Helda Khusun - Association between consumption of ultra-processed foods and beverages with nutritional status of private senior high school students in Pontianak, West Kalimantan, Indonesia

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ORIGINAL PAPER

Association between consumption of ultra-processed foods and beverages with nutritional status of private senior high school students in Pontianak, West Kalimantan, Indonesia

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Abstract

Background: Many low- and middle-income countries are now facing the "double burden" of malnutrition, one of them is overweight/obesity. Over 340 million children and adolescent were overweight and obesity in 2016. Obesity among adolescents may increase, in part due to changes in the food system which now offers a wide range of ultra-processed foods (UPF) that minimize preparation time. Indonesia has also a large and rapidly growing market for unhealthy drinks, which are sold in various places including schools and hospitals.

Objective: This study aimed to investigate the association of UPF and beverages consumption and other related factors with nutritional status of senior high school students in Pontianak, West Kalimantan, Indonesia.

Methods: This cross-sectional study conducted in Pontianak investigated the association between UPF consumption and nutritional status of SHS students. Data collection was conducted at Imanuel and Petrus SHS Pontianak in June 2023, involving 273 students from grades 10th and 11th. Weight and height measurement was obtained for calculating the BMI for age Z-scores, while UPF and beverages consumption was obtained by FFQ. Structured questionnaire, 24-hours recall, and IPAQ-S were used for assessing sociodemographic status, Total Energy Intake and Physical Activity Level. Data analysis used SPSS version 26.

Results: The result found 40.3% of students were overweight-obesity; 51.6% consumed excessive UPF and beverages. It showed an inverse association between UPF consumption and nutritional status. The study identifies UPF and beverages consumption, gender, mother's education level, and family income as factors associated with nutritional status among adolescents.

Conclusion: The consumption of ultra-processed Foods was high, with the highest UPF intake came from snacks and sweets (22.4%). There was inverse association between UPF and beverages consumption with nutritional status. There was also significant association between UPF and beverages, gender, mother education level and family income with nutritional status.

Keywords: adolescent students, nutritional status, socio-demographic factors, sugar-sweetened beverages, ultra-processed foods

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Introduction

Many low- and middle-income countries are now facing the "double burden" of malnutrition, one of them is overweight/obesity, particularly in urban settings. Over 340 million children and adolescents aged 5-19 were overweight and obesity in 2016.[1]

Obesity amongst adolescents is increasing due to changes in the food system, which now offers a wide range of ultra-processed foods (UPF) that minimize preparation time.[2] The term "ultra-processed food" was developed in a proposed new classification of foods known as the NOVA classification. These types of foods are not considered "real foods" and are created through a process that transforms food substances into ready-to-consume hyper-palatable products using additives. The NOVA classification involves 4 food categories, defined thus: group 1, unprocessed or minimally processed foods; group 2, processed culinary ingredients; group 3, processed foods; group 4, ultra-processed foods. The definition of ultra-processed food itself is industrial formulations typically with 5 or more and usually many ingredients. Besides salt, sugar, oils, and fats, ingredients of ultra-processed foods include food substances not commonly used in culinary preparations, such as hydrolysed protein, modified starches, and hydrogenated or interest erified oils, and additives whose purpose is to imitate sensorial qualities of unprocessed or minimally processed foods and their culinary preparations or to disguise undesirable qualities of the final product, such as colorants, flavourings, non-sugar sweeteners, emulsifiers, humectants, sequestrants, and firming, bulking, de-foaming, anticaking, and glazing agents.[31] Ultra-processing makes these products highly profitable but also unhealthy. The classification group 4 of NOVA includes sugar-sweetened beverages (SSB) and fast food, which are frequently consumed by adolescents.[3]

Adolescents, who have independence in food choices, tend to eat out frequently and have busy schedules. They are the age group that is most exposed to UPF, which have high sugar, salt, and fat content, but low fiber and protein content.[4,5]

Indonesia has also a large and rapidly growing market for sugar-sweetened beverages, which are sold in various places including schools and hospitals.[6] Low physical activity (PA) in youth is associated with a range of adverse health outcomes, however, relatively few adolescents meet physical activity guidelines. In addition, there is emerging evidence that sedentary behaviours in adolescence are negatively associated with adolescent health outcomes such as obesity and metabolic risk although the evidence for this using objective measures are inconsistent.[32]

Unfortunately, there are still lack of study that examine UPF consumption, especially those that separate food and beverages among senior high school students.

