

SOCIAL AND BEHAVIOURAL FACTORS ASSOCIATED WITH ULTRA-PROCESSED FOOD CONSUMPTION AMONG ADOLESCENTS IN SEMARANG CITY

Faktor Sosial dan Perilaku yang Berhubungan dengan Konsumsi Makanan Ultra-Proses pada Remaja di Kota Semarang

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Article History: Received: 20 October 2026 Revised: 21 October 2026 Accepted: 21 October 2026 Publish: 21 October 2026	ABSTRACT Background: Ultra-Processed Food (UPF) consumption among adolescents is increasing and is associated with the risk of overweight and non-communicable diseases. Purpose: This study aimed to analyse the association of sex, parents income, advertising exposure, and eating behaviour with UPF consumption among junior high school students in Semarang City, Indonesia. Methods: A cross-sectional study was conducted in three junior high schools in Semarang City in 2026 among 297 students selected through purposive sampling. Data were collected using questionnaires, including a semi-quantitative food frequency questionnaire. Data were analysed using univariate analysis, the chi-square test, and binary logistic regression. Results: A total of 62.63% of students had high UPF consumption. Advertising exposure ($p<0.001$) and eating behaviour ($p<0.001$) were significantly associated with UPF consumption, whereas sex ($p=0.778$) and parents income ($p=0.315$) were not. Advertising exposure was the most dominant factor (OR=4.40; 95% CI: 2.58–7.49), followed by negative eating behaviour (OR=3.88; 95% CI: 2.28–6.60). Conclusion: Advertising exposure and eating behaviour are the main determinants of UPF consumption among junior high school students. School-based media literacy and nutrition education, together with stronger regulation of food marketing to children and adolescents, should be prioritised.
Keywords: Ultra-processed food; adolescents; advertising exposure; eating behaviour; parents income; Kata Kunci: Makanan Ultra-Proses; remaja; paparan iklan; perilaku makan; pendapatan keluarga;	

	ABSTRAK Latar Belakang: Konsumsi Makanan Ultra-Proses pada remaja terus meningkat dan berkaitan dengan risiko gizi lebih serta penyakit tidak menular. Tujuan: Penelitian ini bertujuan menganalisis hubungan jenis kelamin, pendapatan keluarga, paparan iklan, dan perilaku makan dengan konsumsi UPF pada siswa Sekolah Menengah Pertama (SMP) di Kota Semarang. Metode: Penelitian menggunakan desain cross-sectional di tiga SMP di Kota Semarang pada tahun 2026 dengan sampel 297 siswa yang dipilih secara purposive sampling. Data dikumpulkan menggunakan kuesioner, termasuk food frequency questionnaire semikuantitatif. Data dianalisis secara univariat, bivariat dengan uji chi-square, dan multivariat dengan regresi logistik biner. Hasil: Sebanyak 62,63% siswa memiliki konsumsi UPF yang tinggi. Paparan iklan ($p<0,001$) dan perilaku makan ($p<0,001$) berhubungan bermakna dengan konsumsi UPF, sedangkan jenis kelamin ($p=0,778$) dan pendapatan keluarga ($p=0,315$) tidak berhubungan. Paparan iklan merupakan faktor paling dominan ($OR=4,40$; 95% CI: 2,58–7,49), diikuti oleh perilaku makan ($OR=3,88$; 95% CI: 2,28–6,60). Kesimpulan: Paparan iklan dan perilaku makan merupakan determinan utama konsumsi UPF pada remaja SMP. Intervensi literasi media dan pendidikan gizi di sekolah, disertai penguatan regulasi pemasaran pangan kepada anak dan remaja, perlu diprioritaskan. ©2026 by author. Published by Faculty of Public Health, Hasanuddin University. This is an open access article under CC-BY-SA license (https://creativecommons.org/licenses/by-sa/4.0/)
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INTRODUCTION

Ultra-Processed Foods (UPF) are defined in the NOVA classification as industrial formulations made mostly or entirely from substances extracted or derived from foods, together with additives such as flavors, colors, emulsifiers, and sweeteners, with little or no whole food. Examples include packaged sugar-sweetened beverages, packaged snacks, instant noodles, sausages, nuggets, and various biscuits and confectionery.¹ These products are designed to be convenient, durable, hyper-palatable, and relatively inexpensive, which enables them to readily displace fresh and minimally processed foods in daily diets.¹

