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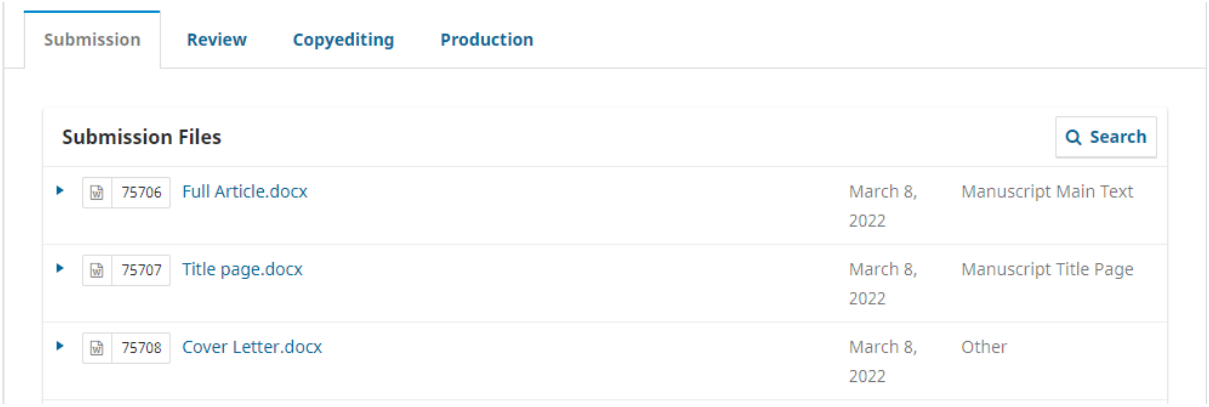
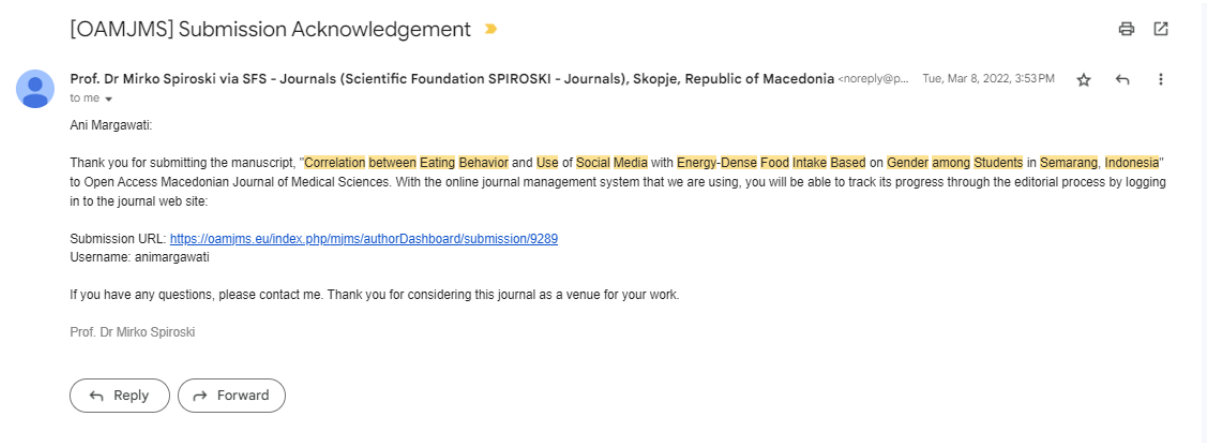
1. Submit Artikel





March 8th 2022

Dear,

Editor of Open Access Macedonian Journal of Medical Sciences

First of all, I would like to introduce myself, I am Ani Margawati as the first author of manuscript entitled *"*Correlation between Eating Behavior and Use of Social Media with Energy-Dense Food Intake Based on Gender among Students in Semarang, Indonesia". I would like to request you to consider the attached manuscript for publication in Open Access Macedonian Journal of Medical Sciences as an original article.

I believe that the findings of this study are relevant to the scope of your journal and will be of interest to its readership. This article based on our research which have been done in Semarang, Indonesia. Eating behavior and the use of social media are believed to affect the intake of energy-dense foods. There are differences in the results of the relationship between eating behavior and energy-dense food intake by gender in previous studies, and there is no research in Indonesia that links eating behavior and social media use with energy-dense food intake. This study aimed to determine the relationship between eating behavior and use of social media with energy-dense food intake in students by gender.

This manuscript has not been published or presented elsewhere in part or in entirety, and is not under consideration by another journal. All authors have approved the manuscript and agree with its submission to Open Access Macedonian Journal of Medical Sciences. Hopefully, this article can be accepted and be sources of public knowledge and sources of reading for researchers.

Thank you for your consideration of this manuscript.

Sincerely,

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Title : Correlation between Eating Behavior and Use of Social Media with Energy-Dense Food Intake Based on Gender among Students in Semarang, Indonesia

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Correlation between Eating Behavior and Use of Social Media with Energy-Dense Food Intake Based on Gender among Students in Semarang, Indonesia

Abstract

BACKGROUND: Eating behavior and the use of social media are believed to affect the intake of energy-dense foods. This study aimed to determine the relationship between eating behavior and use of social media with energy-dense food intake in students by gender.

METHODS: This study used a cross-sectional method. The subjects were 123 peoples from one of university in Semarang, Indonesia aged 18-24 years, taken using the consecutive sampling method. Energy-dense food intake was taken using the Semi-Quantitative Food Frequency Questionnaire, eating behavior was using the Dutch Eating Behavior Questionnaire and social media use was using the Scale of Effects of Social Media on Eating Behavior and self-identity questionnaire. Data were analyzed using Pearson's test, Spearman's rank test, and multiple linear regression.

RESULTS: The intake of energy-dense foods was higher in men than women. This study showed that there was a relationship between emotional eating ($p = 0.001$; $r = 0.408$), external eating ($p = 0.008$; $r = 0.338$), and eating behavior due to social media ($p = 0.001$; $r = 0.415$) and energy-dense food intake. in women, and duration of social media use ($p = 0.003$; $r = 0.377$) with energy-dense food intake in men. Gender and eating behavior due to social media had an effect of 24.9% on energy-dense food intake.

CONCLUSION: In women, emotional eating, external eating, and eating behavior due to social media were related to the intake of energy-dense foods. In men, the duration of social media use was related to the intake of energy-dense foods. Gender and eating behavior due to social media were the most influential variables on energy-dense food intake.

Keywords: energy-dense food, social-media, students

Introduction

Overweight and obesity are nutritional problems that currently occur in many communities. In Indonesia, based on 2018 Basic Health Research (Riset Kesehatan Dasar/Riskesdas), the prevalence of overweight was 13.6% and obesity was 21.8% in the age group over 18 years [1]. Overweight and obesity can cause various health problems, especially degenerative diseases such as cardiovascular disease and diabetes. mellitus. Weight gain is associated with unhealthy lifestyles such as excessive food intake which causes energy to enter beyond the body needs and low physical activity which results in little energy being released from the body [2].

One of the causes of energy intake exceeding the body needs is the result of consuming energy-dense foods, because the energy in these foods has a major contribution to the amount of energy that enters each day. Energy-dense foods are foods that have more than 225 calories of energy per 100 grams [3]. Energy-dense foods usually have high sugar, sodium, and saturated fat content, and are low in nutrients [4]. Energy-dense foods can be divided into sweet foods and non-sweet or savory foods [5]. Based on gender, there are differences in energy-dense food preferences, men tend to choose savory or salty foods, while women prefer sweet foods [6]. Several studies have shown that energy-dense food intake is associated with eating behavior, namely emotional, external, and restrained eating [3,7–9].

