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Correlation of Ultra-processed Food Consumption with Nutritional Status and Blood Pressure in Adolescents

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ABSTRACT

Adolescents are nutritionally vulnerable, and their intake is crucial to avoid nutritional problems during growth. Adolescent food consumption can be obtained from various types of food, one of them ultra-processed food (UPF). Objective: To determine the relationship between ultra-processed food consumption patterns and nutritional status and blood pressure in Catholic Junior High School Sudiang adolescents and Christian Elim High School Makassar. Methods: This study is a quantitative descriptive study with a cross-sectional design. The sample was selected using a proportional random sampling technique of 195 adolescents aged 13-18. UPF consumption was collected using the Semi Quantitative Food Frequency Questionnaire (SQ-FFQ). Results: The research results show adolescents are overweight at 25.6% and obese at 21%; elevated blood pressure (BP) is 14.4%, and state hypertension (HTN) is 8.2%. In addition, obese adolescents with state 1 HTN were 17.1% and elevated BP by 24.4%, while overweight adolescents with state 1 HTN were 8% and elevated BP by 14%. There is a correlation between the amount of UPF consumption and nutritional status (p-value = 0.047), while the results were negative between frequency of UPF consumption and nutritional status (p-value = 0.312), the amount of UPF consumption and BP (p-value = 0.289), and frequency of UPF consumption and BP (p-value = 0.059). The study concludes that there is a significant correlation between the amount of ultra-processed food consumption and nutritional status in adolescents. Further research and public health interventions are recommended to address the impact of UPF on adolescent health.

Keywords: Ultra-processed food; blood pressure; nutritional status

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INTRODUCTION

Adolescence is a transitional period from childhood to adulthood with an age range of 10-20 years. 19 years old.(1) Adolescents are nutritionally vulnerable due to rapid physical growth and development. Adolescent nutrient intake is very important to avoid nutritional problems during growth.(2) During adolescence, nutrient intake will be greater than in childhood. The calorie requirement of children aged 5-9 years is 1400-1650 kcal/day, while adolescent boys require 2000-2650 kcal/day and adolescent girls require 1900-2100 kcal/day.(3)

Increased nutrient intake in adolescents is needed to fulfill the energy that the body has expended through physical activity.(4) In addition, adolescents' eating habits will affect their nutrient intake and needs. However, the consumption patterns of adolescents tend to be wrong as the nutrients consumed do not match the needs required by the body.(5) The intake of energy in and the intake of energy out of the body is sometimes ignored by adolescents; this will result in nutritional problems such as being overweight.(4) When the body is overloaded with energy, the excess energy will be synthesized into body fat. Fat storage will occur when body fat is not used to produce energy. If this continues to happen, it will lead to overnutrition. Overnutrition is a condition of being overweight due to fat accumulation. Overnutrition is recognized as a condition of the excess proportion of total body fat that occurs when a person's calorie intake exceeds the amount of energy burnt by the body.(6)

According to WHO 2022 data, the incidence of overweight and obesity in children and adolescents reached 390 million people, or 20%. In 1990, the incidence of overnutrition in children and adolescents aged 5-19 years increased from 2% (31 million obese) to 8% in 2022, with 160 million obese.(7) The prevalence of overnutrition in Indonesia is increasing every year. Based on data from the 2023 Indonesian Health Survey, the prevalence of overnutrition in adolescents aged 13-15 years was 16.2%, (overweight 12.1% and obesity 4.1%) while in adolescents aged 16-18 years was 12.1% (overweight 8.8% and obesity 3.3%).(8) The prevalence of overnutrition in South Sulawesi among adolescents aged 13-15 years was 15.5% (overweight 11.0% and obesity 4.5%). While in adolescents aged 16-18 years, it is 12.9% (overweight 8.8% and obesity 4.1%).(8) Based on the 2018 Riskesdas data, the prevalence of overnutrition is at the age of 13-15 years reached 27.09% (overweight 17.67% and obesity 9.42%) and at the age of 16-18 years reached 27.09% (overweight 17.67% and obesity 9.42%). adolescents aged 16-18 years up to 15.21% (overweight 11.77% and obese 3.44%).(9)

