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Judul penelitian	:	*Association between Consumption of Ultra-Processed Foods with Nutritional Status of Senior High School Students in Pontianak*
Penyaji	:	Septiana Maria Deba Ginting (NPM: 2106770763)
Media	:	Zoom meeting

maka dengan hormat kami mohon kesediaan Ibu mengizinkan Staf Ibu yaitu:

1. Helda Khusun, MSc, PhD (Pembimbing II)
2. Imas Arumsari S.Gz., M.Sc (Penguji)

Perlu kami informasikan bahwa Program Studi Magister Ilmu Gizi FKUI menyelenggarakan kegiatan ujian dengan menggunakan Bahasa Inggris dan melalui *Zoom Meeting*.

Demikianlah yang dapat kami sampaikan, atas perhatian dan bantuan Ibu kami ucapkan terima kasih.

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UNIVERSITAS INDONESIA

ASSOCIATION BETWEEN CONSUMPTION OF ULTRA-PROCESSED FOODS AND BEVERAGES WITH NUTRITIONAL STATUS OF SENIOR HIGH SCHOOL STUDENTS IN PONTIANAK

THESIS

SEPTIANA MARIA DEBA GINTING
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FACULTY OF MEDICINE
MASTER OF NUTRITION STUDY PROGRAM
JAKARTA
2024

UNIVERSITAS INDONESIA

ASSOCIATION BETWEEN CONSUMPTION OF ULTRA-PROCESSED FOODS AND BEVERAGES WITH NUTRITIONAL STATUS OF SENIOR HIGH SCHOOL STUDENTS IN PONTIANAK

THESIS
Submitted in partial fulfilment of the requirements for
Master of Nutrition

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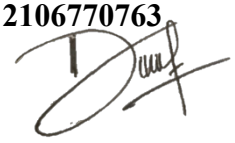
Signature : 

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Date : January, 2024

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Pontianak, January 8, 2024

Septiana Maria Deba Ginting

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ABSTRACT

Name	**: Septiana Maria Deba Ginting**
Study Program	**: Nutrition Science**
Title	**: Association Between Consumption of Ultra-Processed Foods and Beverages with Nutritional Status of Senior High School Students in Pontianak**
Advisors	**: DR. Judhiastuty Februhartanty, M.Sc.**
	Ir. Helda Khusun, M.Sc, PhD

This cross-sectional study conducted in Pontianak, West Kalimantan, investigates the association between ultra-processed food (UPF) and beverages consumption and the nutritional status of senior high school students. The study addresses the rising concern of the "double burden" of malnutrition in low- and middle-income countries, focusing on the increasing prevalence of overweight/obesity among adolescents, driven by changes in the food system. Data collection was conducted in Imanuel and Petrus SHS Pontianak on June 2023, with 273 students grade 10^{th} and 11^{th}. 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, TEI and PAL. Data analysis used SPSS version 26. The result found 40.3% students were overweight-obesity; 51.6% consumed excessive of UPF and beverages. The results reveal a significant correlation between UPF consumption and nutritional status. The study identifies gender, mother's education level, and family income as factors associated with nutritional status among adolescents. This study contributes valuable insights into the complex interplay of dietary patterns, socio-economic factors, and nutritional status among adolescents in the context of a rapidly changing food landscape.

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

ABSTRAK

Nama : **Septiana Maria Deba Ginting**

Program studi : **Ilmu Gizi**

Judul : **Hubungan Konsumsi Makanan dan Minuman Ultra Olahan dengan Status Gizi Siswa SMA di Pontianak**

Pembimbing : **DR. Judhiastuty Februhartanty, M.Sc.**

Ir. Helda Khusun, M.Sc, PhD

Studi cross-sectional yang dilakukan di Pontianak, Kalimantan Barat ini menyelidiki hubungan antara konsumsi makanan ultra-olahan (UPF) dan minuman dengan status gizi siswa SMA. Studi ini membahas meningkatnya kekhawatiran akan "beban ganda" malnutrisi di negara-negara berpenghasilan rendah dan menengah, dengan fokus pada peningkatan prevalensi kelebihan berat badan/obesitas di kalangan remaja, yang didorong oleh perubahan dalam sistem pangan. Pengumpulan data dilakukan di SMA Imanuel dan Petrus Pontianak pada bulan Juni 2023, dengan jumlah siswa kelas 10 dan 11 sebanyak 273 orang. Pengukuran berat badan dan tinggi badan diperoleh untuk menghitung IMT Z-score, sedangkan UPF dan konsumsi minuman diperoleh dengan FFQ. Kuesioner terstruktur, recall 24 jam dan IPAQ-S digunakan untuk menilai status sosiodemografi, TEI dan PAL. Analisis data menggunakan SPSS versi 26. Hasil penelitian ditemukan 40,3% siswa mengalami kelebihan berat badan-obesitas; 51,6% mengonsumsi UPF dan minuman berlebihan. Hasilnya menunjukkan adanya korelasi yang signifikan antara konsumsi UPF dan status gizi. Penelitian ini mengidentifikasi jenis kelamin, tingkat pendidikan ibu, dan pendapatan keluarga sebagai faktor yang berhubungan dengan status gizi pada remaja. Studi ini memberikan kontribusi wawasan berharga mengenai interaksi yang kompleks antara pola makan, faktor sosio-ekonomi, dan status gizi di kalangan remaja dalam konteks lanskap pangan yang berubah dengan cepat.

Kata kunci: remaja, status gizi, faktor sosio-demografi, minuman manis, makanan ultra-olahan

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LIST OF ABBREVIATIONS

BPS	*Badan Pusat Statistik*
BMI	Body Mass Index
CDC	Centers for Disease Control
CHD	Congenital heart disease
CI	Confidence interval
DVD	Digital versatile disk
FFQ	Food Frequency Questionnaire
ING	*Informasi Nilai Gizi*
IPAQ-S	International Physical Activity Questionnaire Short Form
Kemendikbud	*Kementerian Pendidikan dan Kebudayaan*
MET	Metabolic Equivalent of Task
MoH	Ministry of Health
MSG	Monosodium glutamate
MVPA	Moderate to vigorous physical activity
NCDs	Non-communicable diseases
NGO	Non-Governmental Organization
OR	Odd ratio
PMK	*Peraturan Menteri Kesehatan*
PA	Physical activity
SAT	Subcutaneous adipose tissue
SES	Socio-economic status
SSB	Sugar-Sweetened Beverages
SSGI	*Studi Status Gizi Indonesia*
ST	Screen time
SQ-FFQ	Semi Quantitative Food Frequency Questionnaire
TEI	Total Energy Intake
TV	Television
UNICEF	United Nations Children's Fund
UPF	Ultra-Processed Food
USA	United States of America
VAT	Visceral Adipose tissue
WHO	World Health Organization
Riskesdas	*Riset Kesehatan Dasar*

CHAPTER 1
INTRODUCTION

2.2 Background

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. It has risen dramatically within 4 decades of nearly 5 times (4% in 1975 to 18% in 2016). World Health Organization (WHO) also stated that most of the world’s population live in countries where overweight and obesity kills more people than underweight.[1] In Indonesia, based on recent data from *Riset Kesehatan Dasar (Riskesdas),* obesity prevalence of adolescents 16-18 years old has increased from 1.6% in 2013 to 4% in 2018. The same trend also showed in West Kalimantan, the prevalence of obesity was increased from 1% in 2013 to 3.4% in 2018. Although this percentage is still below the national average, the percentage had tripled within 5 years.[2-3]

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.[74] 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[78], but low fibre and protein content.[5] 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. Ultra-processing makes these products highly profitable but also unhealthy.[76] The classification group 4 of NOVA includes sugar-sweetened beverages (SSB) and fast food, which are frequently consumed by adolescents.

A study conducted in Pontianak in 2015 found that consuming higher amounts of fast food increases the risk of obesity in adolescents. This is due to the high energy content and prevalence of energy-dense snacks in fast food. In that year, fast food consumption among adolescents is quite high, coupled with the sale of frozen food quite a lot everywhere. Similar results have been found in other studies in 2022 and can be attributed to globalization and changes in food consumption patterns.[77, 80] Studies also show that consuming SSB increases the risk of obesity, and over two-thirds of adolescents in

Indonesia consume at least one SSB per day. Sugars in liquid form may not suppress solid food intake, resulting in the consumption of excessive calories.[78-79]

Various factors contribute to the increasing consumption of UPF, such as rising household incomes, urbanization, and aggressive marketing.[66] The socioeconomic status of the population affects the availability of food options, with high-income areas having easier access to formal markets.[75] Private school students tend to be more inactive and have unhealthy eating habits compared to public school students due to their better economic situation, which increases their risk of obesity.[65]

Gender-based also showed different results of UPF consumption. Study from Taiwan showed that the girls adolescents spent less on original foods and more on UPF than boys. It is because of limited budgets or uncertain health-seeking behaviours.[66] The other result showed that boys have preference from taste, and also the norms that allowing boys in Bangladesh greater access than girls to go out and reach the retailers or vendors as boys stays outdoors more.[68]

Indonesia has also a large and rapidly growing market for unhealthy drinks, which are sold in various places including schools and hospitals.[70] Adolescents are highly influenced by advertisements for food and beverages, and there has been an increase in retail sales and fast-food transactions.[74-75] Pontianak has the highest percentage of instant food and drink consumption. The percentage has also increased, indicating a trend towards consuming UPF.[50]

According to data from the WHO's "Health in School-aged Children" initiative, adolescents who spend more time sitting in front of screens are at risk of obesity, depression, sleep problems, inattention, and cardiovascular disease risk factors.[28] Studies from Czech Republic and Samarinda have also shown a link between screen time, physical activity, and obesity among adolescents, particularly among boys.[59, 72] Girls are more likely to be obese due to physical inactivity and high consumption of UPF. Adolescents who spend more time in front of screens are also more exposed to UPF advertisements, which can lead to increased consumption.[65]

Based on the problems above, the authors are interested to find out the association between ultra-processed foods consumption and its correlation with nutritional status among senior high school students.

2.3 Problems Statement

a. Global prevalence of overweight and obesity has risen 14% in the past 40 years. In Indonesia, in 2013 – 2018 also showed the same trend, the prevalence of overweight and obesity has increased almost 4% in only 5 years. The prevalence of overweight and obesity aged 16-18 in West Kalimantan are 7.6% and 3.4%.
b. Adolescents is the critically age group that exposed to the UPF consumption based on their lifestyle, such as exposure to UPF advertisement through frequent use of gadget, peer influence of eating behaviour or food choice.
c. Adolescents from private schools have a higher chance of being exposed to UPF than their counterpart public schools, because of higher socio-economic status allowing them to access or buy the UPF product and high exposure to various types of food and drinks sold in their school canteens and the surrounding environment that highly contain of UPF.
d. There are still lack of study about UPF consumption with the association of nutritional status especially among senior high school students in Pontianak.

2.3.1 Research Question

Is there any association between Ultra-Processed Foods and Beverages consumption with nutritional status among senior high school students in Pontianak?

2.4 Hypotheses

There is an association between Ultra-Processed Foods and Beverages consumption with nutritional status among senior high school students in Pontianak

2.5 Objectives

2.5.1 General Objective

The purpose of this study is to investigate the association of Ultra-Processed Foods and Beverages consumption and other related factors with nutritional status of senior high school students in Pontianak

2.5.2 Specific Objectives

1. To describe socio-demographic characteristics of the senior high school students in Pontianak

2. To assess the ultra-processed food and beverages consumption of the senior high school students in Pontianak
3. To assess the nutritional status (based on BMI-for-age Z Scores) of the senior high school students in Pontianak
4. To analyse the association of ultra-processed food and beverages consumption and other related factors with the nutritional status of the senior high school students in Pontianak

2.6 Benefits of the Study

a. For Community/individual

   This research is expected to increase the awareness of the senior high school students on their food consumption behaviour especially on ultra-processed food and beverages

b. For Researcher/Academics

   The result of this study may stimulate further exploration on investigating evidence to design more relevant food and nutrition programmes for school students

c. For Policy Makers and Health Educators

   This study may provide additional body of literature on the association between consuming ultra-processed foods and beverages with nutritional status. This may contribute to discussion on the improvement of programmes and policy to manage obesity among adolescents

CHAPTER 2
LITERATURE REVIEW

2.1. Nutritional Status

The nutritional status of an individual is usually a result of multiple factors that interact with each other at different levels. The consumption of adequate amount of food both in terms of quantity and quality is one of the key determinants, which has a significant impact on the nutritional status.[17] Investing in nutrition throughout the life cycle will have both short term and long-term benefits of economic and social significance, including large savings in health care costs, increased educability and intellectual capacity, and increased adult productivity. Adolescents are in a between group phase, with some nutrition problem commonalities with children and some with adults. If the adolescents are well nourished, they can make the optimal use of their skills, talents, and also the energies for today, and be healthy and responsible citizen and parent for healthy babies in the future.[18]

The global economic development and urbanization has resulted in great changes in the weight status of adolescents worldwide. A decreasing trend in the prevalence of under-nutrition has been identified in developing countries. On the other hand, an increasing shift towards higher rates of overweight and obesity among adolescents has been reported in developed and developing countries.[19]

The assessment of the nutritional status involves two methods: Direct (deals with individuals and measures the objective criteria) and indirect (uses community health indices reflecting nutritional influences). These methods include anthropometric, biochemical, clinical, dietary, emotional, and functional measurements to cover all the phases of the disease.[17]

2.1.1. Body Mass Index/Age

WHO definitions for overweight and obesity are also based on both weight and length/height estimates, i.e., weight-for-length/height and body mass index (BMI) but not mid-upper arm circumference.[15]

Calculated as weight in kg/ (height in metres)2. In adults, a Body Mass Index (BMI) 18.5 and 25 and 30kg/m2 is in the obese range.[16]

Body Mass Index (BMI) is a person's weight in kilograms (or pounds) divided by the square of height in meters (or feet). A high BMI can indicate high body fatness. BMI screens for weight categories that may lead to health problems, but it does not diagnose the body fatness or health of an individual. BMI does not measure body fat directly, but BMI is correlated with more direct measures of body fat.[20]

For children and teens, BMI is age- and sex-specific and is often referred to as BMI-for-age.[45] Assessment using BMI is recommended as a basis for anthropometric indicators for thin or overweight adolescents. The BMI index based on age has the advantage that it does not require information about chronological age, because after all the weight/height index will change according to changes in age. That's why at a certain height, the weight that corresponds to a common percentile is not the same for all ages. The weight/height indicator during adolescence is only used for a limited age category. Therefore, BMI by age has been recommended as the best indicator for adolescence.[44] Nutritional status classification are shown in Table 2.1.

Table 2. 1 Interpretation of Cut-Offs of Nutritional Status for 5-18 years

Nutritional status category	Cut-offs (Z-scores)
Thinness	-3 SD - <- 2 SD
Normal	-2 SD - +1 SD
Overweight	+1 SD - +2 SD
Obese	> + 2 SD

Source: PMK No 2 Th 2020[29]

2.1.2. Nutritional problems among senior high school students

Adolescence is a period that clearly shows the transition from childhood to adulthood. The transition period is marked by changes in biological, cognitive, and social emotional. Adolescence is a period where the teenagers are expected to understand the norms that exist in society without must be dictated, and have learned to think wisely. In adolescence, the teenagers can also start issuing their own opinion and they are also easily to be influenced by peers, including the eating habit. The changed eating habit in teenager is affected by lots of factor in which among them is the current globalization that is widely spread out. The teenager is one of groups who are vulnerable to over nutrition. Over

nutrition to the teenager is characterized by a relatively excessive increase in weight when compared to the age or height of their teenage age peers.[32]

Excess weight/obesity is a multi-factorial disorder and derives from two different origins, namely, genetic and environmental factors. However, the relative contributing role of genetic susceptibility and environmental factors to development of obesity is not clear. A great number of previous studies have indicated that childhood and adolescent overweight and obesity are linked to obvious familial aggregation, as a result of complex interaction between genetic and environmental effects. Both genetic and environmental factors contribute to childhood obesity. Some environmental factors including parental overweight, shared family lifestyle, dietary habits, and socio-economic status (SES) are linked to childhood overweight. Previous studies have indicated that low SES families have little access to healthy foods; therefore, their consumption of high-calorie, low nutrient foods are higher than that of high SES groups.[33]

According to the World Health Organization (WHO), overweight and obesity are described as an excessive or unnatural accumulation of fat that affects health. The fundamental cause is an imbalance between consumed and spent calories, generally the result of inappropriate eating patterns, with ingestion of highly energetic food rich in fat and physical inactivity, known as sedentary.[42]

Overweight is a form of malnutrition. It does not happen in isolation and nor does it occur only in certain people or certain countries. Different forms of malnutrition (stunting, wasting, micronutrient deficiencies, overweight and diet-related non-communicable diseases) can coexist in the same country, the same community and even in the same family or individual. In 2017, to address this 'double burden' of malnutrition, the prevention of overweight in children and adolescents was integrated into the UNICEF Strategic Plan (2018- 2021) as part of Goal Area 1: Every child survives and thrives. The aim is to reduce malnutrition in all its forms.[16]

The association between obesity and morbid outcomes makes it a public health concern for children and adolescents. Obesity has an enormous impact on both physical and psychological health. Consequently, it is associated with several comorbidity conditions such as hypertension, hyperlipidemia, diabetes, sleep apnea, poor self-esteem, and even serious forms of depression. In addition, children with obesity who were followed-up to adulthood were much more likely to suffer from cardiovascular and

digestive diseases. The increase in body fat also exposes the children to increase in the risk of numerous forms of cancers, such as breast, colon, esophageal, kidney, and pancreatic cancers.[4]

Deforche stated that weight gain has significant association with decrease of sedentary behaviours (physical activity; TV/DVD viewing, playing computer games), other sedentary behaviours (internet use; sitting time), decrease of fruit and vegetable consumption and alcohol consumption in Belgian students. But in contrast, increases in sitting time while studying was related to less weight gain. Self-control might be confounding this relationship. High self-control is related with higher levels of physical activity, healthier eating patterns, less alcohol consumption, lower BMI and sticking to study schedule.[27]

Excessive screen time is associated with poor sleep through several mechanisms, including night time exposure to bright lights, which may suppress melatonin production, and displacement of other activities beneficial for sleep, such as physical activity. The American Academy of Pediatrics recommends avoiding screens at least 1 hour before bedtime. This practice may mitigate sleep disturbances, especially given that sleep quality may be poorer because of stressors or anxiety.[38]

Iron deficiency anemia is still the most prevalent nutrition problem worldwide. Iron anemia caused by insufficient dietary intake and absorption of iron, and/or iron loss from bleeding which can originate from a range of sources such as the intestinal, uterine, or urinary tract. Iron deficiency causes approximately half of all anemia cases worldwide. One of the causes of nutritional anemia is that the amount of iron absorbed is insufficient to meet the body's requirements. This insufficiency may be due to both inadequate iron intake from food and to low bioavailability. Teenagers consume less food than do adults and their diet often consists of foods with a low iron content and in which the bioavailability of iron is poor. [31]

Ministry of Health (MoH) of Indonesia has a program to prevent and treat anemia, especially for girl adolescents and pregnant women. One of the programs that has been implemented to prevent anemia among girl adolescents is administration of blood-added tablets carried out by the local health center to schools in the target areas.[63]

Conversely, the Indonesian government still does not have a specific program to reduce the prevalence of obesity. In fact, this is very necessary given the prevalence of obesity which continues to increase from year to year.

2.2. Ultra-Processed Foods (UPF)

The term “ultra-processed food” was developed in a proposed new classification of foods known as the NOVA classification. It differs fundamentally from established advice on optimal dietary patterns in that it is based not on nutrient intake but on the degree of processing of foods. 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.[7]

Table 2.2 above is about Nova Classification will explain the groups of Nova Classification globally, the definition of each groups, and the example of foods.

Table 2. 2 NOVA Classification[30]

NOVA Group	Definition	Examples
Group 1 Unprocessed or minimally processed foods	The aims of this processed is to extend the life of unprocessed foods, enabling their storage for longer use, or to make them edible, and to make their preparation easier or more diverse Minimally processed foods contain additives that prolong product duration, protect original properties or prevent proliferation of microorganisms	Fresh, squeezed, chilled, frozen, or dried fruit and leafy and root vegetables; grains such as brown, parboiled or white rice, corn cob or kernel, wheat berry or grain; legume s such as beans, lentils, and chickpeas; starchy roots and tubers such as potatoes, sweet potatoes and cassava; fungi such as fresh or dried mushrooms; meat, poultry, fish and seafood, whole or in the form of steaks, fillets and other cuts; fresh, powdered, chilled or frozen eggs; fresh, powdered or pasteurized milk; fresh or pasteurized fruit or vegetable juices (with no added sugar, sweeteners or flavours); grits, flakes or flour made from corn, wheat, oats, or cassava; tree and ground nuts and other oily seeds (with no added salt or sugar); herbs and spices used in culinary preparations, such as thyme, oregano, mint, pepper, cloves and cinnamon, whole or powdered, fresh or dried; fresh or pasteurized plain yoghurt; tea, coffee, and drinking water. Also includes foods made up from two or more items in this group, such as dried mixed fruits, granola

		made from cereals, nuts and dried fruit with no added sugar, honey or oil; pasta, couscous and polenta made with flours, flakes or grits and water; and foods with vitamins and minerals added generally to replace nutrients lost during processing, such as wheat or corn flour fortified with iron and folic acid.
Group 2 Processed culinary ingredients	Substances obtained directly from group 1 foods or from nature by industrial processes such as pressing, centrifuging, refining, extracting or mining. Used to prepare, season and cook group 1 foods. May contain additives that prolong product duration, protect original properties or prevent proliferation of microorganisms.	Vegetable oils crushed from seeds, nuts or fruit (notably olives); butter and lard obtained from milk and pork; sugar and molasses obtained from cane or beet; honey extracted from combs and syrup from maple trees; starches extracted from corn and other plants; vegetable oils with added anti-oxidants; salt mined or from seawater, and table salt with added drying agents. Also includes products consisting of group 2 items, such as salted butter, and group 2 items with added vitamins or minerals, such as iodised salt.
Group 3 Processed foods	Products made by adding salt, oil, sugar or other group 2 ingredients to group 1 foods, using preservation methods such as canning and bottling, and, in the case of breads and cheeses, using non-alcoholic fermentation. Processes and ingredients here are designed to increase the durability of group 1 foods and make them more enjoyable by modifying or enhancing their sensory qualities.	Canned or bottled vegetables and legumes in brine; salted or sugared nuts and seeds; salted, dried, cured, or smoked meats and fish; canned fish (with or without added preservatives); fruit in syrup (with or

	They may contain additives that prolong product duration, protect original properties, or prevent proliferation of microorganisms.	without added anti-oxidants); freshly made unpackaged breads and cheeses.
Group 4 Ultra-processed foods	Formulations of ingredients, mostly of exclusive industrial use, made by a series of industrial processes, many requiring sophisticated equipment and technology (hence 'ultra-processed'). Processes used to make ultra-processed foods include the fractioning of whole foods into substances, chemical modifications of these substances, assembly of unmodified and modified food substances using industrial techniques such as extrusion, moulding and pre-frying; use of additives at various stages of manufacture whose functions include making the final product palatable or hyper-palatable; and sophisticated packaging, usually with plastic and other synthetic materials. Ingredients include sugar, oils or fats, or salt, generally in combination, and substances that are sources of energy and nutrients that are of no or rare culinary use such as high fructose corn syrup, hydrogenated or interesterified oils, and protein isolates; classes of additives whose function is to make the final product palatable or more appealing such as flavours, flavour enhancers, colours, emulsifiers, and sweeteners, thickeners, and anti-foaming, bulking, carbonating, foaming, gelling, and glazing agents; and additives that prolong product duration, protect original properties or prevent proliferation of microorganisms. Processes and ingredients used to manufacture ultra-processed foods are designed to create highly profitable products (low-cost ingredients, long shelf life, emphatic branding), convenient (ready-to consume) hyper-palatable products liable to displace freshly prepared dishes and meals made from all other NOVA food groups.	Many ready-to consume products such as carbonated soft drinks; sweet or savoury packaged snacks; chocolate, candies (confectionery); ice-cream; mass-produced packaged breads and buns; margarines and other spreads; cookies (biscuits), pastries, cakes, and cake mixes; breakfast 'cereals', 'cereal' and 'energy' bars; 'energy' drinks; milk drinks, 'fruit' yoghurts and 'fruit' drinks; 'cocoa' drinks; 'instant' sauces. Many pre-prepared ready-to-heat products including pies and pasta and pizza dishes; poultry and fish 'nuggets' and 'sticks', sausages, burgers, hot dogs, and other reconstituted meat products; and powdered and packaged 'instant' soups, noodles and desserts. Infant formulas, follow-on milks, other baby products; 'health' and 'slimming' products such as meal replacement shakes and powders.

From group 4 of the NOVA Classification, there are also the subgroup of group 4 (the ultra-processed food group). Table 2.3 will explain the ultra-processed food sub-groups and the foods examples.

Table 2. 3 Ultra-processed food subgroups[71]

Ultra-processed Foods	Foods or beverages included
Snacks and Sweets	
Savory snacks	Crackers; flavoured popcorns (excluding plain air-popped popcorn); chips (potato/vegetable/corn/tortilla/other); pretzels/snack mix
Sweat bakery products	Ready-to-eat or dry-mixed cakes and pies; cookies and brownies; doughnuts, sweet rolls, and pastries
Candies	Candies, chocolate, chewing gums
Cereal or nutrition bars	Cereal or nutrition bars (cereal/energy/protein/meal replacement bars)
Ice cream and desserts	Ice creams and other frozen dairy desserts; ready-to-eat or dry mixed dairy desserts (such as pudding); fruit disserts; jellies and jams and preserves; toppings; gelatine desserts
Sugar-sweetened and diet beverages	
Sugar-sweetened and diet soft drinks	Sugar sweetened and diet soft drinks
Fruit drinks and other sweetened drinks	Fruit drinks, sport / energy drinks, nutrition drinks
Ready-to-eat/heat mixed dishes	
Ready-to-eat/heat pizza	Fast food pizza, pizza prepared from frozen or from school lunch
Ready-to-eat/heat sandwiches and burgers	Fast food or ready-to-eat/eat sandwiches or burgers (cheeseburger, hamburger or chicken burger)
Other ready-to-eat/heat mixed dishes	Frozen or shelf-stable meat/seafood/poultry/egg mixed dishes, grain based mixed dishes (pasta dishes, rice dishes, macaroni and cheese, turnovers, and other), Mexican mixed dishes, Asia mixed dishes, and soups
Industrial grain foods	
Breads, rolls and tortillas	Yeast breads (white/whole wheat/wheat/rye/oat/multigrain bread), rolls, buns, bagels, English muffins, tortillas, pita bread, taco shells (baked) that are not homemade or acquired from bakery store
Biscuits, muffins, and quick breads	Biscuits, cornbread, muffins and other quick breads that are not homemade or obtained from bakery stores
Pancakes, waffles and French toasts	Pancakes, waffles and French toasts that are not homemade or obtained from bakery stores

Ready-to-eat breakfast cereals	Ready-to-eat cereals
Flavoured dairy foods and dairy substitutes	
Flavoured milk	Flavoured milk
Flavoured yogurts	Flavoured yogurts
Dairy drinks and dairy substitutes	Milk shake and other dairy drinks, dairy substitutes such as almond milk, coconut milk, rice drink, soy milk
Other	
Fast-food or reconstituted meat, poultry, and fish products	Fast food meat patties/fried chicken/fish sticks, patties, or fillets; chicken nugget; sausages, ham, lunchmeats; meat spreads; beef/port/other meat jerky
Fast food or pre-prepared potato products	Fast food /pre-prepared /frozen French fries, hash browns, potato puffs, stuffed potatoes
Fats, condiment and sauces	Industrial fats, margarine, light or fat free cream /whipped cream, cream substitutes, light or fat free cream cheese, cheese spread; salad dressings, tomato based/soy-based/other condiments; dips, gravies, and other sauces
Other ultra-processed foods	Including soy products such as meatless patties and fish sticks; sweeteners, and all syrups (excluding 100% maple syrup); distilled alcoholic drinks, baby formula. and onion rings

Ultra-processed food consumption seems to be inevitable due to many factors including convenience, low prices and efficient marketing, but also the possibility of virtually unlimited enrichment with biologically active ingredients. Thus, it creates the illusion that the time saved contributes to consumers well-being, nevertheless, the price to be paid for the convenience can be high. Ultra-processed food is subjected to multidirectional processes and modifications prior to consumption and contains significant amounts of added sugar, salt, saturated fat and number of additives per product.[10]

The processes of ultra-processed food also adapted and marketed to appeal to local tastes and consumer preferences. The added of sugar, salt, and fat also used along with other sophisticated ingredients and manufacturing technologies to produces “the hyper-palatable” products. These same processes will increase the product durability (shelf life) because of long-distance and large-scale distribution. They are designed to be -ready-to-eat or -ready-to-heat products for consumption in any place at any time, thereby requiring minimal preparation and offering convenience for time-pressured consumers.[67]

A similar statement was also stated by Monteiro in his study that the UPF are not ‘real foods”. The UPF are the formulations of food substances often modified by chemical

processes and then assembled into ready-to-consume hyper-palatable food and drink products using flavours, colours, emulsifiers and a myriad of other cosmetics additives. These ultra-processing makes them highly profitable, intensely appealing and unhealthy.[77] There are some aspects of demographic change, political and economic environment, technological advances, natural resource management and social and cultural norms, all of which function in an integrated manner and could have endogenous and exogenous impacts on the food systems. In Figure 2.1 will explain how food systems will impact the diet of children and adolescents.