Emotional eating is a condition that occurs when there is an urge to eat due to negative emotions. The negative emotions that have been associated with emotional eating are depression, anxiety, anger, sadness, and stress [10–13]. Students are a group with high stress due to college assignments, exams, or time management that needs to be done. The stress experienced by these students can result in emotional eating [11]. When viewed by gender, women have a higher level of emotional eating than men. This could be because women have

higher stress levels [14]. Research has shown that high emotional eating causes high intake of energy-dense foods only in women [15].

Then there is external eating which is an increased desire to eat as a result of external influences such as the appearance or smell of certain foods [16]. Not only from food directly, external influences can also be indirectly through photos or food advertisements [17,18]. High exposure to food especially in the form of photos or videos of food, it often happens to students, one of which is the result of the many photos or videos of food that are spread on social media [19,20]. Compared to men, women have higher external eating scores [21]. This may be because women are more reactive to visual food stimuli as evidenced by increased brain activity in women when stimulated with food images [22]. External eating was found to be associated with sweet foods in one study of women and savory foods in another study with both men and women subjects [23,24].

Then there is restrained eating, namely eating behavior by limiting food intake [25]. In contrast to emotional and external eating, which are positively related to energy-dense food intake, restrained eating can result in decreased consumption of energy-dense foods, such as fast food and sweet foods [16,23]. However, a person with unsuccessful restrained eating may thwart his or her diet efforts and experience an increase in food intake when confronted with tempting foods, such as energy-dense foods [26,27]. Research has shown that university students score high on restrained eating, especially in adults. with excess nutritional status or people with negative body image [9]. Women are known to have higher restrained eating scores than men. This can be caused by the tendency of women to have a slimmer body so they choose to go on a diet to lose weight [25].

In addition to eating behavior, the use of social media may affect the intake of energy-dense foods. The use of social media is known to be associated with eating choices in several studies [20,28,29]. One of the what might cause this is the tendency of a person to follow what others are doing, including consuming energy-dense foods [30]. This is coupled with the high exposure to energy-dense foods on social media and the large number of food producers who use social media as a place to market their products [31,32]. In Indonesia, social media is the reason most people use the internet with the most internet users being the age group 15 – 24 years [33,34]. Social media is known to be associated with eating behavior. Research shows that excessive use of social media is related to emotional eating and restrained eating [35]. In addition, the presence of photos or videos of food on social media can be a trigger for someone to eat, especially for people with external eating because they have great attention to food cues [16].

There are differences in the results of the relationship between eating behavior and energy-dense food intake by gender in previous studies, and there is no research in Indonesia that links eating behavior and social media use with energy-dense food intake, researchers want to find out how the relationship between eating behavior and the use of social media with energy-dense food intake in Indonesian students and analyze the possible influence of gender on the relationship.

Methods

This research is included in the scope of community nutrition with a cross sectional research design. The research was conducted online in August until September 2021. The research subjects were 123 peoples based on the calculation of the minimum sample size with the correlative analytical formula. Subjects were taken using consecutive sampling method. The subjects of this study were students from one of university in Semarang, Indonesia aged 18 – 24 years who were in Semarang, Indonesia at the time of the study, had at least one social media account in the form of Instagram, Twitter, Facebook, Pinterest, or YouTube, opened

social media at least once a day, followed at least one account about food, not being sick or having been sick in the past month, and not resigning during the research process.

The dependent variable in this study was the intake of energy-dense foods in the last one month. The instrument used is the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) which contains a list of energy-dense foods with energy >225 kcal/100 grams. The analysis was carried out by adding up the total food consumed in grams/day, then grouped into total energy-dense foods, sweet energy-dense foods, and non-sweet energy-dense foods. total energy-dense foods are the overall energy-dense foods intake, sweet energy-dense foods are energy-dense foods that has a sweet taste, while non-sweet energy-dense foods is energy-dense foods that has a taste other than sweet, such as salty, savory, or spicy.

The independent variables in this study were eating behavior, use of social media, and gender. Eating behavior consists of emotional eating, external eating, and restrained eating. The questionnaire used to collect eating behavior data was the Dutch Eating Behavior Questionnaire (DEBQ) with a total of 32 questions [36]. Social media use was seen from eating behavior due to social media, frequency of use of social media, duration of use of social media, and number of social media. Eating behavior due to social media was taken using the Scale of Effects of Social Media on Eating Behavior (SESMEB) questionnaire with a total of 17 questions [37]. The frequency of social media use is the number of times the subject opens social media in one day. Duration of social media use was the number of hours to open social media in one day. The number of social media was the number of social media owned by the subject. These three things were taken through a self-identity questionnaire. DEBQ and SESMEB were questionnaires with a 5-point Likert scale, namely 1 (never) to 5 (always). Gender was divided into men and women which was taken through a self-identity questionnaire.

The confounding variables in this study were stress, body image, access to food, and economic status. Stress was taken with a Perceived Stress Scale (PSS) questionnaire with a total of 9 questions in the form of a 5-point Likert scale, namely (0) never to (4) always [38]. Stress categories were divided into mild (score 0-9), moderate (score 10 – 22), and weight (score 23 – 36). Body image was taken using the Body Shape Questionnaire 8C (BSQ 8C) questionnaire with a total of 8 questions in the form of a 6-point Likert scale, namely (1) never to (6) always [39]. Body image categories were divided into positive (score < 25) and negative (score ≥ 25). Access to food and economic status were taken from self-identity questionnaire. Access to food was divided into buying food and cooking by yourself, while economic status was the amount of income (Rupiah) for each subject in the last month that can be obtained from pocket money, salary, or other income.

Energy-dense foods intake data was collected through google meets or zoom with the help of a food photo book, while for all questionnaires through a google form. The results of the questionnaires were analyzed by calculating the average score for each question for DEBQ and calculating the total score for each question for SESMEB, PSS, and BSQ8C. Before starting the study, the validity and reliability of the DEBQ, SESMEB, PSS, and BSQ 8C questionnaires were tested on 44 students outside the research university held with the same criteria as the subjects of this study. The results of the test are emotional eating, external eating, and BSQ 8C questionnaires that get cronbach alpha values of 0.916, 0.819, and 0.910, respectively. Meanwhile, the restrained eating questionnaires, SESMEB, and PSS were reduced by one question each and got Cronbach's alpha values of 0.946, 0.906, and 0.784.

Data were tabulated with a computer program and analyzed using SPSS. Univariate analysis was conducted to determine the characteristics and describe the data. Independent T Test, Mann Whitney and Chi Square were used to analyze differences based on gender [15]. Bivariate analysis was used to determine the relationship between variables. Previously, the normality of the data was tested using Kolmogorov Smirnov. Pearson correlation test was used

to analyze the variables of emotional eating, external eating, restrained eating, eating behavior due to social media, and stress with total energy-dense foods and non-sweet energy-dense foods in women. In addition to these variables, the correlation test was using spearman rank. Multivariate analysis was used to determine the predictor variables of energy-dense foods intake using multiple linear regression tests on all subjects. The research was received ethical approval for conducting research from the Medical/Health Research Bioethics Commission, Faculty of Medicine, Sultan Agung Islamic University, Semarang, Indonesia with letter number 198/VII/2021/Bioethics Commission.