Adolescents who are overweight will continue into adulthood. Adolescents aged 10-15 years who are overweight will have an 80% chance of being overweight at the age of 25 years.(10) The incidence of overnutrition in adolescents can affect cognitive abilities, productivity, and performance.(2) Overweight adolescents have the potential to experience metabolic diseases and degenerative diseases such as hypertension. Overweight is one of the risk factors for increased blood pressure. Adolescents with overweight have a 4.85 times risk of developing hypertension compared to adolescents with normal

nutritional status. (11) Based on the analysis of 2013 Riskesdas data by Sudikno et al. (2023), the results of adolescents aged 15-19 years who experienced overweight showed a prevalence of pre-hypertension of 25.9% and hypertension of 11.1%. (12)

High blood pressure in adolescents can continue into adulthood, with a high risk of morbidity and mortality. The amount of fat in the body can cause blood vessels to narrow, resulting in an increase in blood pressure.(13) In a study conducted by Hidayatullah & Pratama (2019), adolescents aged 15-19 years showed that in obese samples, 8.8% experienced pre-hypertension, 65% experienced stage 1 hypertension, and 26.2% of adolescents experienced stage 2 hypertension.(14)

One of the factors leading to increased body weight and blood pressure is dietary habits such as the consumption of ultra-processed food (UPF).(15) Ultra-processed food is generally made from fresh food with additives and preservation methods in the manufacturing process, made with advanced technology to improve sensory characteristics, shelf life, and marketability. Consumption of UPF may result in reduced food preferences, limiting the intake of healthy foods.(16) UPF foods and beverages are characterized by poor nutrition as they are energy-dense, high in Na, trans-saturated fat, and added sugar, and low in fiber and other micronutrients. Consumption of UPF can lead to excess intake, weight gain, and increased risk of hypertension.(17) Instant noodles are one type of ultra-processed food that is popular among teenagers.(18) One serving of instant noodles (77 g) contains 350 kcal of energy, fat (15 g), protein (10 g), carbohydrate (43 g), and sodium (860 mg).(19)

Data from NHANES 2009-2010 states that ultra-processed food accounts for about 59.9% of energy intake, and about 90% comes from added sugar.(20) A study conducted in Indonesia found that UPF accounted for about 16% of the total daily calorie requirement, with the contribution of sugar from food ranging from 23.3% of total daily calories.(15) In addition, in a cross-sectional study conducted by Nardocci et al. (2021), in Canadian adults with an average intake of 1819 kcal per day, with 47% coming from UPF was significantly associated with an increase in the incidence of obesity by 31%, diabetes by 37%, and the incidence of hypertension by 60%.(17) The researcher is interested in conducting research on the relationship between Ultra-processed Food consumption patterns with nutritional status and blood pressure in adolescents at Sudiang Catholic Junior High School and Elim Christian High School Makassar.

METHOD

The study received ethical approval from the Health Research Ethics Committee of Universitas Hasanuddin, with the ethical clearance number 2098/UN4.14.1/TP.01.02/2024, issued on August 6, 2024. The method used in this study is an analytical observational method using a cross-sectional design to determine the relationship between the pattern of Ultra-Processed Food consumption with Nutritional Status and Blood Pressure in adolescents at Sudiang Catholic Junior High School and Elim Christian High School Makassar. This study was conducted at Sudiang Catholic Junior High School and Elim Christian High School Makassar in May-June 2024. The population in this study was 381 adolescents, and the sample size was 195 adolescents. The sampling technique for determining the sample number

is proportional random sampling. Data collection techniques used secondary data (number of students and student rosters) and primary data (sample characteristics, sample nutritional status, blood pressure, and UPF consumption patterns). Data were analyzed using the chi-square test and presented in the form of tables and explanatory narratives.

RESULTS

Overview of Nutritional Status by Sample Characteristics

Table 1. Distribution of nutritional status by sample characteristics

Sample Characteristics	Nutritional Status						Total	
	Obesity		<i>Overweight</i>		Normal		n (195)	%
	n (41)	% (21,0)	n (50)	% (25,6)	n (104)	% (53,4)		
School								
Sudiang Catholic Junior High School	26	33,8	23	29,8	28	36,4	77	100
Elim Mks Christian High School	15	12,7	27	22,9	76	64,4	118	100
Gender								
Male	24	27,0	27	30,3	38	42,7	89	100
Women	17	16,0	23	21,7	66	62,3	106	100
Age Group (yrs)								
Early Adolescence (12)	8	50,0	2	12,5	6	37,5	16	100
Middle Teens (13-15)	24	25,3	29	30,5	42	44,2	95	100
Late Teens (16-18)	9	10,7	19	22,6	56	66,7	84	100
Snack Money								
<Rp.10,000	2	8,0	10	40,0	13	52,0	25	100
Rp.10,000 - Rp.20,000	37	23,9	37	23,9	81	52,2	155	100
> IDR 20,000	2	13,3	3	20,0	10	66,7	15	100
Family History of Obesity								
Yes	12	20,3	18	30,5	29	49,2	59	100
No	29	21,3	32	23,5	75	55,2	136	100