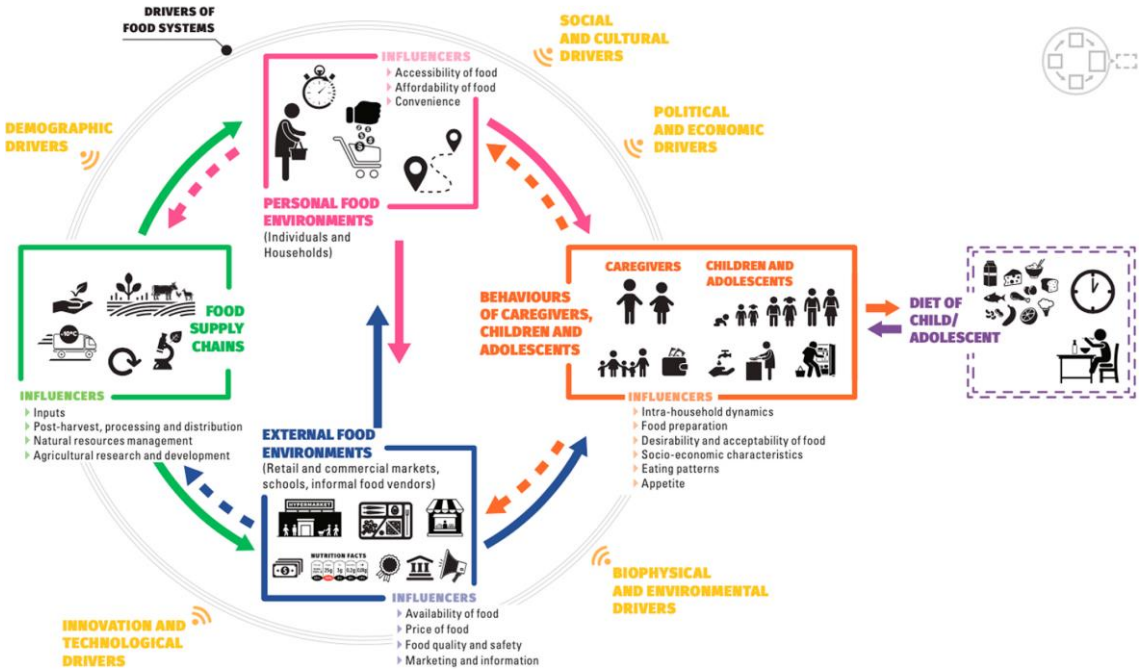


Figure 2. 1 The framework for Food systems and children's and adolescents' diets[75]

Based on study in Brazil showed that there are no differences between sexes (boys and girls) in ultra-processed food consumption. The most UPF consumed were salty snacks, and sweet snacks, followed by margarine, soft drink, and meat products.[60]

2.2.1 Ultra-processed food and Nutritional Status

Changes in the food system are likely to play a key role in the obesity pandemic: they are notably characterized by increased supply of affordable, hyperpalatable energy-dense food products, along with sophisticated distribution systems to improve

accessibility and convenience and intensive food marketing campaigns. These trends in the food systems were accompanied by major dietary changes in the last decades. In particular, industrially processed products and especially ultra-processed food (UPF) consumption drastically rose representing already 50%–60% of total daily energy in some high-income countries. UPFs have a poorer nutritional quality (often high in energy, salt, free sugars, and saturated fats and low in fibre and vitamins) compared to unprocessed food.[21]

UPF represent more than 50% of the total daily energy intake in some high-income countries. The consumption of UPF also has been associated with unhealthy dietary patterns and with overweight and obesity.[69]

High socioeconomic status is becoming the primary determinant of obesity in adolescents due to more frequent media use and consequently sedentary lifestyles coupled with greater exposure to advertising of low nutritional quality and energy-dense foods that look attractive, hyper-palatable, cheap and ready to eat. Concerning childhood and adolescence, UPF consumption is phenomenon of major importance that is rapidly growing. Children's diets in the USA have shifted to contain about two-thirds of daily calorie consumed from UPF, contributing to high levels of body fat in children.[22]

2.3. Sugar-Sweetened Beverages (SSB)

The definition of Sugar-Sweetened Beverages (SSB) is any beverage that contains added caloric sweetener usually sugar. The main categories of sugary drinks include soft-drinks/ fizzy-drinks, sachet mixes, fruit drinks, cordials, flavoured milks, cold teas/coffees, and energy/sports drinks. SSBs are one of the two leading contributors of sugar to the diets of adults and children. Their consumption is known to cause dental diseases, increase the risk of developing unhealthy weight gain, type-2 diabetes, gout, and non-alcoholic steatohepatitis.[11]

Fruit and vegetables are fundamental to a healthy diet and are associated with good health and well-being. WHO recommends that adolescents consume five portions (400 grams) of fruit and vegetables every day. Limiting sugar intake among adults and children is also a key target area for policy-makers. Free sugars, of which sugar-sweetened beverages provide a main source for adolescents, can increase overall energy intake and displace nutrient-rich foods. They are associated with weight gain, increased

risk of noncommunicable diseases and higher risk of dental caries. WHO recommends reducing the intake of free sugars to less than 10% of total energy intake, and a further reduction to below 5% (or roughly 25 grams (six teaspoons)) per day provides additional health benefits.[15?]

Table 2. 4 WHO Recommendation of free sugar intake

	Recommendation
Strong Recommendation (< 10% of TEI)	WHO recommends to reduce intake of free sugars throughout the life course. In both adults and children, WHO recommends reducing the intake of free sugars less than 10% was obtained by the moderate quality of observational study in dental caries
Conditional Recommendation (< 5% of TEI)	WHO suggest a further reduction of the intake of free sugars below 5% of total energy intake considering the occurrence of dental caries is the accumulation of long-term dietary risk factors (i.e. free sugar intake), and reducing free sugar may lower the risk of dental caries and other health problem in their life.

Four major risk factors generate the majority of NCDs. Of these, poor diet makes the biggest contribution, larger than tobacco, alcohol and physical inactivity combined. Globally, increased consumption of processed food containing excess amounts of sugar, salt, saturated and trans fats are compounded by low intakes of healthy foods like fruit and vegetables, whole grains, nuts, pulses and seafood.[25]

WHO defined some differentiation of sugars contain in sugar-sweetened beverages' type. And it is important to note that sugar content can be vary by beverages and by country. (See on table 2.5).

Table 2. 5 Typical Sugar Content of Sugar-Sweetened Beverages (in 330ml)[58]

Type of SSB	**Sugar Content**
Bottled Ice Tea	5.5 teaspoons
Flavoured Yoghurt Drink	7 teaspoons
Flavoured Milk drink	7 teaspoons
Soft drink/soda	8.5 teaspoons
Powdered fruit-flavoured drink mix	9.5 teaspoons
Fruit juice	9.5 teaspoons
Energy drink	10 teaspoons

SSBs have no nutritional benefits and essential for health. For example, if people drink a single can of a carbonated soft drink on average contains 40 grams of free sugars (roughly equivalent of 10 teaspoons of table sugar), while the WHO guidelines recommend to consume of free sugar less than 10% of daily intake (equivalent roughly 12 teaspoons of table sugar for adult with diet of 2000 kcal, and 9 teaspoons of table sugar for children with diet of 1500 kcal).

Based on data from CDC, the consumption of SSB is varies by age, sex, ethnicity, geography and also socioeconomic status. From 2011-2014, there are 63% or 6 in 10 youth drank SSB, this prevalence is higher than adult that has 49% or 5 in 10 adult that drank an SSB on a given day. Besides that, SSB intake is higher among boy adolescent.[56]

In 2022, WHO already released the first-ever global tax manual for sugar-sweetened beverages. Taxes on sugar-sweetened beverages can be a tool to promote health in order to prevent diseases because of the SSBs, such as soft drinks, flavoured milks, energy drinks, vitamin waters, fruit juices and sweetened iced teas that can increase the risk of type 2 diabetes, weight gain and obesity, heart disease, stroke, cancer, and dental cavities in both children and adults.[55]

In Indonesia, there is still lack of policy about the consumption of ultra-processed food especially for sugar-sweetened beverages. This is in line with study by Ratu Ayu that stated that the Indonesian Government has not implemented a significant policy to control sugar consumption, including the SSBs, as part of its efforts to control NCD.[73]

2.3.1 Sugar-Sweetened Beverages and Nutritional Status

Sugar-sweetened beverages (SSBs), sweetened with either sucrose or high-fructose corn syrup, are the leading source of added sugars in the diets of U.S. Excess SSB consumption was associated with weight gain. Emerging evidence suggests that greater consumption of SSBs may be preferentially associated with fat accumulation in visceral adipose tissue (VAT); that is, more fat may be accumulated in VAT, and less fat may be accumulated in subcutaneous adipose tissue (SAT).[23]

It is widely acknowledged that, although they are complex and multifactorial conditions, overweight and obesity would be largely preventable through ‘relatively simple’ lifestyle changes. In addition to ultra-processed foods, an important source of ‘empty calories’ are soft drinks-specifically carbonated and non-carbonated sugar-

sweetened beverages (SSBs), such as sodas and ready-to-drink tea, fruit and fruit flavoured beverages—that usually contain large amounts of refined sugars (most often high-fructose corn syrup) but few or no nutrients. The worldwide demand for these beverages has grown rapidly over the last decades. Compelling evidence from observational studies and experimental trials indicates that the regular consumption of SSBs has a significant impact on the prevalence of overweight and obesity (in both children and adults) and contributes substantially to the onset of other metabolic diseases (notably, type 2 diabetes).[24]

2.4. Physical Activity

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.[34]

Based on WHO, physical activity that recommended by WHO for children and adolescents aged 5 – 17 years: should do at least an average of 60 minutes per day of moderate-to-vigorous intensity, mostly aerobic, physical activity, across the week, should incorporate vigorous-intensity aerobic activities, as well as those that strengthen muscle and bone, at least 3 days a week, should limit the amount of time spent being sedentary, particularly the amount of recreational screen time.[43]

Table 2. 6 Categorization of Physical Activity

MET Scores	Level of PA	Pattern of Activity
< 600	Low	Those individuals who not meet criteria for Categories 2 or 3 are considered to have a 'low' physical activity level.
600 - 2999	Moderate	- 3 or more days of vigorous-intensity activity of at least 20 minutes per day - 5 or more days of moderate-intensity activity and/or walking of at least 30 minutes per day - 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum Total physical activity of at least 600 MET-minutes/week
≥ 3000	High	- vigorous-intensity activity on at least 3 days achieving a minimum Total physical activity of at least 1500 MET-minutes/week

- 7 or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum Total physical activity of at least 3000 MET-minutes/week.

Source: Guideline for IPAQ Short and Long Forms[49]

Habitual physical activity (PA) provides numerous health benefits yet, U.S. data from 2012 indicate that only 24.8 % of adolescents, aged 12–15 years, were participating in enough PA to meet the World Health Organization's physical activity guidelines for children and adolescents of accumulating 60 min of at least moderate-intensity PA on a daily basis. Within the family and home setting, the report suggests that family-based approaches have great potential to encourage and support youth PA, since PA-related habits, values, and beliefs are learned within the family environment.[35]

UNICEF Indonesia stated that there is evidence that Indonesian children, youth and adults have inadequate levels of physical activity, with 57% of children and youth not meeting WHO recommendations.[78]

2.4.1 Screen Time Behaviour associated with physical inactivity

Sedentary behaviour—defined as a form of waking behaviour expending <1.5 metabolic equivalents in a sitting or reclining position is now recognized as a distinct construct from physical (in) activity and may impact health through different mechanisms. Screen time is the most prevalent form of sedentary behaviour in children and youth, this extreme amount of daily screen time has been reliably associated with an increased risk of obesity, and adverse cardiometabolic profile in youth independent of physical activity. However, a paucity of research has examined the association between screen time and mental health indicators, such as mood or symptoms of depression.

Overall exposure to screen time, particularly time spent engaged in video games and recreational computer use, were associated with more severe depressive symptomatology in a sample of overweight and obese adolescents after controlling for a wide range of confounders. These finds suggest that excessive screen time may represent a risk factor or behavioural marker for depressive symptomatology in overweight and obese youth.[39]

A number of possible mechanisms are thought to explain the effects of screen media exposure on obesity. These include displacing physical activity, increasing energy intake

from eating while viewing and/or the effects of advertising, and reducing sleep. Food advertising is another explanation for the link between screen media exposure and excess energy consumption. [81]

2.5. Family Income

Household income or family income is the income received by the household, whether it comes from the income of the head of the household or the income of the household members. Household income can come from remuneration for labour production factors (wages and salaries, profits, bonuses, etc.), capital remuneration (interest, profit sharing, etc.), and income originating from gifts from other parties (transfers).[53]

There are many factors driving the higher processed food in nutrition transition in Asia. Several factors are likely driving the increased consumption of higher processed foods in Asia such as demand-side rising household incomes, rapid urbanization, the increasing female economic participation are likely to be driving demand for convenience foods.[67]

Pontianak, as the capital city of West Kalimantan, has the highest of Provincial Minimum Wage compared to another district in West Kalimantan. Based on data from National Socioeconomic Survey (BPS) 2022 in Indonesia , the expenditure per capita by regency/city in West Kalimantan, Pontianak City has the highest percentage (10.3%), followed by Singkawang City (8.57%) and Sambas District (7.42%).[51] The average percentage of food consumption expenditures per capita in a month in Pontianak City from National Socioeconomic Survey (BPS) 2022 in Indonesia also showed that consumption of instant food and drink has the highest percentage (12.76%), followed by tobacco and betel (8.04%) and grains (4.32%).[50]

Study from Brazil showed that the percentage caloric contribution of UPF was significantly higher among students from private schools compared to public schools, those who do not eat meals offered by schools, those who do not eat breakfast regularly, those who eat while watching TV, and those who spend more time in front of screens. It is also supported by the presence of canteens, advertising, and the sale of unhealthy food were associated with increased consumption of UPFs among adolescents.[61]

The determination of private senior high school by considering that is the student in private schools has the family with higher income, based on the semester fee in private schools is higher than in public schools.

2.6. Senior High School Students Characteristics

"Adolescence" is a dynamically evolving theoretical construct informed through physiologic, psychosocial, temporal and cultural lenses. This critical developmental period is conventionally understood as the years between the onset of puberty and the establishment of social independence. The most commonly used chronologic definition of adolescence includes the ages of 10-18, but may incorporate a span of 9 to 26 years depending on the source.[12]

Adolescence is a period of maturity, a point of physical, emotional, social and psychological change. It is considered to be the period between ages 13 and 19.[13] In adolescents' phase, the changes in lifestyle, risky behaviours and the influence of social interactions are also the aspects that compromise the adoption of consuming foods. The search of attractive, ready and easily accessible foods is seen as a convenient alternative especially for young people, and this will be leading to greater consumption of UPF at this stage of life. Adolescents are looking for the construction of their identity, so analytical and reflective thinking is less comprehensive, which can lead them to adapt their behaviours as a form of acceptance and adaptation to the social environment.[62]

Developmental transitions occurring during adolescence require reciprocal reorganization of the individual and the context influencing cognition, emotion, behaviour and relationships. This interdependent, individual and contextual evolution presents multi-system challenges constituting the basis of risk, resiliency, and opportunity in adolescence.[12]

The finding from the study in Brazil also found that the fact that the adolescent's group is potentially prone to being influenced by the social environment, has less critical capacity and less concern with food and the perception of body image, and these can lead the higher prevalence of excessive consumption of UPF.[62]

Nutrition during early development is directly associated with future obesity. The monthly family income, self-attitude toward obesity, taking extra salt and spending time with computer all are part of a vicious cycle that lead children and adolescents toward

obesity.[14] Fruit and vegetable consumption decrease with age, with more marked declines for fruit, suggesting that as adolescents gain greater independence in relation to their eating behaviour, they are less likely to make healthy choices.[15]

The consumption of added sugars, processed meats, and trans fats is higher than the recommended daily intake. It has been shown that after the transition from adolescence to young adulthood, when independency increases, young adults are continuously challenged to make healthful food choices. Along with unhealthy eating behaviours, a new series of weight-related behavioural patterns begins throughout this period, such as excessive alcohol consumption and a low level of physical activity.[26]

2.7. Previous Similar Studies

Table 2.7 will show the previous study that similar to this study.

Table 2. 7 Previous Similar Studies

Authors	Study Design	Aims	Variables	Subjects	Results
Eurídice Martínez Steele, Larissa Galastri Baraldi, Maria Laura da Costa Louzada, Jean-Claude Moubarac, Dariush Mozaffarian, Carlos Augusto Monteiro[40]	National Health and Nutrition Examination Survey 2009–2010	To investigate the contribution of ultra-processed foods to the intake of added sugars in the USA	UPF consumption, added sugar intake,	9317 participants aged > 1 years	Ultra-processed foods comprised 57.9% of energy intake, and **contributed** 89.7% of the energy intake from added sugars. Content of added sugars in ultra-processed foods (21.1% of calories) was eightfold higher than in processed foods (2.4%) and fivefold higher than in unprocessed or minimally processed foods and processed culinary ingredients grouped together (3.7%).
Carla Cristina Enes, Carolina Moura De Camargo, Maraisa Isabela Coelho Justino[41]	A semiquantitative food frequency questionnaire	To evaluate the relationship between ultra-processed food consumption and obesity indicators in adolescents in Brazil	UPF consumption, sociodemographic, BMI	200 adolescents from 10- to 18-year-old adolescents of both sexes who attended a Non-Governmental Organization (NGO) in the city of Campinas	The frequency of obesity was 47.0%, and 21.5% increased waist circumference. The average energy intake, which 50.6% was derived from ultra-processed foods. The categories with the highest caloric contributions among ultra-processed foods were industrial loaves/cakes (16.2%), sweets and candy (6.2%), pastas (6.0%) and sweetened drinks (5.1%). **No association** was found between ultra-processed food consumption and anthropometric indicators

Michele Honicky, Silvia Meyer Cardoso, Francilene Gracieli Kunradi Vieira, Patricia de Fragas Hinnig, Isabela de Carlos Back and Yara Maria Franco Moreno[46]	A cross-sectional study assessed using three 24-hour recalls	To describe UPF intake and evaluate associations with isolated cardiovascular risk factors and children and adolescents with CHD clustered by cardiovascular risk factors in Southern Brazil	UPF, cardiovascular risk factors	232 children and adolescents with congenital heart disease (CHD)	UPF contributed 69 % to total energy intake, the multivariable logistic regression revealed that an absolute increase of 10 % in UPF intake was **associated** with central adiposity, also associated with children and adolescents with CHD clustered by high cardiovascular risk after adjusting for confounding factors
Fadila, Jihan[47]	An analytic with cross-sectional method using FFQ questionnaire	To determine the relationship between consumption of ultra-processed food and the incidence of overweight in junior high school adolescents in Makassar	UPF, obesity	192 junior high school adolescents	The results show that there was **a relationship** between the amount and frequency of consumption of ultra-processed food and the incidence of overweight.
Septi Lidya Sari[48]	A cross sectional study using online questionnaire and the Semi Quantitative Food Frequency Questionnaire (SQ-FFQ) independently	To find out the proportion of packaged sweetened drink consumption and to find out whether there are differences in the proportion of packaged sweetened drink consumption based on individual characteristics and the use of nutritional value information labels (ING) among adolescents in Jakarta	Consumption of packaged sweetened beverages, ability to read ING labels	167 students of grades X and XI at a private high school	The level of consumption of packaged sweetened drinks tends to be higher in male respondents and also in respondents with low ability to read ING labels (p=0.011)
Pratiwi Azizah Ajeng[64]	2x24 Recall, FFQ, PAQ-C	To assess the correlation between UPF and BAZ	UPF consumption, BAZ, PA, socio-demographic	136 elementary students in the 4th and 5th grades in	35.3% respondents were in 1st tercile UPF consumption. **No significant** association was found between UPF consumption and

		among school-age children 10-12 years old in Surabaya		3public and private schools	BAZ (p=0.217). Only physical activity that **significant** in multivariate analysis (p=0.032)
Rafiony, Ayu[77]	A case-control study design using SQFFQ	Found out the prevalence of obesity and risk factors for energy intake and frequency of consumption of fast food and soft drinks on the incidence of obesity in high school students in Pontianak	Obesity, frequency of fast food and soft drinks consumption, energy intake	160 students of senior high schools in Pontianak	The prevalence of senior high school students in Pontianak was 9.29%. There was a **relationship** between frequency of total fast food and local fast food with obesity (p<0.05: OR=2.03:95% CI=1.03-4.00)
Diska, Fransiska Noviyanti[80]	A case-control study design using FFQ, dietary questionnaire	To found out the relationship between deiatry habit and fast food consumption with obesity among students in school in Pontianak	Fast food consumption, obesity	62 students of senior high school in Pontianak	There was a **relationship** between diet and obesity in teenagers indicated by the results of p = 0.000 and there was a relationship between fast food consumption and obesity in adolescents indicated by the results of p=0.003

Based on the previous similar studies above, there are still lack of studies that examine UPF and SSB separated. Most studies of UPF will include SSB, so it is difficult to see differences between food and beverage consumption. This study taking school-age adolescents as the respondents, because at this age it is a phase that likes to follow trends, and it is easy to accept advertisements including food and beverage advertisements. This study is important for study in West Kalimantan, because there has been no study linking the consumption of UPF and beverages with nutritional status. To address this gap, researchers choose the Pontianak City because currently the fast-food trend is spreading, as well as sweetened drinks.

2.8. Theoretical Framework

Based on the literature review, there are many factors that associated to eating habits of the students, such as sociodemographic factors (i.e., age, family income, parent education level, family lifestyle), stress level of the students, self-attitude, and social media that will give many information about foods and advertisement on social media. Eating habits, stress level, self-attitude and social media will direct association to ultra-processed food and sugar-sweetened beverages consumption. While using phone to use social media, students will spend a lot of time for screen time, and this will cause the physical inactivity, which contribute to obesity. The consumption of ultra-processed food and sugar-sweetened beverages will cause the dental caries and excess of sugar, salt, saturated fat and excess of calorie intake, which contribute also to blood pressures, glucose profile, and obesity. The pathway of the risk factors of nutritional status will be described in Figure 2.2.

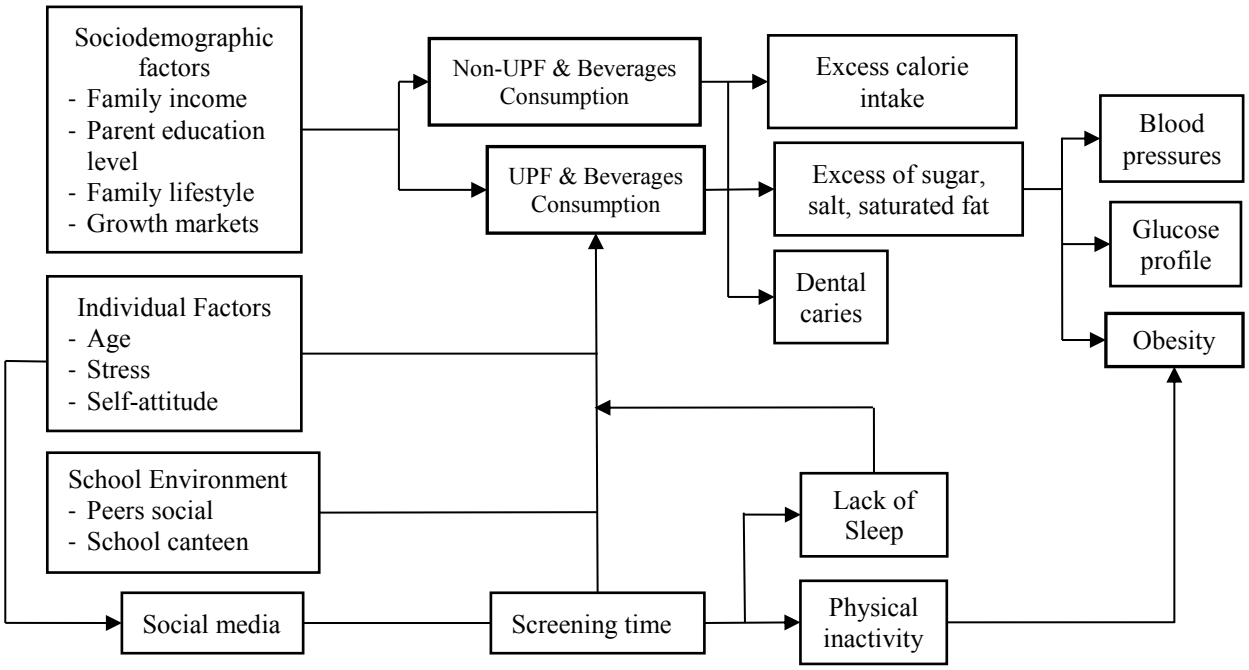


Figure 2. 2 Theoretical Framework of Association Between Consumption of Ultra-Processed Foods and Beverages with Nutritional Status of Senior High School Students in Pontianak

2.9. Conceptual Framework

In this study, the association between ultra-processed food consumption, sugar-sweetened beverages consumption associated with nutritional status and will be assessed by considering other related risk factors such as physical activity and sociodemographic factors (family income and parents education level), and energy intake from non-ultra-processed food consumption.

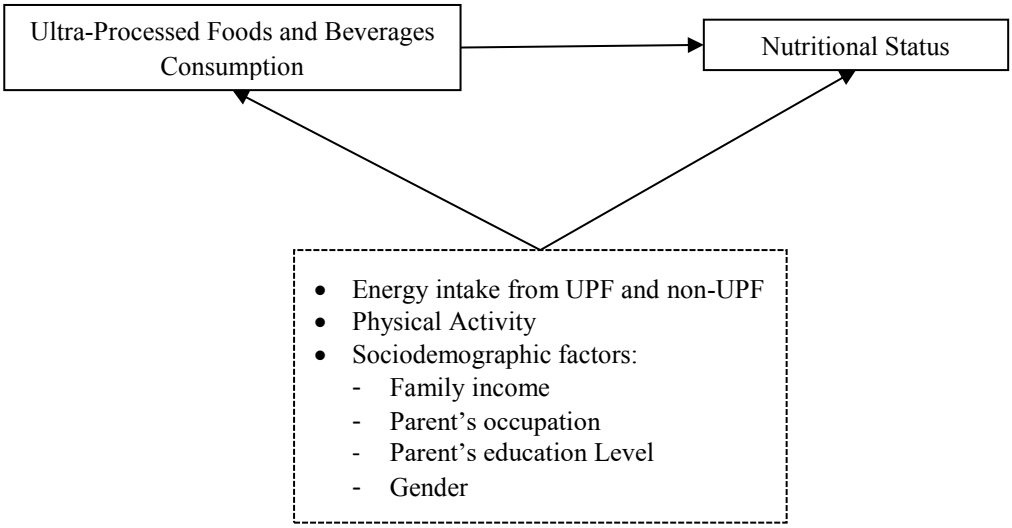


Figure 2. 3 Conceptual Framework of Association Between Consumption of Ultra-Processed Foods and Beverages with Nutritional Status of Senior High School Students in Pontianak

CHAPTER 3
STUDY METHODS

3.1. Study Design

This study was a cross-sectional investigation that assessed the correlation between consumption of Ultra-Processed Foods and Beverages with nutritional status among senior high school students.

3.2. Area and Time of Study

This study was conducted in Pontianak, West Kalimantan. The data collection took place in June 2023 in private senior high schools in Pontianak, following the acquisition of Ethical Clearance.

3.3. Subject of the Study

3.3.1. Population

Population of this study was the students at private senior high schools in Pontianak

Criteria of Subject Study

3.3.1.1. Inclusion criteria:

a. Aged 15-17 years old
b. Registered as a private senior high school student in South Pontianak in 2023

3.3.1.2.Exclusion criteria:

a. Not present at the time of data collection
b. Sick at the time of data collection
c. On a diet (weight loss program) or consuming drinks or slimming drugs
d. An athlete

3.4. Sample Size

3.4.1. Sample Size Calculation

This study aimed to assess the association between the consumption of ultra-processed foods (UPF), sugar-sweetened beverages (SSB), and the nutritional status of senior high school students. The consumption of UPF and SSB was defined as categorical data. Therefore, the sample calculation used an equation for assessing the association and estimating two proportions The study used a sample size equation for the difference between two proportions, with the following equation:

$$n = \frac{\left\{Z_{1-a/2}\sqrt{2P(1-P)} + Z_{1-\beta}\sqrt{P_1(1-P_1)} + P_2(1-P_2)\right\}.^2}{(P_1 - P_2)^2}$$

n = total samples

$Z_{1-a/2}$ = significance level (α=5%) = 1.96

$Z_{1-\beta}$ = power 80% = 1.28

$P1$ = proportion of obesity among those with low SSB consumption

$P2$ = proportion of obesity among those with high SSB consumption

P = $\frac{P1+P2}{2}$

$$n = \frac{\left\{1.96\sqrt{2P(1-P)} + 1.28\sqrt{P_1(1-P_1)} + P_2(1-P_2)\right\}.^2}{(P_1 - P_2)^2}$$

$$n = \frac{\left\{1.96\sqrt{1.312(1-0{,}656)} + 1.28\sqrt{0.377(1-0.377)} + 0.559(1-0.559)\right\}.^2}{0.033}$$

$$n = \frac{\left\{1.96\sqrt{1.312(0.344)} + 1.28\sqrt{0.377(0.623)} + 0.559(0.441)\right\}.^2}{0.033}$$

$n = 115$

Second calculation using the same equation.

$$n = \frac{\left\{Z_{1-a/2}\sqrt{2P(1-P)} + Z_{1-\beta}\sqrt{P_1(1-P_1)} + P_2(1-P_2)\right\}.^2}{(P_1 - P_2)^2}$$

n = total samples

$Z_{1-a/2}$ = significance level (α=5%) = 1.96

$Z_{1-\beta}$ = power 80% = 1.28

$P1$ = proportion of obesity among those with low UPF consumption

$P2$ = proportion of obesity among those with high UPF consumption

$P = \frac{P1+P2}{2}$

$$n = \frac{\left\{1.96\sqrt{2P(1-P)} + 1.28\sqrt{P_1(1-P_1)} + P_2(1-P_2)\right\}.^2}{(P_1 - P_2)^2}$$

$$n = \frac{\left\{1.96\sqrt{0.308(1-0.154)} + 1.28\sqrt{0.137(1-0.137)} + 0.171(1-0.171)\right\}.^2}{0.019}$$

$$n = \frac{\left\{1.96\sqrt{0.308(0.846)} + 1.28\sqrt{0.137(0{,}863)} + 0.171(0.829)\right\}.^2}{0.019}$$

$n = 131$

$2n = 262$

This was a two-proportion study, because of that the total of the sample size needed to calculated twice. To prevent the sample loss, so minimum sample was added with 10% of sample.

