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Association between Social Media Exposure to Food and Beverages with Nutrient Intake of Female Adolescents

Cholida Adiba[1*], Siti Fatimah Pradigdo[2], Martha Irene Kartasurya[2]

[1]Student of Department of Public Health Nutrition, Faculty of Public Health, Universitas Diponegoro, Indonesia
[2]Department of Public Health Nutrition, Faculty of Public Health, Universitas Diponegoro, Indonesia

Abstract

Communication technology development has influenced adolescent's food and beverage choices and intakes. This study aimed to investigate the association between social media exposure to food and beverage content and nutrient intake among female adolescents. This cross-sectional study was conducted on 81 subjects, which were chosen randomly from 104 female students aged 14-18 years at XY High School Semarang, Central Java, Indonesia. Data were collected by interviews using structured questionnaires and a 3x24-hour recall method. Data analysis were conducted by chi-square, Fisher exact tests, and logistic regression. The median and standard deviations of social-media, the duration, frequency, and the number of accounts were 2.3 ± 3.00 hours/access, 2.0 ± 2.00 times/day, and 3.6 ± 2.46 accounts/access, respectively. Mean and standard deviations of adequacy levels for energy 107.4 ± 15.39% and protein 124.8 ± 25.8%. Duration of social media exposures (p-value = 0.040) and body image (p-value = 0.040) were associated with food selection. Food selection was associated with energy (p-value = 0.003) and protein (p-value = 0.002) adequacy levels. After controlling for body image, social-media exposure duration > 2.3 hours had an OR of 3.4 for selecting the accessed foods. It was concluded that social media exposure duration was associated with food selection, which was then associated with energy and protein intakes.

Keywords: female adolescents, food selection, nutrient intake, social media exposure

Introduction

The development of communication technology has expanded human interactions. Most adolescents use applications and many types of social media to communicate and interact with society. This social media has also been used for choosing and buying food.[1] The consumption patterns are changing and becoming more consumptive.[2] Mostly, people do not consider the nutrient content of food and beverages when buying and consuming them.

Food and beverage consumption among adolescents should receive special attention because of their great influence on their growth and development and its impact on nutrition problems as adults. Usually, in this age of 15-18 years, the food intake problem also started and continued to their adult life.[3]

Internet users in Indonesia increased from 54.9 % in 2017 to 64.8% in 2018 and Java became the biggest contributor to the internet use in Indonesia which reached 55% of the total users. Most internet users are between the ages of 15 and 19.[4] Instagram is the first social media applications that focused on uploading photos or short videos, so media become adolescents' favorites.[5] Instagram and some other social media are also used for advertising food and beverages.

Nowadays, adolescents are free from parents and school supervision to choose their food and beverages. In the other hand, adolescents are exposed to a high volume of food and beverage marketing, which are mostly unhealthy foods and drinks. A Canadian study showed that the intensity of adolescents watching food and beverages advertisements on social media is at an average of 189 times/week, different from the children, who were exposed only 30 times/week.[6] Holmberg's study in Sweden,[7] showed that most of the images shared on social media (67.7%) depict high-calorie but low-nutrition foods. Another study by Subardjo, *et al.,*[8] found that children exposed to food and beverage advertisements consumed a higher energy intake than children who were not. In Semarang City, the exposure of social media among adolescents are very high. Among other interests, they use it for accessing food and

Correspondence*: Cholida Adiba, Department of Public Health Nutrtion, Faculty of Public Health, Universitas Diponegoro, Prof. Soedarto Street, SH No. 1269, Tembalang, Semarang City, Central Java, Indonesia, E-mail: cholidaadiba@gmail.com, Phone: +62 812 2629 3240*

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beverage advertisements. Therefore, this study will analyze if the habit of social media use for accessing food and beverages has already affected their nutrient intake, especially macronutrients. Nutrient intake was the dependent variable in this study.

A study in Sidoarjo, East Java, Indonesia described that food photographs on Instagram were related to dining out.[9] This study was conducted to investigate whether adolescents' food selection influenced by social media. Therefore, the food selection was used as the intermediate variable.