Results

Table 1. Characteristics of subjects

Variable	Total (n=123)			Men(n=62)			Women (n=61)			*p*
	n	%	Mean±SD	n	%	Mean±SD	n	%	Mean±SD	
Age (years)			21.37±1.04			20.81±3.97			21.23±0.99	0.041*b
BMI (kg/m^2)			22.85±4.62			23.72±4.79			21.97±4.29	0.007*b
Food access										0.026*c
Buying food	41	33.3		27	43.5		14	23		
Cooking by yourself	82	66.7		35	56.5		47	77		
Economic Status (Rupiah)			999,39±712,08			1048.39±719.86			949.59±706.52	0.448b
Energy-dense food intake (grams/day)										
Total			251.85±123.23			303.77±131.59			199.08±87.48	0.001*b
Sweet			68.11±47.13			80.37±51.25			55.65±39.14	0.002*b
Non sweet			184.71±94.79			225.21±100.46			143.53±67.76	0.001*b
Eating behaviour (score)										
Emotional eating			2.46±0.67			1.32±0.71			2.60±0.60	0.027*b
External eating			3.27±0.52			3.27±0.54			3.27±0.50	0.990a
Restraint eating			2.43±0.95			2.44±0.99			2.43±0.92	0.956b
Use of social media										
Eating behaviour due to social media (score)			38.03±9.01			37.39±9.25			38.69±8.79	0.426a
Frequency of social media use (times/day)			11.17±11.62			15.02±14.52			7.26±5.42	0.001*b
Duration of social media use (hours/day)			4.07±2.84			4.30±3.01			3.84±2.66	0.514b
Number of social media (pieces)			3.24±1.28			3.18±1.31			3.31±1.26	0.629b
Stress (score)			17.64±5.69			16.81±5.64			18.49±5.67	0.063b
Light	10	8.1		7	11.3		3	4.9		
Currently	93	75.6		49	79		44	72.1		
Heavy	20	16.3		6	9.7		14	23		
Body image (score)						26.06±9.01			24.67±8.34	0.376a
Positive	59	48		29	46.8		30	49.2		
Negative	64	52		33	53.2		31	50.8		

Description: the difference test between men and women

[a] = Independent T test; [b] = Mann Whitney U test; [c] = Chi Square test; * = p<0.0

Characteristics of research subjects based on gender are listed in the table 1. The subjects of this study were 123 people with 62 men (50.4%) and 61 women (49.6%). The BMI of male subjects was 23.72 ± 4.79kg/m^2, different from that of women, which was 21.97 ± 4.29 kg/m^2. In access to food, there are differences between men and women. Compared to women (23%), more men buy food (43.5%). The average economic status seen from monthly income was IDR 999,390 ± 712,077. There was a difference in total energy-dense food between men and women. Men had a total energy-dense food of 303.77±131.59 grams/day, bigger than women (199.08 ± 87.48 grams/day). Both men and women, consumed more non-sweet energy-dense food than sweet energy-dense food. There was a difference in emotional eating between men and women. Women had a score of 2.60 ± 0.60, higher than the male (2.32 ± 0.71). There

was no difference between external eating, restrained eating, stress, and body image between gender. Subjects had a social media eating behavior score of 38.03±9.01. The frequency of using social media for men was 15.02 ± 14.52 times/day, greater than women (7.26 ± 5.42 times/day). For the duration of using social media, the subjects spent an average of 4.07 ± 2.84 hours per day.

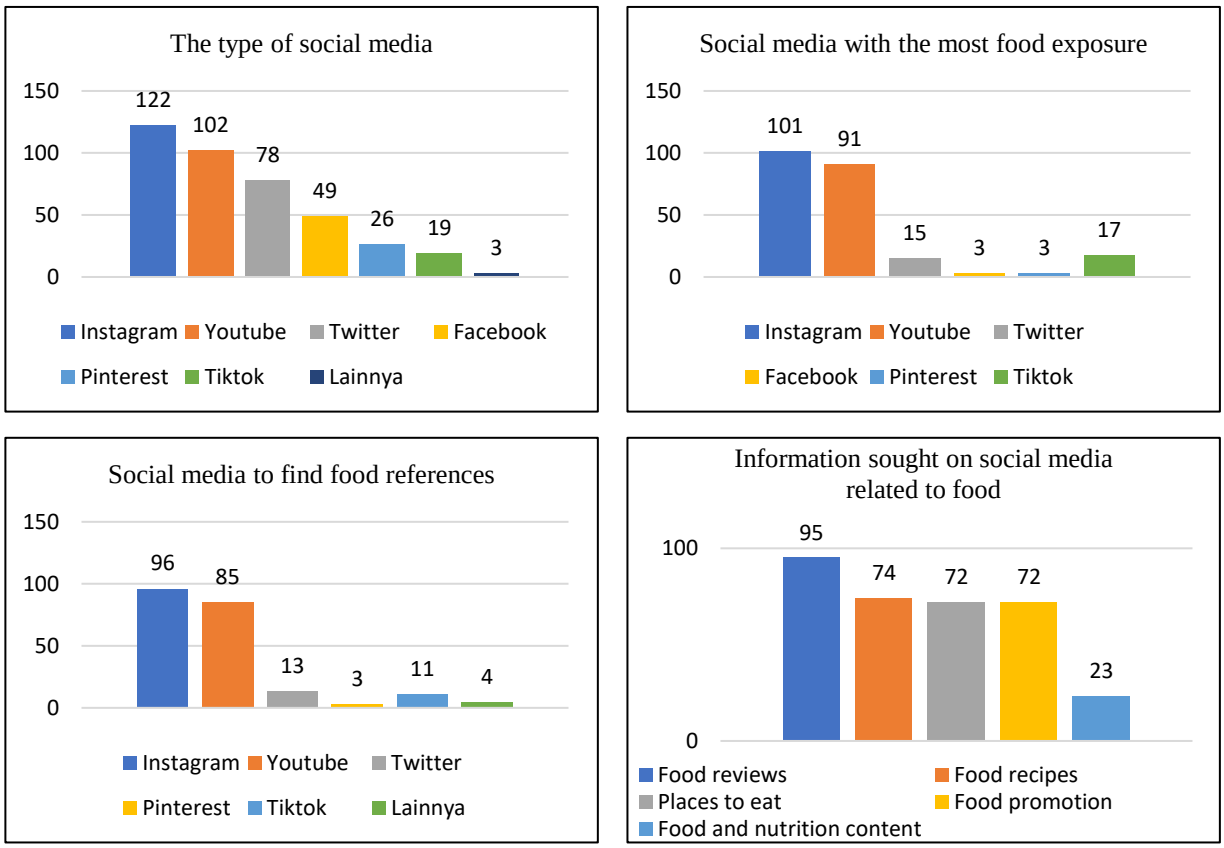

Figure 1. Overview of social media use among subjects

An overview of social media use was shown in Figure 1. Instagram was the most widely owned social media by subjects (99%). Instagram was also the social media that is considered to have the most exposure to food content (82%) and used by 78% of the subjects to search for food references. Food-related things that are often searched on social media were food reviews (77%), food recipes (60%), places to eat (58%), food promotions (58%) and food and its nutritional content (19%).

Table 2. Bivariate analysis in total subjects

Variable	Energy-Dense Food					
	Total		Sweet		Non-Sweet	
	r	*p*	*r*	*p*	*r*	*p*
Emotional eating	0.108	0.235	0.013	0.887	0.130	0.152
External eating	**0.254**	**0.005****	0.164	0.070	**0.218**	**0.016***
Restraint eating	-0.082	0.369	-0.084	0.356	-0.051	0.578
Eating behavior due to social media	**0.241**	**0.007****	0.093	0.307	**0.245**	**0.006****
Frequency of social media use	**0.202**	**0.025***	0.079	0.386	**0.224**	**0.013***
Duration of social media use	**0.208**	**0.021***	0.083	0.363	**0.199**	**0.028***
Number of social media	0.111	0.221	**0.185**	**0.040***	0.029	0.748
Stress	0.081	0.376	0.084	0.356	0.039	0.669
Body Image	0.103	0.256	-0.072	0.426	0.129	0.155
Economic status	0.017	0.848	-0.013	0.887	0.029	0.753

Food Access	-0.108	0.233	0.057	0.529	-0.152	0.093

Spearman rank correlation test * = $p < 0.05$ ** = $p < 0.01$

The results of the bivariate analysis on the total subjects are presented in table 2. Table 2 shows external eating, eating behavior due to social media, frequency of social media use, and duration of social media use have a relationship with total intake of energy-dense food and non-sweet energy-dense food. A positive relationship indicates that the higher the external eating score and eating behavior due to social media, the more frequent the use of social media, and the longer the duration of social media use, the higher the total intake of energy-dense food and non-sweet energy-dense food. In addition, the number of social media has a relationship with sweet energy-dense food. A positive relationship indicates the more social media you have, the higher the sweet energy-dense food intake will be. The r value of 0 - 0.20 indicates that the relationship between variables is very weak, while the r value of 0.21 - 0.40 is weak.