Total sample = 262 + 10%

Total sample = 288 respondents

So, the total number of subjects required of this study are 288 respondents.

Table 3. 1 Sample size calculation

Independent Variable	P1	P2	N
SSB Consumption[54]	0.137	0.171	131
UPF Consumption[55]	0.377	0.559	115

Table 3.1 above showed the sample size calculation for this study. The highest result of total sample calculation will be taken as the sample size of the study.

Based on study from Qian Gan, with the title “Sugar-Sweetened Beverage Consumption Status and Its Association with Childhood Obesity Among Chinese Children Aged 6–17

Years" found that the prevalence of obesity that consume low sugar-sweetened beverages (<1 time/week) is 13.7%, and the prevalence of obesity that consume high sugar-sweetened beverages (1-<5 time/week) is 17.1%.[54]

Hana Fauziyyah in her study that conducted in Padang found the prevalence of obesity that consume low UPF was 37.7% and the prevalence of obesity that consume high UPF was 55.9%.[55]

3.4.2. Sampling procedure

The population of the study were the students in private senior high schools in Pontianak City. Based on data from Pontianak City Health Office, South Pontianak has high prevalence of obesity among adolescents (15.62%). Based on data from 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. Imanuel Senior High School is the school with the largest number of students (933 students). Petrus Senior High School is also a private school with the second largest number of students, with 872 students. These schools are the private schools in South Pontianak, under the work area of South Pontianak Health Care Center. The large number of students from these two schools is expected to be able to represent the characteristics and consumption patterns of adolescents in Pontianak.

In this study, the researcher used simple random sampling to enrol respondents. The participants of this study were students in the 10th and 11th grades. Imanuel High School had a total of 10 classes for grades 10th and 11th, and Petrus Senior High School had 8 classes for each grade and total 16 classes for grades 10th and 11th, making a total of 26 classes across both senior high schools for this study. Therefore, each class required 14-15 respondents for Imanuel School and 9 participants for each class for Petrus School. The list of respondents was randomized using paper with names, and students who met the study criteria and agreed to participate by signing the consent form became the respondents. The flow of the sampling procedure is depicted in Figure 3.1.

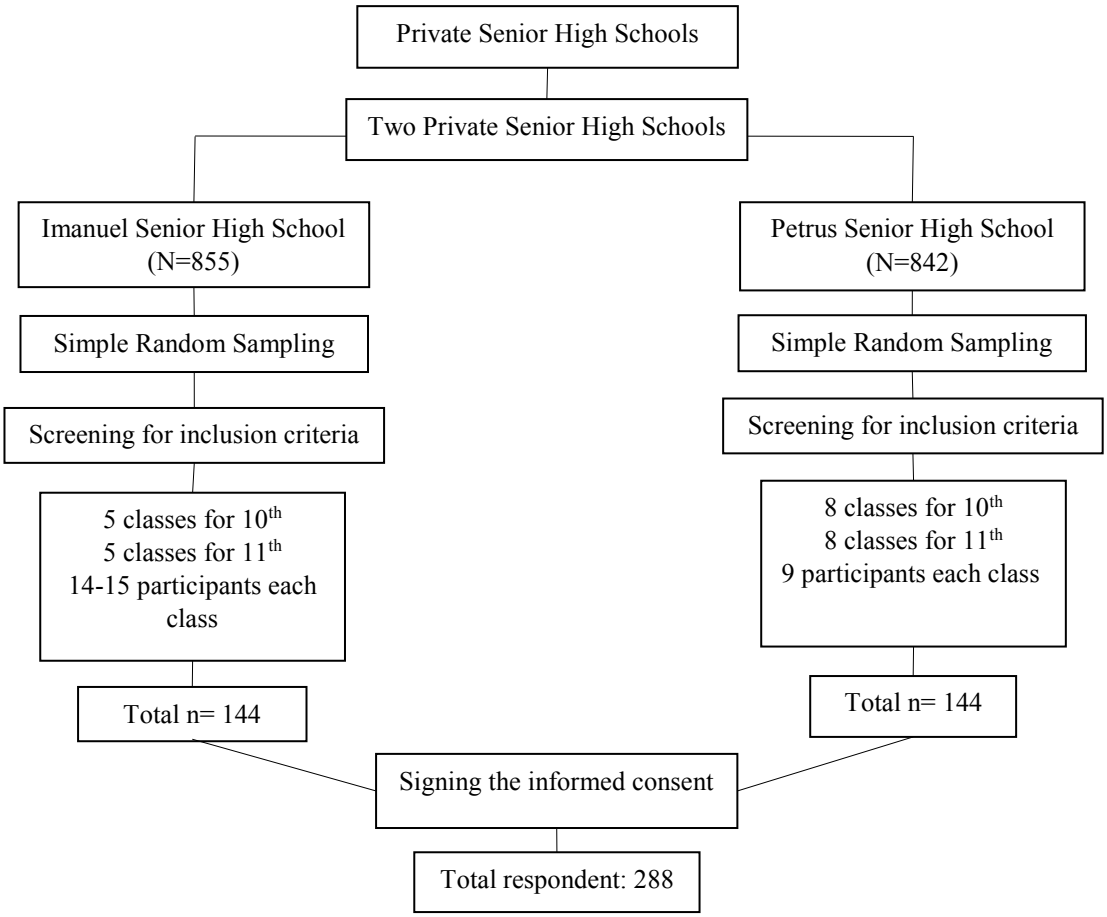


Figure 3. 1 Sampling procedures flow

3.5. Instruments of the Study

The language of all instrument in this study was in Bahasa Indonesia. Several instruments were used for data collection, and Table 3.2 presented various forms that were used during the study.

Table 3. 2 Instruments of the Study

Instruments	Code	Purposes
General Information of the study	GI	This form will give a brief explanation about the study (researcher origin, purpose of the study, inclusion criteria of the subject, subject's right, data needed, contact person if needed)
Informed consent	IC	This form will purposively to get the subject's permission and agreement to follow and giving data during the study by filling name and signing the form
General Questionnaire	GQ	To collect primary data of the respondents (Name, age, date of birth, sex, school grade, body weight, height, nutritional status, parent's level of education, parent's occupation, family income)
24 hours recall	HR	To collect information of energy intake of food that consumed by respondents in 2 non-consecutive days
Food frequencies questionnaire	FFQ	To collect information of food frequency that consumed by respondents in a week
International physical activity questionnaire – Short form	IPAQ-S	To assess physical activity level of the respondent which is translated in MET / week, and measure the level of physical activity
Body weight scale		To measure respondent's weight
Height measurement		To measure respondent's height

3.6.Operational Definition

3.6.1. Variables Indicator Matrix

Table 3.3 will explain the detail of variables of this study

Table 3. 3 Variable Indicator Matrix

Variables	Operational Definition	Indicators	Methods	Instruments	Scale
Dependent Variables					
Nutritional status	The condition of the body as a result of the intake, absorption and use of nutrition, as well as the influence of disease-related factors. 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 normal, and overweight and obesity will be combined as obesity.	Normal: -3 SD - +1 SD Obesity: > +1 SD - > +2 SD	• Measure body weight and height • Calculate BMI/age equation • Plotting the result to the graph • Classified BMI result according to the CDC classification of nutritional status	Weight scale and Height scale	Ordinal
Independent Variable					
Ultra-processed food consumption	Ultra-processed food will be defined as food processed in food industries by the addition of many ingredients, and most of these foods are ready-to eat or only require simple preparation before consumption. Food categorized based on NOVA classification group 4. The UPF consumption frequency will be assess using FFQ (at Appendix 4). The frequency will be sum up to get the total score of UPF frequency. The total score of UPF consumption will be categorized based on median data distribution.	Normal: < median of total score Excessive: ≥ median of total score	Direct interview (FFQ)	Food Frequency Questionnaire	Ordinal

Sugar-sweetened beverages consumption	Drink / beverages with high of sugar, sucrose, and contain high energy. Sugar-sweetened beverages will be defined as the consumption of all type of beverages (milk-based drinks, fermented/condensed milk, carbonated drinks, fruit flavour drink, tea, coffee, sport/electrolyte drink, flavoured drink, non-100% fruit juice, chocolate drinks, etc.). In this study, the researcher will exclude the 100% fresh juice. Sugar-sweetened beverages consumption frequency will be assess using FFQ (at Appendix 4). The total score of SSB consumption will be categorized based on median data distribution.	Normal: < median of total score Excessive: ≥ median of total score	Direct interview (FFQ)	Food Frequency Questionnaire	Ordinal
Total Energy Intake	Total energy intake (TEI) is total energy from all foods of UPF and beverages (include SSB) within whole day. Total energy intake in this study was assessed using two non-consecutive days 24-hours recalls which representative for weekday and weekend intake. Total energy will summary each day of recall, and then it will be compared with the RDA TEI will categories into 3 categories.	1. <80% RDA 2. 80-100% RDA 3. >100% RDA	Direct interview (24-hours recall)	24 hours recall Questionnaire	Ordinal
Physical activity	Any bodily movement produced by skeletal muscles that requires energy expenditure. PA refers to all movement including during leisure time, for transport to get to and from places, or as part of a person's work.[43] In this study, physical activity will be assessed using International Physical Activity Questionnaire-Short Form (IPAQ-S) (see in Appendix 5) 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. After that, the duration and frequency of those activity were calculated in the following calculation:	Low: < 600 MET-minutes/week Moderate: 600 – 2999 MET-minutes/week High: ≥ 3000 MET-minutes/week[49]	• Direct interview (IPAQ-S) • Classified metabolic equivalent of task (MET) in a week	IPAQ-S	Ordinal

$$Vigorous\ MET = 8.0\ x\ vigorous - intensity\ activity\ (minutes)\ x\ vigorous\ days$$

$$Moderate\ MET = 4.0\ x\ moderate - intensity\ activity\ (minutes)\ x\ moderate\ days$$

$$\underline{Walking\ MET = 3.3\ x\ walking\ (minutes) x\ walking\ (days)}$$
$$\underline{+}$$

$$Total\ PA\ MET = Vigorous + Moderate + Walking\ MET$$

$$Total\ PA\ MET = Vigorous + Moderate + Walking\ MET$$

Gender	Gender of respondent in this study is defined as sex which categorized as male and female	1: Male 2: Female	Physical observation / direct interview (General questionnaire)	Questionnaire	Nominal
Parent's Occupation	Type of usual profession or job of the subject's parents as main source of income of respondent's parent. Occupation level in this study will be defined as government, non-government, not working. Parent who works as civil servants, police, army or stated-owned corporation worker will be categorized as government worker, otherwise will be categorized as non-government worker.	1: Government 2: Non-Government 3: Unemployed	Direct interview (General questionnaire)	Questionnaire	Categorical
Parent's education level	The level of education that a person achieves after taking lessons in the highest grade at a school level by obtaining a graduation certificate (diploma). In this study will be categorized as Basic (primary school), Intermediate (junior until senior high school), and Advance (diploma until doctorate)[52]	1: Basic 2: Intermediate 3: Advance	Direct interview (General questionnaire)	Questionnaire	Ordinal
Family income	Income that received by the household concerned, both from the income of the head of the household and the income of household members. Family income will be categorized as low and high. According to the regional minimum wage for Pontianak City 2023, IDR.2.750.644.55 will be include to the high category of family income.[53]	Low: <IDR. 2.750.644,55, - High: ≥IDR. 2.750.644,55, -	• According to the regional minimum wage for Pontianak 2023 • Direct interview (General questionnaire)	Questionnaire	Ordinal

3.7. Data Collection Procedures

3.7.1. Preparation

In the preparation phase, the researcher developed the study proposal and prepared the necessary instruments. The proposal was based on a literature review and discussions with advisors for study planning. The study proposal was examined before obtaining ethical clearance from the Ethical Committee as ethical permission to conduct the study. In this phase, the researcher prepared all the instruments, such as the general questionnaire, Food Frequency Questionnaire (FFQ), 24-hours recall form, International Physical Activity Questionnaire-Short Form (IPAQ-S), and anthropometric tools, such as a weight scale and height meter. For the FFQ, the researcher first conducted a market survey to develop a food list so that the obtained list became more valid. The questionnaire was also pre-tested before data collection, involving thirty students with characteristics similar to the respondents. The researcher searched for enumerators to help with data collection during the procedures. The enumerators were trained by the researcher before data collection to obtain valid data.

3.7.2. Data Collection

3.8.2.1 Nutritional status

3.8.2.1.1. Anthropometric Measurement

Anthropometric measurements are non-invasive quantitative assessments of the body. As per the Centres for Disease Control and Prevention (CDC), anthropometry offers a valuable means of assessing nutritional status in children, adolescents, and adults.[36]

Respondents assessed their height and weight to evaluate their nutritional status. 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.

3.7.2.1. Body Weight Measurement

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.

Table 3. 4 SAGA Weight Scale Calibration and Measurement

Saga weight scale calibration	Steps to do body weight measurement
Place the weighing scale on a hard, flat floor and in a well-bright area	Install the battery correctly at the bottom of the scale Place the weighing scale on a hard, flat floor and in a well-bright area
Turning on the weigh scale	Activate the scale by pressing/stepping on the scale, wait until the number 0.0 appears
Place a 5 kg stone weight on the weighing tool. You can also use something else that weighs 5 kg	Pay attention to the position of the patient's feet right in the middle of the weighing instrument, not supporting it on one leg, a calm attitude (DO NOT MOVE) and head is not lowered (looking straight ahead)
If the scale shows the number 5.0 then the scale has been calibrated. If there is a difference of about 0.15 kg or 150 grams, check the battery and replace the battery	Wait until the weight number appears and does not change (static) Read and record weight on status Respondent stepped on the scales with the foot position right above the foot image on the scales, and did not cover the numbers on the scales Ask the respondent to get off the weighing scale

3.7.2.2. Height Measurement

3.10.3.2.1 Parts of Height Measuring Tools

Multifungsi® is the tools to measure the height of respondents. Multifungsi® also used as a national standardized tool for measuring height used during SSGI 2022. This tool has the maximum measurement of 196.0 cm and an accuracy of 0.1 cm. There are several parts of the Multifungsi® tool that must be installed before taking a height measurement:

a. 3 measuring sticks (0-78.9 cm, 79.0 - 137.9 cm), (138.0 - 196.0 cm)
b. Footboard with lock
c. Sliding tool with reading window filled with numbers
d. The pedestal tool used when measuring height

3.10.3.2.2. Multifungsi® Height measurement tool preparation:

a. Install the first measuring stick on the footboard, then attach the lock to the hole on the footboard
b. Attach the slide tool to the stick. Make sure the position of the reading window must be on a measuring scale
c. Attach the second and third measuring sticks according to the order of the scale
d. Install the pedestal / support tool at the top of the stick, adjust to the position of the tool lock so that the measuring rod remains perpendicular
e. The height meter is ready to use

Table 3. 5 Multifungsi® Tools Calibration and Measurement

Multifungsi® Calibration	Steps to measure
Prepare the calibration measuring sticks	Ask the respondent to remove footwear (sandals/shoes), hat (headgear) and other accessories that can affect the measurement results.
Measure the length of the calibration stick on the height stick	Place the Multifungsi® tool on a hard, flat floor and in a well-bright area, make sure the pedestal stick to the wall
If the measurement results of the calibration measuring stick show the number 83.0 cm (according to the length of the calibration measuring rod), the Multifungsi measuring tool is ready to use	The respondent step on the footboard with his back to the measuring sticks The respondent stands straight, feet together, shoulders relaxed, hands at the side, and looks straight ahead, the point of the earlobe with the tip of the eye must form an imaginary line that is perpendicular to the back wall of the measuring instrument (90°) (Frankfort Horizontal Plane) The measuring sticks must be in the middle of the respondent's back, do not deviate to the left or right The head, back, buttocks, calves and heels are attached to the measuring tool The enumerator position is on the left of the respondent Drag the slider tool until it touches the head, do not apply too much pressure. Then tighten the sliding panel by turning the screw but not too tight Respondents were asked to get off the measuring instrument Read the measurement results with your eyes at eye level with the reading window line and the numbers shown. Read from small numbers to bigger numbers Fill in the measurement results without rounding

3.7.3. Questionnaires

There are 4 questionnaires used in this study consisting of general questionnaire, Food Frequencies Questionnaire (FFQ), 24-hours recall form, and International Physical Activity Questionnaire Short Form (IPAQ-S).

1. General questionnaire contains data regarding general information of the subjects including name, date of birth, age, sex, school grade, body weight, height, nutritional status, parent's information (occupation, family income, level of education).
2. Food frequencies questionnaire (FFQ) is to collecting frequency list of foods that consumed by students, to obtain a qualitative description of food consumption patterns.
3. 24-hours recall form is to collecting data of energy intake from UPF and SSB that consumed by students, to obtain the quantitative of food intake.
4. International Physical Activity Questionnaire Short Form (IPAQ-S) is to measure the level of physical activity of students. IPAQ short form is an instrument designed primarily for population surveillance of physical activity among adults. It has been developed and tested for use in adolescents to adults (age range of 15-69 years) and until further development and testing is undertaken. The use of IPAQ with older and younger age groups is not recommended.

3.10.4.1. General Questionnaire

Respondents were interviewed using general questionnaire to assess the sociodemographic factors and respondent's data, such as name, date of birth, grade, date of interview, gender, parent's education level, parent's occupation, family income. The questions in this section mostly refer to BPS classification.[52, 53] This process was conducted after obtained the consent from respondents by signing the assent form and the informed consent from this study will be given to parents of the students. In the field, each respondent was interviewed for 10-15 minutes for general questionnaires, FFQ and 24-hours recall, and 7 minutes for filling out the IPAQ-S questionnaires by themselves.

3.10.4.2. Food Frequency Questionnaire

In this study, food frequency questionnaire was used to assess the ultra-processes food consumption and sugar-sweetened beverages consumption. For ultra-processes food consumption was assess according to NOVA Classification group 4 and its subgroup category. The food list also modified based on the prior study conducted in Makassar, Indonesia, and developed by market survey near schools' area, and also canteen survey at the schools.

Before data collection, FFQ was developed according to NOVA classification group 4, after that modified by prior study that conducted in Makassar. Subsequently, a market survey and canteen survey were conducted in the school's vicinity to enhance the foods list in the FFQ, making it closely reflective of the commonly available foods and drinks in the study setting.

After developed the FFQ, then researcher was conducting the pretesting questionnaires. All questionnaires were pretested to minimize the odd data.

In the food frequency questionnaire, the respondents were asked to list down their food consumption in the last 7-days. They will list the foods based on the eating frequency. The filling out of the FFQ was a self-reporting process guided by enumerators and researchers.

The same process also was conduct to the SSB drink and beverages list. The assessment of sugar-sweetened beverages consumption followed the list of sugar-sweetened beverages according to NOVA Classification group 4 and its subgroup categories. The food list also modified based on the prior study conducted in Makassar, Indonesia, and developed by market survey near schools' area. In the FFQ, the respondent was asked to list down all their drinks and beverages in the form based on their consumption in the last 7-days. They were list the beverages and drinks based on the drink frequency. Once respondents completed the questionnaire, enumerators retrieved the completed forms.

3.10.4.3. 24-hours recall form

Before data collection, the researcher conducted the pretesting questionnaires. All questionnaires were pretested to minimize the odd data.

Total Energy Intake (TEI) of respondents was assessed using 2 non-consecutive days of 24-hours recall. The data collection was carried out on Monday and Thursday.

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. First, the enumerators asked the respondents all the foods and beverages that they consumed in previous day and listed on the form. Second, respondents asked to mention the ingredients of each food and beverages, followed by cooking method and amount of consumption. For helping the respondent to make standardized perception of foods and beverages consumption, the researcher provided the Food Photography Book published by MoH of Indonesia in 2013. Last, the trained enumerator 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.

3.10.4.4. International Physical Activity Questionnaire – Short Form

Before data collection, the researcher conducted pretesting of the questionnaires. All questionnaires were pretested to minimize the odd data.

Physical activity of respondents was assessed using the International Physical Activity Questionnaire Short Form (IPAQ-S). 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).

3.8.Data Management and Analysis

3.8.1. Data Coding

Each variable will be coded in the master database. Sex written in form A will be code as A_SEX, while age will be coded as A_AGE, School grade will be coded as A_GRADE, body weight will be coded as A1_BW and A2_BW. The options for the variable which has multiple choices were also coded based on its level. Options for variable “nutritional status” will be coded (1) for underweight to (4) obese. Options for variable parent’s

education will be coded (1) basic to (3) advanced for parents who graduated in bachelor to magister degree.

3.8.2. Data Editing and Cleaning

This step will be carried out after the data collection finished. First, collected data checked for completeness. If there are incomplete data, will be reconfirmed to the respondent by phone or direct visit by trained enumerator. After all data is complete, researcher will sign the questionnaire, then the data will be filled into licensed SPSS software for windows Version 26.0.

3.8.3. Data Processing and Analysis

If all data assure complete and the questionnaires already fulfilled, the researcher will input the data into Microsoft Excel 2016 MSO. After that, all the data will be processed using licensed IBM SPSS Version 26.0 for further statistical analysis.

This study will use univariate, bivariate, and multivariate analysis.

3.8.3.1.Univariate Analysis

Univariate analysis used to analyse descriptively the sociodemographic data, ultra-processes food consumption, sugar-sweetened beverages consumption and nutritional status. Data distribution will be analysing to see if any extreme data that could affect the statistical analysis.

3.8.3.2.Bivariate Analysis

A 95% degree of freedom with p-value of <0,05 is considered as statistically significant. Bivariate analysis will be used to assess the association between ultra-processes food consumption with nutritional status, and also sugar-sweetened beverages consumption

3.8.3.3.Multicollinearity

Multicollinearity is a situation where there is a strong correlation or relationship between two or more independent variables in a multiple regression model. This study will assess the consumption of ultra-processed food and sugar-sweetened beverages, to test is there any intercorrelation between UPF and SSB this study will do the multicollinearity. Sugar-sweetened beverages is including in type of ultra-processed food, so it is possible to these variables will be multicollinearity. Multicollinearity test will be processed using IBM SPSS Version 26.0.

In the output of SPSS, the results of the intercorrelation analysis between the independent variables can be seen in the crosses between the independent variables. If the result less than 0.8, the multicollinearity cannot be detected. Next step to check the multicollinearity, that is based on the standard error value and the partial regression beta coefficient. If the standard error value is less than one, it is mean that the standard error value is low, the multicollinearity still cannot be detected. Furthermore, it can be ascertained again with the values of the upper and lower bound confidence interval ranges, whether they are wide or narrow. Next is detect with VIF Value and Tolerance in Regression. If the VIF value is less than 10 and or the Tolerance value is more than 0.01, it can be concluded emphatically that there is no multicollinearity problem.

3.8.3.4.Multivariate Analysis

Multivariate analysis will be used to assess other potential factors with nutritional status. Independent variables which had p-value less than 0,25 will be included in multivariate analysis. Multiple linear regression will be used to assess the association ultra-processed food, sugar-sweetened beverages and nutritional status adjusted with other potential factors.

3.8.4. Data Presentation

Categorical data was presented by frequency or percentage (%). Statistical analysis which shows p-value <0.05 will be considered as significantly associate. The result will be presented on table.

3.8.5. Study Procedure

3.11.1 Study Preparation

3.11.1.1. Questionnaire Preparation

The questionnaires consist of general data (socio-demographic and socio-economic data), FFQ, 24-hours recall form, and IPAQ-S.

1. General questionnaire to capture the socio-demographic and socio-economic data of respondent. The questions in this section consist of subject's name, date of interview, phone number, gender, date of birth, school grade, body weight, height, and nutritional status. Data of parent's level of education refer to BPS, data of parent's occupation refer to BPS, and family income refer to minimum wage for Pontianak
2. Food Frequency Questionnaire (FFQ)

   FFQ is a form and method to collecting dietary data and use a context-specific food list to estimate the usual diet and understand the relationship between consumption patterns and health outcomes. Before data collection, FFQ foods list will be list according NOVA Classification group 4, based on the prior study conducted in Indonesia, and developed by market survey near from schools' samples, and canteen in the schools' area survey. In this study, FFQ aim to identify the frequency of food items in the last week, especially for ultra-processed food and sugar-sweetened beverages. Food classification following these steps:

   a. Each kind of food and drink for FFQ will be classified based on group 4 of NOVA classification, developed with the FFQ from prior study, market surveys and canteen survey
   b. Drink / beverages will be separated from ultra-processed food group
3. 24-hours Recall Form

   24-hours recall form is a form and method to collecting dietary data especially for the quantity of food intake in 24 hours in the whole day before. 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).
4. International Physical Activity Questionnaire-Short Form (IPAQ-S)

   The IPAQ-S measure the asses the level of physical activity in the last 7 days, the duration of each activity will be classified into low, moderate, and high (walking,

moderate-, vigorous-intensity activity), and then compute to estimate the total amount of time spent in physical activity per week (MET-min/week)

3.11.1.2. Ethical Clearance

In the issues of respondent's data, the researcher is responsible to protecting respondent's rights, identity, and personal data confidentiality. The Ethical Clearance of this study will be issued by Human Research Ethics Committee Faculty of Medicine, Universitas Indonesia.

3.11.1.3. Enumerator Staffing and Training

The enumerator's academic qualification is 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. The training will be delivered by researcher. The training will be carried out before data collection period to strengthen the enumerator's understanding of the study procedure, skills in interviewing and probing to obtain the accurate information related to the questions, and minimize inter- and intra- variation in anthropometric measurement.

The materials of the training are:

a. Study procedures, including informed consent of the study
b. Anthropometric measurement, including body weight measurement using SAGA Weight Scale and height measurement using Multifungsi® Height Measurement
c. Questionnaires that will be used in this study
d. Collecting data using general questionnaire, FFQ, 24-hours recall form, and IPAQ-S

3.11.1.4. Questionnaire Pretesting

All the questionnaires will be pretesting to evaluate the flow of data collection, checking the understanding of the participants to answer the questionnaires, and ensure the validity of the questionnaires. Pretesting will be carried out to the 30 students of that has the similar characteristics to the respondents. These are the several steps to conduct pilot testing:

a. The nearest subdistrict of the sampling area will be selected to obtain similar characteristics to the real data collection respondents
b. The researcher will have coordinating with the principal of the selected school to facilitate the trained enumerators for collecting the data
c. The trained enumerators directly interview and do the anthropometric measurement to the pretesting subjects
d. Each complete questionnaire will be checked and signed by researcher
e. Researcher will evaluate the flow of data collection from the trained enumerator, such as time management, the subject's understanding about the questionnaires, and ensure the validity of the questionnaires, to minimize errors during data collection

3.11.2. Subject Recruitment and Data Collection Procedure

This study will recruit the subject and collected data until the minimum sample size fulfil. The several steps of data collection will be stated below:

a. The trained enumerator will explain the study procedure to the subjects, then screening whether there are the exclusion criteria. If the students meet the inclusion criteria, they will be asked to sign the informed consent.
b. After screening the respondents, the trained enumerator will be collecting the data from respondent by interviewing them using the provided questionnaires, start from the general questionnaire, and then do measuring respondent's body weight using SAGA weight scale and height using Multifungsi® height measurement tool according to the standard steps.
c. Then the trained enumerator will proceed to FFQ, 24-hours recall form, and IPAQ-S interview to collect data about food and beverages consumptions and physical activity of the respondents in the last 7 days for FFQ and IPAQ-S, and 2 non-consecutive days for 24-hours recall form.

3.11.3. Quality Assurance

The quality of the study was assured from the beginning of the study. The researcher has received the courses of research methodology, nutritional assessment etc. Researcher have also received anthropometric measurement training carried out by the *Studi Status*

Gizi Indonesia (SSGI) 2022 Team, and have been part of SSGI 2022. The enumerators that recruited to this study will be trained before data collection by the researcher, and the questionnaires that will be used during data collection will be developed by market survey, canteen survey and pretested before data collection.

3.11.4. Questionnaire Checking

The researcher will be checking the completeness of the filled questionnaires and confirmed to the enumerator for any incomplete or odd data. The enumerator then reconfirmed to the subject by phone or directly visiting the subject's house.

3.11.5. Data Collection Monitoring

The researcher will visit and follow the trained enumerator during the data collection in the field to monitor and to ensure there is no missing data and to ensure accurate data.

