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The Relationship between Ultra-Processed Food Consumption with Diet Quality and Overweight Status in Young Adults

Hubungan Konsumsi Makanan Olahan Ultra Proses dengan Kualitas Diet dan Status Gizi Lebih pada Usia Dewasa Muda

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ABSTRACT

Background: A transition in diet habits towards a greater intake of ultra-processed processed foods is prone to transpire during adulthood. An elevated intake of ultra-processed processed foods affected poor diet quality and elevates the risk of developing obesity.
Objectives: To ascertain the correlation between the intake of ultra-processed food, the quality of one's diet, and the prevalence of overweight in young adults.
Methods: The study was undertaken using a cross-sectional design. A total of 87 participants in the study were college students between the ages of 18 and 25. They were selected using a purposive sampling technique. The data was collected using the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) to assess ultra-processed food intake. The Diet Quality Index-International (DQI-I) was used to evaluate the total diet quality. The Body Impedance Analyzer (BIA) was employed to measure body fat percentage and identify the nutritional status. The statistical analysis employed the Mann-Whitney and ANOVA tests.
Results: There are 9.1% of the participants were classified as overweight, with a diet of low quality at a level of 62.15%. Additionally, 64.4% of the participants consumed ultra-processed foods that fell inside quintile 3. The higher the intake of ultra-processed foods, the higher the total intake of energy, carbs, proteins, and fats, which affects diet quality (r=-0.480). There is a correlation between the consumption of ultra-processed processed foods and excess nutritional status (p=0.022) and low quality of the subject's diet (p=0.000).
Conclusions: High levels of ultra-processed food intake is correlated with lower diet quality and overweight nutritional status.

INTRODUCTION

Overnutrition, namely overweight and obesity, results from an excessive buildup of fat induced by a prolonged imbalance in food consumption[1]. Obesity can affect individuals of all ages, with the highest occurrence in adult. According to the National Basic Health Research in 2018, 34.4% of individuals aged >18 had excessive nutrition. The current prevalence exceeds the rates of overnutrition revealed in 2013, which were 26.6% and 18.8% in 2007 and 2002, respectively. Undernutrition is defined as having a Body Mass Index (BMI) more than 25 kg/m[22,3]. Nevertheless, the utilisation of BMI could be more precise in assessing body composition due to its inability to differentiate between body fat and lean body mass. Body fat composition measurements might be utilised to assess the risk of health issues resulting from excessive feeding[4]. Elevated body fat mass, particularly visceral fat, is correlated to higher risks of cardiovascular disease, type 2 diabetes, cancer, and mortality[5].

The rise in malnutrition is also impacted by alterations in the food system that result in a transition from consuming traditional foods to ingesting more processed and ready-to-eat items (ultra-processed foods)[6]. Ultra-processed foods are industrial products created using components obtained from food sources (such as fats, sugars, and oils), derived from food constituents (such as hydrogenated fats), or synthesised from other organic sources (such as flavour enhancers and sweeteners), with minimal or no inclusion of whole food elements. These foods are designed to have a rich taste, prolonged freshness, convenient consumption, and high profitability due to inexpensive ingredients and extended shelf life[7,8]. Ultra-processed foods typically have poor nutritional value due to their processing methods, frequently high in calories, sugar, and fat; however, lacking in fibre, protein, minerals, and vitamins. Furthermore, ultra-processed foods have a lower satiety factor, perhaps resulting in excessive consumption[9].

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The proportion of daily energy intake from ultra-processed foods is 57.9% in the US, 56.8% in the UK, 47.7% in Canada, and 15.7% in Indonesia[10]. Adults who consume more ultra-processed foods may experience a decline in the quality of their diet and an increased risk of overnutrition and non-communicable diseases[8,11,12]. Ultra-processed foods contain obesogenic ingredients that are high in calories and have a sweet and salty taste. These factors contribute to low diet quality and excessive weight gain from consuming too many calories[13]. This study aimed to determine the correlation between the intake of ultra-processed foods and the quality of diet and the nutritional status of young adults.

METHODS

The research was conducted with a cross-sectional approach. The study included 87 subjects, determined using Lemeshow's formula and subject selection using purposive sampling. The eligibility criteria encompassed individuals aged 18-25 currently enrolled as students, not under medical supervision, non-smokers, devoid of chronic medical conditions, and having completed the informed consent process. The exclusion criteria for this research encompassed individuals who declined to participate as subjects after comprehending a concise overview of the research and providing informed permission.