Table 3. Bivariate analysis in men subjects

Variable	Energy-Dense Food					
	Total		Sweet		Non-Sweet	
	r	*p*	*r*	*p*	*r*	*p*
Emotional eating	0.077	0.550	-0.037	0.773	0.129	0.317
external eating	0.172	0.180	0.105	0.418	0.113	0.382
Restraint eating	-0.068	0.601	-0.204	0.111	0.033	0.800
Eating behavior due to social media	0.151	0.240	0.003	0.982	0.187	0.145
Frequency of using social media	0.095	0.464	-0.033	0.799	0.135	0.297
Duration of use of social media	**0.377**	**0.003****	0.181	0.160	**0.380**	**0.002****
Number of social media	0.079	0.540	0.099	0.443	0.077	0.552
Stress	0.230	0.073	0.126	0.330	0.218	0.089
Body Image	0.035	0.787	-0.223	0.081	0.116	0.368
Economic status	0.108	0.402	-0.102	0.431	0.196	0.126
Food Access	-0.010	0.939	0.244	0.055	-0.135	0.294

Spearman rank correlation test * = $p < 0.05$; ** = $p < 0.01$

The results of the bivariate analysis for men are presented in table 3. For men, it was found that there was a relationship between duration of social media use with total energy-dense food and non-sweet energy-dense food. A positive relationship indicates the higher the duration of social media use, the higher the total intake of energy-dense food and non-sweet energy-dense food in men. The r value of 0.21 - 0.40 indicates that the relationship between variables is weak.

Table 4. Bivariate analysis in women subjects

Variable	Energy-Dense Food					
	Total		Sweet		Non-Sweet	
	r	p	r	p	r	p
Emotional eating	0.408	0.001**[a]	0.190	0.143[b]	0.422	0.001**[a]
external eating	0.338	0.008**[a]	0.250	0.052[b]	0.323	0.011*[a]
Restraint eating	-0.145	0.265[a]	0.024	0.855[b]	-0.226	0.080[a]
Eating behavior due to social media	0.415	0.001**[a]	0.224	0.083[b]	0.408	0.001**[a]
Frequency of using social media	0.107	0.413[b]	0.039	0.764[b]	0.089	0.494[b]
Duration of use of social media	0.027	0.838[b]	-0.043	0.745[b]	0.029	0.826[b]
Number of social media	0.029	0.823[b]	0.162	0.211[b]	-0.110	0.401[b]
Stress	0.081	0.536[a]	0.123	0.347[b]	-0.008	0.951[a]
Body Image	0.121	0.352[b]	0.032	0.807[b]	0.084	0.520[b]
Economic status	-0.131	0.316[b]	0.025	0.850[b]	-0.210	0.104[b]
Food Access	0.018	0.892[b]	0.009	0.946[b]	0.053	0.684[b]

[a] = Pearson correlation test; [b] = Spearman rank correlation test; * = $p < 0.05$; ** = $p < 0.01$

The results of the bivariate analysis on women are presented in table 4. In women, there was a relationship between emotional eating, external eating, and eating behavior due to social media with the total intake of energy-dense food and non-sweet energy-dense food. A positive relationship indicates the higher the score for emotional eating, external eating and eating behavior due to social media, the higher the total intake of energy-dense food and non-sweet energy-dense food in women. The r value of 0.21 - 0.40 indicates that the relationship between variables is weak, while the r value of 0.41 - 0.60 is sufficient.

Table 5. Multivariate analysis on energy-dense food intake

Variable	Energy-Dense Food							
	Total				Non-Sweet			
	Beta (Standardized Coefficients)	*P*	constant	Adjusted R Square	Beta (Standardized Coefficients)	*p*	constant	Adjusted R Square
Gender	3.643	0.001			3.368	0.001		
Eating behaviour due to social media	0.959	0.024	3.665	0.249	0.861	0.022	2.187	0.268
Emotional eating					2.587	0.045		

Multiple linear regression analysis test, significant if $p < 0.05$

Based on the bivariate results on the total subjects, the variable with $p < 0.25$ was included in the multivariate test (table 5). In the total energy-dense food multivariate analysis, the variables included are gender, emotional eating, external eating, eating behavior due to social media, frequency of use of social media, duration of use of social media, number of social media, and access to food. The results of the analysis shows that gender and eating behavior due to social media are predictors of total energy-dense food by 24.9%. Men have a total energy-dense food intake of 3.643 grams greater than women, and every one point of increase in eating behavior score due to social media will increase the total energy-dense food intake by 0.959 grams.

In the multivariate analysis of non-sweet energy-dense food, the variables included are gender, emotional eating, external eating, eating behavior due to social media, frequency of use of social media, duration of use of social media, body image, and access to food (table 5). The results of the analysis showed that gender, eating behavior due to social media, and emotional eating were predictors of non-sweet energy-dense food by 26.8%. Men have a non-sweet energy-dense food intake which is 3.368 grams greater than women, every one point of increase in eating behavior score due to social media will increase non-sweet energy-dense food intake by 0.861 grams, and every one point of increase in emotional eating score will increase non-sweet energy-dense food intake by 0.861 grams. 2,587 grams.

Discussion

This study shows that men have a higher energy-dense food intake than women. This study was in line with research conducted in China [15]. Men have a higher food intake than women because men have greater energy requirements as a result of their larger body size and higher metabolic rate. In addition, men have a tendency to eat fatty foods or salty foods, while women prefer vegetables or fruit [40]. The same thing was revealed by another study which stated that men tend to eat more fast food than women because women are more likely to eat fast food. practice healthy eating habits than men [41]. This study also revealed that the intake of non-sweet foods was higher than the intake of sweet foods. This study was in line with previous research which shown the average of sensory liking scores were higher for salt (3.77) and fat (3.79) than sweet (3.73) in non-obese adult group [42]. However, Basic Health Research/Riskesdas in 2018 showed that 37.8% of subjects aged 20-24 years consumed sweet

foods ≥ one times per day, lower than the consumption of fatty foods (41.8%) but higher than consumption of salty foods (30.2%) [1].

The results of this study showed there was a relationship between eating behavior and energy-dense food intake. Emotional eating was related to total energy-dense food intake and not sweet energy-dense food only in women. This study was in line with research conducted in China which showed that the relationship between emotional eating and intake of energy-dense foods was only found in women [15]. This study was also in line with research conducted in the Netherlands, where no relationship was found between emotional eating and intake of sweet foods [24]. However, the results of this study was contradict with other studies which stated that emotional eating is associated with the intake of sweet and non-sweet foods in both sexes [5,7]. Emotional eating is known to cause higher energy-dense food intake because energy-dense food usually contains fat high and added sugar so it has a high palatability. Eating foods with high palatability can reduce negative mood in a short time [7]. Consuming energy-dense food can also decrease the endocrine stress response by influencing hypothalamic-pituitary-adrenal axis, which characterized by low cortisol levels. In addition, eating foods with high carbohydrate and low protein content can increase the level of tryptophan in the blood that will result in increased activity of the serotonergic brain system. Serotonin is a neurotransmitter associated with mood [43]. The relationship between emotional eating and energy-dense food only found in women and not in men, could be because women tend to consume energy-dense food in response to emotions [15]. Research before showed the difference scores in emotional eating between gender with women have higher emotional eating values than men [7,15].

