DETERMINANT FACTORS AFFECTING ADOLESCENT FRUIT AND VEGETABLE CONSUMPTION IN INDONESIA

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Abstract

Objectives: Adolescence is a critical period for getting used to eating fruit and vegetables for their health because it can affect health in adulthood. The behavior of adolescents in Indonesia who eat vegetables and fruit is still not in line with expectations. This study examined the factors influencing adolescent fruit and vegetable consumption in Indonesia.

Materials and Methods: The cross-sectional study used secondary data from the Indonesia Global School-Based Student Health Survey (IGSHS). The IGSHS sample comprises 75 schools, with 11.142 students representing three regions (Sumatra, Java-Bali, Outer Sumatra, and Java-Bali) in 26 provinces and 68 districts/cities in Indonesia.

Results: Age, soft drinks, and identified fast food consumption as determinants of fruit and vegetable consumption (p=0.001). Sex also affected fruit consumption (p=0.023). Adolescents who did not consume fast food were three times more likely to consume fruit than adolescents who did (OR=3.087, 95% CI=2.508-3.800). Meanwhile, adolescents who did not consume fast food were twice as likely to consume vegetables as those who did (OR=1.723,95% CI=1.395-1.731).

Conclusion: Age, soft drinks, and fast food consumption are determinants of fruit and vegetable consumption. These findings may provide meaningful recommendations for developing policies and health promotion programs to improve community nutrition by increasing the consumption of fruits and vegetables among adolescents to achieve a better nutritional status.

Keywords: Consumption, fruit, vegetables, adolescent, determinant, Indonesia.

Introduction

Fruit and vegetable consumption, particularly among adolescents, reduces noncommunicable disease deaths (NCDs).[1] The rising prevalence of NCDs, such as obesity, hypertension, diabetes, and hypercholesterolemia, is one of the growing health concerns among adolescents.[2] They link this condition to NCD risk factors, such as smoking, lack of physical activity, and inadequate consumption of fruits and vegetables. Fruits and vegetables contain various vitamins, minerals, and fiber. The fiber in vegetables and fruit helps to prevent diseases like heart disease, diabetes, and stroke by lowering bad cholesterol, controlling blood sugar levels, launching the digestive system, and making a person feel fuller so they don't overeat. One effort to prevent the occurrence of NCDs is to increase adolescent fruit and vegetable consumption.[3]

Noncommunicable diseases (NCDs) are long-term illnesses caused by genetic, physiological, environmental, and behavioral factors. According to etymology, NCDs can occur because of controllable or modifiable and uncontrollable risk factors. The death rate associated with NCDs is the highest in the world. According to WHO data, NCDs cause over 41 million deaths yearly, accounting for 71 percent of all deaths worldwide, with 77 percent occurring in low- and middle-income countries such as Indonesia.[4]

The main NCDs are cardiovascular diseases such as heart attacks and strokes, cancer, chronic respiratory diseases such as chronic obstructive pulmonary disease and asthma, and metabolic diseases such as diabetes.[5] These four disease groups account for over 80% of all premature deaths. Cardiovascular disease causes most deaths from NCDs (17.9 million) each year, followed by cancer (9.3 million), respiratory disease (4.1 million), and diabetes (1.5 million).[6]

Fruit and vegetable consumption is part of adolescents' daily diet. The WHO recommends 400 grams of vegetables and fruits per person per day for a healthy lifestyle, which includes 250 grams of vegetables (equivalent to 2 servings or two glasses of vegetables after cooking and draining) and 150 grams of fruit (equivalent to 3 fruits). One medium Ambon banana, one medium papaya, or three medium oranges, As much as 400-600 grams per person per day for Indonesians, especially adolescents and adults.[7]

Adolescence is a critical period for getting used to eating fruit and vegetables for their health because it can affect their health in adulthood. Many factors, such as taste, preference, delicacy, eating habits of parents and families, availability, affordability, and acceptability, influence teenagers' food choices.[8] The behavior of adolescents in Indonesia who eat vegetables and fruit is still not in line with expectations. Riskesdas data in 2013 states that 93.5% of the population of adolescents and adults consume vegetables and fruits below the recommended level, where the daily consumption of fruits and vegetables for adolescents and adults in Indonesia is only 57.1 grams.[9]