The study was conducted at a privately owned institution in Surakarta from April to June 2022. The study's independent variable was the consumption of ultra-processed foods, measured using the Semi Quantitative Food Frequency Questionnaire (SQ-FQ) instrument during the previous month. The research team designed the Semi-Quantitative Food Frequency Questionnaire (SQ-FQ) instrument by integrating additional categories of food and beverages classed as ultra-processed foods, totalling 31 items. The consumption data of ultra-processed foods were categorised into five groups based on how much energy they contribute to the total daily energy intake. These groups are referred to as quintile 1 (<7.25% total energy/day), quintile 2 (7.26-14.88% total energy/day), quintile 3 (14.89-24.10% total energy/day), quintile 4 (24.11-37.54% total energy/day), and quintile 5 (≥37.55% total energy/day)[8]. The energy adequacy level per day was based on the energy adequacy level for the adult population in Indonesia, which is 2100 kcal[14].

The study focused on the dependent variables of nutritional status and food quality. The Diet Quality Index-International (DQI-I) instrument was used to assess the diet quality of the subjects. Their diet quality was then classified as either low (total score ≤60) or high (total score >60)[15]. The nutritional status of the subjects was assessed by measuring their body fat percentage using the Body Impedance Analyzer (BIA). The results were categorised as either overweight or normal nutritional status. Individuals having a body fat percentage greater than 20% for men and greater than 25% for women were categorised as overnourished[16]. Additional subject-specific data gathered in this research included nutritional status assessed using Body Mass Index (BMI), and sedentary activity quantified using the Sedentary Behaviour Questionnaire (SBQ) tool. The subject's nutritional status, as determined by their Body Mass Index (BMI), was categorised into three groups: undernutrition (BMI <18.5 kg/m^2), normal nutrition (18.5-22.9 kg/m^2), and overnutrition (≥23 kg/m^2)[17,18], Sedentary activity was classified as either light sedentary activity (≤6 hours per day) or heavy sedentary activity (>6 hours per day)[18].

A descriptive analysis was conducted to examine the characteristics of the subjects. The association between the independent and dependent variables was assessed using the Pearson and Mann-Whitney tests, with a significance level (α) set at 0.05. The Ethics Committee of Kusuma Husada University Surakarta approved this study (731/UKH.L.02/EC/VI/2022).

RESULTS AND DISCUSSION

A total of 87 research subjects satisfied the research criteria. Most participants in this study were females aged between 21 and 25. Most subjects (70.1%) were classified as overweight based on their fat mass percentage; on the other hand, a significant proportion (62.1%) had high sedentary behaviour. The participants in this study exhibited a suboptimal level of diet quality (62.1%), and their consumption of ultra-processed foods fell within quintile 3 (64.4%). This suggests that the participants' intake of ultra-processed foods accounted for 14.89-24.10% of their total daily calorie intake.

Table 1. Distribution of Subject Characteristics

Parameter	n	%	Median	SD
Age				
19-20 Years	27	31	21	0.101
21-25 Years	60	69		
Sex				
Male	18	20.7		
Female	69	79.3		
Nutritional Status (BMI)				
Underweight	12	13.8		
Normal	41	47.1	21.75	0.61
Overweight	34	39.1		
Body Fat Mass				
Normal	26	29.9	27.7	0.721
Overweight	61	70.1		
Diet Quality				
Low Diet Quality	54	62.1	58.53	0.81

Parameter	n	%	Median	SD
High Diet Quality	33	37.9		
Ultra Processed Food Intake				
Quintile 1	2	2.3		
Quintile 2	6	6.9		
Quintile 3	56	64.4	21.2	0.83
Quintile 4	13	14.9		
Quintile 5	10	11.5		
Sedentary Activities				
Light Sedentary Activities	33	37.9		
Heavy Sedentary Activities	54	62.1		

BMI: Body Mass Index, SD: Standard Deviation

The participants in this study consisted of individuals between the ages of 18-25 who were categorised as young adults. Young adults, frequently ranging from (18-25) years old, is a stage of life characterised by the cessation of physical growth and an emphasis on productivity, such as education or employment. However, this period is also susceptible to the risk of malnutrition. Ageing induces physiological alterations in the body, resulting in a decline in muscle mass, an increase in fat mass, and a reduction in metabolic capability. These changes contribute to weight gain when coupled with a sedentary lifestyle[19]. Most individuals were female and had low nutritional status (70.1%). Research indicates that a significant proportion, ranging from 50% to 80%, of students experience weight gain, with the average increase between 2.5 and 5

kilogmes[20]. The number is 20. The typical weight growth in men varies from that in women. Women frequently have a higher body weight than men because they have lower muscle mass, higher body fat mass, poorer metabolism, and hormonal factors[21,22].