This study showed that external eating was related to total energy-dense food and non-sweet energy-dense food. This study was in line with a study in the Netherlands which found an association between external eating and intake of non-sweet foods and not with intake of sweet foods [24]. However, this study was not in line with other studies that have found an association between external eating and intake of sweet foods and did not find an association with intake of non-sweet foods in female subjects [23]. External eating was associated with a greater attentional bias towards food cues [17]. When compared with low-energy foods, energy-dense food was rated as more attention-grabbing due to greater activation of reward pathways in the brain when exposed to energy-dense food [44]. When viewed by gender, the relationship between external eating and energy-dense food intake was only found in women. Women are more reactive to visual food stimuli as evidenced by increased brain activity in women when stimulated with food images [22]. A study also stated that although there was no difference in external eating scores between men and women, the relationship between external eating and eye movements are found in women only. The study found that the higher the external eating level, the more often women were fixated on sugary, high-calorie foods [45].

In this study, there was no relationship between restrained eating and energy-dense food intake for both men and women. This was not in line with research in the Netherlands which showed restrained eating was negatively associated with intake of sweet foods [24]. This difference in results could be due to differences in nutritional status, where in this study the subjects had normal nutritional status, whereas in the Dutch study the subjects had excess nutritional status. People with overweight nutritional status have a higher tendency to restrict eating [9]. In addition, people with nutritional status are more likely to have higher restrained eating scores [46]. People with successfully engage in restrained eating will have lower energy-dense food intakes, whereas people with not succeed in restrained eating will frustrate their diet efforts when dealing with tempting foods such as energy-dense food. The success of restrained eating depends on self-control. A person with a higher level of self-control is more likely to succeed in restrained eating. When dealing with energy-dense food, people with restrained eating and good self-control will be able to resist the food [26].

This study found a relationship between eating behavior due to social media, frequency of social media use, and duration of social media use with a total of energy-dense food and non-sweet energy-dense food and the number of social media with a sweet energy-dense food. Research in America showed that using social media can affect eating choices, increase the desire to eat even though they are not hungry, cause a person to not be aware of time so that mealtimes can be missed which then ends up eating easy-to-eat foods such as fast food and playing social media while eating can also lead to more food intake because they are not aware of the amount of food consumed [20]. The use of social media can influence eating choices due to product marketing or the influence of other social media users. Social media is an ideal medium used by food producers to interact with young adults. Social media allows an advertisement to be more easily spread to reach more consumers [47]. Endorsement is one of the marketing strategies that is currently being carried out by many food producers, including food producers [48]. In addition, the marketing of a product is also indirectly assisted by most young adults because of their habit of using social media to show the foods they consume [47]. Young adults reveal that they pay more attention and are motivated to make purchases of products recommended by their friends on social media [49]. The use of social media can affect energy-dense food intake due to the large amount of energy-dense food exposure on social media. A study revealed that 75% of the food shared by students on social media is unhealthy food [31]. Unhealthy food advertisements in social media are easier to remember and celebrities are more likely to promote unhealthy foods will increase eating preferences for these foods [50].

The relationship between the frequency and duration of social media use with a total energy-dense food and non-sweet energy-dense food can be caused by the use of social media with a more frequent frequency and a longer duration will increase the possibility of being exposed to photos and food advertisements more. A study revealed that the longer and more frequent exposure to food advertisements causes the advertisements to be easier to remember so that the tendency to consume these foods will increase [50]. Research in Semarang also revealed that the duration of exposure to food content on social media will affect eating choices, but the relationship between frequency of exposure and dietary preferences were not found in this study [28]. Other studies have also found an association of high duration of social media use with unbalanced food intake. The study also revealed that the subjects often consumed sweet, salty, and fatty foods. The study also found a relationship between the number of social media they had and their sweet energy-dense food [51].

When viewed by gender, the relationship between eating behavior due to social media with total energy-dense food and non-sweet energy-dense food was only found in women. One of the reasons that could cause this is that women are more likely to be influenced by social influences than men [52]. Whereas, the relationship between duration of social media use with total energy-dense food and non-sweet energy-dense food was only found in men could be due to men have a higher average duration of social media use than women. In this study, it was also found that Instagram was the most widely used social media by subjects. Instagram is a photo-based social media, this causes Instagram to be considered easier to use because it allows users to use a little effort to think [49]. On Instagram, many uploads are found about food, one of the hashtags, namely #foodporn, around 71 million uploads in 2015 [47].

The multivariate test showed that gender and eating behavior due to social media were the biggest predictors of total energy-dense food. In addition, gender, eating behavior due to social media, and emotional eating were the biggest predictors of non-sweet energy-dense food. Gender was a predictor because there was a significant difference in energy-dense food intake between men and women, with men having more energy-dense food intake.

Conclusions

In women, it was found that there was a relationship between emotional eating, external eating, and eating behavior due to social media with total energy-dense food and energy-dense food was not sweet. In men, it was found that the relationship between the duration of social media use and the total energy-dense food and energy-dense food was not sweet. Gender and eating behavior due to social media were the biggest predictors of total energy-dense food. In addition, gender, eating behavior due to social media, and emotional eating were the biggest predictors of non-sweet energy-dense food.

Efforts are needed to reduce energy-dense food intake by increasing self-control, learning to manage emotions, avoiding places filled with food, and reducing the use of social media or limiting viewing food content on social media for women and limiting the duration of social media use for men. Paying attention to energy-dense food intake from a young age is important to avoid various non-communicable diseases in the future such as diabetes, hypertension, heart disease and others.

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2. Review dan Revisi Artikel

Gmail Ani Margawati <animargawati@gmail.com>

[OAMJMS] Editor Decision
5 messages

Assoc. Prof. Dr Sasho Stoleski, MD, PhD via SFS - Journals (Scientific Foundation SPIROSKI - Journals), Skopje, Republic of Macedonia <noreply@publicknowledgeproject.org> Sat, Mar 26, 2022 at 3:31 AM
Reply-To: "Assoc. Prof. Dr Sasho Stoleski, MD, PhD" <sstoleski@yahoo.com>
To: Anisah Septiani Muthia <anisahseptianim@gmail.com>, Ani Margawati <animargawati@gmail.com>, Deny Yudi Fitranti <denyyudi@gmail.com>, Fillah Fithra Dieny <fillahdieny@gmail.com>, Annisa Hananingtyas <annisahana29@gmail.com>

Anisah Septiani Muthia, Ani Margawati, Deny Yudi Fitranti, Fillah Fithra Dieny, Annisa Hananingtyas (Author):

We have reached a decision regarding your submission to Open Access Macedonian Journal of Medical Sciences, "Correlation between Eating Behavior and Use of Social Media with Energy-Dense Food Intake Based on Gender among Students in Semarang, Indonesia", Manuscript ID = OJS9289.

Our decision is to:

Sasho Stoleski

Reviewer A:

/

Recommendation: Accept Submission

Assoc. Prof. Dr Sasho Stoleski, MD, PhD via SFS - Journals (Scientific Foundation SPIROSKI - Journals), Skopje, Republic of Macedonia <noreply@publicknowledgeproject.org> Sat, Mar 26, 2022 at 3:37 AM
Reply-To: "Assoc. Prof. Dr Sasho Stoleski, MD, PhD" <sstoleski@yahoo.com>
To: Ani Margawati <animargawati@gmail.com>, Ahmad Syauqy <syauqy@fk.undip.ac.id>, Aras Utami <aras.utami@gmail.com>, Annisa Hananingtyas <annisahana29@gmail.com>

Ani Margawati, Ahmad Syauqy, Aras Utami, Annisa Hananingtyas (Author):

We have reached a decision regarding your submission to Open Access Macedonian Journal of Medical Sciences, "Prevalence of Anemia and Associated Risk Factors among Pregnant Women in Semarang, Indonesia during COVID-19 Pandemic", Manuscript ID = OJS9332.

