | | |
| Age (years) | | | | | |
| 12-13 | 52 | 22.9 | 175 | 77.1 | 0.593; 1.148 (0.753-1.751) |
| 14-15 | 59 | 20.6 | 228 | 79.4 | 1.00 |
| Grade | | | | | |
| VII | 34 | 19.0 | 145 | 81.0 | 0.350; 0.786 (0.500-1.235) |
| VIII-IX | 77 | 23.0 | 258 | 77.0 | 1.00 |
| Pocket money (IDR per day) | | | | | |
| > 20,000 | 22 | 22.9 | 74 | 77.1 | 0.833; 1.099 (0.647-1.868) |
| ≤ 20,000 | 89 | 21.3 | 329 | 78.7 | 1.00 |
| Sleep duration (hours per day) | | | | | |
| < 8 | 63 | 20.6 | 243 | 79.4 | 0.573; 0.864 (0.656-1.322) |
| ≥ 8 | 48 | 23.1 | 160 | 76.9 | 1.00 |
| Late-night sleeping | | | | | |
| Yes | 17 | 27.4 | 45 | 72.6 | 0.306; 1.439 (0.788-2.628) |
| No | 95 | 20.8 | 358 | 79.2 | 1.00 |
| Screen time duration (hours per day) | | | | | |
| > 4 | 91 | 25.7 | 263 | 74.3 | 0.001*; 2.422 (1.432-4.097) |
| ≤ 4 | 20 | 12.5 | 140 | 87.5 | 1.00 |
| Physical activity (times per week) | | | | | |
| < 3 | 98 | 22.5 | 338 | 77.5 | 0.318; 1.450 (0.767-2.740) |
| ≥ 3 | 13 | 16.7 | 65 | 83.3 | 1.00 |
| Nutrition literation | | | | | |
| Bad | 64 | 24.4 | 198 | 75.6 | 0.138; 1.410 (0.923-2.155) |
| Good | 47 | 18.7 | 205 | 81.3 | 1.00 |
| Main meals (times per day) | | | | | |
| < 3 | 94 | 24.8 | 285 | 75.2 | 0.005*; 2.289 (1.309-4.005) |
| ≥ 3 | 118 | 12.6 | 135 | 87.4 | 1.00 |
| Breakfast habits | | | | | |
| Rare | 72 | 26.9 | 196 | 73.1 | 0.003*; 1.950 (1.261-3.015) |
| Frequent | 39 | 15.9 | 207 | 84.1 | 1.00 |
| Interpersonal factors | | | | | |
| Father’s education | | | | | |
| Elementary-Junior high school | 37 | 19.6 | 152 | 80.4 | 0.461; 0.745 (0.530-1.286) |
| Senior high school-university | 74 | 22.8 | 251 | 77.2 | 1.00 |
| Mother’s education | | | | | |
| Elementary-Junior high school | 50 | 25.0 | 150 | 75.0 | 0.165; 1.383 (0.904-2.115) |
| Senior high school-university | 61 | 19.4 | 253 | 80.6 | 1.00 |
| Father’s occupation | | | | | |
| Not working | 4 | 20.0 | 16 | 80.0 | 1.000; 0.904 (0.296-2.761) |
| Working | 107 | 21.7 | 387 | 78.3 | 1.00 |
| Mother’s occupation | | | | | |
| Working | 37 | 27.6 | 97 | 72.4 | 0.065; 1.577 (1.000-2.488) |
| Not working | 72 | 19.5 | 306 | 80.5 | 1.00 |
| Family members (persons) | | | | | |
| > 4 | 54 | 23.0 | 181 | 77.0 | 0.554; 1.164 (0.763-1.770) |
| ≤ 4 | 57 | 20.4 | 222 | 79.6 | 1.00 |

Table 3. *Continued*

| Determinant of UPF | Domination of energy intake | | | | *p*; cOR (95% CI) |
|---|---|---|---|---|---|
| | UPF | | Non-UPF | | |
| | n | % | n | % | |
| Family status | | | | | |
| Incomplete | 19 | 33.3 | 38 | 66.7 | 0.035*; 1.984 (1.093-3.601) |
| Complete | 92 | 20.1 | 365 | 79.9 | 1.00 |