Epidemiological evidence indicates that UPF consumption is associated with a range of adverse health outcomes. An umbrella review of 45 meta-analyses found that greater UPF exposure was associated with 32 health outcomes, including cardiovascular mortality, common mental disorders, obesity, and type 2 diabetes mellitus.² Among children and adolescents, a multicounty study showed that the higher the contribution of UPF to total energy intake, the poorer the obesity-related dietary nutrient profile, characterised by high energy density, free sugars, and saturated fat, and low fibre.³

Globally, UPF sales remain highest in high-income countries, but their growth is now fastest in Asia, the Middle East, and Africa, driven by food system transformation and the expansion of transnational food corporations.⁴ In the United States, the contribution of UPF to total energy intake among children and adolescents aged 2–19 years increased from 61.4% in 1999–2000 to 67.0% in 2017–2018.⁵ As a middle-income country with a large adolescent population, Indonesia is undergoing a similar nutrition transition. The prevalence of overweight among adolescents aged 13–15 years increased from 11.2% in 2018 to 12.1% in 2023.⁶ Several Indonesian studies have also reported a high prevalence of habitual UPF consumption among adolescents, dominated by processed frozen foods, packaged sugar-sweetened beverages, packaged snacks, and instant noodles.^{7,8} Adolescents with high UPF intake have 2.87 times higher odds of obesity than those with low intake.⁹

Adolescent eating behaviour is shaped by the interaction of individual, social, and environmental factors. Individual factors include taste preferences, breakfast habits, snacking frequency, and eating while using screens, whereas environmental factors include food availability in and around schools, peer influence, and mass media.¹⁰ Junior high school students are in a transitional stage in which autonomy in food choice increases while parental supervision decreases. Under these conditions, unhealthy eating behaviours such as skipping breakfast and frequently buying packaged snacks may increase UPF consumption.¹⁰

Food marketing is an environmental factor that continues to receive growing attention. A meta-analysis of 80 studies showed that exposure to food and non-alcoholic beverage marketing among children and adolescents was associated with increased intake, choice, preference, and purchase requests for the advertised products.¹¹ Another meta-analysis among pre-adolescents and adolescents also found a significant effect of media food marketing on unhealthy eating outcomes.¹² Such marketing is increasingly shifting to social media through influencer content, advergames, and entertainment content that is difficult to recognise as advertising, and most of the products promoted fall into the UPF category.¹³

Sociodemographic factors such as sex and parents income are also thought to play a role, but the evidence remains inconsistent. Parents income relates to household purchasing power and the amount of adolescents' pocket money, which may broaden access to packaged food products. Among Brazilian adolescents, consumption patterns of specific UPF products differed by sex and socioeconomic indicators.¹⁴ In Bangladesh, boys were more likely to consume UPF and deep-fried foods, whereas adolescents from the wealthiest households consumed more fast food.¹⁵ A study of junior high school students in Tangerang Regency, in contrast, found no direct effect of sex or socioeconomic status on UPF consumption.⁶

These inconsistent findings, together with the limited number of Indonesian studies that have examined advertising exposure, eating behaviour, and sociodemographic factors simultaneously in a single model, indicate the need for further investigation. Semarang City, a provincial capital with an urban food environment dense with modern retail outlets and high digital media penetration, is a relevant

setting for such a study. This study aimed to analyse the association of sex, parents income, advertising exposure, and eating behaviour with UPF consumption, and to identify the most dominant factor among junior high school students in Semarang City.

METHODS

This was a quantitative observational analytic study with a cross-sectional design, conducted in three junior high schools in Semarang City, Central Java, Indonesia, representing the central and peripheral areas of the city. The population comprised all students in grades VII–IX at the selected schools. A total of 297 students were selected using purposive sampling. The inclusion criteria were being an actively enrolled student, being present on the day of data collection, being willing to participate, and having parental or guardian consent. Students on a medically indicated special diet and those who did not complete the questionnaire were excluded. The dependent variable was UPF consumption, measured using a semi-quantitative Food Frequency Questionnaire (FFQ) listing food products grouped according to the NOVA classification,¹ and categorised as high or low based on the median consumption score/frequency. The independent variables were (1) sex (male/female); (2) parents income categorised as high or low based on the Semarang City minimum wage; (3) advertising exposure, defined as the frequency and duration of students' exposure to food and beverage advertisements on television and social media (e.g., YouTube, Instagram, and TikTok), categorised as high or low based on the median score; and (4) eating behaviour, covering snacking habits, circumstances that trigger the desire to eat, food cravings, and eating under stress, categorised as positive or negative based on the median score. The questionnaire had been tested for validity and reliability.