Based on the problems above, this study aimed to investigate the association between ultra-processed foods and beverages consumption and its association with nutritional status among senior high school students.

Methods

This study was a cross-sectional investigation that assessed the association between consumption of Ultra-Processed Foods and beverages with nutritional status among senior high school students conducted in Pontianak, West Kalimantan.

This study obtained the ethical clearance from Ethical Committee Faculty of Medicine Universitas Indonesia with approval number: KET-786/UN2.F1/ETIK/PPM.00.02/2023.

The population of this study was the students at private senior high schools in Pontianak. The criteria of subjects were aged 15-17 years old and registered as a private SHS in South Pontianak in 2023, with the exclusion does not present at the time of data collection, sick at the time of data collection, on a diet (weight loss program) or consuming drinks or slimming drugs, and an athlete.

Based on data from the Ministry of Education (*Kemendikbud*) 2023, there are two private senior high schools that have the potential to be included

in this research. Schools' selection was based on the largest number of students.

Figure 1 shows the sampling procedure of this study. The sampling method used was simple random sampling. The sample calculation based on estimating two proportions with total calculation was 262, and to prevent the sample loss, so the total sample requires an additional 10% of sample, so the total sample was 288

respondents. The calculation comes up based on study from Qian Gan found that the prevalence of obesity that consume low sugar-sweetened beverages (<1 time/week) was 13.7%, and the prevalence of obesity that consume high sugar-sweetened beverages (1-<5 time/week) was 17.1%.[33]
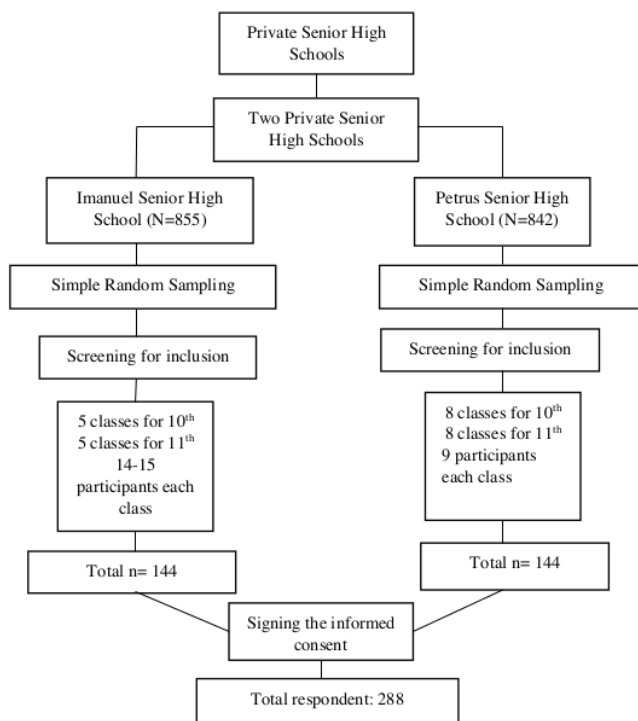
Figure 1. Sampling procedure

The tools used in this study was anthropometric measurement for body weight measurement and height measurement, and questionnaires including General Questionnaire, 24-hours recall, FFQ, and IPAQ-S. Weight measurement was assess using body weighing scale of SAGA with the capacity 3 - 180 kg, and nearest scale of 0.1 kg. Before do the measurement, the tools had to be calibrated first to ensure the accuracy. This study used Multifungsi® as the tools to measure the height of respondents. This tool has the maximum measurement of 196.0 cm and an accuracy of 0.1 cm. Before measurements, all respondents were requested to remove any items they had on their bodies (e.g., jewellery, wallet, handphone, coins, watch, keys, accessories) that could potentially affect the accuracy of the measurements.