This study aimed to develop interventions to increase adolescent vegetable and fruit consumption. This is crucial research as it produces recommendations for increasing adolescent fruit and vegetable consumption, which requires a scientific, evidence-based strategy. Several previous studies show that the daily consumption of fruits and vegetables remains an unsolved issue. Fayasari's research (2020) shows that 67.1% of Indonesian adolescents consume less fruit, and 59.3% consume fewer vegetables.[10] Another study by Anggraeni and Sudarti (2018) discovered that only 4.3 percent of adolescents consumed adequate fruit and vegetables, at least 400 g per day. Asih Anggraeni and Sudiarti.[11] Oktavia et al. (2019) discovered that the frequency of vegetable consumption was less than three times per day in urban areas, which was 57.1 percent higher than in rural areas, which was 48 percent. Meanwhile, respondents in rural areas consumed fruit less than twice per day at a rate that was 85.7 percent higher than in urban areas by 39.8 percent.[12] This study aimed to examine the impact of determinant factors on adolescent fruit and vegetable consumption in Indonesia.

Materials and Methods

Study design and data sources

We conducted this study with a cross-sectional study. It used data from the 2015 Indonesia Global School-Based Health Survey (IGSHS) held by the *Health Research and Development Agency,* the Ministry of Health of the Republic of Indonesia, in collaboration with the World Health Organization and the *US Centers for Disease Control and Prevention.*

The student's ages ranged from 12 to 19 years. A two-stage cluster sample design was used to generate data representative of all Indonesian students in grades 7-12. The first step in sampling is the selection of schools with probabilities proportional to enrollment size. Following that, the class is chosen at random, and all students in the class are chosen. The Indonesian GSHS assesses alcohol, eating habits, drug use, hygiene, mental health, physical activity, sexual behavior, tobacco use, violence, and unintentional injury.

The sample size was determined using calculations performed by the CDC Atlanta America with the PC Sample School Selection Algorithm as a reference. This survey is a component of a more extensive global survey. The sample size was calculated using the Probability Proportional to Size (PPS) method, and the class sample was chosen to use systematic sampling. The IGSHS sample comprises 75 schools with 11,142 students from three

regions in Indonesia (Sumatra, Java-Bali, Outer Sumatra, Java-Bali) in 26 provinces and 68 districts/cities. The national school response rate is 100%, the student response rate is 94%, and the overall response rate is 94%.

The WHO's GSHS questionnaire was used, with minor modifications as needed. We collected data using a self-report questionnaire, paying particular attention to the anonymous aspect to avoid bias and the importance of information confidentiality. I asked students not to include their names or any other form of identification. They instructed respondents to complete the available questionnaire with an explanation or guide on how to do so. We gathered all information with the consent of the respondents and their parents, taking into account research permission and ethical considerations.

Ethical Approval

The WHO, the US Centers for Disease Control (CDC) Ethics Committees, and the Indonesian Ministry of Health allowed the initial survey. This research examined existing public data that is readily available online but stripped of all identifying information. The GSHS project provided permission to view the Indonesia dataset. Data source from: https://www.cdc.gov/gshs/countries/seasian/indonesia.htm, released on Feb 13, 2019.

Data collection

Determinant factor

This study's determinants were age, gender, hunger, soft drinks, and fast food. The question "How old are you?" defines an age. Age-separated early adolescents (11-14 years) and age-separated late adolescents (15-18 years) (n = 11127). Gender (n = 11111) was divided into two categories: males and females. Hunger (n=11093) was assessed using the question: "Have you ever felt hungry because there wasn't enough food in your house in the last 30 days?" with yes and no responses. Soft drinks (n=11086) were defined by answering yes or no to the question, "Did you drink carbonated soft drinks in the last 30 days?" Fast food consumption (n=1100) was assessed using the question "How often do you eat fast food?" with the codes 1 = 0 days, 2 = 1-3 days, and 3 = 4-7 days.

Consumption of fruit and vegetables

Fruit consumption was defined by the question, "Over the past 30 days, how many times a day did you usually eat fruit, such as pineapple, banana, orange, or watermelon?" with code 1 = < 3 times per day, and 2 = 3 times per day. The question measured vegetable consumption, "During the last 30 days, how many times a day do you usually eat vegetables, such as carrots, cabbage, spinach, or kale/kangkung? With the same code as fruit consumption.

Statistical analysis

We analyzed complex samples using primary sampling units, strata, and sample weights. The data analysis methods used were frequency distribution, percentage, chi-square, and multivariate logistic regression. The percentage of frequency distribution was used to analyze the characteristics of adolescents in Indonesia, including age, gender, the sensation of hunger, consumption of carbonated/soda drinks, fast food, and consumption of fruits and vegetables. The Chi-square test was used to analyze the relationship between the determinant factors (age, gender, sensation of hunger, consumption of carbonated/soda drinks, fast food) and consumption of vegetables and fruit. Multivariate logistic regression analysis with an odds ratio of 95% CI was used to estimate the relationship between fruit and vegetable consumption and determinant factors.