In Nisak's study,[9] females were more likely to eat out than males (64% vs 36%). A systematic review on social media use for nutrition outcome on young adults also showed that most of the study subjects were female, with the range of 61-100% in 18 out of 21 studies.[10] Therefore, this study was also done among female students in XY High School, Semarang.

The dependent variable, nutrient intake was counted from food consumption, which was influenced by their food selection. Therefore, this study aimed to investigate the correlation between social media exposure to food and beverage content (independent variables) and food selection (intermediate variable) and food selection and nutrient intake among adolescents. Whether the exposure to social media content on food and beverage was associated with nutrient intake will also be determined. The confounding variables that influence food selection (intermediate variable) and nutrient intake (dependent variable) were also measured and statistically tested.

Method

This cross-sectional study was conducted at XY High School Semarang in September 2019. This school was chosen for its extensive use of smartphones for food ordering. The study population was female adolescents, and the target population consisted of all the female students at XY High School. The minimal sample size of 81 was calculated based on an alpha of 0.05 and a power of 90%. Clustered random sampling technique based on classes was used to choose the subjects. There were 10 classes in the school. The number of subjects in each class is proportional to the number of female students in each class, so 81 subjects are obtained. The number of subjects in each class ranged from four to eleven female students. From the female students' lists in each class, which were numbered, random table numbers were used to choose each class's subjects. All subjects were apprised of the study, then the informed consent forms were signed, and the subjects were included to participate.

The independent variable was social media application (Youtube, Instagram, Facebook, Twitter, and Pinterest) exposure to food and beverage content, specifically duration, frequency of exposure, and the number of accounts accessed. The duration of exposure was counted by the average length of time spent to access food and beverage content from social media in a month. The frequency of exposure was the average number of times in a month the subjects were exposed to food and beverage content from social media. The number of accounts accessed was the average number of food and beverage accounts accessed in any one period of exposure.

The intermediate variable in the study was food selection by the subjects. This variable was nominal, 'yes' or 'no'. If the food selected was based on previously accessed food and beverage, the food selection was indicated as 'yes', but if the food selected was not the food or beverage accessed, the selection was indicated as 'no'. The considered confounding variables for food selection were nutritional knowledge, body image, and peer influence, as these variables are known to influence food selection. Nutrition knowledge was calculated in scores, which were then divided into two categories, either low (for scores of $< 80\%$) or good (for scores $\geq 80\%$). Body image and peer influence were also measured in scores from the questionnaires. Then the body image scores were divided into positive and negative based on their medians. Peer influence was also divided into two categories: weak and strong, based on the questionnaire scores. Scores of equal or less than two were categorized as weak, while more than two were categorized as strong.

The dependent variables were nutrient intakes (energy, carbohydrate, protein, and fat) calculated from food consumption. The considered confounding variable for nutrient intake was sleep duration, as is known to influence food intake. Duration of sleep was categorized into "inadequate" if less than eight hours and "adequate" if $\geq$ eight hours.

Data on social media exposure to food and beverage content, food selection, nutritional knowledge, body image, peer influence, and sleep duration were collected through interviews using structured questionnaires. Food intake was measured by interviews using a 3x24-hour recall method. The portion of the food consumed was asked as food pictures were shown. Nutrient intakes (energy, carbohydrate, protein, and fat) were calculated using the free version of NutriSurvey software. The four intake types' adequacy levels were then calculated by comparing the results to Indonesian Reccomended Nutrient Intake. The adequacy levels of the four groups were categorized as deficient, adequate, and over.

Kolmogorov–Smirnov normality tests started data analysis on all variables. All variables were not normally distributed, except for body image and adequacy levels of energy, protein, and fat. As social media exposures (duration, frequency, and the number of accessed

accounts) were not normally distributed, dichotomous variables were used, with the median as the cut-off. Thus, the correlation between the independent (social media exposures) and intermediate variables (food selection) was obtained using chi-square tests for the duration and the number of accounts accessed and Fisher exact tests for the frequency of exposures. The correlation between intermediate (food selection) and dependent variables (nutrient adequacy level) was tested by Kolmogorov–Smirnov non-parametric, as the nutrient adequacy levels were categorical variables with three groups.[11] The correlation between confounding variables (peer influence, body image, and nutritional knowledge) to the intermediate variables (food selection) was conducted by chi-square and Fisher's exact tests. The correlation between confounding variables (sleep duration) to the dependent variables (nutrient adequacy levels) was tested using Kolmogorov–Smirnov non-parametric.[11] After the tests, it was found that only body image was the confounding variable in this study. Therefore, a logistic regression method was used for controlling body image on the effect of social media exposures on food selection.