The respondents were asked to fill the general questionnaire about socio-demographic characteristics including name, date of birth, age, sex, school grade, body weight, height, nutritional status, parent's information (occupation, family income, level of education); and International Physical Activity Questionnaire Short Form (IPAQ-S) to measure the level of physical activity of students. The IPAQ-S measured physical activity over the last 7 days, covering four main physical activity domains: vigorous activity, moderate activity, and walking or low activity. To obtain the physical activity level, frequency and duration for each type of activity were calculated into Metabolic Equivalent of Task (MET). The duration of each activity, including walking, moderate-intensity activity, and vigorous-intensity activity, was computed to estimate the total amount of time spent in physical activity per week (MET-min/week).[34]

FFQ foods list will be list according to NOVA Classification group 4, based on the prior study conducted in Indonesia, and developed by market survey near schools' samples, and canteen in the schools' area survey. Respondents will be asked to their consumption in the last-7days based on the list of FFQ. Food frequencies questionnaire (FFQ) is to collecting frequency list of foods that consumed by students, to obtain a qualitative description of food consumption patterns. In this study, the list of food and beverages based on NOVA classification were separated. The categorization of FFQ were categorized into two categories, normal (< median of total score), and excessive (≥ median of total score).

Respondents were asked for 24-hours recall form to collecting data of energy intake that consumed by students, to obtain the quantitative of food intake. In this study, the 24-hours recall form aims to identify the energy intake of respondent in 2 non-consecutive days (representative the weekday and weekend intake). All respondents were asked to mention all foods and beverages that they consumed in the last 24 hours from waking up in the morning until the night before going to bed. The enumerators repeated all the foods and beverages consumption to check the completeness of the data. Data from 24-hours recall was calculated in Nutrisurvey 2004 to get the amount of the energy intake of the respondents. The categorization of TEI were categorized into three categories, namely <80% RDA, 80-100% RDA, and >100% RDA.

In this study, physical activity will be assessed using International Physical Activity Questionnaire-Short Form (IPAQ-S) and calculated as metabolic equivalent (MET). For calculating the MET of respondent, first, all duration of vigorous, moderate, and light/walking activities in minute. Some activities will be including in vigorous, moderate, and light/walking level. For vigorous such as lifting heavy weight, digging, aerobics, fast cycling, soccer, futsal, basketball, jumping rope, swimming, tennis, badminton. For moderate level such as lifting light weight, cycling at normal speeds, household chores such as sweeping, mopping, jogging (excluding walking). Light/walking level such as work at home, walk to travel from place to place, and other walk that you have done solely for recreation, sports, exercise, or leisure. Physical activity level was categorized into three categories, low (< 600 MET-minutes/week), moderate (600 – 2999 MET-minutes/week), high (≥ 3000 MET-minutes/week).[34]

The enumerators of this study have academic qualification was having complete a diploma or

bachelor from nutrition science, or students in final year majoring nutrition. Enumerators will be trained to increase their skills in the data collection during this study. All the questionnaires pretested to evaluate the flow of data collection, checking the understanding of the participants to answer the questionnaires, and ensure the validity of the questionnaires.

Additionally, the parent's education level was categorized into three categories, namely primary, secondary, and vocational. For parent's occupation category was categorized into three categories namely government, non-government, and unemployed. The family income was classified into two categorized; low (<IDR. 2.750.644,55, -) and high (≥IDR. 2.750.644,55, -). The nutritional status calculated from weight (kg) divided by height squared (m2): kg/(m)2, and then the result of BMI will be plotted in the BMI-for-age percentiles grow chart from CDC based on age (years) and BMI. The result will be categorized as 4 categories. In further analysis, thinness and normal will be combined as non-obesity (-3 SD - +1 SD), and overweight and obesity will be combined as obesity (> +1 SD - > +2 SD).[35]