Our decision is: Revisions Required

Sincarely,

Prof. Dr Mirko Spiroski,
Editor-in-Chief, OAMJMS

Sasho Stoleski

Reviewer A:

/

Recommendation: Accept Submission

Reviewer B:

Thank you for the opportunity to read and review the article. The topic addresses important public health issue. This article is evidence for increased need of social and health policy for anemic women in our country and your work should be acknowledged.

Few considerations by me: 1. Estimation of a prevalence requires strict methodology - cluster sampling is perfect way but should be explain in detail (Did you have a full list of all pregnant women based on which this sampling was done?). I recommend adjusting the 95CI based on the sampling technique and to report the prevalence together with the confidence interval).

1. Risk factor cannot be assessed directly with that cross - sectional study. That's also true for a protective factor ("inadequate calcium intake (p = 0.043) was a protective factor"- **there is not enough statistical and scientifical evidence to report that**). Cross-sectional studies are known to be confounded - and adjusting for some of millions confounding factors doesn't mean that relationships is causal). I recommend using **a propensity score matching** as good opportunity to deal with that. Try to use "the factor is associated" rather than "courses, increases or decreases the outcome" unless you're ready to prove a causal relationship.
2. Try to avoid repetitive sentences or phrases in the introduction.

In nutshell the researched done has more strength that limitation. After a mild revision this article should be published.

Recommendation: Revisions Required

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Prevalence of Anemia and Associated Risk Factors among Pregnant Women in Semarang, Indonesia during COVID-19 Pandemic

Abstract

BACKGROUND: Anemia is a blood disorder that often occurs in people throughout the world and can threaten the safety of the mother and child. Corona Virus Disease-2019 (COVID-19) pandemic causing various adjustments that can affect human health status, including anemia in pregnant women.

AIM: This study aimed to assess the prevalence of anemia and identify the factors associated with anemia in pregnant women during COVID-19 pandemic.

METHODS: A cross-sectional study was carried out among 238 pregnant women from 2 districts in Semarang, Central Java, Indonesia. Population in this study was chosen with cluster sampling technique. Data was collected by interview and anthropometric measurements by trained enumerators and taking hemoglobin levels by trained nurses during Antenatal Care (ANC) visits.

RESULTS: Among participants, 34 (14.3%) were anemic, 32.3% had moderate anemia and 67.6% had mild anemia. The prevalence of anemia increased significantly with less obedient of ANC compliance ($p = 0.020$), excessive phosphorus intake ($p = 0.039$) and inadequate zinc intake ($p = 0.003$). On the other hand, inadequate calcium intake ($p = 0.043$) was a protective factor for anemia among pregnant women.

CONCLUSIONS: In Semarang, Indonesia, anemia among pregnant women was a mild public health problem. Less obedient of ANC compliance, excessive phosphorus intake, and inadequate zinc intake were found to be significantly associated with anemia among pregnant women during COVID-19 pandemic

Keywords: anemia, corona, hemoglobin, pregnancy, risk factors

Introduction

Anemia in pregnant women is a problem that occurs throughout the world, both in developing and developed countries. Anemia among pregnant women is a serious problem because it can threaten the safety of the mother and the fetus. Anemia in pregnant women is associated with morbidity, mortality, poor birth outcomes and impaired development in children. Maintaining hemoglobin levels in pregnant women is an important component to improve the health status of the mother and fetus [1,2].

Chaparro, in his study, estimated that around 32.9% of the world's population is anemic. Population groups that are vulnerable to anemia are children under five years, infants and children under two years, women of productive age, and pregnant women [2]. World Health Organization (WHO) in 2011 showed that 29% of women of childbearing age and 38% of pregnant women aged 15-29 years in the world experience anemia [3]. Meanwhile, in Indonesia, based on data from the Basic Health Research in 2018, 48.9% of pregnant women were anemia [4].

Reducing the high prevalence of anemia among pregnant women in developing countries is still be the priority, including Indonesia. WHO has set a global target to a 50% reduction of anemia prevalence among women of reproductive age in 2025. In response to this, Indonesian government has made programs to reduce anemia, such as the blood-supplementing tablets [5].However, the current Corona Virus Disease-2019 (COVID-19) pandemic is causing various social changes and new adjustments that can affect human health status, including anemia and sustainability of health programs [6].

Indonesian government was made social restriction regulations to reduce the number of COVID-19 spreads. The implementation of social restriction policies negatively impacts the number of workers who have lost their jobs and have affected the family economy [6].Pregnant

women with a low family economy have a risk to decreasing their ability to buy healthy food, increasing food insecurities, uncertainty about work in the long term, and decreasing in activities [7].Moreover, previous research was stated that there was a decrease in the administration of blood-supplementing tablets to reduce anemia in the period from February to April 2020 [8].

Several developing countries in Asia have shown various increases in anemia as disruptions in food supply systems and economic activity during the COVID-19 pandemic [9].This various increased implies the importance of conducting a local survey on the distribution of anemia in pregnant women and identifying risk factors to evaluate the implementation of anemia prevention and control programs during the COVID-19 pandemic. Based on the description above, the aim of this research is to assess the prevalence of anemia and to identify the factors associated with anemia in pregnant women during the COVID-19 pandemic.

Methods

Participants

An observational method with a cross-sectional study was carried out among pregnant women living in 2 districts in Semarang, Central Java, Indonesia. Data collection was conducted at the health facility during Ante Natal Care (ANC) visit. Sampling was carried out with a cluster sampling technique. Based on the calculation of the minimum sample using the Lemeshow formula 1997, and the minimum sample size is 216 pregnant women [10]. All of the subjects were willing to participate in this study by signed written informed consent.

Data collection

Research preparation was carried out by visiting the public health center and meeting with the head of the targeted public health center to request approval for research participation. The researcher introduces the research objectives, shows a research proposal, a letter of assignment to carry out the research, and ethical approval. Data were collected through face-to-face interviews and anthropometric measurements by 13 trained enumerators on pregnant women with cautions to avoid bias. The interviews were conducted in private by applying health protocols related to COVID-19 and took about 15 minutes. Other data, laboratory examination data, namely hemoglobin, were taken by trained nurses.

Research instruments

Each participant was interviewed to fill out a structured questionnaire to meet the research objectives. The questionnaires were consisted of 4 sections. The first section was to examine sociodemographic factors. Based on age, research participants were categorized into pregnancy in young age (<20 years), safe gestational age (20 – 35 years), and older age (>35 years) [11]. Total incomes were categorized as low (under minimum wage of city) and sufficient (above or equal minimum wage of city) [12]. Research participants with Elementary School or Junior High School educational levels were categorized as low education and Senior High School or higher educational levels were categorized as moderate education [13].

The second section included obstetric status. Subjects were categorized into obedient to ANC visits if at least one time in the first trimester, one time in the second trimester, and two times in the third trimester [14]. Gestational ages were categorized as first and second trimester (≤28 weeks) and third trimester (>29 weeks) [15].