Results

The study was conducted on 81 female students at XY High School, Semarang from grade 10, 11, and 12. The ages of the subjects ranged between 14–18 years. Data distribution of social media exposure to food and beverage content (duration, frequency, and the number of accounts accessed) were abnormal. The median and standard deviation of the duration of exposure was 2.3±3.00 hours/access, with the frequency of 2.00±2.00 times/day and 3.6±2.46 the number of accounts/access time. These data showed that female students had a lot of social media exposure to food and beverage contents. The subjects were exposed to Instagram, Youtube, Facebook, Twitter, and Pinterest. The largest exposures were from Instagram (75%) and Pinterest (75%).

Mostly the subjects accessed food or beverage information from social media at lunch (73%) and dinner (75%) times. The type of food information most sought by the subjects was popular food (88%) and restaurant/cafe information (83%). The type of beverage information most sought by the subjects was popular drinks (88%) and restaurant/cafe information (83%). The most popular reasons for the subjects' decisions to buy food were the convenience of the place (82%) and the distance from homes and schools (75%). The most reasons for buying drinks after viewing social media were the distance (75%) and discounts (75%).

Table 1 shows media social exposures, food intake, nutrition knowledge, body image, and sleep duration in categorical variables. Table 2 shows the association between social media exposure and food selection. It demonstrates that the duration of exposure is associated with food selection. Thus, the subjects who had longer periods of social media exposure tended to select food based on those exposures. In comparison, the frequency

Table 1. Media Social Exposures, Food Intake, Nutrition Knowledge, Body Image, and Sleep Duration

Variables	Category	n	%
Duration of exposure	Short (< 2.25 hours/access)	40	49.4
	Long (≥ 2.25 hours/access)	41	50.6
Exposure frequency	Low (< 2.00/day)	25	30.9
	High (≥ 2.00/day)	56	69.1
Number of accounts	Little (< 3 accounts/access)	32	39.5
	Lots (≥ 3 accounts/access)	49	60.5
Food selection	Yes (based on social media exposure)	66	81.5
	No (not based on social media exposure)	15	18.5
Energy adequacy level	Deficient (< 100%)	20	24.7
	Adequate (100%–105%)	19	23.5
	Over (> 105%)	42	51.9
Carbohydrate adequacy level	Deficient (< 80%)	10	12.3
	Adequate (80%–110%)	54	66.7
	Over (> 110%)	17	21.0
Fat adequacy level	Deficient (< 80%)	10	12.3
	Adequate (80%–110%)	26	32.1
	Over (> 110%)	46	55.6
Protein adequacy level	Deficient (< 80%)	2	2.5
	Adequate (80%–110%)	22	27.2
	Over (> 110%)	57	70.4
Nutrition knowledge	Low (< 80%)	33	40.7
	Good (≥ 80%)	48	59.3
Body image	Negative	40	49.4
	Positive	41	50.6
Peer influence	Weak	65	80.2
	Strong	16	19.8
Sleep duration	Inadequate (< 8 hours)	52	64.2
	Adequate (≥ 8 hours)	29	35.8

and the number of accounts accessed were not related to food selection.

Table 3 shows that there is an association between body image and food selection. The subjects who had negative body images tended to not select food based on social media exposure. There was no association between nutritional knowledge and food selection or between peer influence and food selection. Thus, only the body image variable confounded the association between social media exposure and food selection.

Table 4 shows that there is a significant association between food selection and energy and protein adequacy levels. Subjects who selected food based on social media exposures tended to have higher energy and protein adequacy levels. Thus, the subjects who select food based on social media exposures tend to choose food and beverages with higher energy and protein.

Table 5 shows that there is no correlation between the duration of sleep and energy and protein intake. Thus, in this study, the duration of sleep did not confound the effect of food selection on nutrient intake.