If all data was assured to be complete and the questionnaires were already fulfilled, the data was inputted in Microsoft Excel 2016 MSO. After that, all the data was processed using licensed IBM SPSS Version 26.0 for univariate, bivariate, and multivariate analysis. Chi-square test was used to determine whether there is a significant association between UPF and beverages and other confounding factors with nutritional status. Logistic regression was used for modelling the probability of a binary outcome based on the predictor variables. Bivariate analysis was conducted between nutritional status and socio-demographic status; nutritional status and total energy intake; nutritional status and UPF and beverages consumption; and nutritional status and physical activity level. Factors which showed p-value less than 0.05 were considered as potential factors and included in multivariate analysis. In this study, multivariate analysis was conducted to analyse the association between nutritional status and UPF consumption with several potential factors. The association between nutritional status and socio-demographic status was conducted to find potential factors that might influence the association between nutritional status and UPF consumption. Socio-demographic status consists of age, gender, father and mother educational level, father and mother occupation, family income, total energy intake and physical activity level.

Results

During data collection, there were 288 students expected to participate. However, there were 4 students who did not come in the day of data collection, and 11 students did not complete the dietary data. Therefore, 273 students included as subjects for analysis.

Table 1 shows that female and male students recruited in this study were comparable. Based on the educational level of the respondents' parents, most of father and mother of respondents had graduated from senior high school. Most of respondent's fathers were working in non-government area, while most of the mothers were housewives. More than 85% of the respondents had high family income i.e., above the regional minimum wage for Pontianak. Total energy intake of respondents was compared to the recommended dietary allowance (RDA) of Indonesia for age 15-18 years old in 2019 which was 2640 kcal/day for males and 2100 kcal for females. **Table 1** showed that 53.1% of the respondents had total energy intake more than 100% of RDA. Level of physical activity of the respondents in this study shows that 48.0% of them had moderate level.

In this study, Ultra-Processed Foods will be categorized into three categories; UPF and beverages were described as all foods and beverages that included in classification of NOVA classification group 4, UPF were described as all foods only, and Sugar-Sweetened Beverages were described as beverages only. **Table 2** shows that the median frequency of UPF and beverages consumption was 50 times consumed UPF in the

last 7-days, median of UPF for foods only was 35 times in the last 7-days, and median of SSB was 12 times consumed SSB in the last 7-days. The highest consumption of UPF and beverages of respondents of this study was 143 times of consumed UPF and beverages in the last 7-days.

Furthermore, **Table 2** showed that more than half of the respondents has excessive

consumption of Ultra-Processed Foods and beverages frequency. that 50.9% of the respondents has excessive of Ultra-Processed Foods consumption frequency. showed that 50.5% of the respondents has excessive of Ultra-Processed Foods consumption frequency.

Table 1. Characteristic of respondents based on sociodemographic (n=273)

Sociodemographic variables	n (%)
Age (year)	
15	31 (11.4)
16	154 (56.4)
17	88 (32.2)
Gender	
Male	135 (49.5)
Female	138 (50.5)
Father's educational level	
Elementary School	20 (7.3)
Middle School	32 (11.7)
High School	119 (43.6)
Vocational Education	102 (37.4)
Mother's educational level	
Elementary School	5 (1.8)
Middle School	84 (30.8)
High School	101 (37.0)
Vocational Education	83 (30.4)
Father's Occupation	
Government	29 (10.6)
Non-Government	232 (85)
Unemployed	12 (4.4)
Mother's Occupation	
Government	16 (5.9)
Non-Government	87 (31.9)
Unemployed	170 (62.3)
Family Income	
Low	40 (14.7)
High	233 (85.3)
Total Energy Intake	
<80% RDA	67 (24.5)
80-100% RDA	61 (22.3)
>100% RDA	145 (53.1)
Physical Activity Level	
Low	83 (30.4)
Moderate	131 (48.0)
High	59 (21.6)