Students' weight gain is attributed to their sedentary lifestyle, which involves extensive engagement in activities such as reading, writing, smartphones, and computers, resulting in limited physical activity[20,23]. According to the findings of this survey, 62.1% of students reported experiencing difficulty in sitting. Furthermore, the risk of weight increase in college students is affected by factors such as stress experienced during lectures, prolonged study sessions lasting into the late hours, poor diet habits, and irregular sleep patterns[20,24].

Table 2. Distribution of Subjects Based on Ultra Processed Food Intake

Parameter	Total (n=87) Mean (SD)	Ultra Processed Food Intake Mean (SD)					p-value
		Quintile 1 (n=2)	Quintile 2 (n=6)	Quintile 3 (n=56)	Quintile 4 (n=13)	Quintile 5 (n=10)	
Total Energy (kcal/day)	3643.43 (98.81)	2012.14 (441.45)	2808.74 (261.16)	3649.91 (109.87)	3820.83 (314.6)	4115.21 (275.19)	0.003*
Energy from Ultra Processed Foods (g/day)	1239.54 (47.29)	691.6 (131.60)	884.17 (137.78)	1248.95 (58.79)	1335.49 (107.29)	1373.53 (133.01)	0.004
Total Protein (g/day)	288.03 (12.92)	101.26 (33.49)	197.99 (47.08)	278.87 (12.00)	274.94 (37.81)	392.43 (50.43)	0.000*
Total Carbohydrate (g/day)	970.43 (60.44)	210.45 (66.69)	509.02 (123.66)	819.14 (53.19)	916.53 (133.08)	1532.57 (251.63)	0.000*
Total Fat (g/day)	238.83 (15.01)	81.81 (3.75)	133.55 (39.19)	226.7 (14.73)	222.16 (38.01)	376.65 (54.73)	0.025*
Total Fiber (g/day)	18.63 (2.97)	10.47 (3.05)	12.50 (5.30)	16.37 (6.05)	18.96 (9.87)	22.45 (10.24)	0.066

* ($p<0.05$, ANOVA test), Mean (SD): data is presented in mean (standard deviation)

The mean energy consumption of the participants of this study was 3643 ± 98.81 kilocalories. Approximately 50% of the daily energy intake was derived from ultra-processed foods, amounting to 1239.54 ± 47.29 kcal. The increased consumption of ultra-processed foods led to a higher intake of carbs and fat among the participants in the study. This conclusion was derived from the analysis of quintiles of consumption of ultra-processed food.

Significant variations in total energy, protein, carbohydrate, and fat consumption were observed across quintiles of ultra-processed food intake. Specifically, individuals in quintile 5 exhibited higher total energy, protein, carbohydrate, and fat intake than those in the

other quintiles. According to Table 2, the individuals' total fibre consumption increased proportionately to the energy they obtained from ultra-processed foods. However, more than this rise was needed to achieve the recommended daily fibre intake of 25 g.

The prevalence of an unhealthy diet among students is marked by a shift in consumption patterns, with a preference for processed foods and beverages high in sugar and fat, such as fast food. At the same time, the intake of fruits and vegetables is reduced. Ultra-processed foods, routinely accessible in the market, are essentially processed foods that contain large amounts of sugar and fat[24]. Consuming a large amount of ultra-processed foods clearly illustrates an unhealthy eating

pattern that leads to subpar nutritional value. Greater consumption of ultra-processed foods leads to higher total energy intake, protein, carbohydrates, and fats. The study revealed that participants consumed an average of 21.1% of their total energy from ultra-processed foods, which were determined to have a low diet quality of 62.1%. A separate study in Korea revealed that the mean intake of ultra-processed food ranged from 3.6% to 52.4% of the total daily energy consumption[8]. Another study demonstrated that individuals who consumed over 80% of their diet from ultra-processed foods could provide more than 500 kcal of energy[25]. Increased consumption of ultra-processed foods among adults can result in a decline in diet quality, characterised by elevated intake of

total energy, fat, sugar, and saturated fat, and reduced intake of protein, fibre, minerals, and vitamins[8,26,27].