Based on Table 1, the distribution of nutritional status with sample characteristics shows that the samples who experienced malnutrition, in this case, were obese, as much as 21.0%, and overweight, as much as 25.6%. Most of the samples with obese nutritional status, namely 26 people (33.8%), and overweight, namely 23 people (29.8%), came from Sudiang Catholic Junior High School. Based on gender characteristics, most of the males were in the *overweight* nutritional status of 27 people (30.3%) and obese as many as 24 people (27.0%). In terms of age characteristics, the obese sample was mostly in the early adolescent group (12 years). Namely, 8 people (50%), and the *overweight* sample was mostly in the middle adolescent group (13-15 years), 29 people (30.5%).

Based on the characteristics of pocket money, obese adolescents mostly have pocket money Rp.10,000 - Rp. 20,000, namely 37 people (23.9%) and adolescents who are *overweight* mostly have pocket money <Rp.10,000, namely 10 people (40.0%). Based on the characteristics of family history of obesity, samples who did not have a history of obesity were more likely to be overweight. Most of the family *members* were obese, 29 people (21.3%) while 18 people (30.5%) had overweight nutritional status.

Blood Pressure and Sample Characteristics

Table 2. Distribution of blood pressure by sample characteristics

Sample Characteristics	Blood Pressure						Total	
	Grade 1 Hypertension		Increased Blood Pressure		Normal Blood Pressure			
	n (16)	% (8,2)	n (28)	% (14,4)	n (151)	% (77,4)	n (195)	% (150)
School								
Sudiang Catholic Junior High School	2	2,6	10	13,0	65	84,4	77	100
Elim Mks Christian High School	14	11,9	18	15,2	86	72,9	118	100
Gender								
Male	12	13,5	17	19,1	60	67,4	89	100
Women	4	3,8	11	10,4	91	85,8	106	100
Age Group (Year)								
Early Adolescence (12)	0	0,0	3	18,8	13	81,2	16	100
Middle Teens (13-15)	4	4,2	9	9,5	82	86,3	95	100
Late Teens (16-18)	12	14,3	16	19,0	56	66,7	84	100
Snack Money								
<Rp.10,000	5	20,0	2	8,0	18	72,0	25	100
Rp.10,000 - Rp.20,000	9	5,8	24	15,5	122	78,7	155	100
> IDR 20,000	2	13,3	2	13,3	11	73,4	15	100
Family History of Obesity								
Yes	6	10,2	5	8,4	48	81,4	59	100
No	10	7,4	23	16,9	103	75,7	136	100
Family History of Hypertension								
Yes	5	8,6	6	10,4	47	81,0	58	100
No	11	8,0	22	16,1	104	75,9	137	100

Based on Table 2, the distribution of blood pressure by sample characteristics, it is known that samples with hypertensive blood pressure are 14 people (11.9%) and increased blood pressure are 18

people (15.2%) from Elim Christian High School Makassar. Based on gender characteristics, most males were in the category of grade 1 hypertension as many as 12 people (13.5%) and the category of elevated blood pressure as many as 17 people (19.1%). In age characteristics, samples with grade 1 hypertension, namely 12 people (14.3%), and increased blood pressure, namely 16 people (19.6%), were mostly in the late adolescent group (16-18 years). Based on the characteristics of pocket money, samples with grade 1 hypertension mostly have pocket money < Rp. 10,000, namely five people (20%), while samples with increased blood pressure, namely 24 people (15.5%), mostly have pocket money Rp.10,000 - Rp. 20,000.

Based on family obesity history, it was found that samples with hypertension category 1, namely six people (10.2%), had a family history of obesity, while samples who did not have a family history of obesity were in the category of increased blood pressure, namely 23 people (16.9%). In the characteristics of family history of hypertension, it was found that samples with hypertension category 1, namely five people (8.6%), had a family history of hypertension, while samples who did not have a family history of hypertension were in the increased blood pressure category, namely 23 people (16.9%). Family history of hypertension is in the category of increased blood pressure, namely 22 people (16.1%).