[1]Educational level: Elementary School (graduated from Elementary School), Middle School (Junior High School), High School (Senior High School), Vocational Education (minimal Diploma level)
[2]Family Income: According to the regional minimum wage for Pontianak City 2023, IDR.2,750,644.55
[3]Physical Activity Level: Low (<600 MET), Moderate (600 – 2999 MET), High (≥ 3000 MET)

Table 2 Frequency of all ultra-processed foods and beverages consumption of respondents (n=273)

Consumption	Median (Min-Max)	n (%)
UPF and beverages consumption	50 (11-143)	
UPF consumption	35 (8-107)	
SSB consumption	12 (1-50)	
UPF and Beverages consumption		
Normal		132 (48.4)
Excessive		141 (51.6)
UPF consumption		
Normal		134 (49.1)
Excessive		139 (50.9)
SSB Consumption		
Normal		135 (49.5)
Excessive		138 (50.5)

*Consumption in the last 7-days

Nutritional status in this study was measured by BMI-for-age Z-Score (BAZ) assessment and then plotted in the grow chart by CDC for children and adolescents based on their gender. **Figure 2** shows the percentage of UPF and beverages consumption frequency based on the type of foods and drinks in the last 7-days. These types of foods refer to the food list from the FFQ of this study. The total percentage was obtained from the total frequency of UPF consumption, both food and drink, in the last 7-days. The highest percentage frequency of ultra-processed foods consumption came from snacks and sweets for foods, and the highest percentage of frequency consumption of drinks came from beverages type such as electrolyte drinks, carbonated drinks, packaged drinks, while the lowest consumption frequency came from others from foods and drinks (e.g. protein powder and popcorn).

Table 3 shows that 40.3% respondents have overweight and obesity nutritional status.
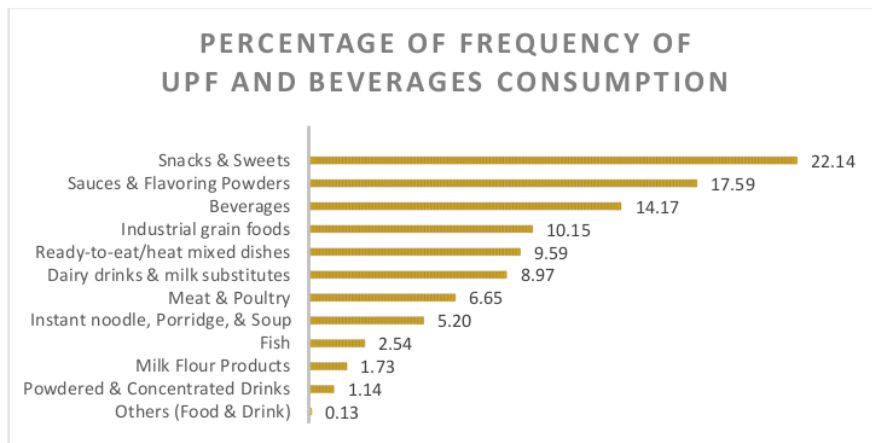
*Others Food and Drink (ea. protein powder, popcorn)

Figure 2. Percentage of frequency of ultra-processed foods and beverages consumption among respondents

Table 3 Nutritional status of respondents (n=273)

Nutritional status	n (%)
Underweight	4 (1.5)
Normal	159 (58.2)
Overweight	99 (36.3)
Obesity	11 (4.0)

*Underweight (-3 SD - < -2 SD), Normal (-2 SD - +1 SD), Overweight (+1 SD - +2 SD), Obesity (> +2 SD)

The association between nutritional status and UPF and beverages consumption was analysed in bivariate and multivariate analysis.

Table 4 shows there was no significant association between age, father's educational level, father's occupation, and mother's occupation with nutritional status (p>0.05). The same results were also found in total energy intake and physical activity. Data on table 4.5 shown the association between total energy intake and physical activity were not significantly correlated with nutritional status (p>0.05). But for gender, mother's educational level and family income, there was an association to nutritional status (p≤0.05).