A logistic regression method was used to control body image as the confounding variable between exposure duration and food selection. The first step of regression analysis was carried out by bivariate selection. Only variables with a p-value < 0.250 were included for

Table 2. Correlation between Exposure to Social Media and Food Selection

Variables	Category	Food Selection				Cc	p-value
		No		Yes			
		n	%	n	%		
Exposure duration	Short	11	27.5	29	72.5	0.223	0.040[a]
	Long	4	9.8	37	90.2		
Exposure frequency	Low	7	28	18	72	0.161	0.214[b]
	High	8	14.3	48	85.7		
Number of accounts	Low	3	9.4	29	90.6	0.187	0.087[a]
	High	12	24.5	37	75.5		

Notes: [a]Chi-square test, [b]Fisher's exact test, Cc: Contingency Coefficient

Table 3. Correlation between Confounding Variables and Food Selection

Variables	Category	Food Selection				Cc	p-value
		No		Yes			
		n	%	n	%		
Nutritional knowledge	Lack	8	24.2	25	75.8	0.121	0.272[a]
	Good	7	14.6	41	85.4		
Body image	Negative	11	27.5	29	72.5	0.223	0.040[a]
	Positive	4	9.8	37	90.2		
Peer influence	Weak	12	18.5	53	81.5	0.003	1.000[b]
	Strong	3	18.8	13	81.2		

Notes: [a]Chi-square test, [b]Fisher's exact test, Cc: Contingency Coefficient

Table 4. Correlation between Food Selection with Nutrient Adequacy Level

Food Selection	Category	Nutrient Adequacy Level						Cc	p-value
		Deficient		Normal		Over			
		n	%	n	%	n	%		
Energy adequacy level	No	10	66.7	3	20	2	13.3	0.431	0.003[a]
	Yes	10	15.2	16	24.2	40	60.6		
Carbohydrate adequacy level	No	3	20	12	80	0	0	0.246	0.392[a]
	Yes	7	10.6	42	63.6	17	25.8		
Fat adequacy level	No	3	20	7	46.7	5	33.3	0.210	0.323[a]
	Yes	7	10.6	19	28.8	40	60.6		
Protein adequacy level	No	1	6.7	10	66.7	4	26.7	0.415	0.002[a]
	Yes	1	1.5	12	18.2	53	80.3		

Notes: [a]Kolmogorov–Smirnov test, Cc: Contingency Coefficient

Table 5. Correlation between Confounding Variables with Nutrient Adequacy Levels

Sleep Duration	Category	Nutrient Adequacy Level						Cc	p-value
		Deficient		Normal		Over			
		n	%	n	%	n	%		
Energy adequacy level	Inadequate	12	23.1	11	21.2	29	55.8	0.105	0.643[a]
	Adequate	8	27.6	8	27.6	13	44.8		
Protein adequacy level	Inadequate	0	0	16	30.8	36	69.2	0.225	1.000[a]
	Adequate	2	6.9	6	20.7	29	72.4		

Notes: [a]Kolmogorov–Smirnov test, Cc: Contingency Coefficient

multivariate analysis. The final logistic regression model showed that a long duration of social media exposure posed a 3.35 times higher risk to select food based on social media content after being controlled for body image. The R-square for this model is 0.160, which means that the contribution of the duration of exposure and body image to food selection was 16%, while 84% derived from other factors outside the model. As sleep duration was not a confounding variable for the nutrient intake in this study, the analysis was not continued to logistic regression.

Discussion

The chi-square test results showed a significant association between the duration of social media exposure and food selection (p-value = 0.042). There was no association between the frequency of social media exposure and the number of exposed accounts with food selection. Food and beverage photos or videos on social media are attractive to individuals. The study in Sidoarjo also showed that photographs from social media were associated with the dining out.[9] Some internet users tended to consume foods and soft drinks containing lots of calories, which affected these internet users' nutritional status over time.[12] The higher a person's internet access level, the greater their risk of becoming overweight and obese.[13,14]

The longer the duration of content exposure, the more it tends to encourage individuals' interest in the food. Nowadays, food consumption is no longer aimed solely at nutritional fulfillment. It also serves leisurely fulfillment of the desire to enjoy the taste, the performance of the food presentation, and the social environment of eating out.