3.8.6. Study Flow

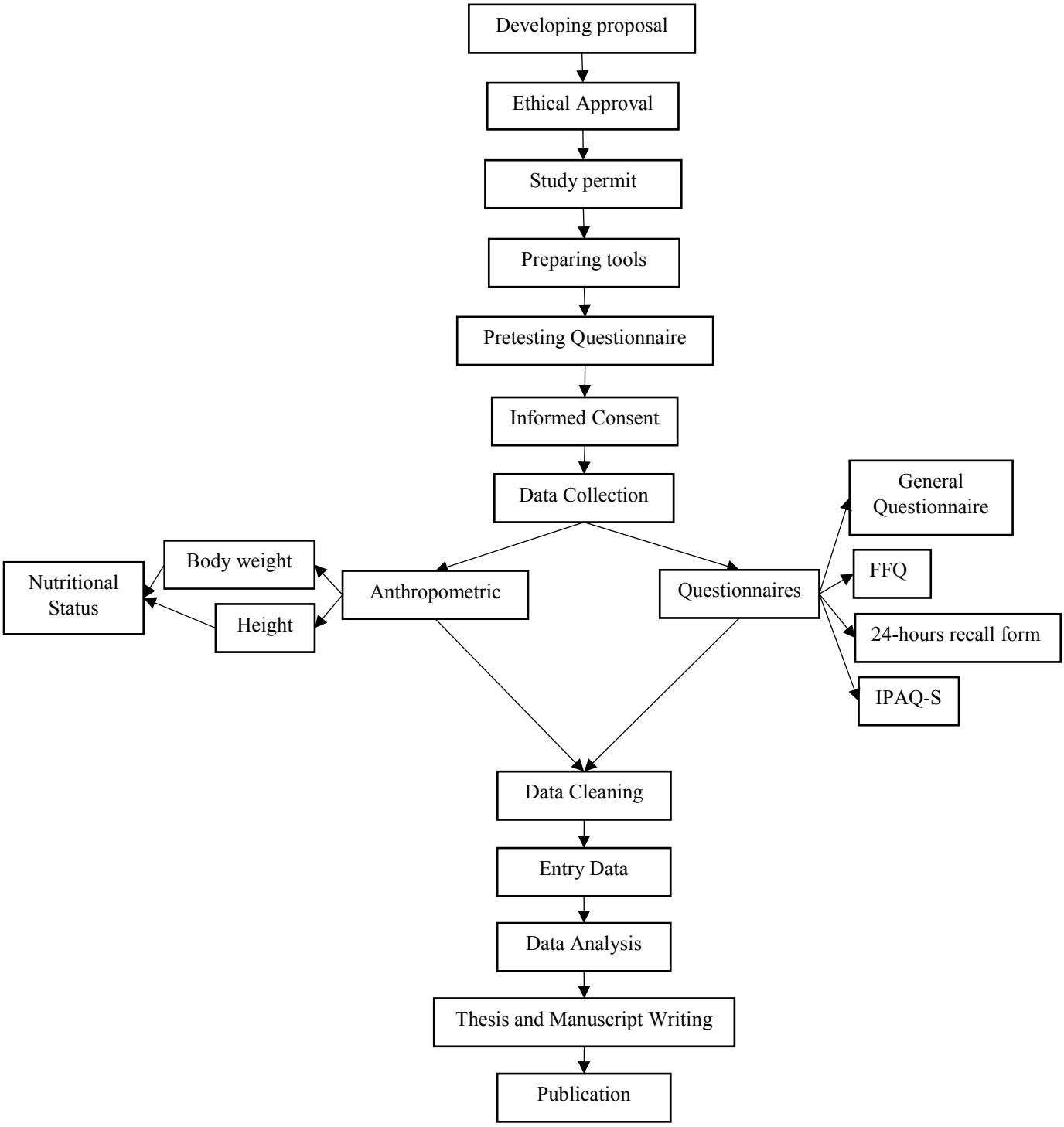


Figure 3. 2 Study Flow

3.8.7. Study Organization

a. Main Researcher : Septiana Maria Deba Ginting
b. Advisor 1 : DR. Judhiastuty Februhartanty, M.Sc.
   Advisor 2 : Ir. Helda Khusun, M.Sc., PhD
c. 3 Enumerators : To be confirmed

Table 3. 6 Study Organization

No	Component	Description	Job description
1.	Main researcher	Magister Student/Main researcher	Proposal development, managing permits, recruiting enumerators, monitoring data collection, data analysis, report completion
2.	Advisor	Supervisor for the main researcher	Supervising and providing guidance or consult during the research processes
3.	Enumerators	Alumni/ final year of nutrition majoring student	Data collection of UPF and SSB consumption questionnaire, 24-hours recall form, physical activity questionnaire, and anthropometric measurement

3.8.8. Ethical Consideration

Ethical consideration is an ethical permission to conduct the study is prepared during study preparation. The study proposal was reviewed and approved by Ethics Committee of Faculty of Medicine, Universitas Indonesia. Data collection was started after have permission from school. Researcher informed the candidate of respondent regarding study objective and the procedures. If the student agreed to participate the study, the respondents will be asked to signing the informed consent to ensure that respondents were involved voluntarily and have authority to refuse/ withdraw from the study.

CHAPTER 4
RESULTS

This study aimed to explore the association between consumption of Ultra-Processed Foods (UPFs) and beverages and factors influencing the nutritional status of senior high school students in Pontianak. It considered socio-demographic factors including physical activity levels, total energy intake, UPF consumption, SSB consumption and nutritional status. Consuming Ultra-Processed Foods (UPFs) and beverages has been associated with higher energy intake and weight gain when compared to an unprocessed diet. These foods not only exhibit poorer nutritional quality but also undergo intense processing methods such as moulding and high-temperature extrusion. Additionally, UPFs often include cosmetic food additives and industrial ingredients aimed at enhancing the flavour and palatability of the final product.[90]

4.1 Characteristics of respondents

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

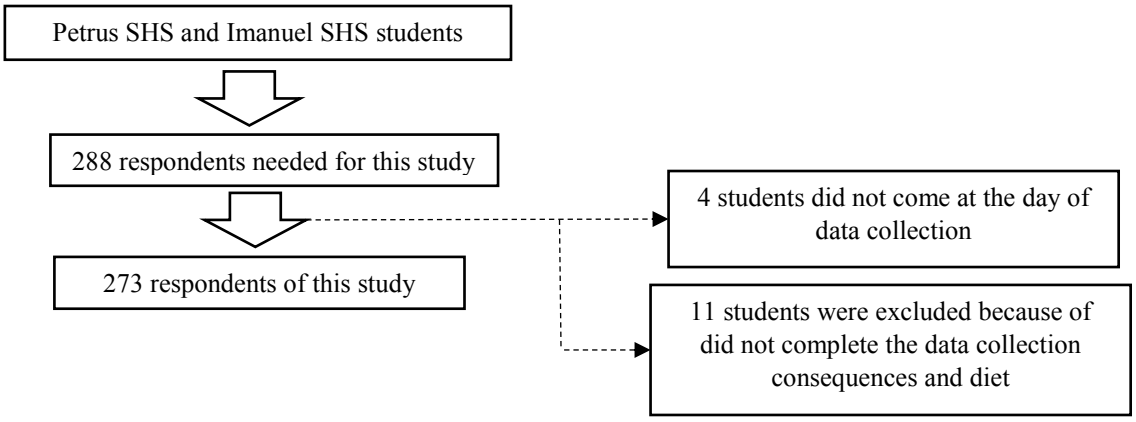


Figure 4.1 Sampling Procedure

Table 4.1 shows the characteristics of respondents. Age of respondents was 15-17 years old. The proportion of female students involved in this study was higher than male students, 50.5% and 49.5%, respectively.

Based on the educational level and occupation of parents of the respondents, 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 not working. More than 85% of the respondents has high family income, which means that their family income is 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 4.1 showed that 53.1% of the respondents has total energy intake more than 100% of RDA.

Level of physical activity in this study was measured by International Physical Activity Questionnaire for short form. Based on physical activity level, there are 48.0% of respondents had moderate physical activity level.

Table 4.1 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)

4.2 Frequency of Ultra-Processed Foods and beverages consumption of respondents

Ultra-processed foods and beverages in this study were described as all foods and beverages that included in classification of NOVA classification group 4. The median of the frequency of UPF and beverages consumption was 50 times consumed UPF in the last 7-days.

Table 4.2 Frequency of Ultra-Processed Foods and beverages consumption of respondents (n=273)

Variable	Median (Min-Max)
UPF and beverages consumption	50 (11-143)

*UPF and beverages consumption in the last 7-days

4.2.1 Frequency of Ultra-Processed Foods consumption of respondents

Ultra-processed foods in this study were described as all foods that included in classification of NOVA classification group 4. The median of the frequency of UPF consumption was 35 times consumed UPF in the last 7-days.

Table 4.2.1 Frequency of Ultra-Processed Foods consumption of respondents (n=273)

Variable	Median (Min-Max)
UPF consumption	35 (8-107)

*UPF (foods) consumption in the last 7-days

4.2.2 Frequency of Sugar-Sweetened Beverages consumption of respondents

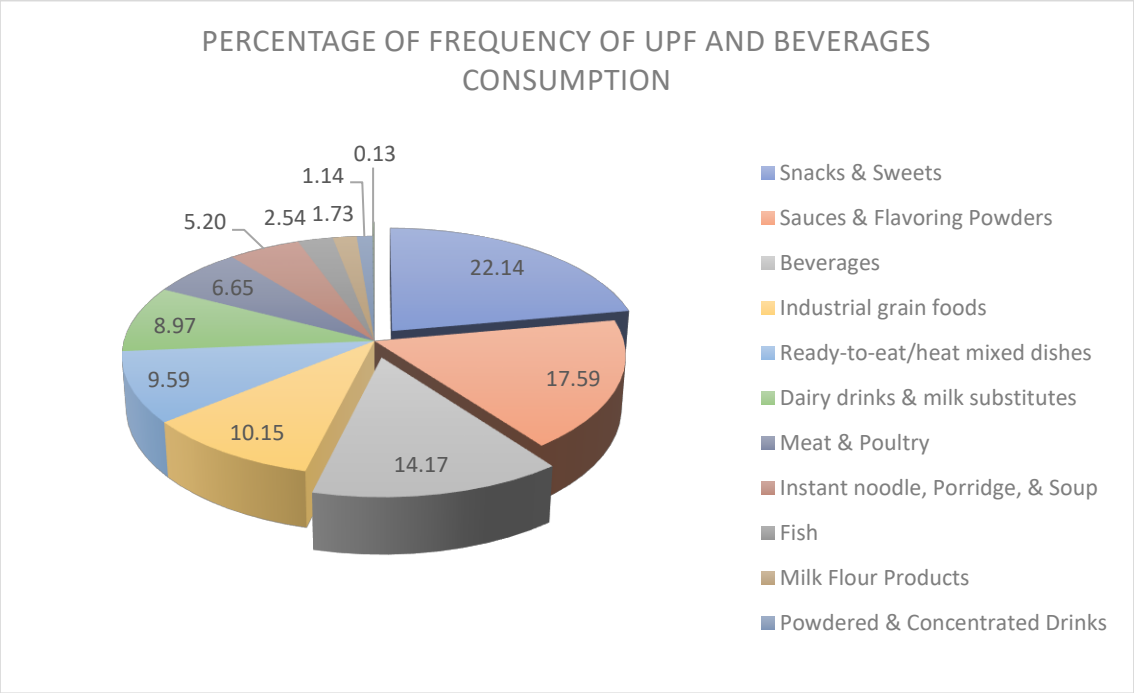
Sugar-Sweetened Beverages in this study were described as all beverages that included in NOVA classification group 4. The median of the frequency of SSB consumption was 12 times consumed SSB in the last 7-days.

Table 4.2.2 Frequency of Sugar-Sweetened Beverages consumption of respondents (n=273)

Variable	Median (Min-Max)
SSB consumption	12 (1-50)

*SSB consumption in the last 7-days

4.2.3 Percentage of Frequency of UPF and Beverages Consumption of respondents



*Others Food and Drink (ea. protein powder, popcorn)

Figure 4.2 Percentage of Frequency of Ultra-Processed Foods and beverages consumption among respondents (%)

Figure 4.2 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 (ea. protein powder and popcorn).

Table 4.2.3 showed that more than a half of the respondents has excessive consumption of Ultra-Processed Foods and beverages frequency.

Table 4.2.3 Ultra-Processed Foods and beverages consumption frequency of respondents (n=273)

UPF and beverages consumption	n (%)
Normal	132 (48.4)
Excessive	141 (51.6)

*Median of frequency: 50

Table 4.2.5 showed that 50.9% of the respondents has excessive of Ultra-Processed Foods consumption frequency.

Table 4.2.5 Ultra-Processed Foods consumption frequency of respondents (n=273)

UPF consumption	n (%)
Normal	134 (49.1)
Excessive	139 (50.9)

*Median of frequency: 35

Table 4.2.6 showed that 50.5% of the respondents has excessive of Ultra-Processed Foods consumption frequency.

Table 4.2.6 Sugar-Sweetened Beverages consumption frequency of respondents (n=273)

UPF and beverages consumption	n (%)
Normal	135 (49.5)
Excessive	138 (50.5)

*Median of frequency: 12

4.3 Nutritional Status of respondents

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. Table 4.3 showed there are 40.3% respondents has overweight and obesity nutritional status.

Table 4.3 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)

4.4. Factors associated with Nutritional Status among adolescents in Pontianak

The association between nutritional status and UPF and beverages consumption was analysed in bivariate and multivariate analysis. 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 0.005 was 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 consist of age, gender, father and mother educational level, father and mother occupation, family income, total energy intake and physical activity level. For age, father's educational level, father's occupation, and mother's occupation, we did not find significant association between nutritional status and these factors ($p>0.05$). 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 ($p<0.05$).

Table 4.4 Association between socio-demographic factors and Nutritional Status (n=273)

Sociodemographic 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)	0.000 [a]
Female	97 (70.3)	41 (29.7)	
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)	0.033 [a]
High	133 (57.1)	100 (42.9)	
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)	

[a]Chi-Square test;

*Educational level: Primary (graduated from Elementary & Junior High School), Secondary (graduated from Senior High School), Vocational (university level)

4.5 Association between Ultra-Processed Foods and beverages with Nutritional Status

Data on table 4.5 shown the association between Ultra-Processed Foods and beverages has a significant association with nutritional status ($p \leq 0.05$).

Table 4.5 Association between Ultra-Processed Foods and beverages and Nutritional Status

UPF and beverages consumption	Nutritional Status		p-value
	Non-Obesity	Obesity	
Normal	69 (53.3)	63 (47.7)	0.015
Excessive	94 (66.7)	47 (33.3)	

*Nutritional status: Non-Obesity (combine of underweight and normal status), Obesity (combine of overweight and obesity)

Table 4.5.1 shown the association between Ultra-Processed Foods has no significantly associated with nutritional status ($p \leq 0.05$).

Table 4.5.1 Association between Ultra-Processed Foods and Nutritional Status

UPF consumption	Nutritional Status		p-value
	Non-Obesity	Obesity	
Normal	73 (54.5)	61 (45.5)	0.084
Excessive	90 (64.7)	49 (35.5)	

Table 4.5.2 shown the association between Sugar-Sweetened Beverages has no significantly associated with nutritional status ($p \leq 0.05$).

Table 4.5.2 Association between Sugar-Sweetened Beverages and Nutritional Status

SSB consumption	Nutritional Status		p-value
	Non-Obesity	Obesity	
Normal	74 (54.8)	61 (45.2)	0.103
Excessive	89 (64.5)	49 (35.5)	

4.6 Association between Ultra-Processed Foods and beverages with Nutritional Status, adjusted by other potential factors

Before the multivariate test done, the researcher did the multicollinearity test. And the result shown that there is no multicollinearity found between UPF and SSB. Multivariate analysis was done in order to assess the association between UPF consumption and nutritional status, and other potential factors. In multivariate analysis after adjusted to other several confounders, gender, mother educational level and family income were significantly correlated with nutritional status.

Table 4.6 Multivariate Analysis between All Processed Foods and Nutritional Status, adjusted by other potential factors (n=273)

Variables	B	t	p-value
UPF and beverages consumption	-0.135	-1.329	0.185
Normal			
Excessive			
UPF consumption	0.045	0.487	0.627
Normal			
Excessive			
SSB consumption	-0.050	-0.766	0.444
Normal			
Excessive			
Gender	-0.170	-2.829	0.005*
Male			
Female			
Family Income	0.183	2.228	0.027*
Low			
High			
Mother Educational Level	-0.153	-4.302	0.000*
Primary			
Secondary			
Vocational			
Total Energy Intake	-0.026	-0.731	0.465
<80% RDA			
80-100% RDA			
>100% RDA			

Physical Activity	-0.011	-0.255	0.779
Low			
Moderate			
High			
Constant	1.913		

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

CHAPTER 5
DISCUSSION

5.1 Characteristics of respondents

Sociodemographic characteristics were assessed in this study based on the age, gender, parent's education level, parent's occupation, and family income. According to CDC, adolescents are in the range of age 15-18 years old. In this study, median of age of the respondents was 16 years old. Adolescents are physically, cognitively, and socioemotionally more advanced than children but prone to behave in ways that are inconsistent with adult values and norms. Adolescents begin to explore their emerging identities in ways that foster autonomy and connectedness. They feel capable of choosing everything, including food and lifestyle.[20, 82]

In this study, the ratio of girl respondent's participations was higher than boy. A previous study stated that gender was a key factor of difference health-related awareness. Females tend to have higher awareness might affecting on higher participation in health research. [83]

In term of education level of parents, national data in 2022 found the highest education attainment number of Indonesian population especially in West Kalimantan was elementary school, which has different finding with this study.[84] 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.

Education level of parents has associated with their occupation and affecting the family income.[91] In this study, family income of the respondents was higher than regional minimum wage salary per month for Pontianak 2023, which means that their family income was higher than Rp. 2.750.644,55, -. More than 85% of the respondents has high family income. Adolescents who have family with higher finance, increased the chance of consuming UPF, compared to family with income under minimum wage.[92] High socioeconomic status is becoming the primary determinant of obesity in adolescents due to more frequent media use and consequently sedentary lifestyles coupled with greater

exposure to advertising of low nutritional quality and energy-dense foods that look attractive, hyper-palatable, cheap, and ready to eat.[22]

Other characteristics of respondents might associate with nutritional status were total energy intake and physical activity. Individual's total energy intake expenditure influenced by age, gender, weight, height, and physical activity. Energy input comes from foods and beverages consumption in a whole day, while energy output depends on physical activities while walking and doing other activities including studying. The higher the physical activity, leads to higher energy expenditure. Therefore, calorie input should be equal to calorie expenditure for obtaining energy balance.

In this study, most of respondents had inadequate energy intake, in other words energy intake more than 100% of RDA; and moderate level of physical activity. Based on data from Riskesdas 2018, PAL was assessed using modified Global Physical Activity Questionnaire (GPAC) from WHO, while this study used IPAQ Short Form. Most of the respondents had moderate physical activity level could be due to their activities mostly spent on sitting time in class, but they still have sports subjects that help them to burn more energy. They also go to and from school using vehicles, making them walk less.

5.2 Ultra-Processed Foods Consumption of respondents

The Ultra-Processed Foods nowadays becoming a global health issue since it caused the excessive of calories inputs and excessive of sugar consumption. All the respondents of this study were in adolescents' phase, which also in transition period from children-hood to adulthood. At this phase, they would start to have the independence stage of choosing everything in their life, include the foods.

In this study, more than a half of the respondents consumed excessive of UPF. The highest consumption of ultra-processed foods came from snacks and sweets, while the lowest consumption came from others from foods and drinks such as popcorn. Concerning childhood and adolescence, UPF consumption is phenomenon of major importance that is rapidly growing. Children's diets in the USA have shifted to contain about two-thirds of daily calorie consumed from UPF, contributing to high levels of body fat in children.[22]

UPF represent more than 50% of the total daily energy intake in some high-income countries. The consumption of UPF also has been associated with unhealthy dietary patterns and with overweight and obesity.[69] UPFs have a poorer nutritional quality (often high in energy, salt, free sugars, and saturated fats and low in fibre and vitamins) compared to unprocessed food.[21]

Beverages also became the one of favourite for adolescents, especially sugary drinks. The main categories of sugary drinks include soft-drinks/ fizzy-drinks, sachet mixes, fruit drinks, cordials, flavoured milks, cold teas/coffees, and energy/sports drinks. Their consumption is known to cause dental diseases, increase the risk of developing unhealthy weight gain, type-2 diabetes, gout, and non-alcoholic steatohepatitis .[11]

Besides that, Indonesian school children spend 7 to 10 hours per day at school. This long time spent away from home increases the likelihood of school children purchasing food and beverages at their school's canteen during the day. Foods sold in Indonesian schools are predominantly calorie-dense and nutrient-poor, and are typically consumed in excess,19 and 50% of the snack foods sold contain harmful chemicals.[98]

5.3 Nutritional Status of respondents

More than a half of the adolescents had normal of nutritional status based on CDC cut off categorization of nutritional status for children and adolescents. This finding was similar with study by Aghnia which found that the highest categorization of the nutritional status of adolescents was normal category (54.5%).[85] However, according to percentage of each category of BMI, there were respondents with overweight and obesity, in this study the categorization of overweight and obesity combined into one category. The percentage of obesity nutritional status category is not much different from normal nutritional status. This could allow an increase in cases of obesity among adolescents.

In this study, there are 59.7% of respondents had normal nutritional status, and 40.3% were obesity. The percentage of obesity among adolescents can increase along with their consumption patterns and their lack of physical activity. Besides that, frequent use of gadgets can also affect the nutritional status of teenagers, making them less of activities. These factors could lead the increasing of body weight of adolescents.

Over the past five decades, there has been a global increase in paediatric obesity, with notable rises in age-standardized prevalence rates for both girls and boys aged 5–19 years. Projections from the World Obesity Federation suggest a concerning future scenario, estimating that by 2030, around 254 million children and adolescents globally could be living with obesity. The top-ranking countries with over 1 million affected children are projected to be China, India, the USA, Indonesia, and Brazil, highlighting the widespread nature of this public health issue, with a majority of high-burden countries being non-high-income.[86]

The transition to adolescence brings about significant changes in both physical and psychosocial development, influencing food choices and eating patterns. Increased independence and peer interactions during this stage can lead to the preference for calorically dense fast foods. Additionally, sedentary behaviours, such as increased video and computer use, may limit physical exercise during the teenage years. Adolescence is characterized by an enhanced focus on appearance, body weight, and various psychological concerns. These factors collectively contribute to the complexity of dietary and lifestyle choices during this developmental period.[87]

5.4 Association between Ultra-Processed Foods consumption and Nutritional Status among adolescents

Ultra-processed foods characterized by high levels of sugar, salt, and saturated fats, also includes items like soft drinks, breakfast cereals, reconstituted meat products, packaged breads, and ready-to-eat foods.[88] Chi-square test found there is a significant correlation between UPF and nutritional status, which is in line with research conducted by De Amicis in Brazil which found a positive association between consumption of ultra-processed food and obesity and adiposity parameters with a follow-up longer than 4 years.[89]

In contrast, study by Pratiwi found that with ANOVA test found there was no significant correlation between BAZ and UPF consumption ($p>0.05$) among school aged children, conducted during Covid-19 pandemic, analyze the existing data taken before the pandemic and social distancing to keep the data quality and minimize bias because direct offline data collection was not possible in the field.[64]

UPF represent more than 50% of the total daily energy intake in some high-income countries. The consumption of UPF also has been associated with unhealthy dietary patterns and with overweight and obesity.[69] Not in line to this finding, this study has reverse result between UPF and total energy intake. There was a high level of underreporting of energy intakes. The finding that overweight/obese adolescents were more likely to underreport energy intake than their normal/underweight peers may be due to an unconscious or subconscious bias in misreporting intakes of snacks or food items often considered to be unhealthy. And this is truthfully reported low food and energy intakes.[97]

5.5 Association between socio-demographic status and Nutritional Status

Socio-demographic are also some factors that influence the nutritional status. In this study, gender has associated with nutritional status. Male students have more risk to eating UPF and SSB due to their habit and activity. For example, drink energy beverages or soft drink after exercise, or eating UPF while playing game in gadget. Based on data from CDC, the consumption of SSB is varies by age, sex, ethnicity, geography, and socioeconomic status. From 2011-2014, there are 63% or 6 in 10 youth drank SSB, this prevalence is higher than adult that has 49% or 5 in 10 adult that drank an SSB on a given day. Besides that, SSB intake is higher among boy adolescent.[56]

Family is the first environment that people know so that the family is the basic determinant of the formation of one's character. The family is a group that plays an important role in the process of development, prevention, and improvement in any health problems found in the family.[93] Mother has the role to preparing the foods for family, and it is correlated to the knowledge of the nutritious foods. Although lower level of maternal education is associated with situations of risk to health and nutritional status in childhood and adolescents, as it reflects less availability of resources for care and greater difficulty in accessing information. But, the higher level of education of mothers is generally associated with higher family income, which can contribute to a greater insertion of UPF in the meals' routine.[42]

Family income influences dietary intakes is highly determined by the price of foods.[94] Higher household income can increase consumption of specific ultra-processed

foods, such as pies, sausages, pastries, ice cream, soft drinks, energy drinks, and processed juices. This situation can make adolescents consume the UPF and SSB easily.[95] This is also related to the pocket money given by parents to their children. The higher the pocket money given, the higher the consumption of UPF and sweetened drinks among adolescents.[99]

Over the last two decades, the contribution of UPF to the total energy intake of the Brazilian population has continuously increased by replacing fresh foods and culinary preparations for ready-to-eat and processed foods.[95] But in this study, there is inverse correlation between UPF consumption and total energy intake with nutritional status. This could be possible due to underreporting of data. Adolescents are indeed sensitive to social desirability. Bias towards underreporting might be larger along with a higher propensity to report intakes more consistent with dietary guidelines, particularly when they are overweight. Foods are more often eaten outside the home, particularly snacks, which are more prone to be forgotten. Additionally, with frequent skipping of meals and, more commonly, mealtime irregularities are more common in this stage.[96]

5.6 Strengths and Limitation

The author is aware of this study might have limitation and strengths. For assessing the Ultra-Processed Foods consumption of respondents, researcher used the Food Frequency Questionnaire (FFQ) based on Nova Classification group 4, then modified according to the types of food found in Pontianak City. The researcher also did the market survey to develop foods list so that the foods list in the FFQ obtained becomes more valid.

The researcher realize that this study was still had some limitations. However, the researcher had been done some actions for minimizing the error and bias in this study. Before data collection, the researcher trained the enumerators to collected data and conducted a pre-test on several respondents. Enumerators are selected based on their academic qualifications in nutrition science.

The pretesting of questionnaires with a sample similar to the respondents helps evaluate the flow of data collection, participant understanding, and questionnaire validity. This step contributes to the refinement of the instruments, reducing errors during the actual data collection. For data collection of nutritional status, the instruments had been

calibrating before used. For anticipating the under-reported data, researcher considered to exclude respondents who was an athlete and did diets.

Data collection was carried out when the school had already carried out final exams and was going on holiday, so there was little time given for data collection. Researcher modified the data collection so that one school could only collect data for 3 days.

This study also tries to separate food and drinks in the UPF classification so that different results can be seen between foods and drinks that are included in the UPF. As is known, most of the research that has been carried out is examining ultra-processed foods combined between food and drink.

On the other hand, the findings of this study can help the school officials to have important implications for make regulations and designing programs aimed at promoting health and well-being among school students. Educating adolescents about the impact of ultra-processed foods on their nutritional status can empower them to make healthier food choices. Programs can be designed to encourage healthier eating habits and discourage the excessive consumption of ultra-processed foods among adolescents. The regulations can also engage communities and families in nutritional awareness programs. Educating not only the adolescents but also their families and communities can create a more comprehensive approach to improving dietary habits.

CHAPTER 6
CONCLUSION AND RECOMMENDATION

6.1 Conclusions

1. Respondents of this study were adolescents with middle up socio-economic status.
2. The consumption of Ultra-Processed Foods was high, with the highest UPF intake came from snacks and sweets (22.4%).
3. There was significant association between UPF consumption and nutritional status.
4. There was also significant correlation between gender, mother education level and family income with nutritional status.

6.2 Recommendations

1. Since the study found high consumption of Ultra Processed-Foods among adolescents, it is necessary to give education to adolescents about how important to know and understand balance nutrition diet.
2. Setting standards for school food environments is also important in shaping the quality of children's diet. Considering the relatively high UPF consumption among adolescents, the socialization about the risk of excessive consumption of UPF is needed. To minimize the access of got the unhealthy diet, the schools should provide the policy of healthy canteen that should provide healthy food and beverages.
3. The role of parents is also very important in supporting reducing excessive consumption of UPF. Such as making healthy lunches from home, thereby minimizing teenagers' consumption of excessive UPF. Apart from that, the pocket money given also needs to be controlled because giving excessive pocket money also makes it easier for teenagers to buy UPF and SSB as they wish.

REFERENCES

1. World Health Organization. (2021, June 9). *Overweight and Obesity*. July 15, 2022. https://Www.Who.Int/News-Room/Fact-Sheets/Detail/Obesity-and-Overweight.

2. Kemenkes RI. Laporan Nasional Riskesdas 2018. Badan Penelitian dan Pengembangan Kesehatan. 2018; 578

3. Kemenkes RI. Laporan Nasional Riskesdas 2013. Badan Penelitian dan Pengembangan Kesehatan. 2013; 262-263

4. Sanyaolu A, Okorie C, Qi X, Locke J, Rehman S. Childhood and Adolescent Obesity in the United States: A Public Health Concern. Glob Pediatr Heal. 2019;6.