The association between Ultra-Processed Foods and beverages has a significant association with nutritional status (p≤0.05) on **Table 4**. While the association between Ultra-Processed Foods has not significantly associated with nutritional status (p>0.05). The same result also shown at the association between Sugar-Sweetened Beverages has no significantly associated with nutritional status (p≤0.05).

Before conducting multivariate analysis, the researcher conducted multicollinearity analysis first. And the result shown that there is no multicollinearity found between UPF and SSB. Multivariate analysis is conducted to identify complex relationships between variables such as UPF and SSB consumption, nutritional status, and other potential factors simultaneously, to understand how these variables influence each other. In multivariate analysis after adjusted to other several confounders, UPF and beverages consumption, gender, mother educational level and family income were significantly correlated with nutritional status (p≤0.05). But for total energy intake and physical activity has no significant association to nutritional status. (**Table 5**).

Discussion

Adolescents, though more advanced in physical and cognitive aspects, may exhibit behaviors inconsistent with adult norms. Girls had a higher participation ratio, aligning with gender-based differences in health-related awareness, potentially influencing increased participation in health research. Unlike national data, this study found a higher percentage of parents with senior high school education, differing from the educational trends in West Kalimantan.[7-10] This study found that the highest percentage of parent's education was in senior high school. Most of respondent's fathers were working in non-government area, while most of the mothers were not working.

Parents' education influences their occupation and impacts family income. In this study, over 85% of respondents had a family income exceeding the regional minimum wage for Pontianak in 2023 (Rp. 2,750,644.55). Adolescents from higher-income families were more likely to consume ultra-processed foods (UPF). High socioeconomic status emerged as a key factor in adolescent obesity, linked to increased media use, sedentary lifestyles, and exposure to appealing but nutritionally poor and energy-dense foods.[11-13]

Responders' nutritional status is influenced by factors like total energy intake and physical activity. Total energy intake is shaped by age, gender, weight, height, and daily activities. The balance between calorie intake from food and beverages and energy expenditure through physical activities is crucial for maintaining energy balance.

Table 4. Association between socio-demographic factors and all ultra-processed foods and beverages with nutritional status (n=273)

Variables	Nutritional Status		p-value
	Non-Obesity	Obesity	
Age (year)			
15	17 (54.8)	14 (45.2)	
16	91 (59.1)	63 (40.9)	0.735 [a]
17	55 (62.5)	33 (37.5)	
Gender			
Male	66 (48.9)	69 (51.1)	
Female	97 (70.3)	41 (29.7)	0.000 [a]
Father's Educational Level			
Primary	30 (57.7)	22 (42.3)	
Secondary	70 (58.8)	49 (41.2)	0.858 [a]
Vocational	63 (61.8)	39 (38.2)	
Mother's Educational Level			
Primary	27 (30.3)	62 (69.7)	
Secondary	85 (84.2)	16 (15.8)	0.000 [a]
Vocational	51 (61.4)	32 (38.6)	
Father's Occupation			
Government	20 (69.0)	9 (31.0)	
Non-Government	135 (58.2)	97 (41.8)	0.473 [a]
Unemployed	8 (66.7)	4 (33.3)	
Mother's Occupation			
Government	11 (68.8)	5 (31.3)	
Non-Government	49 (56.3)	38 (43.7)	0.603 [a]
Unemployed	103 (60.6)	67 (39.4)	
Family Income			
Low	30 (75.0)	10 (25.0)	
High	133 (57.1)	100 (42.9)	0.033 [a]
Total Energy Intake			
<80% RDA	35 (52.2)	32 (47.8)	
80-100% RDA	38 (62.3)	23 (37.7)	0.357 [a]
>100% RDA	90 (62.1)	55 (37.9)	
Physical Activity			
Low	56 (67.5)	27 (32.5)	
Moderate	73 (55.7)	58 (44.3)	0.218 [a]
High	34 (57.6)	25 (42.4)	
UPF and beverages consumption			
Normal	69 (53.3)	63 (47.7)	0.015 [a]
Excessive	94 (66.7)	47 (33.3)	
UPF consumption			
Normal	73 (54.5)	61 (45.5)	0.084 [a]
Excessive	90 (64.7)	49 (35.5)	
SSB consumption			
Normal	74 (54.8)	61 (45.2)	0.103 [a]
Excessive	89 (64.5)	49 (35.5)	