Note: *significant at $p < 0.05$; cOR = Crude odd ratio; 1.00 as reference

Table 4. Final model logistic regression of determinants of energy intake from UPFs in adolescent girls in Tasikmalaya City

| Variable | *p*-Value | aOR | 95% CI |
|---|---|---|---|
| Screen time | 0.001 | 2.424 | 1.420-4.140 |
| Breakfast habits | 0.094 | 1.466 | 0.936-2.295 |
| Main meals | 0.019 | 1.996 | 1.121-3.554 |
| Family status | 0.006 | 2.336 | 1.275-4.282 |

Note: aOR = Adjusted odds ratio

role in shaping adolescents' eating patterns through various mechanisms, including serving as role models (Pitt and Curran, 2023), influencing the home food environment, and establishing mealtime rules (Souza et al., 2023).

In this study, participants who had fewer than 3 main meals per day had higher energy intake from UPFs than from non-UPFs. There has been a decline in the habit of having 3 main meals a day, particularly among women, with a concurrent increase in UPFs consumption (Ribeiro et al., 2023). Studies show that reducing meal frequency (e.g., consuming fewer than 3 meals per day) can lead to a significant increase in appetite and decreased satiety. This suggests that fewer meals can make a person feel hungrier and more susceptible to food cravings. This aligns with findings that reducing meal frequency can increase food cravings due to the body's response to perceived nutrient deficiencies (Meule, 2020).

Food cravings are closely related to high-calorie food consumption. Individuals with high food cravings (HC) are more likely to think about and consume high-calorie snacks compared to those with low food cravings (LC) (Devoto et al., 2025). Furthermore, high-calorie food cravings predict their consumption, which contributes to unhealthy eating habits and potential weight gain (Werthmann et al., 2023). In general, people who eat less than 3 main meals per day will miss one of the standard meal times, namely breakfast, lunch, or dinner (Sun et al., 2023). Adolescents who skipped one of the main meals, such as breakfast, experienced an increase in average energy intake from UPFs, along with increases in BMI-for-age z-scores (BAZ) and body fat percentage (Cândido et al., 2024). Skipping breakfast has been shown to increase hunger and appetite throughout the day, which can lead to overeating at the next meal, such as lunch (Fatima et al., 2020). Skipping meals is a driving factor in unhealthy eating habits, including increased consumption of UPFs among adolescents. This is because UPFs are often more accessible and appealing to adolescents seeking quick, easy meal options (Saleh and Maala, 2021). In this study, participants who ate fewer than 3 main meals per day had higher energy consumption from UPFs than from non-UPFs.

Participants of this study were junior high school students, with study time at school for 8 hours (starting from 7.00 AM to 2.00 PM) (Ministry of Education and Culture of Indonesia, 2017). Therefore, students are still at school during lunchtime. Students who eat breakfast will feel hungry around 12 noon. This is because the average gastric emptying time after eating is about 5.8±0.8 hours, with a significant decrease in gastric contents observed around 4 hours after eating (Cho et al., 2019). To satisfy their hunger, they will buy food provided by the school. In Indonesia, school canteens often provide unhealthy food and drinks, including fried snacks and sweet beverages (Rachmadewi et al., 2021), with low nutritional quality (Sijangga et al., 2026). In addition, various types of food and drinks in the UPFs category are widely sold in school canteens in Indonesia (Ginting et al.,

2024). UPF is often offered in school canteens, including sausages, packaged snacks, sweet drinks, and candy. For example, in Brazilian schools, the presence of canteens is associated with a higher frequency of consumption of these foods among adolescents (Leite et al., 2021). School canteens often sell UPFs, which are industrially formulated products that are typically high in sugars, fats, and salts, and low in essential nutrients. These foods are designed to be convenient, tasty, and appealing, making them popular among students (Leffa, 2023).

## CONCLUSIONS

This study revealed that in more than one-fifth of the participants, energy intake from UPFs was more dominant than that from non-UPFs. A socioecological approach was used to describe the determinants of energy intake from UPFs. Individual factors, including screen time of > 4 hours per day and consuming main meals < 3 times a day, are risk factors for increased energy intake from UPFs. Meanwhile, living with an incomplete family is an interpersonal factor that increases energy intake from UPFs. Parents must monitor their children's nutritional intake, especially by limiting UPF consumption. Policies regarding healthy snacks sold in school canteens also need to be implemented.

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