5. Enes, C. C., de Camargo, C. M., & Justino, M. I. C. (2019). Ultra-processed food consumption and obesity in adolescents. *Revista de Nutricao*, *32*. http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1415-52732019000100512&tlng=en

6. Bleich, S. N., & Vercammen, K. A. (2018). The negative impact of sugar-sweetened beverages on children's health: an update of the literature. *BMC Obesity*, *5*(1), 6. https://bmcobes.biomedcentral.com/articles/10.1186/s40608-017-0178-9

7. Gibney MJ. OPINION Ultra-Processed Foods: Definitions and Policy. (2019) :1–7.

8. Steele EM, Baraldi LG, Da Costa Louzada ML, Moubarac JC, Mozaffarian D, Monteiro CA. Ultra-processed foods and added sugars in the US diet: Evidence from a nationally representative cross-sectional study. BMJ Open. 2016;6(3).

9. Sulistiyani. Risiko Konsumsi 'Ultra Processed Foods' Pada Pangan Jajanan Anak Sekolah (PJAS) Dan Potensinya Terhadap Kejadian Obesitas Anak Sekolah Di Kota Semarang. 2009;22(2):184–206.

10. Gramza-Michałowska A. The effects of ultra-processed food consumption— is there any action needed? Nutrients. 2020;12(9):1–4.

11. Zealand N, Guidance B. Policy brief: Options to reduce sugar sweetened beverage (SSB) consumption in New Zealand. Pac Health Dialog. 2014;20(1):98–102.

12. Ledesma RG. Defining adolescence. Contemp Psychol. 1997;42(2):119–119.

13. Dars S, Sayed K, Yousufzai Z. Relationship of menstrual irregularities to BMI and nutritional status in adolescent girls. Pak J Med Sci. 2014 Jan;30(1):141-4. doi: 10.12669/pjms.301.3949. PMID: 24639848; PMCID: PMC3955559.

14. Özdemir A. Adolescent Obesity. 2015;(August).

15. Region WHOE. trends and inequalities in the WHO European Region, Adolescent obesity and related behaviours: Adolescent obesity and related behaviours: trends and inequalities in the WHO. 2014;2002–14.

16. UNICEF, N. G. S. (2019, August). *Prevention of Overweight and Obesity in Children and Adolescents*. September 8, 2022

17. Shrivastava, S. R., Shrivastava, P. S., & Ramasamy, J. (2016). *SHORT COMMUNICATION Assessment of Nutritional Status in the Community and Clinical Settings*. *34*(5), 211–213. http://www.jmedscindmc.com/text.asp?2014/34/5/211/143648

18. Erkan T. Adolescent nutrition. Turk Pediatr Ars. 2011;46(SUPPL.1):49–53.

19. Doustmohammadian A, Keshavarz SA, Doustmohammadian S. Nutritional status and dietary intake among adolescent girls. J Paramed Sci. 2013;4(Supplement):72–7.

20. CDC (September 24, 2022). About Child and Teen BMI. U.S Department of Health & Human Services. September 30, 2022 https://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html

21. Beslay M, Srour B, Méjean C, Allès B, Fiolet T, Debras C, et al. Ultra-processed food intake in association with BMI change and risk of overweight and obesity: A prospective analysis of the French NutriNet-Santé cohort. PLoS Med. 2020;17(8):1984–5.

22. De Amicis R, Mambrini SP, Pellizzari M, Foppiani A, Bertoli S, Battezzati A, et al. Ultra-processed foods and obesity and adiposity parameters among children and adolescents: a systematic review. Eur J Nutr [Internet]. 2022;61(5):2297–311. Available from: https://doi.org/10.1007/s00394-022-02873-4

23. Ma J, Sloan M, Fox CS, Hoffmann U, Smith CE, Saltzman E, et al. Sugar-sweetened beverage consumption is associated with abdominal fat partitioning in healthy adults. J Nutr. 2014;144(8):1283–90.

24. Ferretti F, Mariani M. Sugar-sweetened beverage affordability and the prevalence of overweight and obesity in a cross section of countries. Global Health. 2019;15(1):1–14.

25. Hyseni L, Atkinson M, Bromley H, Orton L, Mcgill R, Capewell S. The effects of policy actions to improve population dietary patterns and prevent diet-related non-communicable diseases: scoping review. 2017;(October 2016):694–711.

26. Sogari G, Velez-argumedo C, Miguel IG, Mora C. College Students and Eating Habits: A Study Using an Ecological Model for Healthy Behavior. 2018;1–16.

27. Deforche B, Dyck D Van, Deliens T, Bourdeaudhuij I De. Changes in weight, physical activity, sedentary behaviour and dietary intake during the transition to higher education: a prospective study. 2015;1–10.

28. Ye S, Chen L, Wang Q, Li Q. Correlates of screen time among 8-19-year-old students in China. BMC Public Health. 2018;18(1):1–7.

29. Kemenkes RI. Standar Antropometri Anak. Badan Penelitian dan Pengembangan Kesehatan. 2020;15

30. Monteiro CA, Cannon G, Lawrence M, Costa Louzada ML, Machado PP. The NOVA food classification system and its four food groups [Internet]. Ultra-processed foods, diet quality, and health using the NOVA classification system. 2019. 6–9 p. Available from: http://www.wipo.int/amc/en/mediation/rules

31. EL-Tahan NR, A. Alfky NA. Effect of Iron and Vitamin C Fortified Candies on the Iron Status of Early Teenager. Int J Adv Res. 2016;4(3):6–11.

32. Tianingrum NA, Mustofa A, Dianandari A, Susanti M, Sarmawati S. Risk of Overweight Among Teenagers Who Fond To Consume Fried Food in Loh Sumber, Kutai Kartanegara. J Ilmu Kesehat. 2020;8(2):62–8.

33. Bahreynian M, Qorbani M, Khaniabadi BM, Motlagh ME, Safari O, Asayesh H, et al. Association between obesity and parental weight status in children and adolescents. JCRPE J Clin Res Pediatr Endocrinol. 2017;9(2):111–7.

34. Harding, S. K., Page, A. S., Falconer, C., & Cooper, A. R. (2015). Longitudinal changes in sedentary time and physical activity during adolescence. *International Journal of Behavioral Nutrition and Physical Activity*, *12*(1). https://doi.org/10.1186/s12966-015-0204-6

35. Morrissey, J. L., Janz, K. F., Letuchy, E. M., Francis, S. L., & Levy, S. M. (2015). The effect of family and friend support on physical activity through adolescence: A

longitudinal study. *International Journal of Behavioral Nutrition and Physical Activity*, *12*(1). https://doi.org/10.1186/s12966-015-0265-6

36. Casadei K, Kiel J. Anthropometric Measurement. [Updated 2022 Sep 26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK537315/

37. Pont, S. J., Puhl, R., Cook, S. R., & Slusser, W. (n.d.). *Stigma Experienced by Children and Adolescents with Obesity*. http://publications.aap.org/pediatrics/article-pdf/140/6/e20173034/913008/peds_20173034.pdf

38. Nagata, J. M., Abdel Magid, H. S., & Pettee Gabriel, K. (2020). Screen Time for Children and Adolescents During the Coronavirus Disease 2019 Pandemic. *Obesity*, *28*(9), 1582–1583. https://doi.org/10.1002/oby.22917

39. Goldfield, G. S., Murray, M., Maras, D., Wilson, A. L., Phillips, P., Kenny, G. P., Hadjiyannakis, S., Alberga, A., Cameron, J. D., Tulluch, H., & Sigal, R. J. (2016). Screen time is associated with depressive symptomatology among obese adolescents: a HEARTY study. *European Journal of Pediatrics*, *175*(7), 909–919. https://doi.org/10.1007/s00431-016-2720-z

40. Steele, E. M., Baraldi, L. G., da Costa Louzada, M. L., Moubarac, J. C., Mozaffarian, D., & Monteiro, C. A. (2016). Ultra-processed foods and added sugars in the US diet: Evidence from a nationally representative cross-sectional study. *BMJ Open*, *6*(3). https://doi.org/10.1136/bmjopen-2015-009892

41. Enes, C., Camargo, C., Justino M. (2019). Ultra-processed food consumption and obesity in adolescents Consumo de alimentos ultraprocessados e obesidade em adolescentes. 1–11.

42. Fernanda, T., Cabrera, C., Fernandes, I., Correia, L., Oliveira, D., Santos, D., Lopes Pacagnelli, F., Tereza, M., Prado, A., Dias Da Silva, T., Bandeira De Mello Monteiro, C., Gonçalves, D. C., & Fernani, L. (2014). ANALISYS OF THE PREVALENCE OF OVERWEIGHT AND OBESITY AND THE LEVEL OF PHYSICAL ACTIVITY IN CHILDREN AND ADOLESCENTS OF A SOUTHWESTERN CITY OF SÃO PAULO. In *Journal of Human Growth and Development* (Vol. 24, Issue 1).

43. WHO (October 5, 2022). Physical Activity. January 8, 2023. https://www.who.int/news-room/fact-sheets/detail/physical-activity

44. Wahyuni, Sri Nyemas (September 16, 2022). *Indeks Massa Tubuh Remaja*. Kementerian Kesehatan Direktorat Jenderal Pelayanan Kesehatan. January 29, 2023. https://yankes.kemkes.go.id/view_artikel/1546/indeks-massa-tubuh-remaja

45. CDC (September 24, 2022). About Child and Teen BMI. January 29, 2023. https://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html

46. Honicky, M., Cardoso, S., Kunradi Vieira, F., Hinnig, P., Back, I., & Moreno, Y. (2022). Ultra-processed food intake is associated with children and adolescents with congenital heart disease clustered by high cardiovascular risk factors. *British Journal of Nutrition,* 1-9. doi:10.1017/S0007114522002240

47. Fadila, Jihan (2022). Hubungan Konsumsi Ultra Processed Food Terhadap Kejadian Berat Badan Lebih Pada Remaja di SMPN 3 Makassar. Skripsi thesis, Universitas Hasanuddin.

48. Lidya Sari, S., Mulyawati Utari, D., Sudiarti Program Studi Gizi, T., & Kesehatan Masyarakat, F. (2021). *ILMU GIZI INDONESIA Konsumsi minuman berpemanis kemasan pada remaja Sugar-sweetened beverages consumptions among adolescents*. Universitas Indonesia

49. Guidelines for Data Processing and Analysis of the International Physical Activity Questionnaire (IPAQ)-Short and Long Forms. (2005). www.ipaq.ki.se.

50. Badan Pusat Statistik Kota Pontianak (July 9, 2018). Persentase Rata-Rata Pengeluaran Konsumsi Makanan dan Non Makanan Per Kapita Sebulan di Kota Pontianak (Rupah). January 31, 2023. https://pontianakkota.bps.go.id/statictable/2015/12/04/45/persentase-rata-rata-pengeluaran-komsumsi-makanan-dan-non-makanan-per-kapita-sebulan-di-kota-pontianak-rupiah-2010-2016.html

51. Badan Pusat Statistik Kota Pontianak. Pengeluaran per Kapita Menurut Kabupaten/Kota (Ribu Rupiah). January 31, 2023. https://pontianakkota.bps.go.id/indicator/26/336/1/pengeluaran-per-kapita-menurut-kabupaten-kota.html

52. Badan Pusat Statistik Kota Pontianak. Konsep/Penjelasan Teknis Pendapatan. Janaury 31, 2023. https://pontianakkota.bps.go.id/subject/6/tenaga-kerja.html#subjekViewTab1

53. Badan Pusat Statistik Kota Pontianak. Istilah dalam Tingkat Pendidikan. January 30, 2023. https://www.bps.go.id/istilah/index.html?Istilah%5Bberawalan%5D=P&Istilah_page=7#:~:text=Pendapatan%20rumah%20tangga%20adalah%20pendapatan,pendapatan%20anggota%2Danggota%20rumah%20tangga.

54. Gan, Q., Xu, P., Yang, T., Cao, W., Xu, J., Li, L., Pan, H., Zhao, W., & Zhang, Q. (2021). Sugar-sweetened beverage consumption status and its association with

childhood obesity among chinese children aged 6–17 years. *Nutrients*, *13*(7). https://doi.org/10.3390/nu13072211

55. Fauziyyah, H., Diana, F. M., & Femelia, W. (n.d.). *RELATIONSHIP OF ULTRAPROCESSED FOOD CONSUMPTION, SLEEP HABITS, AND ONLINE FOOD ORDERING PRACTICES WITH OBESITY IN ADULTS*.

56. CDC (April 11, 2022). Get the Facts: Sugar-Sweetened Beverages and Consumption. U.S. Department of Health & Human Services. February 3, 2023. https://www.cdc.gov/nutrition/data-statistics/sugar-sweetened-beverages-intake.html

57. WHO (December 13, 2022). WHO Calls on Countries to Tax Sugar-Sweetened Beverages to Save Lives. Department news. February 4, 2023. https://www.who.int/news/item/13-12-2022-who-calls-on-countries-to-tax-sugar-sweetened-beverages-to-save-lives

58. Miller, C., Wakefield, M., Braunack-Mayer, A., Roder, D., O'Dea, K., Ettridge, K., & Dono, J. (2019). Who drinks sugar sweetened beverages and juice? An Australian population study of behaviour, awareness and attitudes. *BMC Obesity*, *6*(1). https://doi.org/10.1186/s40608-018-0224-2

59. Sigmund, E., Sigmundová, D., Badura, P., Kalman, M., Hamrik, Z., & Pavelka, J. (2015). Temporal trends in overweight and obesity, physical activity and screen time among Czech adolescents from 2002 to 2014: A national health behaviour in school-aged children study. *International Journal of Environmental Research and Public Health*, *12*(9), 11848–11868. https://doi.org/10.3390/ijerph120911848

60. Mesas, A. E., González, A. D., de Andrade, S. M., Martínez-Vizcaíno, V., López-Gil, J. F., & Jiménez-López, E. (2022). Increased Consumption of Ultra-Processed Food Is Associated with Poor Mental Health in a Nationally Representative Sample of Adolescent Students in Brazil. *Nutrients*, *14*(24). https://doi.org/10.3390/nu14245207

61. Rocha, L. L., Gratão, L. H. A., Carmo, A. S. do, Costa, A. B. P., Cunha, C. de F., Oliveira, T. R. P. R. de, & Mendes, L. L. (2021). School Type, Eating Habits, and Screen Time are Associated With Ultra-Processed Food Consumption Among Brazilian Adolescents. *Journal of the Academy of Nutrition and Dietetics*, *121*(6), 1136–1142. https://doi.org/10.1016/j.jand.2020.12.010

62. Silva, J. B., Elias, B. C., Warkentin, S., Mais, L. A., & Konstantyner, T. (2022). Factors associated with the consumption of ultra-processed food by Brazilian adolescents: National Survey of School Health, 2015. In *Revista Paulista de Pediatria* (Vol. 40). Sao Paulo Pediatric Society. https://doi.org/10.1590/1984-0462/2022/40/2020362

63. Kementerian Kesehatan Republik Indonesia. (2018). *Pedoman Pencegahan dan Penanggulangan Anemia pada Remaja Putri dan Wanita Usia Subur*, 8, 24-26.

64. Pratiwi, A. A. (2022). Association of Ultra-Processed Food Consumption and Body Mass Index for Age among Elementary Students in Surabaya. *Amerta Nutrition*, *6*(2), 140–147.

65. de Oliveira, A. S. D., Moreira, N. F., de Moraes, A. B. de V., Pereira, R. A., & de Veiga, G. V. (2017). Co-occurrence of behavioral risk factors for chronic non-communicable diseases in adolescents: Prevalence and associated factors. *Revista de Nutricao*, *30*(6), 747–758. https://doi.org/10.1590/1678-98652017000600007

66. Chen, Y. C., Huang, Y. C., Lo, Y. T. C., Wu, H. J., Wahlqvist, M. L., & Lee, M. S. (2018). Secular trend towards ultra-processed food consumption and expenditure compromises dietary quality among Taiwanese adolescents. *Food and Nutrition Research*, *62*. https://doi.org/10.29219/fnr.v62.1565

67. Baker, P., & Friel, S. (2014). Processed foods and the nutrition transition: Evidence from Asia. *Obesity Reviews*, *15*(7), 564–577. https://doi.org/10.1111/obr.12174

68. Islam, M. R., Rahman, S. M., Rahman, M. M., Pervin, J., Rahman, A., & Ekström, E. C. (2022). Gender and socio-economic stratification of ultra-processed and deep-fried food consumption among rural adolescents: A cross-sectional study from Bangladesh. *PLoS ONE*, *17*(7 July). https://doi.org/10.1371/journal.pone.0272275

69. Vandevijvere, S., de Ridder, K., Fiolet, T., Bel, S., & Tafforeau, J. (2019). Consumption of ultra-processed food products and diet quality among children, adolescents and adults in Belgium. *European Journal of Nutrition*, *58*(8), 3267–3278. https://doi.org/10.1007/s00394-018-1870-3

70. Relmbuss Biljers Fanda Agus Salim Tri Muhartini Kurnia Putri Utomo Shita Listya Dewi Clara Abou Samra, A. (n.d.). *CHPM Policy Brief Center for Health Policy and Management Tackling High Consumption of Sugar Sweetened Beverages (SSB) in Indonesia TACKLING HIGH CONSUMPTION OF SUGAR SWEETENED BEVERAGES (SSB) IN INDONESIA A POLICY BRIEF*.

71. Livingston, A. S., Cudhea, F., Wang, L., Steele, E. M., Du, M., Wang, Y. C., Pomeranz, J., Mozaffarian, D., & Zhang, F. F. (2021). Effect of reducing ultraprocessed food consumption on obesity among US children and adolescents aged 7-18 years: Evidence from a simulation model. *BMJ Nutrition, Prevention and Health*, *4*(2), 397–404. https://doi.org/10.1136/bmjnph-2021-000303

72. Wisnuwardani, R. W., Noviasty, R., Saputri, A., & Kurniawati, E. R. (n.d.). *PERUBAHAN AKTIVITAS FISIK DAN KONSUMSI MAKANAN ULTRA PROSES PADA MAHASISWA SELAMA PANDEMI COVID-19: PENELITIAN*

OBSERVASIONAL Changes of Physical Activity and Ultra-Processed Food Consumption in College students during COVID-19 Pandemic: An Observational Study. https://doi.org/10.204736/mgi.v17i3.293-301

73. Sartika, R. A. D., Atmarita, Duki, M. I. Z., Bardosono, S., Wibowo, L., & Lukito, W. (2022). Consumption of Sugar-Sweetened Beverages and Its PotentialHealth Implications in Indonesia. *Kesmas*, *17*(1), 1–9. https://doi.org/10.21109/kesmas.v17i1.5532

74. Faisal-Cury, A., Leite, M. A., Escuder, M. M. L., Levy, R. B., & Peres, M. F. T. (2022). The relationship between ultra-processed food consumption and internalising symptoms among adolescents from São Paulo city, Southeast Brazil. *Public Health Nutrition*, *25*(9), 2498–2506. https://doi.org/10.1017/S1368980021004195

75. Raza, A., Fox, E. L., Morris, S. S., Kupka, R., Timmer, A., Dalmiya, N., & Fanzo, J. (2020). Conceptual framework of food systems for children and adolescents. *Global Food Security*, *27*. https://doi.org/10.1016/j.gfs.2020.100436

76. Monteiro, C. A., Cannon, G., Levy, R. B., Moubarac, J. C., Louzada, M. L. C., Rauber, F., Khandpur, N., Cediel, G., Neri, D., Martinez-Steele, E., Baraldi, L. G., & Jaime, P. C. (2019). Ultra-processed foods: What they are and how to identify them. In *Public Health Nutrition* (Vol. 22, Issue 5, pp. 936–941). Cambridge University Press. https://doi.org/10.1017/S1368980018003762

77. Rafiony, A. (2015). Konsumsi Fast Food dan Soft Drink Sebagai Faktor Risiko Obesitas Pada Remaja. *Jurnal Gizi Klinik Indonesia*, *11*, 170–178.

78. UNICEF INDONESIA. (2019). *Analisis Lanskap Kelebihan Berat Badan dan Obesitas di Indonesia*. https://www.unicef.org/indonesia/media/15581/file/AnalisisLanskapKelebihanBeratBadandanObesitasdiIndonesia.pdf

79. Sejati, M., & Handini, M. (2019). *GAMBARAN FAKTOR RISIKO OBESITAS PADA ANAK DI ENAM SEKOLAH MENENGAH PERTAMA DI KOTA PONTIANAK*. Jurnal Mahasiswa PSPD FK Universits Tanjungpura. Vol 5. No 1, 7-10

80. Noviyanti, F., Diska, S., Lakshmi Puspita, W., Gambir, J., Sarjana, P., Gizi, T., Dietetika, D., Kesehatan, P., & Pontianak, K. (2022). *HUBUNGAN POLA MAKAN DAN KONSUMSI FAST FOOD TERHADAP OBESITAS PADA REMAJA DI SMA BINA UTAMA PONTIANAK*. http://ejournal.poltekkes-pontianak.ac.id/index.php/JVK

81. Robinson, T. N., Banda, J. A., Hale, L., Lu, A. S., Fleming-Milici, F., Calvert, S. L., & Wartella, E. (2017). Screen Media Exposure and Obesity in Children and Adolescents. In *PEDIATRICS* (Vol. 140).

http://publications.aap.org/pediatrics/article-pdf/140/Supplement_2/S97/907704/peds_20161758k.pdf

82. Pfeifer JH, Berkman ET. The Development of Self and Identity in Adolescence: Neural Evidence and Implications for a Value-Based Choice Perspective on Motivated Behavior. Child Dev Perspect. 2018;12(3):158–64.

83. Everett B, Zajacova A. Gender differences in hypertension and hypertension awareness among young adults. Biodemography Soc Biol. 2015;61(1):1–17.

84. https://www.bps.go.id/indicator/28/1980/1/tingkat-penyelesaian-pendidikan-menurut-jenjang-pendidikan-dan-provinsi.html

85. 1. Aghnia S, Setyaningsih S. Hubungan Tingkat Pengetahuan Gizi, Status Gizi terhadap Pola Konsumsi Fast Food dan Soft Drink pada Siswa SMKN 1 Kota Tegal. Era Klin J Penelit Ilmu Kesehat. 2023;1(1):13–8.

86. Jebeile H, Kelly AS, O'Malley G, Baur LA. Obesity in children and adolescents: epidemiology, causes, assessment, and management. Lancet Diabetes Endocrinol [Internet]. 2022;10(5):351–65. Available from: http://dx.doi.org/10.1016/S2213-8587(22)00047-X

87. Kansra AR, Lakkunarajah S, Jay MS. Childhood and Adolescent Obesity: A Review. Front Pediatr. 2021;8(January):1–16.

88. Chavez-Ugalde Y, De Vocht F, Jago R, Adams J, Ong KK, Forouhi N, et al. Manuscript title: Ultra-processed food consumption in UK adolescents: distribution, trends, and sociodemographic correlates using the National Diet and Nutrition Survey 2008/09 to 2018/19. 2008;1–26. Available from: https://doi.org/10.1101/2023.06.05.23290977

89. De Amicis R, Mambrini SP, Pellizzari M, Foppiani A, Bertoli S, Battezzati A, et al. Ultra-processed foods and obesity and adiposity parameters among children and adolescents: a systematic review. Eur J Nutr [Internet]. 2022;61(5):2297–311. Available from: https://doi.org/10.1007/s00394-022-02873-4

90. Srour B, Touvier M. Ultra-processed foods and human health: What do we already know and what will further research tell us? EClinicalMedicine. 2021;32:9–10.

91. Aulia Wicaksari S, Novita Chandra D, et al. Sugar-Sweetened Beverages Consumption and Its Association with Body Mass Index among College Students Living in Dormitory. 2021;1:33–45.

92. Gomes DR, Neto ETDS, de Oliveira DS, Salaroli LB. Characteristics associated with the consumption of in natura or minimally processed and ultra-processed foods in one Brazilian metropolitan region. Cienc e Saude Coletiva. 2023;28(2):643–56.

93. Intan Fazrin, Katarina Kaka Daha, Kamaru lImron Musa. The Role of Parents in Preparing Balanced Menu with Children's Nutritional Status. J Nurs Pract. 2022;5(2):229–38.

94. Marchese L, Livingstone KM, Woods JL, Wingrove K, MacHado P. Ultra-processed food consumption, socio-demographics, and diet quality in Australian adults. Public Health Nutr. 2022;25(1):94–104.

95. Simões B dos S, Cardoso L de O, Benseñor IJM, Schmidt MI, Duncan BB, Luft VC, et al. O consumo de alimentos ultraprocessados e nível socioeconômico: Uma análise transversal do estudo longitudinal de Saúde do Adulto, Brasil. Cad Saude Publica. 2018;34(3):1–13.

96. Lioret S, Touvier M, Balin M, Huybrechts I, Dubuisson C, Dufour A, et al. Characteristics of energy under-reporting in children and adolescents. Br J Nutr. 2011;105(11):1671–80.

97. Jones L, Ness A, Emmett P. Misreporting of Energy Intake From Food Records Completed by Adolescents: Associations With Sex, Body Image, Nutrient, and Food Group Intake. Front Nutr. 2021;8(December):1–10.

98. Hadi H, Triastanti RK, Anggraeni D, Nurwanti E, Lewis EC, Colon-Ramos U, et al. The role of the school food environment in improving the healthiness of school canteens and readiness to reopen post COVID-19 pandemic: A study conducted in Indonesia. J Public health Res. 2022;11(1).

99. Williams BD, Churilla JR. Ultra-Processed Food Intake in U.S. Adolescents: National Public Health Implications. J Adolesc Heal [Internet]. 2022;70(2):173–4. Available from: https://doi.org/10.1016/j.jadohealth.2021.10.031

APPENDICES

Appendix 1. Information Form

LEMBAR PENJELASAN PENELITIAN KEPADA CALON PARTISIPAN

Saya, Septiana Maria Deba Ginting, mahasiswa Angkatan 2021 Magister Ilmu Gizi Fakultas Kedokteran Universitas Indonesia Jakarta akan melakukan penelitian yang berjudul "***Association Between Consumption of Ultra-Processed Foods with Nutritional Status of Senior High School Students in Pontianak*** **(Hubungan Antara Konsumsi Makanan Ultra-Olahan dan Status Gizi pada Siswa SMA di Pontianak)**".

Makanan ultra-olahan dan minuman berpemanis saat ini sudah menjadi trendsetter di kalangan orang banyak, terutama remaja. Kelebihan mengkonsumsi makanan ultra-olahan dan minuman berpemanis memiliki banyak resiko, salah satunya adalah obesitas. Salah satu cara untuk mengetahui tingkat status gizi manusia adalah dengan melakukan pengukuran berat badan dan tinggi badan, kemudian diketahui indeks massa tubuh (IMT), dan menghasilkan status gizi. Obesitas merupakan penyakit tidak menular. Data dari WHO menunjukkan bahwa semenjak masa pandemic, obesitas saat ini menjadi salah satu penyakit berbahaya yang telah membunuh lebih dari 4 juta orang, dan dalam kurun waktu 40 tahun, obesitas mengalami peningkatan yang signifikan sebanyak 14%. Salah satu factor penyebab obesitas adalah pola makan yang tidak teratur, serta konsumsi makanan cepat saji dan minuman berpemanis yang tinggi kalori dan gula, serta kurangnya aktifitas fisik. Oleh karena itu, penelitian ini bertujuan untuk mengetahui hubungan konsumsi makanan ultra-olahan dan minuman berpemanis terhadap status gizi pada remaja SMA swasta di Pontianak.

Saya mengajak adik/kamu untuk ikut serta dalam penelitian ini. Penelitian ini membutuhkan sekitar 288 responden penelitian pada bulan Juni 2023.

A. Kesukarelaan untuk mengikuti penelitian

Adik/kamu bebas untuk menentukan keikutsertaan dalam penelitian ini tanpa ada paksaan dari pihak manapun. Apabila adik/kamu sudah memutuskan untuk

mengikuti dan mengambil peran dalam penelitian ini, adik/kamu juga bebas untuk mengundurkan diri / berubah pikiran setiap saat tanpa dikenai denda ataupun sanksi.

B. Prosedur Penelitian

1. Apabila adik/kamu bersedia berpartisipasi dalam penelitian ini, adik/kamu akan dimohon untuk menandatangani lembar persetujuan ini. Orang tua adik/kamu juga akan diminta tandatangan sebagai tanda persetujuan untuk anak-anaknya mengikuti penelitian.
2. Prosedur selanjutnya adalah adik/kamu akan diwawancarai oleh tim peneliti mengenai data karakteristik responden seperti nama, umur, tanggal lahir, data orang tua.
3. Selanjutnya adik/kamu akan dilakukan pengukuran berat badan dan tinggi badan untuk mengetahui status gizi responden.
4. Setelah dilakukan pengukuran berat badan dan tinggi badan, adik/kamu akan diwawancara mengenai catatan makanan dan minuman yang dikonsumsi selama 7 hari terakhir. adik/kamu akan diberikan penjelasan terlebih dahulu oleh tim peneliti bagaimana cara pengisian form Food Frequency Questionnaire (FFQ).
5. Setelah itu adik/kamu akan diwawancarai mengenai konsumsi makan dan minum selama 24 jam hari terakhir selama 2 hari (wawancara akan dilakukan pada hari Senin dan Kamis). Adik/kamu akan diminta untuk memberitahu makanan dan minuman apa saja yang dikonsumsi serta jumlah dan beratnya.
6. Kemudian adik/kamu akan didiminta untuk mengisi form mengenai kegiatan / aktifitas yang sudah dilakukan selama 7 hari terakhir, seperti berjalan kaki, berolahraga, berlari, dll.
7. Data penelitian ini selanjutnya akan diolah oleh tim peneliti untuk beberapa waktu.

C. Manfaat

Adik/kamu dapat mengetahui status gizi serta pola konsumsi makanan ultra-olahan dan minuman berpemanis, dan level aktifitas fisik.