Correlation between Ultra Processed Food Consumption and Nutritional Status

40.2% of the participants were classified as overweight and fell into quintile 3 for consuming ultra-processed foods. A significant association was observed between the consumption of ultra-processed food and the nutritional state of the participants (p=0.022), with a positive albeit modest correlation (r=0.248). There is a positive correlation between the consumption of ultra-processed foods and the nutritional status of the individuals surveyed.

Table 3. Correlation between Ultra Processed Food Consumption and Nutritional Status

Parameter	Ultra Processed Food Intake										p-value	r
	Quintile 1		Quintile 2		Quintile 3		Quintile 4		Quintile 5			
	n	%	n	%	n	%	n	%	n	%		
Normal	1	1.1	2	2.3	21	24.1	1	1.1	1	1.1	0.022*	0.248
Overweight	1	1.1	4	4.6	35	40.2	12	13.8	9	10.3		
Total	2	2.3	6	6.9	56	64.4	13	14.9	10	11.5		

p<0,05, Mann Whitney

Correlation between Ultra-Processed Food Consumption and Diet Quality

Most participants in this study had a diet intake of ultra-processed foods that fell under quintile 3, and their diet quality was low, as indicated in Table 4. Consumption of ultra-processed food is strongly correlated to the quality of one's diet (p = 0.000). The correlation between the consumption of ultra-processed

food and the quality of one's diet shows a negative association of moderate strength (r = -0.480). It is established that there is an inverse correlation between the consumption of ultra-processed foods and the quality of one's diet. In other words, as the intake of ultra-processed foods increases, the quality of the subject's diet decreases.

Table 4. Correlation between Ultra-Processed Food Consumption and Diet Quality

Parameter	Ultra Processed Food Intake										p-value	r
	Quintile 1		Quintile 1		Quintile 1		Quintile 1		Quintile 1			
	n	%	n	%	n	%	n	%	n	%		
Low Diet Quality	0	0	0	0	33	37.9	11	12.6	10	11.5	0.000*	-0.480
High Diet Quality	2	2.3	6	6.9	23	26.4	2	2.3	0	0		
Total	2	2.3	6	6.9	56	64.4	13	14.9	10	11.5		

p<0,05, Mann Whitney

Ultra-processed foods possess visually appealing forms, exhibit pleasant flavours, offer lower costs, and facilitate effortless consumption, rendering them appealing for consumption, particularly among young adults[13]. These foods are frequently consumed excessively. Excessive consumption of ultra-processed foods is correlated to a higher risk of gaining weight and developing obesity[10]. As the total intake of ultra-processed foods increased, the prevalence of overweight rose from 34.1% to 43.9%, and obesity increased from 9.8% to 13.1%[28]. Consuming ultra-processed food is a contributing factor to weight gain and obesity. Specifically, a high intake of ultra-processed food can increase the risk of developing abdominal obesity by 1.39 times and total obesity by 1.61 times higher[29]. This is because ultra-processed foods have a high-calorie density but lack other essential components[30].

Consuming ultra-processed foods might lead to excessive energy consumption because these items have a high energy density. Ultra-processed food products

with high refined carbohydrate content can modify insulin response and promote the storage of excess intake as fat in adipose tissue. Moreover, the substantial presence of refined carbohydrates and lipids in ultra-processed food items induces alterations in brain circuits, resulting in compulsive eating patterns and excessive consumption of such products[31].

CONCLUSIONS

This study's consumption of ultra-processed food might account for up to 50% of the total energy intake. Most individuals had consumption levels of ultra-processed food categorised in quintile 3. There is a positive correlation between the consumption of ultra-processed foods and the total energy intake. In other words, as the consumption of ultra-processed foods increases, so does the total energy intake. The macronutrient composition includes carbohydrates, fats, and proteins. There is a correlation between intake of ultra-processed foods and the incidence of obesity in

young adults, and there is a correlation between intake of ultra-processed foods and diet quality in young adults. The research subjects are expected to decrease their consumption of ultra-processed foods and enhance their diet by following a well-balanced nutritional intake pattern. This will assist improve the total quality of their diet and prevent nutritional issues, particularly overnutrition, among young adults.

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