The third section included medical status. The Hamilton Rating Scale for Anxiety (HRSA) form was used as an instrument to determine the subject's level of anxiety which had been tested for validity and reliability in the Indonesian version. The anxiety questionnaire consisted of 14 questions with a range value of 0 (not experiencing), 1 (mild), 2 (moderate), 3 (severe), and 4 (very severe). The total score obtained was 0 until 56.[16] Anxiety levels were measured into mild anxiety (score ≤17), mild to moderate anxiety (score 18 – 24), moderate to

severe anxiety (score ≥25) [16]. Nutritional status was measured using the Mid-Upper Arm Circumference (MUAC) band. MUAC values <23,5 cm are categorized as malnutrition, and MUAC values ≥23.5 cm are categorized as normal nutrition status [17].

In the last section of the questionnaire, nutritional factors were collected. The nutrition knowledge consisted of 10 questions which have been tested for validity and reliability [18]. Research participants with scores > 60 were categorized as having good knowledge [19]. Adequacy of food intakes were measured using the form of the Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) and categorized it as inadequate (<90%), adequate (90 – 119%), and excessive (≥120%) [20].

Hemoglobin levels in pregnant women were measured by hemocue method. Subject blood samples were taken using a pipette and microcuvette. Each microcuvette was inserted into the hemocue to get the hemoglobin levels. We classified hemoglobin levels as low (<11 gr/dL) and normal (≥ 11 gr/dL) [21]. Anemia severity was considered for mild (10 – 10.9 gr/dL), moderate (7 – 9.9 gr/dL) and severe (< 7 gr/dL) [22].

Statistical analysis

All statistical analyses were performed using SPSS 24 (IBM Corp., Armonk, NY, USA). Categorical variables are presented as a number (percentage) for all subjects between anemic and non-anemic participants. Univariate and multivariate analysis was performed using a logistic regression test to estimate the factors associated with anemia in pregnant women during the COVID-19 pandemic. Pregnant women with proven anemia status based on hemoglobin levels were tested against predictor variables thought to be associated with anemia as categorized into 4 domains, namely sociodemographic, obstetric status, medical status and nutritional factors. Four multivariate adjusted logistic regression models were approached to capture the independent predictor variables associated with anemia in pregnant women in each domain. An overall model that combines the four models was also carried out. Variables from the final model were determined using a stepwise backward removal method, removing variables with p-values above 0.25 until an adequate model was reached. Odds ratio (OR) and 95% confidence interval (CI) were calculated for the predictor variables in the analysis. All statistical tests were two-sided, and the value of $p \leq 0.05$ was considered statistically significant.

Ethical considerations

The protocol was approved by ethical committee of the Medical Faculty Universitas Sultan Agung Semarang, Indonesia number 308/IX/2020/*KomisiBioetik*. All participants were agreed to participate in this study by signed written informed consent.

Results

Table 1. Characteristics of subjects

Variable	Frequency n = 238 (100)	Hemoglobin Levels	
		Low n = 34 (14.3)	Normal n = 204 (85.7)
Sociodemographic			
Age			
>35 years old	36 (15.1)	4 (11.8)	32 (15.7)
20-35 years old	198 (83.2)	29 (85.3)	169 (82.8)
<20 years old	4 (1.7)	1 (2.9)	3 (1.5)
Total income			
Sufficient (≥ minimum wage of the city)	151 (63.5)	23 (67.7)	128 (62.7)
Low (< minimum wage of the city)	87 (36.5)	11 (32.4)	76 (37.3)
Education			
Moderate (Senior High School – S2)	189 (79.4)	28 (82.4)	161 (78.9)
Low (Elementary School – Junior High School)	49 (20.6)	6 (17.6)	43 (21.1)
Obstetric status			

ANC compliance			
Quite obedient	225 (94.5)	29 (85.3)	196 (96.1)
Less obedient	13 (5.5)	5 (14.7)	8 (3.9)
Gestational age			
1st and 2nd trimester (≤ 28 weeks)	144 (60.5)	17 (50.0)	127 (62.3)
3rd trimester (>29 weeks)	94 (39.5)	17 (50.0)	77 (37.7)
Medical status			
Anxiety			
Mild anxiety (score ≤ 17)	190 (79.8)	23 (67.7)	167 (81.9)
Mild to moderate anxiety (score 18 – 24)	36 (15.1)	8 (23.5)	28 (13.7)
Moderate to severe anxiety (score ≥ 25)	12 (5.1)	3 (8.8)	9 (4.4)
MUAC			
Normal (≥ 23.5 cm)	202 (84.9)	30 (88.2)	172 (84.3)
Malnutrition (< 23.5 cm)	36 (15.1)	4 (11.8)	32 (15.7)
Nutritional factors			
Nutritional knowledge			
Good (score > 60)	228 (95.8)	33 (97.1)	195 (95.6)
Low (score ≤ 60)	10 (4.2)	1 (2.9)	9 (4.4)
Calory intake			
Excessive (≥120%)	68 (28.6)	9 (26.5)	59 (28.9)
Adequate (90 - 119%)	84 (35.3)	15 (44.1)	69 (33.8)
Inadequate (<90 %)	86 (36.1)	10 (29.4)	76 (37.3)
Protein intake			
Excessive (≥120%)	25 (10.5)	2 (5.9)	23 (11.3)
Adequate (90 - 119%)	54 (22.7)	10 (29.4)	44 (21.6)
Inadequate (<90 %)	159 (66.8)	22 (64.7)	137 (67.1)
Fat intake			
Excessive (≥120%).	78 (32.8)	13 (38.2)	65 (31.9)
Adequate (90 - 119%)	74 (31.1)	11 (32.4)	63 (30.9)
Inadequate (<90 %)	86 (36.1)	10 (29.4)	76 (37.2)
Vitamin C intake			
Excessive (≥120%).	157 (66.0)	23 (67.6)	134 (65.7)
Adequate (90 - 119%)	27 (11.3)	2 (5.9)	25 (12.2)
Inadequate (<90 %)	54 (22.7)	9 (26.5)	45 (22.1)
Calcium intake			
Excessive (≥120%).	12 (5.0)	2 (5.9)	10 (4.9)
Adequate (90 - 119%)	27 (11.4)	6 (17.6)	21 (10.3)
Inadequate (<90 %)	199 (83.6)	26 (76.5)	173 (84.8)
Phosphorus intake			
Excessive (≥120%).	186 (78.2)	32 (94.2)	154 (75.5)
Adequate (90 - 119%)	35 (14.7)	1 (2.9)	34 (16.7)
Inadequate (<90 %)	17 (7.1)	1 (2.9)	16 (7.8)
Magnesium intake			
Excessive (≥120%).	90 (37.8)	15 (44.1)	75 (36.7)
Adequate (90 - 119%)	68 (28.6)	13 (38.2)	55 (27.0)
Inadequate (<90 %)	80 (33.6)	6 (17.7)	74 (36.3)
Iron intake			
Excessive (≥120%).	6 (2.5)	2 (5.9)	4 (2.0)
Adequate (90 - 119%)	36 (15.1)	6 (17.6)	30 (14.7)
Inadequate (<90 %)	196 (82.4)	26 (76.5)	170 (83.3)
Zinc intake			
Excessive (≥120%).	12 (5.1)	1 (2.9)	11 (5.4)
Adequate (90 - 119%)	71 (29.8)	4 (11.8)	67 (32.8)
Inadequate (<90 %)	155 (62.1)	29 (85.3)	126 (61.8)
Manganese intake			
Excessive (≥120%).	225 (94.5)	31 (91.2)	194 (95.1)
Adequate (90 - 119%)	9 (3.8)	1 (2.9)	8 (3.9)
Inadequate (<90 %)	4 (1.7)	2 (5.9)	2 (1.0)

ANC: Ante Natal Care, MUAC: Mid-Upper Arm Circumference

Categorical variables are presented as a number (percentage). Hemoglobin levels categorized as low if <11 gr/dL and normal if ≥ 11 gr/dL.