Overview of Nutritional Status and Blood Pressure of the Sample

Based on Table 3, it was found that the samples who were in the category of hypertension level 1, namely 7 people (17.1%), and increased blood pressure, namely 10 people (24.4%), had an obese nutritional status.

Table 3. Distribution of nutritional status and blood pressure

Nutritional Status	Blood Pressure						Total	
	Grade 1 Hypertension		Increased Blood Pressure		Normal Blood Pressure			
	n (16)	% (8,2)	n (28)	% (14,4)	n (151)	% (77,4)	n (195)	% (100)
Obesity	7	17,1	10	24,4	24	58,5	51	100
Overweight	4	8,0	7	14,0	39	78,0	80	100
Normal	5	4,8	11	10,6	88	84,6	104	100

Based on Figure 1, it can be seen that the three types of UPF with the highest proportion of consumption are Instant Noodles (97%), Krispi Chicken (88%), and Liquid Milk (84%), and the low proportion of red meat nugget and cornet is 12%, 13% respectively.

Overview of Ultra-processed Food Consumption Types

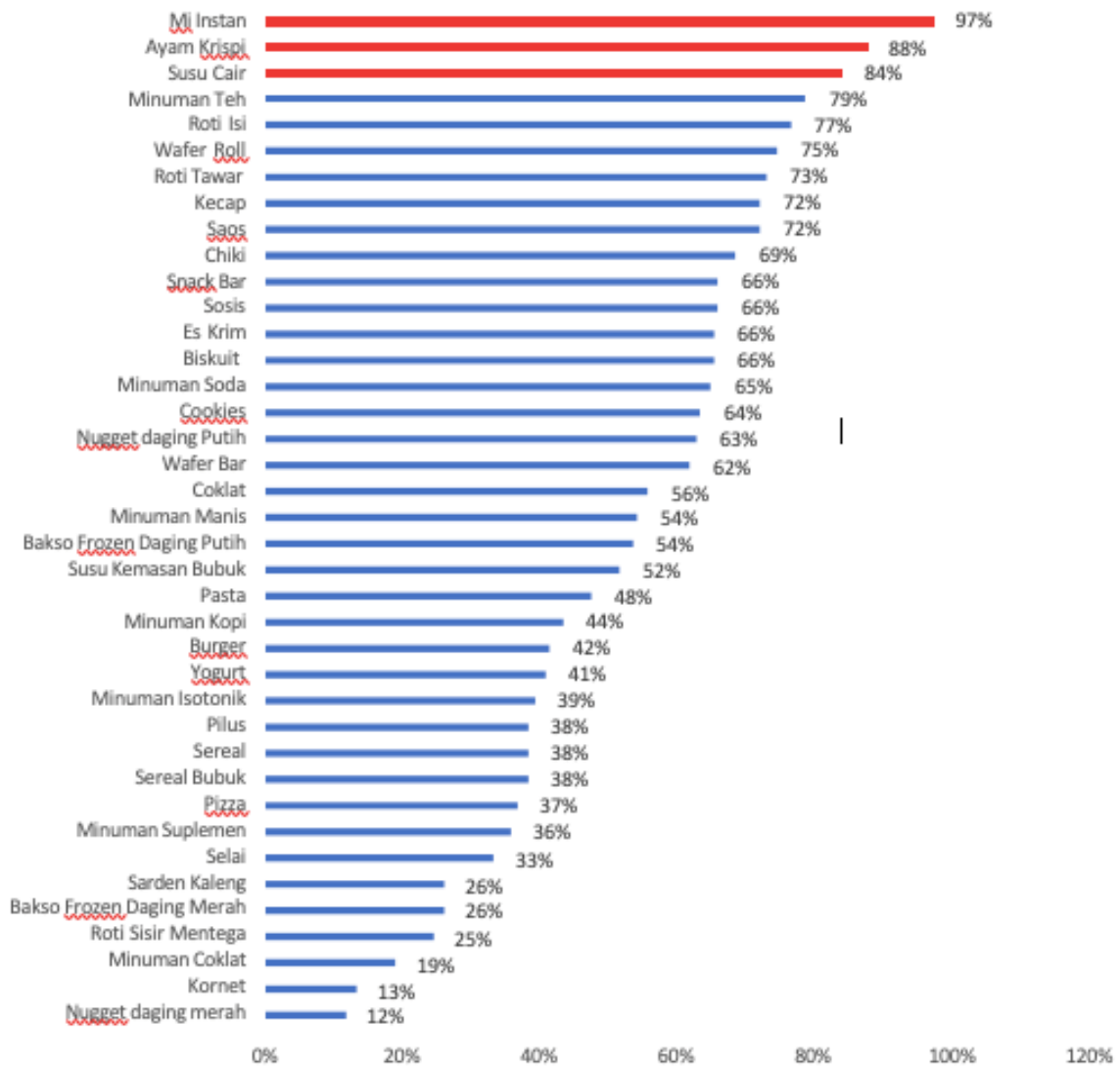


Figure 1. Overview of Ultra-processed Consumption Types

Overview of Ultra-processed Food Consumption Types

Table 4. Relationship between Ultra-processed Food Consumption Pattern and Nutritional Status

UPF Daily Consumption	Nutritional Status						Total		p-value
	Obesity		Overweight		Normal		n	%	
	n	%	n	%	n	%			
	(41)	(21)	(50)	(25,6)	(104)	(53,4)	(195)	(100)	
Frequency									
Frequent > 7 x/day	10	15,4	16	24,6	39	60,0	65	100	0,312
Infrequent ≤ 7 x/day	31	23,8	34	26,2	65	50,0	130	100	
Total									
High ≥37.55% of total requirement	17	18,2	18	19,4	58	62,4	93	100	0,047
Low < 37.55% of total demand	24	23,5	32	31,4	46	45,1	102	100	

Relationship between UPF Frequency and Nutritional Status

Based on Table 4, it can be seen that samples with obese and overweight nutritional status are included in the category of rarely consuming UPF. The samples with obese nutritional status were 31 people (23.8%), and those who were overweight were 34 people (26.2%). While the normal nutritional status sample, as many as 65 people (50%) had a frequency of frequent UPF consumption. The results of the chi-square analysis obtained $p\text{-value} = 0.312$ ($p > 0.05$), which means H_0 is accepted and H_a is rejected. So, it can be said that there is no relationship between the frequency of ultra-processed food consumption and nutritional status.

Relationship between the number of UPF and nutritional status

