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Original Research Article

Children's food habits, consumption, and food safety of popular snacks in school environment in Indonesia

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ABSTRACT

Background: School age is a period of children's growth and development into adolescence. Therefore, an adequate intake of nutrients and food that is safe to consume is essential. The food safety level of school snacks is still poor. Good snacking habits can contribute enough energy and protein to children. Conversely, improper and unhealthy snacking habits can have negative impacts on children.
Methods: This cross-sectional study was conducted in six selected public elementary schools from January 2018 until April 2019. The study involved selecting a sample using the purposive sampling method. The total samples from six schools were 214 students.
Results: The study found a significant difference between eating frequency of school children in urban and rural areas ($p<0.05$). Regarding snacking habits, most students in urban (61.0%) and rural (76.2%) had snacks 4-6 times per week. Snack's contribution to daily energy and protein intake in rural was 21.7% for energy and 18.1% for protein, while in rural, 31.6% for energy and 24.1% for protein. The results of the microbiological contamination analysis of popular snacks from all of the schools came out negative.
Conclusions: Based on those findings, the schools should continuously supervise the practice of selling snacks around the school. The department of education and culture and the health office need to conduct training for food vendors and teachers about healthy snacks in schools. Parents need to pay more attention to children's food consumption.

Keywords: Adolescents, Food intake, Food safety, Snacking habits

INTRODUCTION

School age is a child's period of growth and development into adolescence. Therefore, adequate intake of nutrients and food that is safe to consume is very important. School-age children often buy snacks while at school. About 5% of school-aged children bring food from home, so school-age children tend to buy snacks at school; and almost all (91.1%) of school-aged children like to buy snacks.[1] However, there are potential problems with the safety of snack food sold at the school, namely hazardous food contamination (microbiological and chemical), hygiene and sanitation problems during its preparation, as well as the contribution of snack foods as an unhealthy source of calories.[2] All the problems occur due to food handling procedures that ignore food safety and consumer ignorance (school children and teachers) of safe and quality snacks.[3] The harm caused by bacteria is usually caused by *E. coli* bacteria that become sanitary parameters and Salmonella (pathogen bacteria).[4] Consumption of food habits can influence the individual's

health, social and psychological aspects.[5] The adolescent population and health is a very special issue and is the focus of attention globally for various reasons.[6] A study concluded that adolescents have a habit of low consumption of fruits, green vegetables, and milk; consume lots of snacks, sweets, and soft drinks; and skip breakfast. The result of this eating habit is the continuous increase in adiposity among children.[7] Schools may play an important role in improving children's eating preferences and patterns. From this perspective, integrating smaller, more frequent meals in the school environment may be an effective way to battle childhood obesity.[8] Frequent snacking can adversely affect the adolescent's health due to excess intake of energy-dense food rich in fat ingredients they contain. This may be associated with breakfast-skipping habits because it may lead to more snacks whenever adolescents feel hungry.[9] A study on healthy canteen assessment in Depok City showed that the evaluated canteens were unhealthy because there were still many bacteria contaminants, hazardous substances, and food additives above the maximum limit stated in SNI (Indonesian National Standard).[10] Similar results were also shown in the characteristics of snack food at primary schools in Indonesia; i.e., there were still no eligible snacks due to excessive and unacceptable food additives and the presence of microorganism contamination. The cyclamate content was the leading cause of snacks (ice, jelly, and soft drinks) becoming not edible. The presence of high bacterial contamination was indicated in meatballs and snacks based on the total plate count (TPC) test parameter. Noodles were known to contain preservatives in the form of formalin.[11] Food safety is an essential element of food security. Thus, food safety must be an essential component of health-based nutrition policies and education.[12] The low food safety level of school children's snacks requires special attention because it can indirectly become one of the most important obstacles in Indonesia's human resource development in the future. Generally, school-aged children often buy snack foods sold in the canteens or around the schools without realizing that some of the foods consumed can endanger their health. The condition is aggravated by improper way of sale that is on the side of the road which is relatively open, thereby prone to be contaminated by microorganisms harmful to human health. Therefore, monitoring and supervision of the school canteen and/or vendors around the school should be continuously improved since most snacks are made in inappropriate conditions and ways. The food safety level of school snacks is still poor and has become a serious problem. One of the ways that can be done is to provide rules or conditions for sellers selling their foods in the canteen or around the school environment. According to this, the rules that must be obeyed may help change one's behavior.[13] This research aims to assess school children's food consumption, snack's contribution, and the food safety of snacks sold in school environments consumed by children in urban and rural areas.