D. Kerahasiaan

Seluruh informasi yang berkaitan dengan identitas responden penelitian akan dirahasiakan dan hanya akan diketahui oleh peneliti. Hasil penelitian akan dipublikasikan tanpa identitas responden penelitian.

E. Kompensasi

Adik/kamu akan mendapatkan *souvenir* berupa ATK (bolpoint dan pensil) sebagai tanda terimakasih atas keikutsertaan dalam penelitian ini.

F. Pembiayaan

Adik/kamu tidak akan dikenakan biaya sepeserpun selama mengikuti penelitian ini.

G. Informasi Tambahan

Adik/kamu diberi kesempatan untuk menanyakan semua hal yang belum jelas kapan pun kepada peneliti. Apabila sewaktu-waktu adik/kamu membutuhkan penjelasan lebih lanjut yang berkaitan dengan penelitian ini, adik/kamu dapat menghubungi Septiana Maria Deba Ginting melalui email: debaginting.dg@gmail.com atau melalui whatsapp dan no HP 085245677701.

Appendix 2. Informed Assent

SERTIFIKAT PERSETUJUAN KEIKUTSERTAAN DALAM PENELITIAN (INFORMED ASSENT)

Semua penjelasan terkait penelitian ini telah disampaikan kepada Saya dan semua pertanyaan Saya telah dijawab oleh tim peneliti. Saya mengerti bahwa apabila Saya memerlukan penjelasan, Saya dapat menanyakan lebih lanjut kepada Septiana Maria Deba Ginting melalui email: debaginting.dg@gmail.com atau melalui whatsapp dan no HP 085245677701.

Penelitian ini bersifat sukarela tanpa adanya paksaan dari pihak manapun. Dengan menandatangani formulir ini, maka Saya menyatakan **SETUJU** untuk mengikuti dan berpartisipasi dalam penelitian berjudul "*Association Between Consumption of Ultra-Processed Foods with Nutritional Status of Senior High School Students in Pontianak* (Hubungan Antara Konsumsi Makanan Ultra-Olahan dan Status Gizi pada Siswa SMA di Pontianak)" dan bersedia melaksanakan peraturan penelitian ini.

Tanda tangan responden

Tanggal penanda tanganan:

_ _ / _ _ / _ _ _ _

Nama Jelas: …….....

Untuk ditandatangani peneliti:

Saya telah membaca dengan seksama atau menyaksikan pembacaan formulir persetujuan (*assent*) secara akurat terhadap kandidat subjek/partisipan penelitian, dan sang anak telah diberikan kesempatan untuk bertanya. Saya mengkonfirmasi bahwa sang anak telah memberikan persetujuan (*assent*) secara bebas.

Nama peneliti : Septiana Maria Deba Ginting

Tanda tangan peneliti :

Tanggal :

Pernyataan oleh peneliti/peminta *consent*

Saya telah membacakan lembar informasi secara akurat kepada kandidat subjek/partisipan, dan memastikan sesuai dengan kemampuan terbaik saya bahwa sang anak mengerti bahwa hal-hal dibawah ini akan dikerjakan:

1. Dilakukan penimbangan BB dan pengukuran TB
2. Mengisi kuesioner umum
3. Diwawancara mengenai kuesioner FFQ, Recall 24-jam
4. Mengisi kuesioner IPAQ-S

Saya mengkonfirmasi bahwa sang anak telah diberikan kesempatan untuk mengajukan pertanyaan mengenai penelitian ini, dan memastikan seluruh pertanyaannya sepanjang kemampuan saya telah dijawab dengan benar. Saya mengkonfirmasi bahwa tidak ada pemaksaan dalam pemberian *assent*, dan *assent* diberikan secara bebas dan sukarela.

Satu lembar salinan dari formulir persetujuan (*assent*) ini telah diberikan kepada subjek/partisipan.

Nama peneliti/peminta persetujuan (*assent*) : Septiana Maria Deba Ginting

Tanda tangan peneliti/peminta persetujuan (*assent*) :

Tanggal :

Salinan diberikan kepada subjek/partisipan_____(diberikan inisial oleh peneliti/asisten)

Orangtua/Wali telah menandatangani lembar *informed consent*	*Yes*		*No*	

_____(diberikan inisial oleh peneliti/asisten)

Appendix 2. Informed Consent

LEMBAR PERSETUJUAN
(INFORMED CONSENT)

Untuk subjek penelitian ***(……..)*** yang ikut dalam penelitian:

Hubungan Antara Konsumsi Makanan Ultra-Olahan dan Status Gizi pada Siswa SMA di Pontianak,

saya telah membaca dan mengerti informasi yang tercantum pada lembar informasi dan telah diberi kesempatan untuk mendiskusikan dan menanyakan hal tersebut. Saya setuju untuk mengijinkan anak saya mendapatkan penimbangan BB, pengukuran TB, dilakukan wawancara kuesioner umum, kuesioner FFQ, kuesioner recall 24 jam, dan kuesioner IPAQ-S. Saya mengerti bahwa saya dapat menolak untuk ikut dalam penelitian, dan dapat mengundurkan diri kapan saja. Saya mengerti bahwa apabila saya tidak mengikuti penelitian ini, anak saya tidak akan mendapatkan sanksi apa pun.

Saya, sebagai **ORANG TUA/WALI** dari .....

SETUJU untuk berpartisipasi dalam penelitian ini.

Tanggal **: ……**
Tanda tangan Orang Tua/Wali **: ……**
Nama Orang Tua/Wali : **……**

Tanda tangan Saksi **: ……**
Nama Saksi **: ……**

Appendix 3. General Questionnaire

ASSOCIATION BETWEEN CONSUMPTION OF ULTRA-PROCESSED FOODS WITH NUTRITIONAL STATUS OF SENIOR HIGH SCHOOL STUDENTS IN PONTIANAK

Identitas Responden

Nama :

Jenis Kelamin : ☐ Laki-Laki ☐ Perempuan

Tanggal Lahir : ……../……. /……. (dd/mm/yyyy)

Umur : ……. Tahun

Kelas :

Berat Badan : 1. …… Kg 2. …… Kg

Tinggi Badan : 1. …… Cm 2. …… Cm

Status Gizi : (Diisi oleh peneliti)

☐ -3 SD - -2 SD (Underweight)

☐ -2 SD - +1 SD (Normal)

☐ +1 SD - +2 SD (Overweight)

☐ > +2 SD (Obese)

Informasi Orang Tua

Tingkat Pendidikan :

Ibu :	☐ Dasar (SD)	Ayah :	☐ Dasar (SD)
	☐ Menengah (SMP - SMA)		☐ Menengah (SMP - SMA)
	☐ Tinggi (Bachelor – Magister)		☐ Tinggi (Bachelor – Magister)

Pekerjaan :

Ibu	☐ PNS	Ayah :	☐ PNS
	☐ Swasta		☐ Swasta
	☐ IRT / Tidak Bekerja		☐ Tidak Bekerja

Pendapatan Keluarga :	☐ <Rp. 2.750.644,55, -	☐ ≥Rp. . 2.750.644,55, -

Appendix 4. Food Frequency Questionnaire

Food Frequency Questionnaire

Nama : Tanggal Interview :
Jenis Kelamin : Kelas :
No HP : Interviewer :

No.	Jenis Makanan	Contoh UPF	Frekuensi Konsumsi				
			1 kali / hari	> 1 kali / hari	2-3 kali / minggu	4-6 kali / minggu	Tidak Pernah
1	**Makanan ringan dan manis**						
	Camilan gurih	Camilan mengandung keju, sosis, bakso					
	Roti manis	Holland Bakery, Cotton Bread, Roti Gembong					
	Permen	Alpenliebe, Kis, Fox, Mentos, Yupi					
	Sereal / bar nutrisi	Milo Cereal Bar, Flimbar, Fitbar, Simba CerealBar					
	Eskrim	Cornetto, Baskin Robbins, Vienetta, Campina, Wall's, Aice, Eskrim Angi					
	Cokelat dan meises	SilverQueen, Toblerone, Cadburry, Delfi, Ceres, Safari					
	Marshmallow	Chomp Chomp Mallow, Haribo Chamallow					
	Keripik kentang	Chitato, Lays, Pringles					
	Keripik singkong	Qtela, Kusuka, Chuba					
	Pilus	Tic Tac, Garuda					

	Kacang-kacangan	Dua Kelinci, Mr.P, Sukro					
	Keripik jagung	Happy Tos, Doritos					
2	**Hidangan campuran siap saji / panas**						
	Pizza	Pizza Hut, Dominos					
	Sandwich	Sandwich dengan roti tawar, sosis, daging, keju, saos					
	Daging beku	Fiesta, daging beku yang dijual di supermarket/hypermarket kemudian dimasak					
	Ayam goreng cepat saji	KFC, McD, CFC, Fiesta					
	Kentang goreng cepat saji	Fiesta, French Fries, KFC					
	Burger	McD, KFC, Pizza Hut, burger isi sosis, daging asap, keju, saos					
3	**Makanan biji-bijian industri**						
	Roti	Roti gandum, roti tawar					
	Biskuit	Roma, Regal, Butter Cookies, Selamat					
	Wafer	Nabati, Nissin, Tango, Wafello					
	Sereal siap saji	Koko Krunch, Stars Crunch					
	Bubuk sereal	Energen, Quaker Oat, Sereal Fit					
	Havermut	Quaker Oat, Havermut Instant					
	Kue kering	Pastry, cookies					
4	**Daging dan Unggas**						
	Sosis	So Good, Champ, Fiesta, Hanzel, Kenzler					
	Bakso ayam / daging	Champ, So Good					
	Nugget ayam / daging	Fiesta, Bellfoods, Champ					
	Daging kornet dan asap	Pronas, Kornetku,					

5	**Ikan**						
	Bakso ikan	So Good, Shifudo					
	Nugget ikan	Pina, Minaku					
	Olahan ikan	Sarden kaleng, otak otak, roll ikan					
6	**Saus dan Penyedap Bubuk**						
	Saos tomat / sambal	ABC, Indofood, Del Monte					
	Saus Keju	Mama Suka, Knorr, Prochiz,					
	Saus spageti instan	La Fonte, Del Monte, Pronas					
	Kecap manis / asin	Bango, ABC, Sedaap, Tropicana Slim, Indofood					
	Saus salad	Kewpie, Kraft, Maestro, Thousand Island					
	Mayonaise	Maestro, Clip Art, Heinz, Mayumi					
	Bumbu siap saji	Indofood, Finna, Royco, Sajiku, Racik, Sasa Larasa					
	Selai cokelat / kacang / strawberry	Morin, Smuckers, Mariza					
	Margarin dan Mentega	Blue Band, Filma, Palmia, Butter, For Vita, Anchor					
7	**Instant Noodle, Porridge and Soup**						
	Mie instan	Indomie, Sedaap, Lemonilo, La Fonte					
	Bubur instan	Super Bubur, Bur Yam					
	Sup instan	Mama Suka Sup Krim Ayam, Izisoup Mushroom creamsoup, Royco supkrim jagung					
8	**Minuman**						
	Minuman elektrolit	Pocari Sweat, Oceana, Super02, Mizone					
	Minuman berkarbonasi	Coca Cola, Sprite, Fanta					
	Minuman jus buah kemasan	Buavita, Country Choice					
	Minuman jelly	Vita Jelly Drink, Okky Jelly Drink, Jell Vit					

	Teh Kemasan	Sosro, Nu Greentea, Ichitan, Pucuk					
	Teh non Kemasan	Teh manis di kantin, rumah makan, cafe					
	Kopi Kemasan	Goodday, Nescafe, Luwak Coffee, Kopiko, Kopi Kenangan					
	Kopi non Kemasan	Starbuck, kopi café, kopi kantin					
	Sirup	Marjan, ABC, Tropicana					
9	**Minuman olahan susu dan pengganti susu**						
	Susu beraroma	Indomilk, Ultra Milk, Frisian Flag, Cimory, Diamond, Greenfields, Kin					
	Susu UHT	Indomilk, Ultra Milk, Frisian Flag, Cimory, Diamond, Greenfields, Kin					
	Yogurt	Cimory, Elle n Vire, Greenfields, Kin, Yummy Yogurt					
	Kental Manis	Frisian Flag, Enaak, Omela, Nestle Carnation					
	Pudding	Nutrijell, Haan, Pondan, Ceres, pudding yang dijual di minimarket/supermarket dll					
	Boba dan Teh Susu	Milk Tea, Chatime, Boba Time, Jojo, Kokumi					
10	**Produk Tepung Susu**						
	Tepung Susu rendah lemak	Nestle Omega, Tropicana Slim, Prolac					
	Tepung Susu fullcream	Indomilk, Nestle Dancow, Milo, Frisian Flag					
11	**Minuman serbuk dan konsentrat**						
	Bubuk coklat	Cocoa, Van Houten,					
	Konsentrat buah	Sunfield, Fantasy, Flor					
	Milk shake	Zee, Herbalife, Pop Ice, milk shake caffee, kantin					
12	**Lainnya (Food / drink)**						

Appendix 5. 24-hour Recall Form

FORMULIR RECALL 24 JAM

Tanyakan tentang makanan dan minuman apa saja yang dikonsumsi kemarin (dari bangun tidur sampai tidur kembali)

Waktu	Makanan utama / selingan	Nama menu (makanan/ minuman)	Metode memasak	Rincian bahan makanan (tulis nama merk jika relevan)	Jumlah makanan yang dikonsumi	
					URT	Gram

Appendix 6. International Physical Activity Questionnaire – Short Form

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE – SHORT FORM

(IPAQ-S)

Kami tertarik untuk mengetahui jenis aktivitas fisik yang dilakukan orang sebagai bagian dari kehidupan sehari-hari. Pertanyaan tersebut akan menanyakan tentang waktu yang Anda habiskan untuk aktif secara fisik dalam **7 hari terakhir**. Harap jawab setiap pertanyaan meskipun Anda tidak menganggap diri Anda sebagai orang yang aktif. Tolong pikirkan tentang aktivitas yang Anda lakukan di tempat kerja, sebagai bagian dari pekerjaan rumah dan pekarangan Anda, berpindah dari satu tempat ke tempat lain, dan di waktu luang Anda untuk rekreasi, olahraga atau latihan.

Pikirkan semua **aktivitas berat** yang Anda lakukan dalam **7 hari terakhir**. Aktivitas fisik yang berat mengacu pada aktivitas yang membutuhkan upaya fisik yang berat dan membuat Anda bernapas lebih keras dari biasanya. Pikirkan *hanya* tentang aktivitas fisik tersebut yang Anda lakukan setidaknya selama 10 menit dalam satu waktu.

1. Selama **7 hari terakhir**, berapa hari Anda melakukan **aktivitas fisik berat** seperti angkat berat, mencangkul, aerobik, atau bersepeda cepat?

   _____ **hari per minggu**

   ☐ Tidak melakukan aktivitas fisik yang berat → ***Lanjut ke pertanyaan 3***

2. Berapa banyak waktu yang biasanya Anda habiskan untuk melakukan **aktivitas fisik yang berat** pada salah satu hari tersebut?

   _____ **jam per hari** _____ **menit per hari**

   ☐ Tidak tahu /tidak yakin

Pikirkan semua **aktivitas sedang** yang Anda lakukan dalam **7 hari terakhir**. Aktivitas sedang ini mengacu pada aktivitas yang memerlukan upaya fisik sedang dan membuat Anda bernapas agak lebih keras dari biasanya. Pikirkan *hanya* tentang aktivitas fisik tersebut yang Anda lakukan setidaknya selama 10 menit dalam satu waktu.

1. Selama **7 hari terakhir**, berapa hari Anda melakukan **aktivitas fisik sedang** seperti mengangkat beban ringan, bersepeda dengan kecepatan biasa, atau tenis ganda? Tidak termasuk berjalan.

   _____ **hari per minggu**

   ☐ Tidak melakukan aktivitas fisik sedang → ***Lanjut ke pertanyaan 5***

2. Berapa banyak waktu yang biasanya Anda habiskan untuk melakukan **aktivitas fisik sedang** pada salah satu hari tersebut?

_____ **jam per hari** _____ **menit per hari**

☐ Tidak tahu /tidak yakin

Pikirkan tentang waktu yang Anda habiskan untuk **berjalan kaki** dalam **7 hari terakhir**. Ini termasuk berjalan di tempat kerja dan di rumah, berjalan kaki untuk bepergian dari satu tempat ke tempat lain, dan jalan kaki lainnya yang telah Anda lakukan seperti untuk rekreasi, olahraga, atau bersantai di waktu luang.

1. Selama **7 hari terakhir**, berapa hari Anda berjalan kaki **minimal** 10 menit dalam satu waktu?

_____ **hari per minggu**

☐ Tidak berjalan → ***Lanjut ke pertanyaan 7***

2. Berapa banyak waktu yang biasanya Anda habiskan untuk **berjalan kaki** pada salah satu hari tersebut?

_____ **jam per hari** _____ **menit per hari**

☐ Tidak tahu /tidak yakin

Pertanyaan terakhir adalah tentang waktu yang Anda **habiskan untuk duduk** di hari kerja selama 7 hari terakhir. Sertakan waktu yang dihabiskan di tempat kerja, di rumah, saat melakukan pekerjaan kursus dan selama waktu senggang. Termasuk waktu yang dihabiskan untuk duduk di depan meja, mengunjungi teman, membaca, atau duduk atau berbaring untuk menonton televisi.

Selama **7 hari terakhir**, berapa banyak waktu yang Anda habiskan untuk **duduk** dalam satu hari **kerja**?

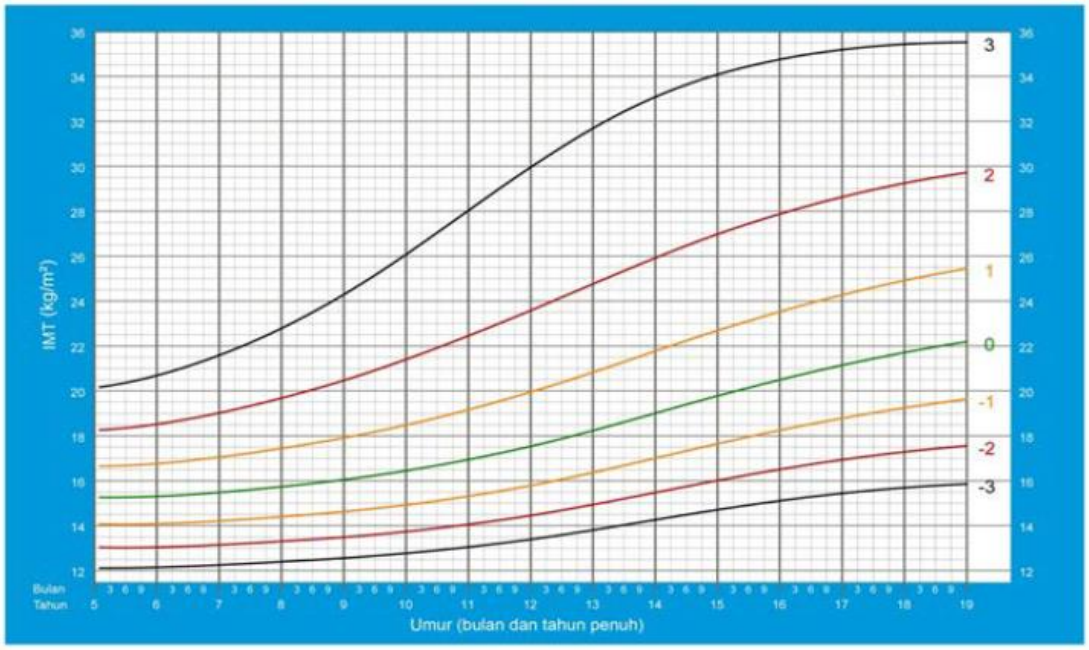
_____ **jam per hari** _____ **menit per hari**

☐ Tidak tahu /tidak yakin

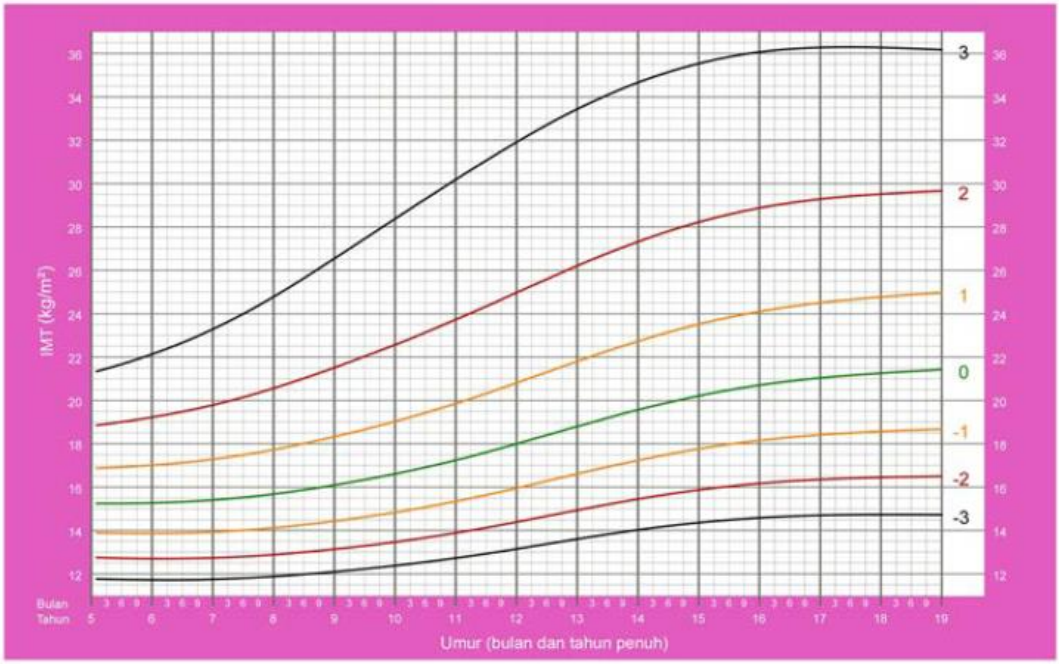
<u>Ini adalah akhir dari kuesioner, terima kasih telah berpartisipasi.</u>

Appendix 7. Grow Chart BMI/Age for Adolescents

Grafik Indeks Massa Tubuh Menurut Umur Anak Laki-laki 5-18 Tahun (z-scores)



Grafik Indeks Massa Tubuh Menurut Umur Anak Perempuan 5-18 Tahun (z-scores)



Appendix 9. Ethical Clearence

KOMITE ETIK PENELITIAN KESEHATAN
RSUP NASIONAL DR. CIPTO MANGUNKUSUMO
FAKULTAS KEDOKTERAN UNIVERSITAS INDONESIA
Gedung H Fakultas Kedokteran UI, Jalan Salemba Raya No. 6 Jakarta 10430 PO. Box 1358
Telp: (021) 3157008, website: https://komite-etik.fk.ui.ac.id/

KEDOKTERAN

Nomor : KET- 786 **/UN2.F1/ETIK/PPM.00.02/2023**

KETERANGAN LOLOS KAJI ETIK
ETHICAL APPROVAL

Komite Etik Penelitian Kesehatan Fakultas Kedokteran Universitas Indonesia – RSUPN Dr. Cipto Mangunkusumo dalam upaya melindungi hak asasi dan kesejahteraan subjek penelitian kedokteran, telah mengkaji dengan teliti protokol penelitian yang berjudul:

The Ethics Committee of the Faculty of Medicine, University of Indonesia – Cipto Mangunkusumo Hospital with regards of the Protection of human rights and welfare in medical research, has carefully reviewed the research entitled:

"Hubungan Antara Konsumsi Makanan Ultra-Olahan dan Status Gizi pada Siswa SMA di Pontianak."

Protocol Number	: **23-05-0715**
Peneliti Utama *Principal Investigator*	: **Septiana Maria Debu Ginting, S.Gz**
Nama Institusi *Name of the Institution*	: **Fakultas Kedokteran Prodi Ilmu Gizi Komunitas**
Lokasi Penelitian *Site*	: **1. Sekolah Menengah Atas Immanuel Pontianak** **2. Sekolah Menengah Atas Santu Petrus Pontianak**
Tanggal Persetujuan *Date of Approval*	: 1 2 JUN 2023 ***(valid for one year beginning from the date of approval)***
Dokumen Disetujui *Document Approved*	: **Proposal Penelitian, Version 0.1 tanggal 04 Mei 2023** **Lembar Persetujuan Orang Tua/Wali, Version 2.0 tanggal 07 Juni 2023** **Lembar Penjelasan Penelitian Kepada Calon Partisipan, Version 2.0 tanggal 31 Mei 2023**

dan telah menyetujui protokol berikut dokumen terlampir.
and approves the above mentioned protocol including the attached document.

Ditetapkan di : Jakarta
Specified in
Ketua
Chair

Prof. dr. Rita Sita Sitorus, Ph.D., Sp.M(K)

** Peneliti berkewajiban:
1. Menjaga kerahasiaan identitas subjek penelitian
2. Memberitahukan status penelitian apabila:
   a. Setelah masa berlakunya keterangan lolos kaji etik (ethical approval) habis sebelum selesai, dalam hal ini *ethical approval* harus diperpanjang. Harap pengajuan perpanjangan etik dilakukan 30 hari sebelum masa aktif lolos kaji etik habis.
   b. Penelitian berhenti ditengah jalan.
3. Melaporkan kejadian serius yang tidak diinginkan (*serious adverse events*).
4. Peneliti tidak boleh melakukan tindakan apapun pada subjek sebelum protokol penelitian mendapat lolos kaji etik dan sebelum memperoleh *informed consent* dari subjek penelitian.
5. Menyampaikan laporan akhir, bila penelitian sudah selesai.
6. Cantumkan nomor protokol ID pada setiap korespondensi dengan KEPK FKUI-RSCM.
7. Semua protokol persetujuan dilakukan sesuai dengan standar ICH-GCP

Appendix 10. Research Permission Letter

UNIVERSITAS INDONESIA
FAKULTAS KEDOKTERAN

Gedung Fakultas Kedokteran UI
Jl. Salemba Raya No.6, Jakarta 10430
PO.Box 1358
T. 62.21.3912477, 31930371, 31930373,
3922977, 3927960, 3153236,
F 62 21 3912477, 31930372, 3157288,
E. humas@fk.ui.ac.id, office@fk.ui.ac.id
fk.ui.ac.id

Nomor : S-209/UN2.F1.DEPT.13/PPM.00/2023
Lampiran : dua berkas
Perihal : Permohonan Izin Penelitian

22 Juni 2023

Yth. Kepala Sekolah SMA Imanuel Pontianak
Di tempat

Bersama dengan surat ini, kami mengajukan permohonan izin lokasi penelitian yang akan dilaksanakan oleh mahasiswa Program Studi Magister Ilmu Gizi FKUI, yaitu **Septiana Maria Deba Ginting**, untuk mengambil data penelitian dengan judul:

"ASSOCIATION BETWEEN CONSUMPTION OF ULTRA-PROCESSED FOODS WITH NUTRITIONAL STATUS OF SENIOR HIGH SCHOOL STUDENTS IN PONTIANAK"

Pelaksanaan penelitian direncanakan pada 23-28 Juni 2023 dengan salah satu lokasi penelitian di SMA Imanuel Pontianak. Sebagai bahan pertimbangan, kami lampirkan salinan Proposal Penelitian,dan lolos kaji etik. Jika ada hal yang ingin dikonfirmasi lebih lanjut, mohon dapat disampaikan kepada saudari Septiana Maria Deba Ginting (WA) pada nomor 085245677701

Demikian kami sampaikan. Atas perhatian dan kerjasama yang diberikan, kami ucapkan terimakasih.

Juni 2023
Ketua Departemen Ilmu Gizi FKUI-RSCM,

dr. Nurul Ratna Mutu Manikam, MGizi, SpGK(K)
NUP 100220710252509791

Tembusan:
1. Ketua Program Studi Magister Ilmu Gizi FKUI

UNIVERSITAS INDONESIA
FAKULTAS KEDOKTERAN

Gedung Fakultas Kedokteran UI
Jl. Salemba Raya No.6, Jakarta 10430
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3922977, 3927360, 3153236,
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fk.ui.ac.id

Nomor : S-205/UN2.F1.DEPT.13/PPM.00/2023 22 Juni 2023
Lampiran : dua berkas
Perihal : Permohonan Izin Penelitian

Yth. Kepala Sekolah SMA Santu Petrus Pontianak
Di tempat

Bersama dengan surat ini, kami mengajukan permohonan izin lokasi penelitian yang akan dilaksanakan oleh mahasiswa Program Studi Magister Ilmu Gizi FKUI, yaitu **Septiana Maria Deba Ginting**, untuk mengambil data penelitian dengan judul:

"ASSOCIATION BETWEEN CONSUMPTION OF ULTRA-PROCESSED FOODS WITH NUTRITIONAL STATUS OF SENIOR HIGH SCHOOL STUDENTS IN PONTIANAK"

Pelaksanaan penelitian direncanakan pada 3-7 Juli 2023 dengan salah satu lokasi penelitian di SMA Imanuel Pontianak. Sebagai bahan pertimbangan, kami lampirkan salinan Proposal Penelitian,dan lolos kaji etik. Jika ada hal yang ingin dikonfirmasi lebih lanjut, mohon dapat disampaikan kepada saudari Septiana Maria Deba Ginting (WA) pada nomor 085245677701

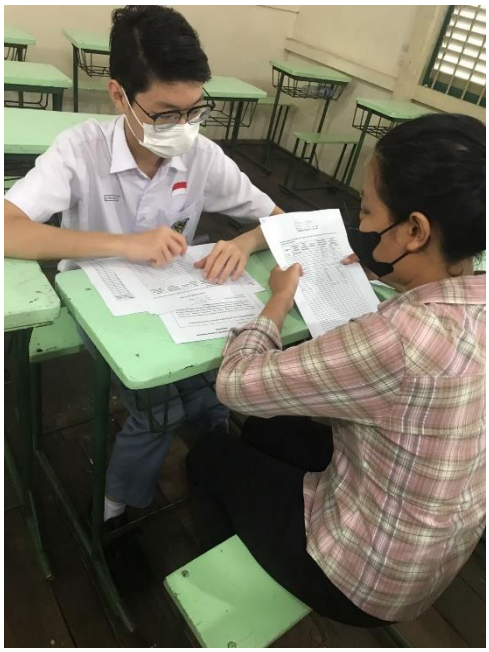
Demikian kami sampaikan. Atas perhatian dan kerjasama yang diberikan, kami ucapkan terimakasih.