Data were collected through self-administered questionnaires completed in the classroom with the assistance of enumerators. Data were analysed using SPSS version 31. Univariate analysis was performed to describe the frequency distribution of each variable. Bivariate analysis used the chi-square test to examine the association between each independent variable and UPF consumption. Multivariate analysis used binary logistic regression with the enter method; all independent variables were entered into the model on theoretical grounds, so that sex and parents income served as control variables.¹⁶ Results are presented as odds ratios (OR) with 95% confidence intervals (95% CI). The statistically significant variable with the largest Wald value and OR was considered the most dominant factor. The significance level was set at $\alpha = 0.05$.

Ethical approval was obtained from the Ethics Committee of the Faculty of Medicine, Universitas Negeri Semarang under ethical clearance number 250/KEPK/FK/KLE/2025. All

respondents gave their assent, and their parents or guardians provided written informed consent before data collection.

RESULTS

Of the 297 students analyzed, the majority (62.63%) had high UPF consumption. Categorical use NOVA classification,¹ and categorized as high or low based on the median consumption score/frequency. Female respondents (54.21%) slightly outnumbered male respondents (45.79%). Most respondents came from low-income families (60.27%). More than half of the respondents had high advertising exposure (58.25%) and negative eating behavior (57.58%) (Table 1).

For sex, the proportion of high UPF consumption among female students (63.35%) was almost identical to that among male students (61.76%), a difference of only 1.59 percentage points. The proportions of low UPF consumption were likewise balanced, at 36.65% among females and 38.24% among males. The chi-square test showed no significant association between sex and UPF consumption ($p = 0.778$), indicating that high UPF consumption occurred evenly in both sexes.

For parents income, students from high-income families had a slightly higher proportion of high UPF consumption (66.10%) than those from low-income families (60.34%). Although greater purchasing power tended to be accompanied by higher UPF consumption, the difference of 5.77 percentage points was not statistically significant ($p = 0.315$). High UPF consumption was therefore not confined to students from better-off families; more than half of the students from low-income families were also in the high consumption category.

In contrast to these two variables, advertising exposure showed a marked difference in proportions. As many as 77.46% of students with high advertising exposure had high UPF consumption, compared with only 41.94% of those with low exposure. This difference of 35.52 percentage points means that nearly eight in ten students who were frequently exposed to food advertising were high UPF consumers, whereas most students with low exposure (58.06%) had low UPF consumption. The association between advertising exposure and UPF consumption was highly significant ($p < 0.001$).

A similar pattern was observed for eating behaviour. The proportion of high UPF consumption among students with negative eating behaviour was 76.61%, much higher than among those with positive eating behaviour (43.65%), a difference of 32.96 percentage points. Among students with positive eating behaviour, more than half (56.35%) had low UPF consumption. The chi-square test showed a significant association between eating behaviour and UPF consumption ($p < 0.001$). Of the four variables tested, only advertising exposure and eating behaviour were significantly associated with UPF consumption in the bivariate analysis (Table 2).

Table 1
Distribution of Respondent Characteristics and UPF Consumption among Junior High School Students in Semarang City

Variable	Frequency (n)	Percentage (%)
UPF Consumption		
High	186	62.63
Low	111	37.37
Sex		
Male	136	45.79
Female	161	54.21
Parents Income		
High	118	39.73
Low	179	60.27
Advertising Exposure		
High	173	58.25
Low	124	41.75
Eating Behaviour		
Negative	171	57.58
Positive	126	42.42
Total	297	100

Source: Primary Data, 2026

Table 2
Association between Independent Variables and UPF Consumption among Junior High School Students in Semarang City

Variable	High UPF		Low UPF		Total		p-value
	n	%	n	%	n	%	
Sex							
Male	84	61.76	52	38.24	136	100	0.778
Female	102	63.35	59	36.65	161	100	
Parents Income							
High	78	66.10	40	33.90	118	100	0.315
Low	108	60.34	71	39.66	179	100	
Advertising Exposure							
High	134	77.46	39	22.54	173	100	<0.001*
Low	52	41.94	72	58.06	124	100	
Eating Behaviour							
Negative	131	76.61	40	23.39	171	100	<0.001*
Positive	55	43.65	71	56.35	126	100	
Total	186	62.63	111	37.37	297	100	

*Significant at $\alpha = 0.05$ (chi-square test)

Source: Primary Data, 2026

Multivariate analysis was performed to determine the effect of each independent variable on UPF consumption after controlling for the other variables. After adjustment, sex remained unassociated with UPF consumption ($p = 0.862$). Parents income was likewise not associated ($p = 0.306$), indicating no significant difference in the odds of high UPF consumption between income categories.