METHODS

Study design

This research used a cross-sectional study design and was conducted in six purposively selected public elementary schools. This study collected data from school children (grade 5).

Study place and period

The study was conducted in public elementary schools in urban area (Tangerang Selatan City) and in rural area (Tangerang District) from January 2018 until April 2019.

Sampling technique

The study used a purposive sampling method. Three out of 140 public elementary schools in the urban area (Tangerang Selatan city) and three out of 757 public elementary schools in the rural area (Tangerang District) were selected based on the local education authority's recommendation (educational office). Calculation of the minimum number of subjects based on the formula for a cross-sectional study according to Lemeshow et al. (1997):

$$\text{n} = n = \frac{Z^2(1-\propto)\ x\ p\ (1-p)}{d^2}$$

Where n is minimum number of samples, a was confidence coefficient (1.96), p was proportion of children's snack habits (>4 times/days) (10%) and d was precision (10%).[14] Thus sample size was calculated to be 34. Based on the calculation results, the minimum number of samples obtained is 34 people from each school. The total sample from six schools is 214 students (above the minimum sample required).

Inclusion criteria

Inclusion criteria for current study were; elementary school children in 5th-grade class, living with mother (not with grandfather or other relatives), and willing to participate on this study.

Exclusion criteria

Exclusion criteria for current study were the sample was sick and did not go to school when the survey took place

Data collecting

The data was collected through interviews with the respondents (school children), filling out the questionnaire, and laboratory analysis. For this purpose, a questionnaire was designed and tried out first before being administered.

Statistical analysis

Data analyses included: data entry, data cleaning, statistical analysis, and creating dummy tables. The data entry was done in Microsoft Excel, and data editing and cleaning were then performed. Data on the sample's characteristics were analyzed descriptively, and comparisons of variables between urban and rural were tested using the independent t-test for numerical data and the Mann-Whitney test for the categorical ones. Pearson and Rank-Spearman correlation tests were used, and SPSS Statistics software was used to conduct the analysis.

RESULTS

Characteristic of this study participant

School age is the beginning of a child's learning to be responsible for his attitude and behavior.[15] School age begins at 6 years of age and ends when individuals show sexual maturity between 13 and 14 years of age. Characteristics of school-age children include gender, age, order of children in the family and pocket money. Children in urban areas (10.6±0.6 years) are slightly older than children in rural areas (10.4±0.6 years). In general, the total percentage of boys (54.3%) is higher than that of girls (45.7%). In urban areas, the percentage of boys (57.1%) is higher than girls (42.9%). Likewise in rural areas, the percentage of boys (51.4%) is higher than that of girls (48.6%).

Food habits

Food habits are human behavior towards food including attitudes, beliefs, and selection in consuming food obtained repeatedly. Food habits are formed in the first two years of a child's life and affect food habits in the following years. Children's food habits are very dependent on their family's food habits at home. People's attitudes towards food can be positive or negative. The frequency of main food consumption also affects the total energy and nutrient intake per day for school children. The frequency of food consumption 3 times per day impacts normal nutritional status, while the frequency of food >3 times per day is related to increased body mass index (overweight). The food habits of elementary school children in urban and rural areas can be seen in (Table 1).

Table 1: Characteristics of children's age, order in their family, sibling, and pocket money.

Characteristics of children	Total (n=210)	City (n=105)	Village (n=105)	P value
Age (Mean±SD)	10.5±0.6	10.6±0.6	10.4±0.6	0.006
Child order (Mean±SD)	2.0±1.0	2.0±1.0	2.0±1.0	0.801
Number of siblings (Mean±SD)	3.0±1.0	3.0±1.0	3.0±1.0	0.107
Pocket money (IDR/day) (Mean±SD)	8,302±3,716	7,600±3,480	9,004±3,827	0.006

US$1=IDR15,500.