[a]Chi-Square test;
Educational level: Primary (graduated from Elementary & Junior High School), Secondary (graduated from Senior High School), Vocational (university level); Nutritional status: Non-Obesity (combine of underweight and normal status), Obesity (combine of overweight and obesity)

Table 5. Multivariate analysis between all processed foods and other potential factors with nutritional status (n=273)

Variables	B	t	p-value
UPF and Beverage's consumption	-0.124	-2.193	0.029*
Normal			
Excessive			
Gender	-0.167	-2.799	0.005*
Male			
Female			
Family Income	0.183	2.239	0.026*
Low			
High			
Mother Educational Level	-0.151	-4.261	0.000*
Primary			
Secondary			
Vocational			
Total Energy Intake	-0.024	-0.692	0.490
<80% RDA			
80-100% RDA			
>100% RDA			
Physical Activity			
Low	-0.006	-0.143	0.887
Moderate			
High			
Constant	1.869		

*Significantly correlated; ENTER method; p-value in ANOVA = 0.000
Dependent variable: Nutritional status
Predictors (constant): UPF and beverages consumption, Gender, family income, TEI, PA

Higher physical activity levels lead to increased energy expenditure, emphasizing the importance of aligning calorie input with output.

In this study, most respondents had excessive energy intake (more than 100% of RDA) and moderate physical activity levels. Physical activity was assessed using IPAQ Short Form, differing from Riskesdas 2018, which used a modified GPAC from WHO.[36] The moderate activity levels may be attributed to prolonged sitting in class, though sports subjects contribute to energy expenditure. Additionally, reliance on vehicles for commuting reduces walking activities.

Ultra-processed foods (UPF) pose a global health concern due to their excessive calorie and sugar content. In this study, more than half of the adolescent respondents consumed excessive UPF, particularly in snacks and sweets. This trend is significant during the transition from childhood to adulthood, where individuals gain independence in choosing their food. In the USA, children's diets consist of about two-thirds UPF, contributing to high body fat levels. High-income countries also witness UPFs constituting over 50% of daily energy intake, linked to unhealthy dietary patterns, overweight, and obesity. UPFs generally have lower nutritional quality, being high in energy, salt, sugars, and fats, while low in fiber and vitamins compared to unprocessed foods.[13,14]

Adolescents, particularly, favor sugary drinks, including soft drinks, sachet mixes, fruit drinks, cordials, flavored milks, cold teas/coffees, and energy/sports drinks. Consumption of these beverages is linked to dental issues and increases the risk of unhealthy weight gain, type-2 diabetes, gout, and non-alcoholic steatohepatitis. Indonesian school children spending 7 to 10 hours at school are prone to purchasing calorie-dense, nutrient-poor foods from school canteens, contributing to excessive consumption. Additionally, 50% of snack foods sold contain harmful chemicals in Indonesian schools.[15,16]

More than half of adolescents in this study had a normal nutritional status according to CDC categorization, aligning with similar findings in another study. Despite this, there were cases of overweight and obesity combined, with 40.3% falling into this category.[17] The percentage of obesity is comparable to normal nutritional status, signaling a potential increase in obesity cases among adolescents. Factors like consumption patterns, reduced physical activity, and frequent gadget use contribute to this trend. Globally, there has been a significant rise in pediatric obesity over the past five decades. Projections suggest that by 2030, around 254 million children and adolescents globally could be living with obesity, with several countries, including China, India, the USA, Indonesia, and Brazil, facing substantial burdens.[18]