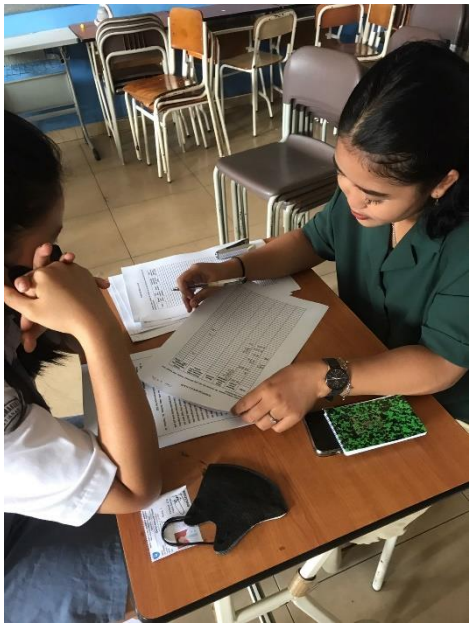
Juni 2023
Ketua Departemen Ilmu Gizi FKUI-RSCM,

dr. Nurul Ratna Mutu Manikam, MGizi, SpGK(K)
NUP 100220710252509791

Tembusan:
1. Ketua Program Studi Magister Ilmu Gizi FKUI

Appendix 11. Documentations





Appendix 12. Univariate Analysis

Student's Age (Year)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15	31	11.4	11.4	11.4
	16	154	56.4	56.4	67.8
	17	88	32.2	32.2	100.0
	Total	273	100.0	100.0	

Student's Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Boy	135	49.5	49.5	49.5
	Girl	138	50.5	50.5	100.0
	Total	273	100.0	100.0	

Father's Educational Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Elementary School	20	7.3	7.3	7.3
	Middle School	32	11.7	11.7	19.0
	High School	119	43.6	43.6	62.6
	Vocational Education	102	37.4	37.4	100.0
	Total	273	100.0	100.0	

Mother's Educational Level

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Elementary School	5	1.8	1.8	1.8
	Middle School	84	30.8	30.8	32.6
	High School	101	37.0	37.0	69.6
	Vocational Education	83	30.4	30.4	100.0
	Total	273	100.0	100.0	

Father's Occupational

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Government	29	10.6	10.6	10.6
	Non-Government	232	85.0	85.0	95.6
	Unemployed	12	4.4	4.4	100.0
	Total	273	100.0	100.0	

Mother's Occupational

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Government	16	5.9	5.9	5.9
	Non-Government	87	31.9	31.9	37.7
	Unemployed	170	62.3	62.3	100.0
	Total	273	100.0	100.0	

Family Income

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low	40	14.7	14.7	14.7
	High	233	85.3	85.3	100.0
	Total	273	100.0	100.0	

Recallcat

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	<80	67	24.5	24.5	24.5
	80-100	61	22.3	22.3	46.9
	>100	145	53.1	53.1	100.0
	Total	273	100.0	100.0	

IPAQ MET LEVEL

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Low	83	30.4	30.4	30.4
	Moderate	131	48.0	48.0	78.4
	High	59	21.6	21.6	100.0
	Total	273	100.0	100.0	

UPF categorize

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Normal	132	48.4	48.4	48.4
	Excessive	141	51.6	51.6	100.0
	Total	273	100.0	100.0	

Nutstatus_4cat

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Underweight	4	1.5	1.5	1.5
	Normal	159	58.2	58.2	59.7
	Overweight	99	36.3	36.3	96.0
	Obesity	11	4.0	4.0	100.0
	Total	273	100.0	100.0	

Appendix 13. Bivariate Analysis

Sociodemographic 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)	0.000 [a]
Female	97 (70.3)	41 (29.7)	
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)	0.033 [a]
High	133 (57.1)	100 (42.9)	
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)	

[a]Chi-Square test;

*Educational level: Primary (graduated from Elementary & Junior High School), Secondary (graduated from Senior High School), Vocational (university level)

UPF consumption	Nutritional Status		p-value
	Non-Obesity	Obesity	
Normal	69 (53.3)	63 (47.7)	0.015
Excessive	94 (66.7)	47 (33.3)	

*Nutritional status: Non-Obesity (combine of underweight and normal status), Obesity (combine of overweight and obesity)

Appendix 14. Multicollinearity Analysis

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	1.169	2	.584	2.445	.089[b]
	Residual	64.509	270	.239		
	Total	65.678	272			

a. Dependent Variable: Z-Scores

b. Predictors: (Constant), Sugar-Sweetened Beverages consumption, Ultra-Processed Foods consumption

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients			Collinearity Statistics	
		B	Std. Error	Beta	t	Sig.	Tolerance	VIF
1	(Constant)	1.539	.069		22.386	.000		
	Ultra-Processed Foods consumption	-.003	.002	-.120	-1.650	.100	.683	1.465
	Sugar-Sweetened Beverages consumption	-.001	.004	-.021	-.287	.775	.683	1.465

a. Dependent Variable: Z-Scores

Appendix 15. Multivariate Analysis

Variables	B	t	p-value
UPF and beverages consumption	-0.135	-1.329	0.185
Normal			
Excessive			
UPF consumption	0.045	0.487	0.627
Normal			
Excessive			
SSB consumption	-0.050	-0.766	0.444
Normal			
Excessive			
Gender	-0.170	-2.829	0.005*
Male			
Female			
Family Income	0.183	2.228	0.027*
Low			
High			
Mother Educational Level	-0.153	-4.302	0.000*
Primary			
Secondary			
Vocational			
Total Energy Intake	-0.026	-0.731	0.465
<80% RDA			
80-100% RDA			
>100% RDA			
Physical Activity	-0.011	-0.255	0.779
Low			
Moderate			
High			
Constant	1.913		

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

Association Between Consumption of Ultra-Processed Foods and Beverages with Nutritional Status of Senior High School Students in Pontianak

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ABSTRACT

This cross-sectional study conducted in Pontianak, West Kalimantan, investigates the association between ultra-processed food (UPF) consumption and the nutritional status of senior high school students. The study addresses the rising concern of the "double burden" of malnutrition in low- and middle-income countries, focusing on the increasing prevalence of overweight/obesity among adolescents, driven by changes in the food system. The study encompasses a thorough examination of socio-demographic factors, family income, total energy intake, physical activity, and UPF consumption using various questionnaires and anthropometric measurements.

The results reveal a significant correlation between UPF consumption, sugar-sweetened beverage (SSB) consumption, and nutritional status. The study identifies gender, mother's education level, and family income as factors associated with nutritional status among adolescents. Despite limitations, such as potential underreporting of data and a brief data collection window, the findings underscore the need for educational interventions targeting adolescents, families, and communities to promote healthier dietary habits. Recommendations include implementing school food environment standards, socializing the risks of excessive UPF consumption, and involving parents in efforts to reduce UPF intake among teenagers. This study contributes valuable insights into the complex interplay of dietary patterns, socio-economic factors, and nutritional status among adolescents in the context of a rapidly changing food landscape.

Keywords— adolescents, nutritional status, socio-demographic factors, sugar-sweetened beverages, ultra-processed foods

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.

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. 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.

Indonesia has also a large and rapidly growing market for unhealthy drinks, which are sold in various places including schools and hospitals. Based on the problems above, the authors are interested to find out the association between ultra-processed foods consumption and its correlation with

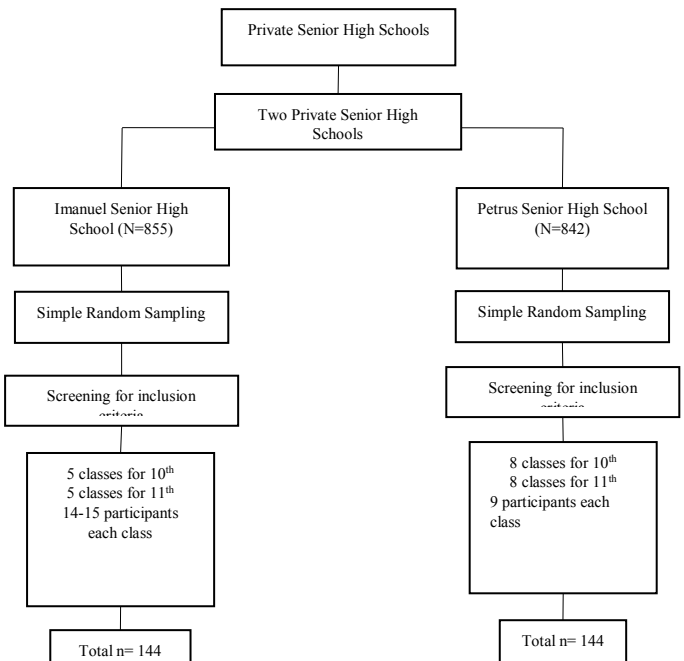
nutritional status among senior high school students.

The purpose of this study was to investigate the association of ultra-processed foods and beverages consumption and other related factors with nutritional status of senior high school students in Pontianak.

METHODS

This study was a cross-sectional investigation that assessed the correlation between the consumption of Ultra-Processed Foods and beverages and nutritional status among senior high school students conducted in Pontianak, West Kalimantan on June 2023 in two private senior high schools.

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 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.



The sample calculation used an equation for assessing the association and estimating two proportions, with the following equation:

$$n = \frac{\left\{Z_{1-a/2}\sqrt{2P(1-P)} + Z_{1-\beta}\sqrt{P_1(1-P_1)} + P_2(1-P_2)\right\}.^2}{(P_1 - P_2)^2}$$

Total sample was 262+10% = 288 respondents.

Based on data from 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.

The tools that used in this study was anthropometric measurement for body weight measurement and height measurement. These measurements need to calibrated before used to show the valid data.

There are 4 questionnaires used in this study consisting of general questionnaire, Food Frequencies Questionnaire (FFQ), 24-hours recall form, and International Physical Activity Questionnaire Short Form (IPAQ-S).

1. General questionnaire contains data regarding general information of the subjects including name, date of birth, age, sex, school grade, body weight, height, nutritional status, parent's information (occupation, family income, level of education).

2. Food frequencies questionnaire (FFQ) is to collecting frequency list of foods that consumed by students, to obtain a

qualitative description of food consumption patterns.

3. 24-hours recall form is to collecting data of energy intake from UPF and SSB that consumed by students, to obtain the quantitative of food intake.

4. International Physical Activity Questionnaire Short Form (IPAQ-S) is to measure the level of physical activity of students. IPAQ short form is an instrument designed primarily for population surveillance of physical activity among adults. It has been developed and tested for use in adolescents to adults (age range of 15-69 years) and until further development and testing is undertaken. The use of IPAQ with older and younger age groups is not recommended.

If all data assure complete and the questionnaires already fulfilled, data will inputed into Microsoft Excel 2016 MSO. After that, all the data will be processed using licensed IBM SPSS Version 26.0 for further statistical analysis. This study used univariate, bivariate, and multivariate analysis.

RESULTS AND DISCUSSIONS

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

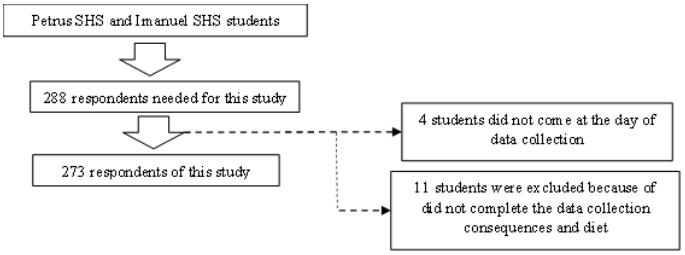


Figure 4.1 Sampling Procedure

Table 4.1 shows the characteristics of respondents. Age of respondents was 15-17 years old. The proportion of female students involved in this study was higher than male students, 50.5% and 49.5%, respectively.

Based on the educational level and occupation of parents of the respondents, 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 not working. More than 85% of the respondents has high family income, which means that their family income is 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 4.1 showed that 53.1% of the respondents has total energy intake more than 100% of RDA.

Level of physical activity in this study was measured by International Physical Activity Questionnaire for short form. Based on physical activity level, there are 48.0% of

respondents had moderate physical activity level.

Table 4.1 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)

Ultra-processed foods in this study were described as all foods that included in classification of NOVA classification group 4. The median of the frequency of UPF consumption was 50.

Frequency of Ultra-Processed Foods and beverages consumption of respondents

Ultra-processed foods and beverages in this study were described as all foods and beverages that included in classification of NOVA classification group 4. The median of the frequency of UPF and beverages consumption was 50 times consumed UPF in the last 7-days.

Table 4.2 Frequency of Ultra-Processed Foods and beverages consumption of respondents (n=273)

Variable	Median (Min-Max)
UPF and beverages consumption	50 (11-143)

*UPF and beverages consumption in the last 7-days

Frequency of Ultra-Processed Foods consumption of respondents

Ultra-processed foods in this study were described as all foods that included in classification of NOVA classification group 4. The median of the frequency of UPF consumption was 35 times consumed UPF in the last 7-days.

Table 4.2.1 Frequency of Ultra-Processed Foods consumption of respondents (n=273)

Variable	Median (Min-Max)
UPF consumption	35 (8-107)

*UPF (foods) consumption in the last 7-days

Frequency of Sugar-Sweetened Beverages consumption of respondents

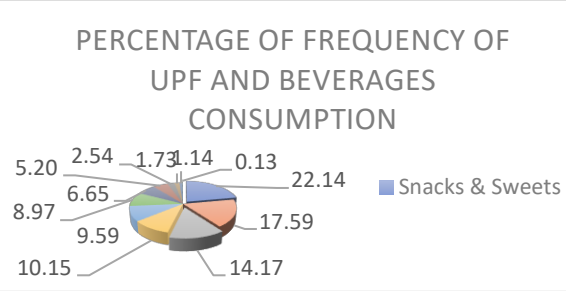
Sugar-Sweetened Beverages in this study were described as all beverages that included in NOVA classification group 4. The median of the frequency of SSB consumption was 12 times consumed SSB in the last 7-days.

Table 4.2.2 Frequency of Sugar-Sweetened Beverages consumption of respondents (n=273)

Variable	Median (Min-Max)
SSB consumption	12 (1-50)

*SSB consumption in the last 7-days

4.2.3 Percentage of Frequency of UPF and Beverages Consumption of respondents



*Others Food and Drink (ea. protein powder, popcorn)

Figure 4.2 Percentage of Frequency of Ultra-Processed Foods and beverages consumption among respondents (%)

Figure 4.2 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 (ea. protein powder and popcorn).

Table 4.2.3 showed that more than a half of the respondents has excessive consumption of Ultra-Processed Foods and beverages frequency.

Table 4.2.3 Ultra-Processed Foods and beverages consumption frequency of respondents (n=273)

UPF and beverages consumption	n (%)
Normal	132 (48.4)
Excessive	141 (51.6)

*Median of frequency: 50

Table 4.2.5 showed that 50.9% of the respondents has excessive of Ultra-Processed Foods consumption frequency.

Table 4.2.5 Ultra-Processed Foods consumption frequency of respondents (n=273)

UPF consumption	n (%)
Normal	134 (49.1)
Excessive	139 (50.9)

*Median of frequency: 35

Table 4.2.6 showed that 50.5% of the respondents has excessive of Ultra-Processed Foods consumption frequency.

Table 4.2.6 Sugar-Sweetened Beverages consumption frequency of respondents (n=273)

UPF and beverages consumption	n (%)
Normal	135 (49.5)
Excessive	138 (50.5)

*Median of frequency: 12

Nutritional Status of respondents

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. Table 4.3 showed there are 40.3% respondents has overweight and obesity nutritional status.

Table 4.3 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)

Factors associated with Nutritional Status among adolescents in Pontianak

The association between nutritional status and UPF and beverages consumption was analysed in bivariate and multivariate analysis. 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 0.005 was 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 consist of age, gender, father and mother educational level, father and mother occupation, family income, total energy intake and physical activity level. For age, father's educational level, father's occupation, and mother's occupation, we did not find significant association between nutritional status and these factors ($p>0.05$). 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 ($p<0.05$).

Table 4.4 Association between socio-demographic factors and Nutritional Status (n=273)

Sociodemographic variables	Nutritional Status		p-value
	Non-Obesity	Obesity	
Age (year)			
15	17 (54.8)	14 (45.2)	0.735 [a]
16	91 (59.1)	63 (40.9)	
17	55 (62.5)	33 (37.5)	
Gender			
Male	66 (48.9)	69 (51.1)	0.000 [a]
Female	97 (70.3)	41 (29.7)	
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)	0.033 [a]
High	133 (57.1)	100 (42.9)	
Total Energy Intake			
<80% RDA	35 (52.2)	32 (47.8)	0.357 [a]
80-100% RDA	38 (62.3)	23 (37.7)	
>100% RDA	90 (62.1)	55 (37.9)	
Physical Activity			
Low	56 (67.5)	27 (32.5)	0.218 [a]
Moderate	73 (55.7)	58 (44.3)	
High	34 (57.6)	25 (42.4)	

[a]Chi-Square test;
*Educational level: Primary (graduated from Elementary & Junior High School), Secondary (graduated from Senior High School), Vocational (university level)

Association between Ultra-Processed Foods and beverages with Nutritional Status

Data on table 4.5 shown the association between Ultra-Processed Foods and beverages has a significant association with nutritional status ($p \leq 0.05$).

Table 4.5 Association between Ultra-Processed Foods and beverages and Nutritional Status

UPF and beverages consumption	Nutritional Status		p-value
	Non-Obesity	Obesity	
Normal	69 (53.3)	63 (47.7)	0.015
Excessive	94 (66.7)	47 (33.3)	

*Nutritional status: Non-Obesity (combine of underweight and normal status), Obesity (combine of overweight and obesity)

Table 4.5.1 shown the association between Ultra-Processed Foods has no significantly associated with nutritional status (p≤0.05).

Table 4.5.1 Association between Ultra-Processed Foods and Nutritional Status

UPF consumption	Nutritional Status		p-value
	Non-Obesity	Obesity	
Normal	73 (54.5)	61 (45.5)	
Excessive	90 (64.7)	49 (35.5)	0.084

Table 4.5.2 shown the association between Sugar-Sweetened Beverages has no significantly associated with nutritional status (p≤0.05).

Table 4.5.2 Association between Sugar-Sweetened Beverages and Nutritional Status

SSB consumption	Nutritional Status		p-value
	Non-Obesity	Obesity	
Normal	74 (54.8)	61 (45.2)	
Excessive	89 (64.5)	49 (35.5)	0.103

Association between Ultra-Processed Foods and beverages with Nutritional Status, adjusted by other potential factors

Before the multivariate test done, the researcher did the multicollinearity test. And the result shown that there is no multicollinearity found between UPF and SSB. Multivariate analysis was done in order to assess the association between UPF consumption and nutritional status, and other potential factors. In multivariate analysis after adjusted to other several confounders, gender, mother educational level and family income were significantly correlated with nutritional status.

Table 4.6 Multivariate Analysis between All Processed Foods and Nutritional Status, adjusted by other potential factors (n=273)

Variables	B	t	p-value
UPF and beverages consumption	-0.135	-1.329	
Normal			0.185
Excessive	0.045	0.487	
UPF consumption			
Normal			0.627
Excessive	-0.050	-0.766	
SSB consumption			
Normal			0.444
Excessive	-0.170	-2.829	
Gender			
Male			0.005*
Female	0.183	2.228	
Family Income			
Low			0.027*
High	-0.153	-4.302	
Mother Educational Level			0.000*
Primary			
Secondary	-0.026	-0.731	
Vocational			
Total Energy Intake			0.465
<80% RDA			
80-100% RDA	-0.011	-0.255	
>100% RDA			0.779
	1.913		
Physical Activity			
Low			
Moderate			
High			
Constant			

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

Discussion

Sociodemographic characteristics were assessed in this study based on the age, gender, parent's education level, parent's occupation, and family income. According to CDC, adolescents are in the range of age 15-18 years old. In this study, median of age of the respondents was 16 years old. Adolescents are physically, cognitively, and socioemotionally more advanced than children but prone to behave in ways that are inconsistent with adult values and norms. Adolescents begin to explore their emerging identities in ways that foster autonomy and connectedness. They feel capable of choosing everything, including food and lifestyle.[20, 82]

In this study, the ratio of girl respondent's participations was higher than boy. A previous study stated that gender was a key factor of difference health-related awareness. Females tend to have higher awareness might affecting on higher participation in health research. [83]

In term of education level of parents, national data in 2022 found the highest education attainment number of Indonesian population especially in West Kalimantan was elementary school, which has different finding with this study.[84] 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.

Education level of parents has associated with their occupation and affecting the family income.[91] In this study, family income of the respondents was higher than regional minimum wage salary per month for Pontianak 2023, which means that their family income was higher than Rp. 2.750.644,55, -. More than 85% of the respondents has high family income. Adolescents who have family with higher finance, increased the chance of consuming UPF, compared to family with income under minimum wage.[92] High socioeconomic status is becoming the primary determinant of obesity in adolescents due to more frequent media use and consequently sedentary lifestyles coupled with greater exposure to advertising of low nutritional quality and energy-dense foods that look attractive, hyper-palatable, cheap, and ready to eat.[22]

Other characteristics of respondents might associate with nutritional status were total energy intake and physical activity. Individual's total energy intake expenditure influenced by age, gender, weight, height, and physical activity. Energy input comes from foods and beverages consumption in a whole day, while energy output depends on physical activities while walking and doing other activities including studying. The higher the physical activity, leads to higher energy expenditure.

Therefore, calorie input should be equal to calorie expenditure for obtaining energy balance.

In this study, most of respondents had inadequate energy intake, in other words energy intake more than 100% of RDA; and moderate level of physical activity. Based on data from Riskesdas 2018, PAL was assessed using modified Global Physical Activity Questionnaire (GPAC) from WHO, while this study used IPAQ Short Form. Most of the respondents had moderate physical activity level could be due to their activities mostly spent on sitting time in class, but they still have sports subjects that help them to burn more energy. They also go to and from school using vehicles, making them walk less.

Ultra-Processed Foods Consumption of respondents

The Ultra-Processed Foods nowadays becoming a global health issue since it caused the excessive of calories inputs and excessive of sugar consumption. All the respondents of this study were in adolescents' phase, which also in transition period from children-hood to adulthood. At this phase, they would start to have the independence stage of choosing everything in their life, include the foods.

In this study, more than a half of the respondents consumed excessive of UPF. The highest consumption of ultra-processed foods came from snacks and sweets, while the lowest consumption came from others from foods and drinks such as popcorn. Concerning childhood and adolescence, UPF consumption is phenomenon of major importance that is rapidly growing. Children's diets in the USA have shifted to contain about two-thirds of daily calorie consumed from UPF, contributing to high levels of body fat in children.[22]

UPF represent more than 50% of the total daily energy intake in some high-income countries. The consumption of UPF also has been associated with unhealthy dietary patterns and with overweight and obesity.[69] UPFs have a poorer nutritional quality (often high in energy, salt, free sugars, and saturated fats and low in fibre and vitamins) compared to unprocessed food.[21]

Beverages also became the one of favourite for adolescents, especially sugary drinks. The main categories of sugary drinks include soft-drinks/ fizzy-drinks, sachet mixes, fruit drinks, cordials, flavoured milks, cold teas/coffees, and energy/sports drinks. Their consumption is known to cause dental diseases, increase the risk of developing unhealthy weight gain, type-2 diabetes, gout, and non-alcoholic steatohepatitis .[11]

Besides that, Indonesian school children spend 7 to 10 hours per day at school. This long time spent away from home increases the likelihood of school children purchasing food and beverages at their school's canteen during the day. Foods sold in Indonesian schools are predominantly calorie-dense and nutrient-poor, and are typically consumed in excess,19 and 50% of the snack foods sold contain harmful chemicals.[98]

Nutritional Status of respondents

More than a half of the adolescents had normal of nutritional status based on CDC cut off categorization of nutritional status for children and adolescents. This finding was similar with study by Aghnia which found that the highest categorization of the nutritional status of adolescents was normal category (54.5%).[85] However, according to percentage of each category of BMI, there were respondents with overweight and obesity, in this study the categorization of overweight and obesity combined into one category. The percentage of obesity nutritional status category is not much different from normal nutritional status. This could allow an increase in cases of obesity among adolescents.

In this study, there are 59.7% of respondents had normal nutritional status, and 40.3% were obesity. The percentage of obesity among adolescents can increase along with their consumption patterns and their lack of physical activity. Besides that, frequent use of gadgets can also affect the nutritional status of teenagers, making them less of activities. These factors could lead the increasing of body weight of adolescents.

Over the past five decades, there has been a global increase in paediatric obesity, with notable rises in age-standardized prevalence rates for both girls and boys aged 5–19 years. Projections from the World Obesity Federation suggest a concerning future scenario, estimating that by 2030, around 254 million children and adolescents globally could be living with obesity. The top-ranking countries with over 1 million affected children are projected to be China, India, the USA, Indonesia, and Brazil, highlighting the widespread nature of this public health issue, with a majority of high-burden countries being non-high-income.[86]

The transition to adolescence brings about significant changes in both physical and psychosocial development, influencing food choices and eating patterns. Increased independence and peer interactions during this stage can lead to the preference for calorically dense fast foods. Additionally, sedentary behaviours, such as increased video and computer use, may limit physical exercise during the teenage years. Adolescence is characterized by an enhanced focus on appearance, body weight, and various psychological concerns. These factors collectively contribute to the complexity of dietary and lifestyle choices during this developmental period.[87]

Association between Ultra-Processed Foods consumption and Nutritional Status among adolescents

Ultra-processed foods characterized by high levels of sugar, salt, and saturated fats, also includes items like soft drinks, breakfast cereals, reconstituted meat products, packaged breads, and ready-to-eat foods.[88] Chi-square test found there is a significant correlation between UPF and nutritional status, which is in line with research conducted by De Amicis in Brazil

which found a positive association between consumption of ultra-processed food and obesity and adiposity parameters with a follow-up longer than 4 years.[89]

In contrast, study by Pratiwi found that with ANOVA test found there was no significant correlation between BAZ and UPF consumption ($p>0.05$) among school aged children, conducted during Covid-19 pandemic, analyze the existing data taken before the pandemic and social distancing to keep the data quality and minimize bias because direct offline data collection was not possible in the field.[64]

UPF represent more than 50% of the total daily energy intake in some high-income countries. The consumption of UPF also has been associated with unhealthy dietary patterns and with overweight and obesity.[69] Not in line to this finding, this study has reverse result between UPF and total energy intake. There was a high level of underreporting of energy intakes. The finding that overweight/obese adolescents were more likely to underreport energy intake than their normal/underweight peers may be due to an unconscious or subconscious bias in misreporting intakes of snacks or food items often considered to be unhealthy. And this is truthfully reported low food and energy intakes.[97]

Association between socio-demographic status and Nutritional Status

Socio-demographic are also some factors that influence the nutritional status. In this study, gender has associated with nutritional status. Male students have more risk to eating UPF and SSB due to their habit and activity. For example, drink energy beverages or soft drink after exercise, or eating UPF while playing game in gadget. Based on data from CDC, the consumption of SSB is varies by age, sex, ethnicity, geography, and socioeconomic status. From 2011-2014, there are 63% or 6 in 10 youth drank SSB, this prevalence is higher than adult that has 49% or 5 in 10 adult that drank an SSB on a given day. Besides that, SSB intake is higher among boy adolescent.[56]

Family is the first environment that people know so that the family is the basic determinant of the formation of one's character. The family is a group that plays an important role in the process of development, prevention, and improvement in any health problems found in the family.[93] Mother has the role to preparing the foods for family, and it is correlated to the knowledge of the nutritious foods. Although lower level of maternal education is associated with situations of risk to health and nutritional status in childhood and adolescents, as it reflects less availability of resources for care and greater difficulty in accessing information. But, the higher level of education of mothers is generally associated with higher family income, which can contribute to a greater insertion of UPF in the meals' routine.[42]

Family income influences dietary intakes is highly determined by the price of foods.[94] Higher household income can increase consumption of specific ultra-processed foods, such as pies, sausages, pastries, ice cream, soft drinks, energy drinks, and processed juices. This

situation can make adolescents consume the UPF and SSB easily.[95] This is also related to the pocket money given by parents to their children. The higher the pocket money given, the higher the consumption of UPF and sweetened drinks among adolescents.[99]

Over the last two decades, the contribution of UPF to the total energy intake of the Brazilian population has continuously increased by replacing fresh foods and culinary preparations for ready-to-eat and processed foods.[95] But in this study, there is inverse correlation between UPF consumption and total energy intake with nutritional status. This could be possible due to underreporting of data. Adolescents are indeed sensitive to social desirability. Bias towards underreporting might be larger along with a higher propensity to report intakes more consistent with dietary guidelines, particularly when they are overweight. Foods are more often eaten outside the home, particularly snacks, which are more prone to be forgotten. Additionally, with frequent skipping of meals and, more commonly, mealtime irregularities are more common in this stage.[96]

Strengths and Limitation

The author is aware of this study might have limitation and strengths. For assessing the Ultra-Processed Foods consumption of respondents, researcher used the Food Frequency Questionnaire (FFQ) based on Nova Classification group 4, then modified according to the types of food found in Pontianak City. The researcher also did the market survey to develop foods list so that the foods list in the FFQ obtained becomes more valid.