It can be seen that the majority (55.7%) of the students had a frequency of eating 3 times/day, while those who had a meal frequency of 2 times/day were 30.5% (Table 1). There was a significant difference between the frequency of eating of rural and urban students ($p<0.05$). The frequency of meals 3 times/day of the students in urban area was 67.6%, while in rural area was 43.8%. As for the frequency of eating 2 times/day of the students in urban area was 20.5% and in rural area was 49.5%. School children are the parties who most often get close to snacks. Most of the students in the urban (61.0%) and the rural (76.2%) were used to having snacks 4-6 times/week. The macronutrient intakes of school children are presented in (Table 2). The energy, protein, fat, and carbohydrate intake of the children in urban shows that the intake of children in rural was higher ($p<0.05$) (Table 2). The level of adequacy of energy, protein, fat, and carbohydrate was also higher in the children in urban compared to that of the children in rural ($p<0.05$). The proportion of energy derived from carbohydrates was 57%, from fat 32%, and protein 11%. The contribution of macronutrients from snacks in urban area was 21.7% energy, 18.1% protein, 24.4% fat, and 21.3% carbohydrates. In comparison, the rural respondents' macronutrient contribution was 31.6% energy, 24.1% protein, 32.8% fat, and 32.8% carbohydrates. The statistical test results showed that there were significant differences ($p<0.05$) between the contribution of energy, protein, fat, and carbohydrate snacks to the urban and rural respondents, where the contribution of energy, protein, fat, and carbohydrate snacks to respondents in rural was higher than that of the respondents in urban.

Food safety

The results of the microbiological contamination analysis of popular snacks from all of the schools came out negative. A study found several major sources contributed to microbial risk in snacks are raw materials, vendor location, utensils and equipment, storage and reheating, and personal hygiene of vendors.[16] It was known through BPOM finding that the source of microbial contamination on snack food was *Salmonella sp*. in fried chicken.[17] Moreover, a previous study in Bogor found that *Salmonella sp* mostly came from contaminated ice cubes in drinks.[18]

DISCUSSION

Intakes of energy and nutrients are essential for children. Intakes of energy and nutrients provide fuel for children to move and support metabolic processes in the children's bodies. Children's snacking habits are one of the factors

that can influence the nutritional intake and nutritional status of children. Good snacking habits will be able to contribute enough energy and protein to children. Conversely, improper and unhealthy snacking habits can have a negative and harmful effect on children. According to Sugiyatmi, there were still many snack vendors who used artificial coloring materials in their merchandise in particular drinks. Snack is a ready-to-eat food and beverage prepared and sold by hawkers or vendors in streets or other public places.[19,20]

Table 2: Distribution of the school children by food habits, N (%).

Food habits	Total (n=210)	Urban (n=105)	Rural (n=105)	P value
Frequency of children's eating (time/day)				
1	3 (1.4)	2 (1.9)	1 (1.0)	0.033
2	83 (39.5)	31 (29.5)	52 (49.5)	
3	117 (55.7)	71 (67.6)	46 (43.8)	
4-6	7 (3.3)	1 (1.0)	6 (5.7)	
Mean±SD	2.6±0.6	2.7±0.5	2.6±0.7	0.230
Habit of having breakfast				
Always (every morning)	94 (44.8)	50 (47.6)	44 (41.9)	0.861
Sometimes (2-5 x/week)	106 (50.5)	46 (43.8)	60 (57.1)	
Never	10 (4.8)	9 (8.6)	1 (1.0)	
Common place for having breakfast				
Home	185 (88.1)	97 (92.4)	88 (83.8)	0.056
School	25 (11.9)	8 (7.6)	17 (16.2)	
Foods usually consumed for breakfast				
Rice (plain/fried/cooked in coconut milk with some spices)	194 (92.4)	97 (92.4)	97 (92.4)	0.444
Bread	59 (28.1)	38 (36.2)	21 (20.0)	
Cereal	4 (1.9)	3 (2.9)	1 (1.0)	
***Energen* (instant cereal drink)**	45 (21.4)	26 (24.8)	19 (18.1)	
Noodle/ vermicelli	37 (17.6)	20 (19.1)	17 (16.2)	
Chicken porridge	25 (11.9)	12 (11.4)	13 (12.4)	
Buras/rice wrapped in banana leaf and boiled	9 (4.3)	3 (2.9)	6 (5.8)	
Fried foods	15 (7.2)	3 (2.9)	12 (11.5)	
Others	20 (9.5)	4 (3.8)	16 (15.3)	
Habits of bringing food to school				
Yes	10 (4.8)	6 (5.7)	4 (3.8)	0.081
No	144 (68.6)	64 (61.0)	80 (76.2)	
Sometimes	56 (26.7)	35 (33.3)	21 (20.0)	
Habits of bringing drinks to school				
Yes	81 (38.6)	50 (47.6)	31 (29.5)	0.061
No	69 (32.9)	26 (24.8)	43 (41.0)	
Sometimes	60 (28.6)	29 (27.6)	31 (29.5)	