Furthermore, the ROC analysis was performed by looking at the AUC area. The area under the curve is an area that shows the level of accuracy of the prediction model and is calculated using a calculation method called Area Under Curve (AUC). Statistical analyses were performed using SPSS Version 21.0 software (SPSS Inc., Chicago, IL, USA). P-value < 0.05.

Results

Sample Characteristics

Early teens (11-14) accounted for 67.7% of Indonesian teenagers. The female gender outnumbers the male gender by 51.1%. Most adolescents in Indonesia do not experience hunger sensations in the same proportion as 56.7%. Most teenagers (96%) do not drink soft drinks and eat fast food 1-3 times per week (48.9%). In Indonesia, the majority of adolescents (84.2%) and vegetables (71.4%) do not consume fruit (Table 1).

The relationship between the determinants of fruit and vegetable consumption habits

The determinant factors related to adolescent fruit consumption were age, gender, soft drinks, and fast food, respectively, with p-values <0.001, 0.013, <0.001, and <0.001. Meanwhile, the determinant factors related to vegetable consumption in adolescents were age (p=<0.001), soft drinks (p=<0.001), and fast food (p=<0.001) (Table 2).

Table 1. Characteristics of Research Participants

Characteristics	n	Percentage
Age (n = 11127)		
Early teens	7537	67.7%
Late teens	3590	32.3%
Gender (n = 11111)		
Woman	5679	51.1%
Man	5432	48.9%
Hunger (n=11093)		
Yes	4799	43.3%
Not	6294	56.7%
Fizzy Drinks (n=11086)		
Yes	446	4%
Not	10640	96%
Fast food (n=1100)		
4-7 days	615	5.6%
1-3 days	5414	48.9%
Not	5051	45.6%
Fruit consumption (n=11021)		
Yes	1746	15.8%
No	9276	84.2%
Vegetable consumption (n=11090)		
Yes	3173	28.6%
Not	7918	71.4%

Determinant factors that affect fruit and vegetable consumption

Age, soft drinks, and fast food were determinants of fruit and vegetable consumption (p=<0.001). Gender influences fruit consumption (p=0.023). Adolescents who do not consume fast food are three times more likely to eat fruit than adolescents who do (OR=3.087,95% CI=2.508-3.800). Meanwhile, adolescents who do not consume fast food are twice as likely as those who do (OR=1.723, 95% CI=1.395-1731). (Table 3).

Table 2. Relationship of Determinant Factors with Fruit and Vegetable Eating Habits

Fruit consumption	Not	Yes	Total	p-value
Age				
Early teens	6133/82.4%	1310/17.6%	7443/100.0%	<0.001
Late teens	3133/87.9%	432/12.1%	3565/100.0%	
Gender				
Woman	4807/85.3%	828/14.7%	5634/100.0%	0.013
Man	4443/82.9%	915/17.1%	5358/100.0%	
Hunger				
Yes	4021/84.7%	725/15.3%	4746/100.0%	0.199
Not	5223/83.7%	1016/16.3%	6238/100.0%	
Soft drink				
Yes	260/59.0%	181/41.0%	441/100.0%	<0.001
Not	8992/85.2%	1556/14.8%	10548/100.0%	
Fast food				
0 days	4409/88.2%	592/11.8%	5001/100.0%	<0.001
1-3 days	4430/82.4%	946/17.6%	5376/100.0%	
4-7 days	407/67.5%	195/32.5%	602/100.0%	
Vegetable consumption				
Age				
Early teens	5150/68.6%	2353/31.4%	7503/100.0%	<0.001
Late teens	2757/77.2%	816/22.8%	3573/100.0%	
Gender				
Woman	4021/71.0%	1640/29.0%	5661/100.0%	0.546
Man	3875/71.8%	1524/28.2%	5399/100.0%	
Hunger				
Yes	3474/72.6%	1309/27.4%	4783/100.0%	0.050
Not	4413/70.4%	1853/29.6%	6266/100.0%	
Soft drink				
Yes	246/55.4%	198/44.6%	443/100.0%	<0.001
Not	7651/72.1%	2960/27.9%	10612/100.0%	
Fast food				
0 days	3727/74.0%	1307/26.0%	5034/100.0%	<0.001
1-3 days	3792/70.3%	1606/29.7%	5398/100.0%	
4-7 days	369/60.6%	240/39.4%	609/100.0%	