Although there was no statistically significant association between exposure and food selection, the subjects who had a higher frequency of exposure tended to make the same food choices accessed on social media. Social media users are oriented to specific goals and do not use it solely to interact with others and fulfill their daily living needs. They form their understanding of the media's content and meaning and actively decide how to use it.[15,16]

Holmberg's study on adolescents in Sweden showed that most subjects ate outside the home, mostly in coffee shop chains. They primarily drank and ate coffee and tea, cakes and pastries, and famous coffee drinks or packaged teas.[7] This result of the present study found that 83% of the subjects also sought information about restaurant or cafe, where they then went together with their friends. They tried to find popular food and drinks from social media. They enjoyed high energy foods; high energy drinks (sweetened milk tea or coffee) were popular. Thus, coffee and popular drink chains have spread everywhere globally, with adolescents among the important markets.

The statistical test analysis (chi-square) showed a significant correlation between body image and food selection (p-value = 0.040). The subjects with positive body image tended to select foods based on exposure to social media. Body image is a combination of a person's attitude and perception of his body and the mental picture. Those include the perceptual component (including size, shape, weight, characteristics, movements, and body appearance) and attitude component (what is felt about the body and how it leads to the behavior). Many things influence the direction of the body image, and the main thing is the environment. Young women generally have a negative body image.[17]

Psychologically, a woman with a negative body image lacks self-confidence, so her thinking patterns will lead her to adopt inappropriate eating behaviors to obtain the ideal body shape, without thinking about her body's nutritional needs.[18] On the other hand, women with a positive body image tend to feel free to consume the desired food even though the food is high in calories, sugar, and fat. Prastiwi's study,[19] on middle school students in Jakarta also showed a significant correlation between body image perception and adolescents' eating behaviors with excess body weight. They tended to be dissatisfied with their body weight, so they decided to skip to achieve weight loss.[19] Thus, body image still

played an important role in food selection, even in subjects who were not overweight and older than those in the Jakarta study.

There was no significant correlation between nutritional knowledge and food selection. In theory, the level of nutrition knowledge influences attitudes and behaviors on food choices. If they have good knowledge, then someone will apply this knowledge in attitude and daily food choices. However, good nutritional knowledge may not be able to change one's eating habits. Thus, not everybody who have a good nutritional knowledge will have a healthy food choice.[20]

There was no significant correlation between peer influence and food selection (p-value = 1.000) in this study. Peers may be a group of people of the same age and maturity. Influences that are often cited by peers relate to changes in behavior and appearance.[21] Adolescents express their ability and willingness to align themselves with their peers by following food preferences. Prastiwi,[19] also found no significant correlation between peer influence and eating behavior. Another study that analyzed fictitious peers' effect on low and high energy food choices showed that the children tended toward high energy-dense food rather than low energy-dense foods.[22]

The results of this study showed a significant association among food selection, energy levels (p-value = 0.003), and protein (p-value = 0.002) adequacy. However, there was no significant association between food selection and the levels of carbohydrates (p-value = 0.392) and fat adequacy (p-value = 0.323). The results of this study indicate that the subjects who made food choices that matched with those accessed on social media tended toward a higher intake of fat and protein. Female adolescents were found to be relatively more interested in fast-food consumption.[23,24] The frequent consumption of fast foods among people in their teens and twenties ate more fast food preparation, convenient, and relatively inexpensive.[25] A study of college students in the United States showed similar situations, in which only 15% of the subjects used nutrition facts to choose their food.[26] But a study in the United Arab Emirates (UAE) showed different results. Subjects who ordered food online tended to seek more information about the quality of the food, particular information on diet, and organic food.[27] However, the UAE study was not only done in adolescents but the general household population.

A systematic review of social media's effect on children's food consumption showed that social media's impact was positive for unhealthy food but negative for healthy food. Children who were exposed to unhealthy dietary marketing increased their caloric intake. Those children were at a higher risk for selecting the advertised food and beverages.[28] Social media is strongly related to the influencers. A study in the United Kingdom showed that influencers affected increasing unhealthy snacks, but not healthy snacks.[29]

Therefore, it is more difficult to change habits to healthy foods compared to unhealthy foods. Other systematic reviews of young adults on social media's effect on nutrition outcomes showed that young adults (older than 18 years old) tended to receive healthy eating advice through social media. However, the studies included in the review mostly came from developed countries, such as the United State of America and Australia. The environment could be different from our study in Semarang, Indonesia.