Table 4 shows that UPF consumption in samples with obese and overweight nutritional status is in the low category. Samples with obese nutritional status were 24 people (23.5%), and overweight were 32 people (31.4%). In samples with normal nutritional status, as many as 58 people (62.4%) consumed UPF, which is included in the high category. The results of chi-square analysis obtained $p\text{-value} = 0.047$ ($p < 0.05$) which means H_0 is rejected and H_a is accepted. So it can be said that there is a relationship between the amount of ultra-processed food consumption and nutritional status.

Relationship between Ultra-processed Food Consumption Pattern and Blood Pressure

Relationship between UPF Frequency and Blood Pressure

Table 5 shows that samples with hypertension level 1 blood pressure, namely 7 people (10.8%), and elevated blood pressure, namely 12 people (18.5%), have a frequent frequency of daily consumption of UPF. While samples with normal blood pressure, namely 105 people (80.8%) had a frequency of daily consumption of UPF rarely. The results of the chi-square analysis obtained $p\text{-value} = 0.289$ ($p > 0.05$), which means H_0 is accepted and H_a is rejected. So, it can be said that there is no relationship between the frequency of consumption of ultra-processed food and blood pressure.

Table 5. Relationship between Ultra-processed Food Consumption Pattern and Blood Pressure

UPF Daily Consumption	Blood Pressure						Total	<i>p-value</i>	
	Grade 1 Hypertension		Blood Pressure increased		Normal Blood Pressure				
	n (16)	% (8,2)	n (28)	% (14,4)	n (151)	% (77,4)			n (195)
Frequency									
Frequent > 7 x/day	7	10,8	12	18,5	46	70,8	65	100	0,289
Infrequent ≤ 7 x/day	9	6,9	16	12,3	105	80,8	130	100	
Total									
High ≥37.55% of the total needs	6	6,5	19	20,4	68	73,1	93	100	0,059
Low < 37.55% of total needs	10	9,8	9	8,8	83	81,4	102	100	

Relationship between Ultra-Processed Food and Blood Pressure

Table 5 shows that samples with low UPF consumption had grade 1 hypertension blood pressure of 10 people (9.8%) and normal blood pressure of 83 people (81.4%). While samples with high UPF consumption were in the category of elevated blood pressure, namely 19 people (81.4%). The results of the chi-square analysis obtained $p\text{-value} = 0.059$ ($p > 0.05$), which means H_0 is accepted and H_a is rejected. So, it can be said that there is no relationship between the amount of ultra-processed food consumption and blood pressure.