Snacks have become part of students' food consumption patterns. Students need to understand that most snacks are only high in carbohydrates, fats, and sugar. Therefore, students should know that meals consumed at home must be prioritized. Intakes of energy and nutrients are very important for children. Intakes of energy and nutrients fuel children to move and support metabolic processes in the children's bodies. Characteristics of the main ingredients for each snack are thought to determine the food hazard risk. Other snacks that were tested safe might be due to commercial products approved by The National food and drug control or because the vendor bought the raw materials and processed the food by themselves. Based on the observation, the main ingredients mostly used were eggs and flour. Reports on microbial contamination usually come from chicken or ice cubes.[17,18] Another factor contributing to these snacks' safety is how they are processed. Most snacks are also processed by frying at stalls in the canteen, so the use of preservatives and microbial risk is minimal. Thus, in this study, the snacks sold in school environments are safe from food hazards. A disturbed eating schedule and snacking in between meals showed to have a negative impact on health.[21]

Table 3: Energy, protein, fat, and carbohydrate intakes of the school children.

Variables	Total (n=210)	Urban (n=105)	Rural (n=105)	P value
Energy				
Intake (kcal)	1.576±441	1.699±437	1.454±413	0.000
RDA (kcal)	2.054±61	2.055±53	2.053±68	
Adequacy level (%RDA)	76.7±21.2	82.6±20.8	70.8±20.0	0.000
Protein				
Intake (g)	42.6±13.1	46.0±13.3	39.2±12.2	0.000
RDA (g)	58.0±2.0	58.0±2.0	58.0±3.0	
Adequacy level (%RDA)	73.9±23.6	80.0±23.9	67.8±21.7	0.000
Fat				
Intake (g)	55.0±20.3	58.0±21.0	51.9±19.3	0.028
RDA (g)	69.0±2.0	69.0±2.0	69.0±2.0	
Adequacy level (%RDA)	80.0±29.4	84.4±30.3	75.5±27.9	0.028
Carbohydrate				
Intake (g)	221.8±67.5	241.4±69.3	202.2±59.9	0.000
RDA (g)	283.0±8.0	283.0±7.0	282.0±9.0	
Adequacy level (%RDA)	78.5±23.6	85.3±24.1	71.6±21.1	0.000

Table 4: Contribution of snack nutrients to daily energy and macronutrient intakes.

Variables	Total (n=210)	Urban (n=105)	Rural (n=105)	P value
Energy				
Daily Intake (kcal)	1.576±441	1.699±437	1.454±413	
Snack (kcal)	412±216	366±186	457±234	0.002
Contribution of snack (%)	26.7±12.8	21.7±10.1	31.6±13.3	0.000
Protein				
Daily Intake (g)	42.6±13.1	46.0±13.3	39.2±12.2	
Snack (g)	8.8±5.5	8.4±5.4	9.2±5.6	0.302
Contribution of snack (%)	21.1±12.4	18.1±9.8	24.1±14	0.000
Fat				
Daily Intake (g)	55.0±20.3	58.0±21.0	51.9±19.3	
Snack (g)	15.8±11.2	14.1±9	17.6±12.9	0.025
Contribution of snack (%)	28.6±15.5	24.4±13.5	32.8±16.4	0.000
Carbohydrate				
Daily intake (g)	221.8±67.5	241.4±69.3	202.2±59.9	
Snack (g)	57±29	50±26	64±30	0.000
Contribution of snack (%)	26.9±13.1	21.3±10.4	32.4±13.1	0.000