There was no significant association between sleep duration and the level of energy (p-value = 0.237) and protein (p-value = 1.000) adequacy. Lack of sleep causes hormonal imbalance, which increases ghrelin hormone and reduces the levels of leptin hormone, which triggers more appetite in the evening.[30] The function of leptin is a signal molecule that conveys messages to the brain regarding the availability of energy stored in body fat. The brain, particularly the hypothalamus, integrates metabolic signals derived from leptin to regulate energy homeostasis by reducing appetite and increasing energy expenditure and thermogenesis.[31] In this study, sleep duration was not associated with energy and protein intake. This intake could be caused by the fact that most subjects had inadequate sleep durations (64.2% had < 8 hours of sleep).

The results showed that the duration of social media exposure was not related to food selection after being controlled for body image, with a p-value of 0.051 (nearly or marginally significant). The duration of exposure had an OR of 3.4, which meant that the subjects who had long durations of social media exposure had 3.4 greater chances to select the food based on the exposure time than subjects who had short exposure to social media, after controlling for body image. The duration of exposure in this study is the length of time the subjects accessed social media content of food and beverages at one time.

After controlling for body image, the duration of social media exposure still strongly influenced food selection. Thus, this study showed that nowadays, social media exposure, especially duration (in this study, the median duration is relatively high, 2.2 hours per access), has a strong impact on female adolescents' food choice. This condition may lead to obesity or other health problems such as diabetes mellitus in the long run. The food selections were high-fat and -protein food, and the popular drinks they consumed contained high levels of sugar. Therefore, more education on choosing healthy food through social media is needed as social media

access is extremely high among female adolescents.

The limitations in this study were the use of 24-hour recall to calculate the nutrient intakes. This method was very dependent on the memories of the subjects. However, the recorded orders in the applications of each subjects had been traced out. Thus, more precise data for the food that were ordered from the social media could be traced out, but not for the other food. The other limitation is this study was only done in one school. It is suggested to the other researchers to include more schools in Semarang.

The strength of the study is the inclusion of intermediate variables in the design and analysis. The correlations between exposure to social media on food selection and between food selection on nutrient intake could be calculated. There is no study on the effect of social media exposures on nutrient intake, with the food selection as the intermediate variable, especially in Indonesia. The focus of this study is also subjected on female adolescents, to minimize the effect of gender on social media exposure to food selection and food consumption. The exposures has also been measured by three important aspects: duration, frequency, and the number of accounts accessed.

Conclusion

Among female adolescents, the duration of exposure to food and beverage content from social media was associated with food selection after controlling for body image. Food selection was associated with energy and protein intake. Thus, the duration of exposure to social media was associated with energy and protein intake. The longer duration of social media exposure on food and beverage content led to higher energy and protein intake.

Recommendation

The availability of healthy food in school canteens and education about healthy food choices among female adolescents is strongly needed. For further studies, more schools and areas of study should be included to generalize the study. Food records could be used instead of 24-hour recall to measure nutrient intake more precisely.

Abbreviations

CNS: Central Nervous System; UAE: United Arab Emirate; OR: Odd Ratio.

Ethics Approval and Consent to Participate

Ethical approval for this study has been granted by the Health Research Ethical Committee, Faculty of Public Health Diponegoro University, with 478/EA/KEPK-FKM/2019. Written informed consent was obtained from all of the subjects.

Competing Interest

Author declares that there are no significant competing financial, professional, or personal interests that might have affected the performance or presentation of the work described in this manuscript.

Availability of Data and Materials

Data and all related materials from this study are available at the first author.

Authors' Contribution

Cholida Adiba, Siti Fatimah Pradigdo, and Martha Irene Kartasurya conceptualized the study, outlined the design, and supervised data analysis. Cholida Adiba collected data. Cholida Adiba and Martha Irene Kartasurya wrote the manuscript and worked out the relevant details. All authors have read and approved the final manuscript.

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