DISCUSSION

Relationship between *Ultra-processed Food Consumption Patterns and Nutritional Status*

Table 4 presents data that respondents with obese nutritional status (24.2%) and *overweight* (25.8%) rarely consume *ultra-processed food* (UPF), while respondents with normal nutritional status (50%) consume UPF frequently. After conducting the *chi-square* test, the $p\text{-value} = 0.311$ ($p > 0.05$), so it can be said that there is no relationship between the frequency of *ultra-processed food* (UPF) consumption and nutritional status. This is in line with research conducted by Pratiwi et al. (2022), which states that no significant relationship was found between UPF consumption and BMI (body mass index according to age) with $p = 0.217$ ($p > 0.05$).⁽²¹⁾

Table 4 shows that UPF consumption in adolescents with obese (23.5%) and *overweight* (31.4%) nutritional status is included in the low category, while adolescents with normal nutritional status, 62.4%, are included in the high category. So after the chi-square test was obtained, $p\text{-value} = 0.047$ ($p < 0.05$) means that the amount of *ultra-processed food* consumption has a relationship with nutritional status. This is in line with research conducted by Ginting et al. (2024), stating a significant relationship between ultra-processed food consumption and nutritional status with a $p\text{-value} < 0.05$.⁽²²⁾ In addition, this study is also in line with research conducted by Setyaningsih et al. (2024), which states that there is a relationship between ultra-processed food intake and the nutritional status of the subject ($p = 0.022$).⁽²³⁾

Frequency of consumption cannot be a benchmark in determining weight gain. Various factors can affect nutritional status, both modifiable and non-modifiable factors. Modifiable factors such as UPF consumption. Consumption of energy-dense foods such as *ultra-processed foods* (UPF) for a long time will cause energy imbalance. UPF consumption tends to be consumed in excessive amounts. This is because UPF is characterized by ultra-processed food, which is attractive, inexpensive, and practical, making it attractive for consumption, especially among adolescents. *Ultra-processed food consumption contributes to* a significant amount of daily calories. High consumption of *ultra-processed food* is associated with the risk of weight gain and obesity.⁽²³⁾ This is because UPF consumption contains high energy density.⁽²⁴⁾

UPF consumption contributes to weight gain and obesity, with high UPF consumption increasing obesity by 1.61 times. Based on research conducted by Nardocci et al. (2018), UPF consumption

accounts for 45% of daily calories, while minimally processed food consumption accounts for 55% of daily calories.(25) Weight gain does not only come from UPF consumption, but main food consumption also plays a role. Staple foods consumed in large quantities will increase body weight gradually, which can affect nutritional status. The amount or portion of food consumed in large quantities will affect nutritional status.(23)

The increase in the incidence of overnutrition is also influenced by changes in the food system that cause a shift in diet from traditional food consumption to more consumption of processed and *ultra-processed food* products. The higher consumption of ultra-processed food in adolescents can lead to poor dietary quality, characterized by a higher total intake of energy, fat, sugar, and saturated fat and a low intake of protein, fiber, minerals, and vitamins. The higher the *ultra-processed food* consumption, the higher the nutritional status of the respondents.(26)

Physical activity is a modifiable risk factor for obesity. High physical activity can prevent obesity. People with 150 minutes of moderate to vigorous physical activity per week are 70% more likely to be metabolically healthy when compared to people with no physical activity. Regular physical activity provides health benefits and is considered an important component in the primary and secondary prevention of obesity-related pathologies.(27)

A family history of obesity is one of the factors that cannot be changed. In a study conducted at Sudiang Catholic Junior High School and Elim Christian High School Makassar, it was found that samples who had a family history of obesity experienced *overweight* as much as 30.5%. In comparison, the number of samples who experienced obesity was 20.3%. If one parent is overnourished, the chance of the child experiencing overnutrition is 40-50%, while if both parents are overnourished, the chance of offspring experiencing overnutrition is 70-80%.(28)