Advertising exposure remained significantly associated with UPF consumption after controlling for sex, parents income, and eating behaviour ($p < 0.001$). Students with high advertising exposure had 4.40 times higher odds of high UPF consumption than those with low exposure. The lower bound of the confidence interval (2.58) indicates that, in the population, these odds are at least 2.5 times higher.

Eating behaviour also remained significant in the multivariate model ($p < 0.001$). Students with negative eating behaviour had 3.88 times higher odds of high UPF consumption than those with positive

eating behaviour. These results indicate that the associations of both variables with UPF consumption are independent and are not substantially influenced by the other variables in the model. Based on the Wald value and OR, advertising exposure was the most dominant factor associated with UPF consumption (Wald = 29.65; OR = 4.40), followed by eating behaviour (Wald = 25.01; OR = 3.88) (Table 3).

Table 3

Logistic Regression Analysis of Factors Associated with UPF Consumption among Junior High School Students in Semarang City

Variable	B	SE	Wald	p	OR	95% CI
Sex (male)	-0.047	0.273	0.03	0.862	0.95	0.56–1.63
Parents Income (high)	0.285	0.279	1.05	0.306	1.33	0.77–2.30
Advertising Exposure (high)	1.481	0.272	29.65	<0.001	4.40	2.58–7.49
Eating Behaviour (negative)	1.356	0.271	25.01	<0.001	3.88	2.28–6.60
Constant	-1.095	0.296	13.71	<0.001	0.33	–

B = Regression Coefficient; SE = Standard Error; OR = Odds Ratio; CI = Confidence Interval.

Reference categories: female, low parents income, low advertising exposure, and positive eating behaviour.

Source: Primary Data, 2026

DISCUSSION

This study found that more than half of junior high school students in Semarang City (62.63%) had high UPF consumption. This figure is consistent with the reported 67.6% prevalence of habitual UPF consumption among Indonesian adolescents,⁷ and with findings among vocational high school students in Sukabumi, where 67.8% of respondents consumed UPF at least once a week.⁸ High UPF consumption among adolescents warrants attention because UPF contributes to an obesogenic dietary profile,³ and is associated with an increased risk of obesity among Indonesian adolescents.⁹

Sex and UPF Consumption

Sex was not associated with UPF consumption in either the bivariate or the multivariate analysis. This finding is consistent with a study of junior high school students in Tangerang Regency that found no direct effect of sex on UPF consumption.⁶ It differs, however, from a study of rural adolescents in Bangladesh showing that boys were more likely than girls to consume all UPF groups and deep-fried foods.¹⁵ A Brazilian study showed that sex differences were more evident for specific product types than for total consumption: girls more frequently consumed biscuits, bread, soft drinks, and flavoured yoghurt, whereas boys more frequently consumed margarine and industrial desserts.¹⁴

The absence of a sex difference in this study is likely related to the homogeneous food environment faced by male and female students. They attend the same schools, are exposed to the same canteens and vendors around the schools, and use similar social media platforms. In urban areas, UPF is widely available and no longer tied to particular gender roles, so exposure to and opportunities for consuming it are relatively equal. This study also measured UPF consumption in aggregate, so differences in product choices between boys and girls, such as those reported in Brazil,¹⁴ could not be identified.

Parents Income and UPF Consumption

Parents Income was also not significantly associated with UPF consumption, although the proportion of high UPF consumption was slightly higher in high-income families (66.10%) than in low-income families (60.34%). This finding is consistent with the Tangerang study, which found no effect of socioeconomic status on UPF consumption,⁶ and with a study in Jambi showing that socioeconomic status was not associated with obesity risk, whereas UPF intake remained an independent risk factor.⁹ A study in Bangladesh, by contrast, found that adolescents from the wealthiest households had 1.55 times higher odds of consuming fast food.¹⁵

Theoretically, parents income determines household purchasing power and the amount of adolescents' pocket money, and may thus broaden access to packaged food products. One characteristic of UPF, however, is its relatively low price and its availability in small, affordable packages accessible to almost all social groups.^{1,4} As a result, purchasing power is no longer a major barrier to UPF consumption. Products such as instant noodles, packaged sugar-sweetened beverages, and packaged snacks can be bought with small daily pocket money by students from both high- and low-income families. Parents income also does not necessarily reflect the amount of pocket money actually managed by students, which makes its relationship with food purchasing behaviour indirect.