The researcher realize that this study was still had some limitations. However, the researcher had been done some actions for minimizing the error and bias in this study. Before data collection, the researcher trained the enumerators to collected data and conducted a pre-test on several respondents. Enumerators are selected based on their academic qualifications in nutrition science.

The pretesting of questionnaires with a sample similar to the respondents helps evaluate the flow of data collection, participant understanding, and questionnaire validity. This step contributes to the refinement of the instruments, reducing errors during the actual data collection. For data collection of nutritional status, the instruments had been calibrating before used. For anticipating the under-reported data, researcher considered to exclude respondents who was an athlete and did diets.

Data collection was carried out when the school had already carried out final exams and was going on holiday, so there was little time given for data collection. Researcher modified the data collection so that one school could only collect data for 3 days.

This study also tries to separate food and drinks in the UPF classification so that different results can be seen between foods and drinks that are included in the UPF. As is known, most of the research that has been carried out is examining ultra-processed foods combined between food and drink.

On the other hand, the findings of this study can help the school officials to have important implications for make regulations and designing programs aimed at promoting health and well-being among school students. Educating adolescents about the impact of ultra-processed foods on their nutritional status can empower them to make healthier food choices. Programs can be designed to encourage healthier eating habits and discourage the excessive consumption of ultra-processed foods among adolescents. The regulations can also engage communities and families in nutritional awareness programs. Educating not only the adolescents but also their families and communities can create a more comprehensive approach to improving dietary habits.

CONCLUSION

Conclusions

1. Respondents of this study were adolescents with middle up socio-economic status.
2. The consumption of Ultra-Processed Foods was high, with the highest UPF intake came from snacks and sweets (22.4%).
3. There was significant association between UPF consumption, sugar-sweetened beverages consumption and nutritional status.
4. There was also significant correlation between gender, mother education level and family income and nutritional status.

Recommendations

1. Since the study found high consumption of Ultra Processed-Foods among adolescents, it is necessary to give education to adolescents about how important to know and understand balance nutrition diet.
2. Setting standards for school food environments is also important in shaping the quality of children's diet. Considering the relatively high UPF consumption among adolescents, the socialization about the risk of excessive consumption of UPF is needed. To minimize the access of got the unhealthy diet, the schools should provide the policy of healthy canteen that should provide healthy food and beverages.
3. The role of parents is also very important in supporting reducing excessive consumption of UPF. Such as making healthy lunches from home, thereby minimizing teenagers' consumption of excessive UPF. Apart from that, the pocket money given also needs to be controlled because giving excessive pocket money also makes it easier for teenagers to buy UPF and SSB as they wish.

REFERENCES

1. World Health Organization. (2021, June 9). *Overweight and Obesity*. July 15, 2022. https://Www.Who.Int/News-Room/Fact-Sheets/Detail/Obesity-and-Overweight.
2. Kemenkes RI. Laporan Nasional Riskesdas 2018. Badan Penelitian dan Pengembangan Kesehatan. 2018; 578
3. Kemenkes RI. Laporan Nasional Riskesdas 2013. Badan Penelitian dan Pengembangan Kesehatan. 2013; 262-263
4. Sanyaolu A, Okorie C, Qi X, Locke J, Rehman S. Childhood and Adolescent Obesity in the United States: A Public Health Concern. Glob Pediatr Heal. 2019;6.

5. Enes, C. C., de Camargo, C. M., & Justino, M. I. C. (2019). Ultra-processed food consumption and obesity in adolescents. *Revista de Nutricao*, *32*. http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1415-52732019000100512&tlng=en

6. Bleich, S. N., & Vercammen, K. A. (2018). The negative impact of sugar-sweetened beverages on children's health: an update of the literature. *BMC Obesity*, *5*(1), 6. https://bmcobes.biomedcentral.com/articles/10.1186/s40608-017-0178-9

7. Gibney MJ. OPINION Ultra-Processed Foods: Definitions and Policy. (2019) :1–7.

8. Steele EM, Baraldi LG, Da Costa Louzada ML, Moubarac JC, Mozaffarian D, Monteiro CA. Ultra-processed foods and added sugars in the US diet: Evidence from a nationally representative cross-sectional study. BMJ Open. 2016;6(3).

9. Sulistiyani. Risiko Konsumsi 'Ultra Processed Foods' Pada Pangan Jajanan Anak Sekolah (PJAS) Dan Potensinya Terhadap Kejadian Obesitas Anak Sekolah Di Kota Semarang. 2009;22(2):184–206.

10. Gramza-Michałowska A. The effects of ultra-processed food consumption— is there any action needed? Nutrients. 2020;12(9):1–4.

11. Zealand N, Guidance B. Policy brief: Options to reduce sugar sweetened beverage (SSB) consumption in New Zealand. Pac Health Dialog. 2014;20(1):98–102.

12. Ledesma RG. Defining adolescence. Contemp Psychol. 1997;42(2):119–119.

13. Dars S, Sayed K, Yousufzai Z. Relationship of menstrual irregularities to BMI and nutritional status in adolescent girls. Pak J Med Sci. 2014 Jan;30(1):141-4. doi: 10.12669/pjms.301.3949. PMID: 24639848; PMCID: PMC3955559.

14. Özdemir A. Adolescent Obesity. 2015;(August).

15. Region WHOE. trends and inequalities in the WHO European Region, Adolescent obesity and related behaviours: Adolescent obesity and related behaviours: trends and inequalities in the WHO. 2014;2002–14.

16. UNICEF, N. G. S. (2019, August). *Prevention of Overweight and Obesity in Children and Adolescents*. September 8, 2022

17. Shrivastava, S. R., Shrivastava, P. S., & Ramasamy, J. (2016). *SHORT COMMUNICATION Assessment of Nutritional Status in the Community and Clinical Settings*. *34*(5), 211–213. http://www.jmedscindmc.com/text.asp?2014/34/5/211/143648

18. Erkan T. Adolescent nutrition. Turk Pediatr Ars. 2011;46(SUPPL.1):49–53.

19. Doustmohammadian A, Keshavarz SA, Doustmohammadian S. Nutritional status and dietary intake among adolescent girls. J Paramed Sci. 2013;4(Supplement):72–7.

20. CDC (September 24, 2022). About Child and Teen BMI. U.S Department of Health & Human Services. September 30, 2022 https://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html

21. Beslay M, Srour B, Méjean C, Allès B, Fiolet T, Debras C, et al. Ultra-processed food intake in association with BMI change and risk of overweight and obesity: A prospective analysis of the French NutriNet-Santé cohort. PLoS Med. 2020;17(8):1984–5.

22. De Amicis R, Mambrini SP, Pellizzari M, Foppiani A, Bertoli S, Battezzati A, et al. Ultra-processed foods and obesity and adiposity parameters among children and adolescents: a systematic review. Eur J Nutr [Internet]. 2022;61(5):2297–311. Available from: https://doi.org/10.1007/s00394-022-02873-4

23. Ma J, Sloan M, Fox CS, Hoffmann U, Smith CE, Saltzman E, et al. Sugar-sweetened beverage consumption is associated with abdominal fat partitioning in healthy adults. J Nutr. 2014;144(8):1283–90.

24. Ferretti F, Mariani M. Sugar-sweetened beverage affordability and the prevalence of overweight and obesity in a cross section of countries. Global Health. 2019;15(1):1–14.

25. Hyseni L, Atkinson M, Bromley H, Orton L, Mcgill R, Capewell S. The effects of policy actions to improve population dietary patterns and prevent diet-related non-communicable diseases: scoping review. 2017;(October 2016):694–711.

26. Sogari G, Velez-argumedo C, Miguel IG, Mora C. College Students and Eating Habits: A Study Using an Ecological Model for Healthy Behavior. 2018;1–16.

27. Deforche B, Dyck D Van, Deliens T, Bourdeaudhuij I De. Changes in weight, physical activity, sedentary behaviour and dietary intake during the transition to higher education: a prospective study. 2015;1–10.

28. Ye S, Chen L, Wang Q, Li Q. Correlates of screen time among 8-19-year-old students in China. BMC Public Health. 2018;18(1):1–7.

29. Kemenkes RI. Standar Antropometri Anak. Badan Penelitian dan Pengembangan Kesehatan. 2020;15

30. Monteiro CA, Cannon G, Lawrence M, Costa Louzada ML, Machado PP. The NOVA food classification system and its four food groups [Internet]. Ultra-processed foods, diet quality, and health using the NOVA classification system. 2019. 6–9 p. Available from: http://www.wipo.int/amc/en/mediation/rules

31. EL-Tahan NR, A. Alfky NA. Effect of Iron and Vitamin C Fortified Candies on the Iron Status of Early Teenager. Int J Adv Res. 2016;4(3):6–11.

32. Tianingrum NA, Mustofa A, Dianandari A, Susanti M, Sarmawati S. Risk of Overweight Among Teenagers Who Fond To Consume Fried Food in Loh Sumber, Kutai Kartanegara. J Ilmu Kesehat. 2020;8(2):62–8.

33. Bahreynian M, Qorbani M, Khaniabadi BM, Motlagh ME, Safari O, Asayesh H, et al. Association between obesity and parental weight status in children and adolescents. JCRPE J Clin Res Pediatr Endocrinol. 2017;9(2):111–7.

34. Harding, S. K., Page, A. S., Falconer, C., & Cooper, A. R. (2015). Longitudinal changes in sedentary time and physical activity during adolescence. *International Journal of Behavioral Nutrition and Physical Activity*, *12*(1). https://doi.org/10.1186/s12966-015-0204-6

35. Morrissey, J. L., Janz, K. F., Letuchy, E. M., Francis, S. L., & Levy, S. M. (2015). The effect of family and friend support on physical activity through adolescence: A longitudinal study. *International Journal of Behavioral Nutrition and Physical Activity*, *12*(1). https://doi.org/10.1186/s12966-015-0265-6

36. Casadei K, Kiel J. Anthropometric Measurement. [Updated 2022 Sep 26]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2022 Jan-. Available from:

https://www.ncbi.nlm.nih.gov/books/NBK537315/

37. Pont, S. J., Puhl, R., Cook, S. R., & Slusser, W. (n.d.). *Stigma Experienced by Children and Adolescents with Obesity*. http://publications.aap.org/pediatrics/article-pdf/140/6/e20173034/913008/peds_20173034.pdf

38. Nagata, J. M., Abdel Magid, H. S., & Pettee Gabriel, K. (2020). Screen Time for Children and Adolescents During the Coronavirus Disease 2019 Pandemic. *Obesity*, *28*(9), 1582–1583. https://doi.org/10.1002/oby.22917

39. Goldfield, G. S., Murray, M., Maras, D., Wilson, A. L., Phillips, P., Kenny, G. P., Hadjiyannakis, S., Alberga, A., Cameron, J. D., Tulluch, H., & Sigal, R. J. (2016). Screen time is associated with depressive symptomatology among obese adolescents: a HEARTY study. *European Journal of Pediatrics*, *175*(7), 909–919. https://doi.org/10.1007/s00431-016-2720-z

40. Steele, E. M., Baraldi, L. G., da Costa Louzada, M. L., Moubarac, J. C., Mozaffarian, D., & Monteiro, C. A. (2016). Ultra-processed foods and added sugars in the US diet: Evidence from a nationally representative cross-sectional study. *BMJ Open*, *6*(3). https://doi.org/10.1136/bmjopen-2015-009892

41. Enes, C., Camargo, C., Justino M. (2019). Ultra-processed food consumption and obesity in adolescents Consumo de alimentos ultraprocessados e obesidade em adolescentes. 1–11.

42. Fernanda, T., Cabrera, C., Fernandes, I., Correia, L., Oliveira, D., Santos, D., Lopes, Pacagnelli, F., Tereza, M., Prado, A., Dias Da Silva, T., Bandeira De Mello Monteiro, C., Gonçalves, D. C., & Fernani, L. (2014). ANALISYS OF THE PREVALENCE OF OVERWEIGHT AND OBESITY AND THE LEVEL OF PHYSICAL ACTIVITY IN CHILDREN AND ADOLESCENTS OF A SOUTHWESTERN CITY OF SÃO PAULO. In *Journal of Human Growth and Development* (Vol. 24, Issue 1).

43. WHO (October 5, 2022). Physical Activity. January 8, 2023. https://www.who.int/news-room/fact-sheets/detail/physical-activity

44. Wahyuni, Sri Nyemas (September 16, 2022). *Indeks Massa Tubuh Remaja*. Kementerian Kesehatan Direktorat Jenderal Pelayanan Kesehatan. January 29, 2023. https://yankes.kemkes.go.id/view_artikel/1546/indeks-massa-tubuh-remaja

45. CDC (September 24, 2022). About Child and Teen BMI. January 29, 2023. https://www.cdc.gov/healthyweight/assessing/bmi/childrens_bmi/about_childrens_bmi.html

46. Honicky, M., Cardoso, S., Kunradi Vieira, F., Hinnig, P., Back, I., & Moreno, Y. (2022). Ultra-processed food intake is associated with children and adolescents with congenital heart disease clustered by high cardiovascular risk factors. *British Journal of Nutrition,* 1-9. doi:10.1017/S0007114522002240

47. Fadila, Jihan (2022). Hubungan Konsumsi Ultra Processed Food Terhadap Kejadian Berat Badan Lebih Pada Remaja di SMPN 3 Makassar. Skripsi thesis, Universitas Hasanuddin.

48. Lidya Sari, S., Mulyawati Utari, D., Sudiarti Program Studi Gizi, T., & Kesehatan Masyarakat, F. (2021). *ILMU GIZI INDONESIA Konsumsi minuman berpemanis kemasan pada remaja Sugar-sweetened beverages consumptions among adolescents*. Universitas Indonesia

49. Guidelines for Data Processing and Analysis of the International Physical

Activity Questionnaire (IPAQ)-Short and Long Forms. (2005). www.ipaq.ki.se.

50. Badan Pusat Statistik Kota Pontianak (July 9, 2018). Persentase Rata-Rata Pengeluaran Konsumsi Makanan dan Non Makanan Per Kapita Sebulan di Kota Pontianak (Rupah). January 31, 2023. https://pontianakkota.bps.go.id/statictable/2015/12/04/45/persentase-rata-rata-pengeluaran-komsumsi-makanan-dan-non-makanan-per-kapita-sebulan-di-kota-pontianak-rupiah-2010-2016.html

51. Badan Pusat Statistik Kota Pontianak. Pengeluaran per Kapita Menurut Kabupaten/Kota (Ribu Rupiah). January 31, 2023. https://pontianakkota.bps.go.id/indicator/26/336/1/pengeluaran-per-kapita-menurut-kabupaten-kota.html

52. Badan Pusat Statistik Kota Pontianak. Konsep/Penjelasan Teknis Pendapatan. Janaury 31, 2023. https://pontianakkota.bps.go.id/subject/6/tenaga-kerja.html#subjekViewTab1

53. Badan Pusat Statistik Kota Pontianak. Istilah dalam Tingkat Pendidikan. January 30, 2023. https://www.bps.go.id/istilah/index.html?Istilah%5Bberawalan%5D=P&Istilah_page=7#:~:text=Pendapatan%20rumah%20tangga%20adalah%20pendapatan,pendapatan%20anggota%2Danggota%20rumah%20tangga.

54. Gan, Q., Xu, P., Yang, T., Cao, W., Xu, J., Li, L., Pan, H., Zhao, W., & Zhang, Q. (2021). Sugar-sweetened beverage consumption status and its association with childhood obesity among chinese children aged 6–17 years. *Nutrients*, *13*(7). https://doi.org/10.3390/nu13072211

55. Fauziyyah, H., Diana, F. M., & Femelia, W. (n.d.). *RELATIONSHIP OF ULTRAPROCESSED FOOD CONSUMPTION, SLEEP HABITS, AND ONLINE FOOD ORDERING PRACTICES WITH OBESITY IN ADULTS*.

56. CDC (April 11, 2022). Get the Facts: Sugar-Sweetened Beverages and Consumption. U.S. Department of Health & Human Services. February 3, 2023. https://www.cdc.gov/nutrition/data-statistics/sugar-sweetened-beverages-intake.html

57. WHO (December 13, 2022). WHO Calls on Countries to Tax Sugar-Sweetened Beverages to Save Lives. Department news. February 4, 2023. https://www.who.int/news/item/13-12-2022-who-calls-on-countries-to-tax-sugar-sweetened-beverages-to-save-lives

58. Miller, C., Wakefield, M., Braunack-Mayer, A., Roder, D., O'Dea, K., Ettridge, K., & Dono, J. (2019). Who drinks sugar sweetened beverages and juice? An Australian population study of behaviour, awareness and attitudes. *BMC Obesity*, *6*(1). https://doi.org/10.1186/s40608-018-0224-2

59. Sigmund, E., Sigmundová, D., Badura, P., Kalman, M., Hamrik, Z., & Pavelka, J. (2015). Temporal trends in overweight and obesity, physical activity and screen time among Czech adolescents from 2002 to 2014: A national health behaviour in school-aged children study. *International Journal of Environmental Research and Public Health*, *12*(9), 11848–11868. https://doi.org/10.3390/ijerph120911848

60. Mesas, A. E., González, A. D., de Andrade, S. M., Martínez-Vizcaíno, V., López-Gil, J. F., & Jiménez-López, E. (2022). Increased Consumption of Ultra-Processed Food Is Associated with Poor Mental Health in a Nationally Representative Sample of Adolescent Students in Brazil. *Nutrients*, *14*(24). https://doi.org/10.3390/nu14245207

61. Rocha, L. L., Gratão, L. H. A., Carmo, A. S. do, Costa, A. B. P., Cunha, C. de F., Oliveira, T. R. P. R. de, & Mendes, L. L.

(2021). School Type, Eating Habits, and Screen Time are Associated With Ultra-Processed Food Consumption Among Brazilian Adolescents. *Journal of the Academy of Nutrition and Dietetics*, *121*(6), 1136–1142. https://doi.org/10.1016/j.jand.2020.12.010

62. Silva, J. B., Elias, B. C., Warkentin, S., Mais, L. A., & Konstantyner, T. (2022). Factors associated with the consumption of ultra-processed food by Brazilian adolescents: National Survey of School Health, 2015. In *Revista Paulista de Pediatria* (Vol. 40). Sao Paulo Pediatric Society. https://doi.org/10.1590/1984-0462/2022/40/2020362

63. Kementerian Kesehatan Republik Indonesia. (2018). *Pedoman Pencegahan dan Penanggulangan Anemia pada Remaja Putri dan Wanita Usia Subur*, 8, 24-26.

64. Pratiwi, A. A. (2022). Association of Ultra-Processed Food Consumption and Body Mass Index for Age among Elementary Students in Surabaya. *Amerta Nutrition*, *6*(2), 140–147.

65. de Oliveira, A. S. D., Moreira, N. F., de Moraes, A. B. de V., Pereira, R. A., & de Veiga, G. V. (2017). Co-occurrence of behavioral risk factors for chronic non-communicable diseases in adolescents: Prevalence and associated factors. *Revista de Nutricao*, *30*(6), 747–758. https://doi.org/10.1590/1678-98652017000600007

66. Chen, Y. C., Huang, Y. C., Lo, Y. T. C., Wu, H. J., Wahlqvist, M. L., & Lee, M. S. (2018). Secular trend towards ultra-processed food consumption and expenditure compromises dietary quality among Taiwanese adolescents. *Food and Nutrition Research*, *62*. https://doi.org/10.29219/fnr.v62.1565

67. Baker, P., & Friel, S. (2014). Processed foods and the nutrition transition: Evidence from Asia. *Obesity Reviews*, *15*(7), 564–577. https://doi.org/10.1111/obr.12174

68. Islam, M. R., Rahman, S. M., Rahman, M. M., Pervin, J., Rahman, A., & Ekström, E. C. (2022). Gender and socio-economic stratification of ultra-processed and deep-fried food consumption among rural adolescents: A cross-sectional study from Bangladesh. *PLoS ONE*, *17*(7 July). https://doi.org/10.1371/journal.pone.0272275

69. Vandevijvere, S., de Ridder, K., Fiolet, T., Bel, S., & Tafforeau, J. (2019). Consumption of ultra-processed food products and diet quality among children, adolescents and adults in Belgium. *European Journal of Nutrition*, *58*(8), 3267–3278. https://doi.org/10.1007/s00394-018-1870-3

70. Relmbuss Biljers Fanda Agus Salim Tri Muhartini Kurnia Putri Utomo Shita Listya Dewi Clara Abou Samra, A. (n.d.). *CHPM Policy Brief Center for Health Policy and Management Tackling High Consumption of Sugar Sweetened Beverages (SSB) in Indonesia TACKLING HIGH CONSUMPTION OF SUGAR SWEETENED BEVERAGES (SSB) IN INDONESIA A POLICY BRIEF*.

71. Livingston, A. S., Cudhea, F., Wang, L., Steele, E. M., Du, M., Wang, Y. C., Pomeranz, J., Mozaffarian, D., & Zhang, F. F. (2021). Effect of reducing ultraprocessed food consumption on obesity among US children and adolescents aged 7-18 years: Evidence from a simulation model. *BMJ Nutrition, Prevention and Health*, *4*(2), 397–404. https://doi.org/10.1136/bmjnph-2021-000303

72. Wisnuwardani, R. W., Noviasty, R., Saputri, A., & Kurniawati, E. R. (n.d.). *PERUBAHAN AKTIVITAS FISIK DAN KONSUMSI MAKANAN ULTRA PROSES PADA MAHASISWA SELAMA PANDEMI COVID-19: PENELITIAN OBSERVASIONAL Changes of Physical*

Activity and Ultra-Processed Food Consumption in College students during COVID-19 Pandemic: An Observational Study. https://doi.org/10.204736/mgi.v17i3.293-301

73. Sartika, R. A. D., Atmarita, Duki, M. I. Z., Bardosono, S., Wibowo, L., & Lukito, W. (2022). Consumption of Sugar-Sweetened Beverages and Its PotentialHealth Implications in Indonesia. *Kesmas*, *17*(1), 1–9. https://doi.org/10.21109/kesmas.v17i1.5532

74. Faisal-Cury, A., Leite, M. A., Escuder, M. M. L., Levy, R. B., & Peres, M. F. T. (2022). The relationship between ultra-processed food consumption and internalising symptoms among adolescents from São Paulo city, Southeast Brazil. *Public Health Nutrition*, *25*(9), 2498–2506. https://doi.org/10.1017/S1368980021004195

75. Raza, A., Fox, E. L., Morris, S. S., Kupka, R., Timmer, A., Dalmiya, N., & Fanzo, J. (2020). Conceptual framework of food systems for children and adolescents. *Global Food Security*, *27*. https://doi.org/10.1016/j.gfs.2020.100436

76. Monteiro, C. A., Cannon, G., Levy, R. B., Moubarac, J. C., Louzada, M. L. C., Rauber, F., Khandpur, N., Cediel, G., Neri, D., Martinez-Steele, E., Baraldi, L. G., & Jaime, P. C. (2019). Ultra-processed foods: What they are and how to identify them. In *Public Health Nutrition* (Vol. 22, Issue 5, pp. 936–941). Cambridge University Press. https://doi.org/10.1017/S1368980018003762

77. Rafiony, A. (2015). Konsumsi Fast Food dan Soft Drink Sebagai Faktor Risiko Obesitas Pada Remaja. *Jurnal Gizi Klinik Indonesia*, *11*, 170–178.

78. UNICEF INDONESIA. (2019). *Analisis Lanskap Kelebihan Berat Badan dan Obesitas di Indonesia*. https://www.unicef.org/indonesia/media/15581/file/AnalisisLanskapKelebihanBeratBadandanObesitasdiIndonesia.pdf

79. Sejati, M., & Handini, M. (2019). *GAMBARAN FAKTOR RISIKO OBESITAS PADA ANAK DI ENAM SEKOLAH MENENGAH PERTAMA DI KOTA PONTIANAK*. Jurnal Mahasiswa PSPD FK Universits Tanjungpura. Vol 5. No 1, 7-10

80. Noviyanti, F., Diska, S., Lakshmi Puspita, W., Gambir, J., Sarjana, P., Gizi, T., Dietetika, D., Kesehatan, P., & Pontianak, K. (2022). *HUBUNGAN POLA MAKAN DAN KONSUMSI FAST FOOD TERHADAP OBESITAS PADA REMAJA DI SMA BINA UTAMA PONTIANAK*. http://ejournal.poltekkes-pontianak.ac.id/index.php/JVK

81. Robinson, T. N., Banda, J. A., Hale, L., Lu, A. S., Fleming-Milici, F., Calvert, S. L., & Wartella, E. (2017). Screen Media Exposure and Obesity in Children and Adolescents. In *PEDIATRICS* (Vol. 140). http://publications.aap.org/pediatrics/article-pdf/140/Supplement_2/S97/907704/peds_20161758k.pdf

82. Pfeifer JH, Berkman ET. The Development of Self and Identity in Adolescence: Neural Evidence and Implications for a Value-Based Choice Perspective on Motivated Behavior. Child Dev Perspect. 2018;12(3):158–64.

83. Everett B, Zajacova A. Gender differences in hypertension and hypertension awareness among young adults. Biodemography Soc Biol. 2015;61(1):1–17.

84. https://www.bps.go.id/indicator/28/1980/1/tingkat-penyelesaian-pendidikan-menurut-jenjang-pendidikan-dan-provinsi.html

85. 1. Aghnia S, Setyaningsih S. Hubungan Tingkat Pengetahuan Gizi, Status Gizi terhadap Pola Konsumsi Fast Food dan Soft Drink pada Siswa SMKN 1 Kota Tegal. Ers Klin J Penelit Ilmu Kesehat. 2023;1(1):13–8.

86. Jebeile H, Kelly AS, O'Malley G, Baur LA. Obesity in children and adolescents: epidemiology, causes, assessment, and management. Lancet Diabetes Endocrinol [Internet]. 2022;10(5):351–65. Available from: http://dx.doi.org/10.1016/S2213-8587(22)00047-X

87. Kansra AR, Lakkunarajah S, Jay MS. Childhood and Adolescent Obesity: A Review. Front Pediatr. 2021;8(January):1–16.

88. Chavez-Ugalde Y, De Vocht F, Jago R, Adams J, Ong KK, Forouhi N, et al. Manuscript title: Ultra-processed food consumption in UK adolescents: distribution, trends, and sociodemographic correlates using the National Diet and Nutrition Survey 2008/09 to 2018/19. 2008;1–26. Available from: https://doi.org/10.1101/2023.06.05.23290977

89. De Amicis R, Mambrini SP, Pellizzari M, Foppiani A, Bertoli S, Battezzati A, et al. Ultra-processed foods and obesity and adiposity parameters among children and adolescents: a systematic review. Eur J Nutr [Internet]. 2022;61(5):2297–311. Available from: https://doi.org/10.1007/s00394-022-02873-4

90. Srour B, Touvier M. Ultra-processed foods and human health: What do we already know and what will further research tell us? EClinicalMedicine. 2021;32:9–10.

91. Aulia Wicaksari S, Novita Chandra D, et al. Sugar-Sweetened Beverages Consumption and Its Association with Body Mass Index among College Students Living in Dormitory. 2021;1:33–45.

92. Gomes DR, Neto ETDS, de Oliveira DS, Salaroli LB. Characteristics associated with the consumption of in natura or minimally processed and ultra-processed foods in one Brazilian metropolitan region. Cienc e Saude Coletiva. 2023;28(2):643–56.

93. Intan Fazrin, Katarina Kaka Daha, Kamaru lImron Musa. The Role of Parents in Preparing Balanced Menu with Children's Nutritional Status. J Nurs Pract. 2022;5(2):229–38.

94. Marchese L, Livingstone KM, Woods JL, Wingrove K, MacHado P. Ultra-processed food consumption, socio-demographics, and diet quality in Australian adults. Public Health Nutr. 2022;25(1):94–104.

95. Simões B dos S, Cardoso L de O, Benseñor IJM, Schmidt MI, Duncan BB, Luft VC, et al. O consumo de alimentos ultraprocessados e nível socioeconômico: Uma análise transversal do estudo longitudinal de Saúde do Adulto, Brasil. Cad Saude Publica. 2018;34(3):1–13.

96. Lioret S, Touvier M, Balin M, Huybrechts I, Dubuisson C, Dufour A, et al. Characteristics of energy under-reporting in children and adolescents. Br J Nutr. 2011;105(11):1671–80.

97. Jones L, Ness A, Emmett P. Misreporting of Energy Intake From Food Records Completed by Adolescents: Associations With Sex, Body Image, Nutrient, and Food Group Intake. Front Nutr. 2021;8(December):1–

98. Hadi H, Triastanti RK, Anggraeni D, Nurwanti E, Lewis EC, Colon-Ramos U, et al. The role of the school food environment in improving the healthiness of school canteens and readiness to reopen post COVID-19 pandemic: A study conducted in Indonesia. J Public health Res. 2022;11(1).

984 99. Williams BD, Churilla JR. Ultra-Processed
985 Food Intake in U.S. Adolescents: National
986 Public Health Implications. J Adolesc Heal
987 [Internet]. 2022;70(2):173–4. Available
988 from:
989 https://doi.org/10.1016/j.jadohealth.2021.1
990 0.031