Snacks that are sold are mostly pre-processed at home, both for vendors in rural and urban areas. Only fried foods were freshly made at stalls. This observes that the raw materials and water sources were difficult to assess. Thus, it is assumed that all raw materials are free from contamination. However, in this study, we did not assess the quality of the raw material used. In order to keep prices affordable for elementary students, vendors might purchase cheap or degraded ingredients.

Food handlers play an important role in ensuring food safety throughout the chain of production, processing, storage, and preparation.[22] Vendor personnel plays an essential role in ensuring food safety because they can become the source of cross-contamination. Observation of the vendors' hands, hair, nails, and clothing found that in the urban area, more vendors pay attention to personal hygiene. This might be due to better knowledge regarding vendors in the urban as they participated in more food safety training. Vendors in the urban are slightly better practice in the aspect of location that enables them to handle the food and dispose of the waste properly due to the facility and infrastructure that the school provides. Thus, rather than the vendors who took the initiative to avoid food hazards, the schools played a pivotal role in pushing them to abide by healthy canteen guidelines.

Limitations

The limitation of this study was that the selection of the sample was carried out purposively so that the conclusions cannot be generalized to the wider population, and the number of schools that were sampled in this study was very limited (3 schools in each location) so that it does not describe the school population in the two research areas.

Table 5: Result of the microbiological analysis of some popular snacks.

Rank	Foods and beverages	*E. Coli* (APM/g)	*Salmonella sp.* (/25 g)	*Bacillus cereus* (colony)
SDN Pamulang Timur 1				
1	*Otak-otak crispy* (fishcake chips)	<3	Negative	0
2	*Cireng isi* (stuffed fritters)	<3	Negative	0
3	*Cilung* (rolled frittes)	<3	Negative	0
4	*Sosis panggang* (grilled sausage)	<3	Negative	0
SDN Pamulang tengah				
1	*Telur gulung* (rolled egg)	<3	Negative	0
2	*Seblak* (spicy wet cracker)	<3	Negative	0
3	*Otak-otak crispy* (fishcake chips)	<3	Negative	0
SDN Pamulang 2				
1	*Telur gulung* (rolled egg)	<3	Negative	0
2	Spaghetti	<3	Negative	0
3	*Pisang coklat* (chocolate banana)	<3	Negative	0
SDN Kedokan				
1	*Sarang laba-laba* (spider web cake)	<3	Negative	0
2	*Bakso Ikan* (fish meatball)	<3	Negative	0
3	*Sosis goreng* (fried sausage)	<3	Negative	0
SDN Cibogo				
1	*Papeda telur puyuh* (steamed sago with quail egg)	<3	Negative	0
2	*Ketupat ulek* (ketupat rice with peanut sauce)	<3	Negative	0
3	*Batagor* (fried tofu and meatball with peanut sauce)	<3	Negative	0
SDN Pajajaran				
1	*Bakso ikan* (fish meatball)	<3	Negative	0
2	Macaroni	<3	Negative	0
3	Martabak (stuffed egg pancake)	<3	Negative	0

CONCLUSION

This study found more school children in urban (67.6%) eat 3 times/day and in rural (49.5%) eat 2 times/day. In urban intakes of energy (82.6% RDA), protein (80.0 % RDA), fat (84.4% RDA), and carbohydrate (85.3% RDA) of school children were found higher than in rural (energy 70.8% RDA, protein 67.8% RDA, fat 75.5% RDA, and carbohydrate 71.6% RDA) ($p<0.05$). Contribution of snacks to energy (31.6%), protein (24.1%), fat (32.8%), and carbohydrate (32.4%) to children daily intakes were higher in rural than in urban (energy 21.7%, protein 18.1%, fat 24.4%, and carbohydrate 21.3%) ($p<0.05$). From this study, it is necessary to provide nutrition education through the school curriculum to improve food consumption and snacks food choices among school children.

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