Advertising Exposure and UPF Consumption

Advertising exposure was the most dominant factor associated with UPF consumption in this study. Students with high advertising exposure had 4.40 times higher odds of high UPF consumption. This finding is in line with the meta-analysis by Boyland *et al.*, which showed that food and beverage marketing was associated with increased intake (standardised mean difference [SMD] = 0.25) and choice of the advertised products (OR = 1.77) among children and adolescents.¹¹ The meta-analysis by Qutteina *et al.* likewise reported a significant effect of media food marketing on unhealthy eating outcomes among adolescents.¹²

Advertising operates through several mechanisms: it increases brand awareness, shapes positive attitudes and preferences toward products, and triggers the desire to purchase and consume them.¹¹ Junior high school students are a vulnerable target because of their intensive use of social media, while their ability to recognize the persuasive intent of advertising is not yet fully developed. A review of social media as a commercial determinant of health showed that most products promoted to children and adolescents on social media are UPF high in fat, sugar, and salt. Such promotion is often delivered covertly through influencers, advergames, and entertainment content, so that it is not recognised as advertising.¹³ The same review also showed that voluntary marketing regulation has not been effective in protecting children and adolescents.¹³ The magnitude of the OR in this study underlines that the digital food environment should be a target of public health interventions.

Eating Behaviors and UPF Consumption

Eating behavior was the second factor significantly associated with UPF consumption. Students with negative eating behavior had 3.88 times higher odds of high UPF consumption. Negative eating

behaviour, covering snacking habits, circumstances that trigger the desire to eat, food cravings, and eating under stress, trigger the desire to eat, food cravings, and eating under stress, categorised as positive or negative based on the median score. According to the framework of Story *et al.*, adolescent eating behavior is influenced by individual factors (taste preferences, hunger, convenience, and time), the social environment (parents and peers), the physical environment (food availability in and around schools), and the macro environment (media and marketing).¹⁰

These results also suggest a link between advertising exposure and eating behavior. Both variables remained independently significant in the multivariate model, yet advertising can shape eating norms and habits that are subsequently expressed in daily behaviour.^{11,13} Efforts to reduce UPF consumption among adolescents should therefore address both aspects simultaneously, namely by improving eating habits and reducing the influence of food marketing. An intervention study among Indonesian adolescents also showed that video-based nutrition education alone was insufficient to change the frequency of UPF consumption,⁷ which underscores the need for a multicomponent approach that includes changes to the school food environment and parents involvement.

CONCLUSION AND RECOMMENDATIONS

Most junior high school students in Semarang City (62.63%) had high UPF consumption. Advertising exposure and eating behaviour were significantly associated with UPF consumption, whereas sex and parents income were not. Advertising exposure was the most dominant factor, with students with high exposure having 4.40 times higher odds of high UPF consumption, followed by negative eating behaviour (OR = 3.88). Schools are recommended to integrate nutrition education and media literacy through the School Health Programme/*Usaha Kesehatan Sekolah* (UKS) and to provide healthy canteens; community health centres (*puskesmas*) should strengthen the promotion of healthy eating behaviour among adolescents; parents should accompany their children's digital media use and encourage regular breakfast; the government should tighten the regulation of marketing of foods high in sugar, salt, and fat to children and adolescents, including on social media; and future studies should use longitudinal designs with probability sampling.

AUTHOR CONTRIBUTIONS

SAN conceptualised and designed the study and supervised data collection; OWKH contributed to the study design and data analysis; ILM contributed to data analysis and drafted the manuscript. All authors have read and approved the final version of the manuscript. SAN = Sri Achadi Nugraheni; OWKH = Oktia Woro Kasmini Handayani; ILM = Ida Leida Maria.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

STATEMENT ON THE USE OF AI

Generative AI (Claude, Anthropic) was used to assist with the English translation and language editing of the manuscript. AI was not used for data collection, data analysis, or interpretation of the results. The authors reviewed and edited all content and take full responsibility for the final manuscript.

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DATA AVAILABILITY

The data supporting the findings of this study are available from the corresponding author upon reasonable request.

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