Table 3. Determinant Factors Affecting Fruit and Vegetable Consumption

Determinant factor	p-value	OR	95% CI	
			Lower bond	*Upper bond*
Fruit consumption				
Age				
Early teens	<0.001	0.65	0.55	0.77
Late teens	Ref.	Ref.	Ref.	Ref.
Gender				
Woman	0.023	0.84	0.73	0.97
Man	Ref.	Ref.	Ref.	Ref.
Soft drink				
Yes	<0.001	0.29	0.23	0.38
Not	Ref.	Ref.	Ref.	Ref.
Fast food				
0 days	<0.001	3.08	2.50	3.80
1-3 days	<0.001	1.99	1.65	2.38
4-7 days	Ref.	Ref.	Ref.	Ref.
Vegetable consumption				
Age				
Early teens	<0.001	0.65	0.53	0.81
Late teens	Ref.	Ref.	Ref.	Ref.
Soft drink				
Yes	<0.001	0.53	0.44	0.63
Not	Ref.	Ref.	Ref.	Ref.
Fast food				
0 days	<0.001	1.72	1.39	2.12
1-3 days	<0.001	1.45	1.22	1.73
4-7 days	Ref.	Ref.	Ref.	Ref.

Predictive ability models

It compares models of fast food predictive factors on adolescent vegetable and fruit consumption. The predictive factor used is fast food because we consider it the factor with the highest determinant, namely the odd ratio value, compared to other factors. The receiver operating characteristics curve was used for the model developed for consuming vegetables and fruits (Figure 1).
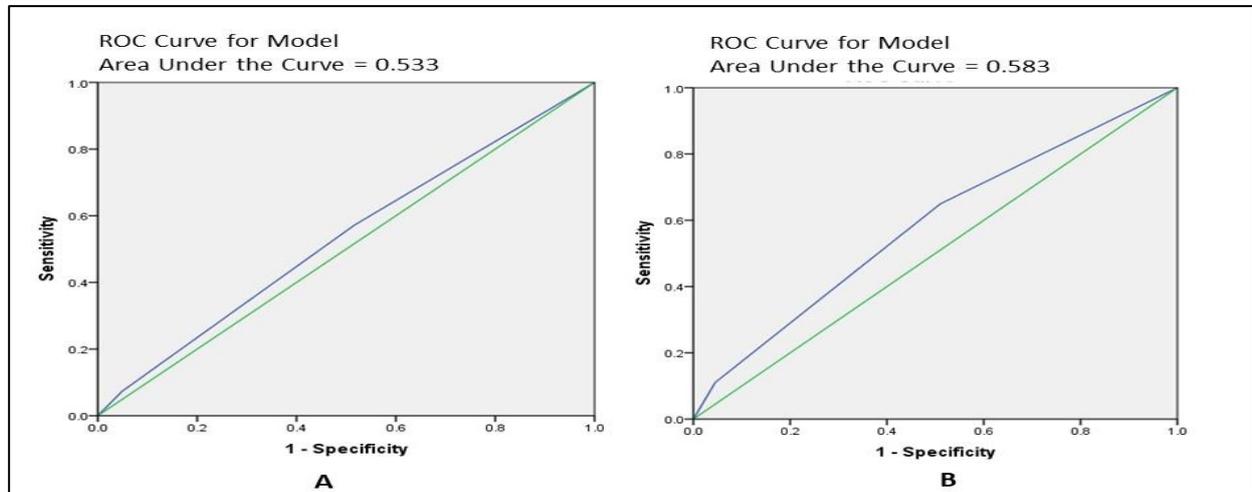
Figure 1. The receiver operating characteristics curve for the model was developed based on the consumption of vegetables and fruits. A. The area under the curve (AUC) in our model was found to be 0.533, equal to 53%. This means that adolescents who consume fast food correctly, with a value of 53%, are predicted to consume fewer vegetables. B. The area under the curve (AUC) in our model was found to be 0.583, equal to 58%. This means that adolescents who consume fast food correctly, with a value of 53%, are predicted to consume fewer fruits.

Discussion

The study found that age was related to fruit and vegetable consumption in adolescents (p=<0.001). These findings are consistent with Albani et al. (2027), who found that the consumption of fruits and vegetables in adolescents changed with age or decreased from childhood to young adulthood. According to the Theory of Planned Behavior (TPB), intention influences a person's eating behavior. Attitudes toward behavior, subjective norms, and perceived behavioral control all influence the emergence of behavioral intentions.[13]

Weak perceived behavioral control over fruit and vegetable consumption occurs as adolescents' knowledge of food options other than fruits and vegetables grows with age.[14] With an increasing variety of food and drink options, teenagers are no longer able to exhibit the behavior of consuming fruits and vegetables every day. Although adolescents believe that increasing age does not directly affect fruit and vegetable consumption behavior but only strengthens intentions, a lack of perceived behavioral control can directly affect fruit and vegetable consumption behavior.