Relationship between *Ultra-processed Food* Consumption Frequency and Blood Pressure

Table 5 shows that adolescents with normal blood pressure are included in the category of rarely consuming *ultra-processed food* (UPF), namely 82.3%. In contrast, adolescents with grade 1 hypertension blood pressure, namely 9.95%, and increased blood pressure, namely 21.2%, are included in the category of frequent consumption of *ultra-processed food* (UPF). The chi-square test conducted obtained a $p\text{-value} = 0.084$ ($p > 0.05$), so it can be concluded that there is no relationship between the frequency of consumption of *ultra-processed food* (UPF) and blood pressure. This is in line with research conducted by Melo et al. (2017), which concluded that there was no relationship between the frequency of consumption of ultra-processed food (UPF) and blood pressure stated that the frequency of UPF consumption did not have a significant relationship with increased blood pressure with a $p\text{-value} = 0.16$.(29)

Based on Table 5, it is known that adolescents with high consumption of ultra-processed food (UPF) have an increased blood pressure of 20.4%, while adolescents with low consumption of UPF have grade 1 hypertension blood pressure of 9.8% and normal blood pressure of 81.4%. The results of *chi-square* analysis obtained $p\text{-value} = 0.059$ ($p > 0.05$) can be said that there is no relationship between

the amount of *ultra-processed food* (UPF) consumption and blood pressure. This is in line with research conducted by Conceicao et.al (2018) which states that UPF consumption does not have a significant relationship with blood pressure where the p value > 0.05 ($p = 0.895$).⁽³⁰⁾

The results of this study are not in line with theory, where UPF contains high trans fat and Na and low mineral content so that it can increase blood pressure.⁽³¹⁾ A diet with a frequent frequency of consuming foods containing high energy, sodium, and saturated fat can increase the risk of hypertension, so more attention needs to be paid to adolescents with *ultra-processed food* consumption.⁽³²⁾ UPF is characterized by high energy, sugar, saturated fat, and salt content but low fiber and micronutrients.²⁹ More frequent consumption of UPF can trigger an increase in blood pressure, considering one of the characteristics of UPF is high in Na, but an increase in blood pressure can also be triggered through daily salt consumption. According to the Ministry of Health (2024), the daily sodium consumption limit is 2000 mg or one teaspoon of salt.⁽³³⁾

Consumption patterns that are high in sodium can increase blood pressure.⁽³⁴⁾ When the body gets an increased intake of salt, fluid retention will occur, resulting in an increase in blood volume. When blood volume increases, the heart will work harder to pump blood through narrow arteries so that the pressure gets stronger, which will cause high blood pressure (hypertension).⁽³⁵⁾

Hypertension used to be mostly experienced by adults, but nowadays, hypertension is also often found in adolescents. The incidence of hypertension in adolescents begins with weight or obesity factors. If an increase in visceral adiposity accompanies weight gain, it will increase the risk of hypertension by 65-75%.⁽¹³⁾ In an obese individual, the heart will pump blood faster throughout the body so that the pressure is stronger and resulting in increased blood pressure.⁽³⁶⁾

Based on research conducted by Shaumi & Achmad (2019), an increase in BMI is related to an increase in the amount of norphinephrine in the kidneys which shows a relationship between obesity-related sympathetic nervous system activity and renin release.⁽¹¹⁾ This increase in sympathetic nervous system activity can cause an increase in adolescent blood pressure. If a person is both obese and centrally obese, they have a greater risk of developing hypertension than if they are only obese or centrally obese.

High blood pressure in adolescents can be caused by various factors, one of which is parental history. Parental history is one of the factors that cause high blood pressure in adolescents that cannot be changed. If both parents have hypertension, the child's risk of developing hypertension is 4 to 15 times higher than if both parents have hypertension with children whose parents do not have hypertension. If one parent has hypertension, then 12.8% of the offspring will have hypertension. ⁽³⁷⁾

CONCLUSIONS AND RECOMMENDATIONS

Total daily consumption of Ultra Processed Food is significantly related to nutritional status. While the frequency of Ultra Processed Food consumption is not significantly related to nutritional status. The amount and frequency of Ultra Processed Food were not significantly related to blood pressure. It is expected that the Education Office, in synergy with the Health Office and schools, will

develop policies regarding the provision of healthy food in school canteens, as well as conducting regular blood pressure measurements for students at risk of overnutrition.

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