Adolescence involves notable changes in physical and psychosocial development, impacting food choices. Greater independence and peer interactions often lead to a preference for calorie-dense fast foods. Sedentary behaviors, like increased screen time, may limit physical activity. Adolescents' heightened focus on appearance and psychological concerns further complicates dietary and lifestyle choices during this developmental period.[19]

Ultra-processed foods, rich in sugar, salt, and saturated fats, include items like soft drinks, breakfast cereals, reconstituted meat products, packaged breads, and ready-to-eat foods. A significant correlation between ultra-processed food (UPF) consumption and nutritional status was found through a chi-square test, consistent with research in Brazil associating UPF with obesity.[20] However, a study during the COVID-19 pandemic found no significant correlation between Body Mass Index (BAZ) and UPF consumption among school-aged children using ANOVA. The study utilized pre-pandemic data to maintain data quality and minimize bias due to the unavailability of direct offline data collection.[21]

Socio-demographic factors, including gender, play a role in nutritional status. Male students are more prone to consuming ultra-processed foods (UPF) and sugar-sweetened beverages (SSB), often due to habits like drinking energy beverages after exercise or eating UPF while gaming.[22] CDC data shows that SSB consumption varies by age, sex, ethnicity, geography, and socioeconomic status, with higher prevalence among adolescent boys. Family, as the primary environment, significantly influences character formation. Maternal education levels impact health and nutritional risk, with lower education linked to challenges in accessing resources and information. Higher maternal education, while associated with greater family income, may contribute to increased UPF incorporation into meals. Household income affects dietary intake, with higher income leading to increased consumption of specific UPFs and SSBs. Additionally, adolescents' pocket money influences their UPF and SSB consumption, with higher allowances correlating with increased intake.[23-26]

Unlike findings in some high-income countries where ultra-processed foods (UPF) contribute over 50% to daily energy intake and are linked to unhealthy dietary patterns, this study reveals a reverse correlation between UPF consumption and total energy intake.[27] However, this discrepancy is attributed to a high level of underreporting of energy intakes, especially among overweight/obese adolescents. The underreporting may result from unconscious biases in misreporting unhealthy food intakes, leading to truthfully reported low food and energy intakes. In Brazil, UPFs' contribution to total energy intake has increased, replacing fresh foods, but this study's inverse correlation suggests potential data underreporting influenced by social desirability bias among adolescents. Mealtime irregularities and frequent skipping of meals may contribute to the underreporting phenomenon.[28-30]

The author is aware of this study's limitations and strengths. The study used a Food Frequency Questionnaire (FFQ) based on the Nova Classification group 4, modified for Pontianak City through market surveys. To enhance validity, enumerators, selected for their academic qualifications in nutrition science, underwent training and pre-testing with a sample similar to respondents. The pretesting helped refine instruments and reduce errors. Nutritional status

data collection instruments were calibrated, and steps were taken to minimize underreported data, such as excluding athletes and those on diets. Data collection occurred during school holidays, with a limited timeframe of 3 days per school due to final exams. Despite acknowledging limitations, the researcher took measures to mitigate errors and biases.

This study uniquely separates food and drinks in the classification of ultra-processed foods (UPF), providing distinct insights compared to research that often combines both. The findings have implications for school officials, offering valuable insights for creating regulations and programs aimed at enhancing the health of students. Educating adolescents about the impact of UPFs on nutritional status can empower them to make healthier choices. Programs can promote healthier eating habits and discourage excessive UPF consumption. Regulations may involve communities and families in nutritional awareness initiatives, fostering a comprehensive approach to improving dietary habits.

Conclusion

In conclusion, this study focused on adolescents with a middle-upper socio-economic status. The findings revealed a high consumption of Ultra-Processed Foods, primarily from snacks and sweets (22.4%). Moreover, an inverse association was observed between UPF consumption, sugar-sweetened beverages intake, and nutritional status. Additionally, there was a significantly association between gender, mother's education level, family income, and nutritional status.

Conflict of interest

Authors declared no conflict of interest regarding this article.

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