The study found that soft drinks were associated with fruit and vegetable consumption in adolescents (p=<0.001), and soft drinks were associated with fruit and vegetable consumption in adolescents. This result

is in line with the research of Beal et al. (2019), which revealed that, in general, school-age adolescents consume unhealthy foods such as those low in fruits and vegetables and consume a lot of carbonated soft drinks. This is in line with the results of research by Jacob et al. (2020) and Khan et al. (2021). They concluded that consuming sugary drinks (carbonated) is a marker of poor dietary habits or reflects a food source with few choices of fruit and vegetables.[15]

Adolescents who drink a lot of soft drinks have a low intake of fruits and vegetables due to personal preferences. Preference is a choice made by consumers from among the various options available. Internal factors influence food preferences, namely conditions within a person that can affect food consumption, such as appetite, which is influenced by a person's physical and psychological conditions, such as sadness and fatigue, eating habits, and boredom caused by less varied food consumption.

Consuming food in large quantities outside can also cause boredom close to the primary mealtime. External factors exist outside of the individual and can influence food consumption. These factors include the taste of the food, its appearance, the variety of the menu, how it is presented, the cleanliness of the food, the cutlery, and the timing of the meal.[16] A low preference for eating fruit and vegetables or a lack of interest in the consumption of fruit and vegetables compared to the preference for the consumption of soft drinks causes the low consumption of fruits and vegetables in adolescents who drink soft drinks.

Fast food consumption was associated with adolescents' fruit and vegetable consumption (p=0.001). Adolescent fruit and vegetable consumption is associated with fast food. Fast food has little or no nutritional value, but it provides a lot of calories and fat, which can be an excellent way to save time in serving, but it isn't a great way to get nutrients. Another study discovered that more than half of adolescents (60.30%) consumed junk food in the previous 30 days, with public schools having the highest rate (65.1%), followed by private schools (56.3%). More than half of the participants consumed salty snacks (58.7%), followed by sweets (57.5%). Consumption time with friends was higher (83.9%).[17]

This finding is consistent with the findings of Cho and Kim (2018), who discovered a significant relationship between fast food and fruit and vegetable consumption behavior (p = 0.001).[18] This condition exists because fast food in the food industry has influenced teenagers' eating habits. Teenagers prefer ready-to-eat foods such as fried chicken and instant noodles to eat fruits and vegetables due to their busy schedules with college assignments and extracurricular activities. Adolescent fast food consumption can hinder healthy foods such as fruits and vegetables.

In adolescents, fruit and vegetable consumption is unrelated to hunger. In this study, we define hunger as the response to questions over the previous 30 days, how frequently participants feel hungry because there is not enough food at home, or to assess eating behavior by relying on physiological signals such as hunger for eating

activities. The findings of this study support the findings of Barad et al. (2019), who concluded that hunger is not significantly associated with adolescent fruit and vegetable consumption (p = 0.91).[19]

Various factors influence adolescent eating behavior and food consumption. Individual factors (cooking skills, food taste, dietary restrictions, as well as knowledge and perceptions), social factors (peer influence and social norms), university-related factors (campus culture and exam frequency), and environmental factors (availability of cooking resources and facilities, as well as food prices) have emerged as important factors influencing adolescents' eating behavior and food consumption and perceptual features), external food factors (information, social environment, physical environment). Personal state factors (biological features and physiological needs, psychological components), habits and experiences), and cognitive factors (knowledge and skills, attitudes, likes and preferences, anticipated consequences, and personal identity) are the main determinants of food choice.[20]

In conclusion, age, soft drinks, and fast food are determinants of fruit and vegetable consumption. Adolescents who do not consume fast food are three times more likely to consume fruit than those who consume fast food. Adolescents who do not consume fast food are twice as likely to consume vegetables as adolescents who consume fast food. To achieve a better nutritional status, health authorities must be able to develop policies and health promotion programs related to efforts to improve community nutrition by increasing adolescent fruit and vegetable consumption.

Ethical Considerations: The WHO, the US Centers for Disease Control (CDC) Ethics Committees and the Indonesian Ministry of Health allowed the initial survey.

Conflict of Interest: The authors declare no conflict of interest.

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