Sociodemographic characteristics

The research participants obtained in this study were 238 pregnant women from 2 districts in Semarang, Central Java, Indonesia. The characteristics of subjects were in table 1. Most of the pregnant women was by the age of 20-35 years (83.2%). 63.5% of pregnant women had sufficient total income. 79.4% of pregnant women had moderate education.

Obstetric status characteristics

Almost entirely subjects in this research were obedient to attend Ante Natal Care. Maternal gestational age of subjects was 60.5% in the 1st and 2nd trimester.

Medical status characteristics

5.1% of pregnant women experienced moderate to severe anxiety and 15.1% of pregnant women experienced mild to moderate anxiety. 84.9% pregnant women had normal MUAC.

Nutritional factors characteristics

The overall nutrition knowledge of pregnant women in this research were good (95.8%). There were variances in adequacy of macronutrient and micronutrient food intake. Majority pregnant women had inadequate energy intake (36.1%), inadequate protein intake (66.8%), inadequate fat intake (36.1%), excessive fat intake (66.0%), inadequate calcium intake (83.6%), excessive phosphorus intake (78.2%), excessive magnesium intake (37.8%), inadequate iron intake (82.8%), inadequate zinc intake (62.1%) and excessive manganese intake (94.5%).

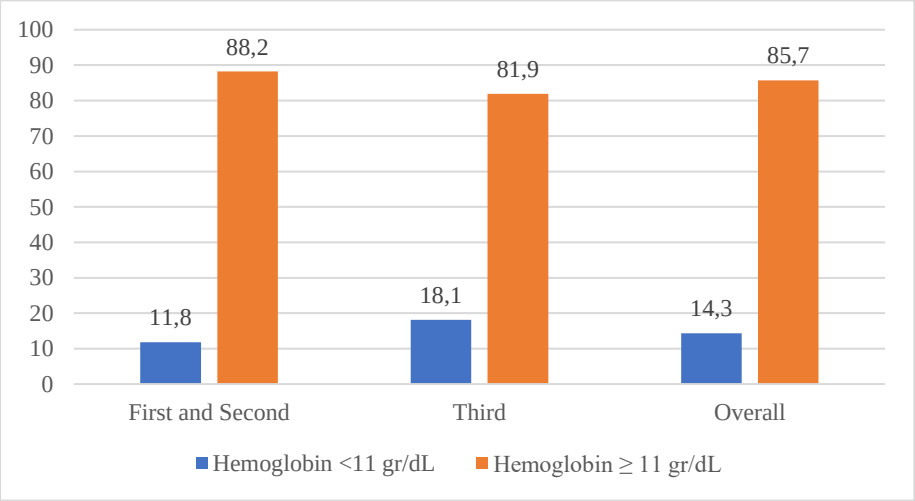

Figure 1. Prevalence of anemia among pregnant women according to the pregnancy trimester

Prevalence of anemia

The prevalence of anemia among pregnant women in this study was 14.3%, as shown in figure 1. Among anemic participants, 11 (32.3%) had moderate anemia and 23 (67.6%) had mild anemia. The prevalence of anemia according to the trimesters were 17(11.8%) for first and second trimesters and 17 (18.1%) for third trimesters.

Table 2. Univariate association between anemia in pregnant women and covariates in sociodemographic, obstetric, medical and nutrition aspects among pregnant women (n=238)

Variable	OR	95% CI for OR		*p-value*
		Lower	Upper	
Sociodemographic				

Age				
20-35 years	Reference			
>35 years	0.728	0.240	2.214	0.576
<20 years	1.943	0.195	19.321	0.571
Total income				
Sufficient (≥ minimum wage of the city)	Reference			
Low (< minimum wage of the city)	0.805	0.372	1.744	0.583
Education				
Moderate (Senior High School – S2)	Reference			
Low (Elementary School – Junior High School)	0.802	0.312	2.062	0.647
Obstetric status				
ANC compliance				
Quite obedient	Reference			
Less obedient	4.224	1.294	13.794	0.017
Gestational age				
1st and 2nd trimester (≤ 28 weeks)	Reference			
3rd trimester (>29 weeks)	1.649	0.795	3.421	0.179
Medical status				
Anxiety				
Mild anxiety (score ≤ 17)	Reference			
Mild to moderate anxiety (score 18 – 24)	2.075	0.845	5.095	0.111
Moderate to severe anxiety (score ≥ 25)	2.420	0.610	9.596	0.209
MUAC				
Normal (≥ 23.5 cm)	Reference			
Malnutrition (< 23.5 cm)	0.717	0.236	2.173	0.556
Nutrition factors				
Nutritional knowledge				
Good (score > 60)	Reference			
Low (score ≤ 60)	0.657	0.081	5.354	0.694
Calory intake				
Excessive (≥120%)	0.702	0.286	1.720	0.439
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	0.605	0.255	1.436	0.255
Protein intake				
Excessive (≥120%)	0.383	0.077	1.895	0.239
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	0.707	0.311	1.606	0.407
Fat intake				
Excessive (≥120%).	1.145	0.478	2.746	0.761
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	0.754	0.301	1.889	0.546
Vitamin C intake				
Excessive (≥120%).	2.146	0.476	9.680	0.321
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	2.500	0.501	12.486	0.264
Calcium intake				
Excessive (≥120%).	0.700	0.119	4.104	0.693
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	0.526	0.194	1.425	0.206
Phosphorus intake				
Excessive (≥120%).	7.065	0.933	53.309	0.058
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	2.125	0.125	36.182	0.602
Magnesium intake				
Excessive (≥120%).	0.846	0.373	1.921	0.690
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	0.343	0.123	0.959	0.041
Iron intake				
Excessive (≥120%).	2.500	0.370	16.888	0.347

Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	0.765	0.290	2.015	0.587
Zinc intake				
Excessive (≥120%).	1.523	0.155	14.920	0.718
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	3.855	1.301	11.427	0.015
Manganese intake				
Excessive (≥120%).	1.278	0.154	10.577	0.820
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	8.000	0.459	139.290	0.154

ANC: Ante Natal Care, MUAC: Mid-Upper Arm Circumference, OR: Odds Ratio, CI: Confidence Interval
Data with p-value < 0.05 indicate statistically significant.

Table 3. Models of logistic multivariate analysis predicting associations between anemia and covariates in sociodemographic, obstetric, medical and nutrition aspects among pregnant women (n=238)

Variable	aOR	95% CI for OR		*p-value*
		Lower	Upper	
Model 1: Sociodemographic				
Total income				
Sufficient (≥ minimum wage of the city)	Reference			
Low (< minimum wage of the city)	0.805	0.372	1.744	0.583
Model 2: Obstetric status				
ANC compliance				
Quite obedient	Reference			
Less obedient	3.994	1.212	13.158	0.023
Gestational age				
1st and 2nd trimester (≤ 28 weeks)	Reference			
3rd trimester (>29 weeks)	1.565	0.746	3.282	0.236
Model 3: Medical status				
Anxiety				
Mild anxiety (score ≤ 17)	Reference			
Mild to moderate anxiety (score 18 – 24)	2.075	0.845	5.095	0.111
Moderate to severe anxiety (score ≥ 25)	2.420	0.610	9.596	0.209
Model 4: Nutrition factors				
Vitamin C intake				
Excessive (≥120%).	2.054	0.373	11.328	0.409
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	3.861	0.613	24.319	0.150
Calcium intake				
Excessive (≥120%).	0.686	0.105	4.476	0.693
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	0.352	0.112	1.105	0.074
Phosphorus intake				
Excessive (≥120%).	9.135	1.123	74.339	0.039
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	1.405	0.064	30.748	0.829
Zinc intake				
Excessive (≥120%).	1.630	0.152	17.435	0.686
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	5.924	1.850	18.968	0.003
Manganese intake				
Excessive (≥120%).	0.941	0.098	8.998	0.958
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	10.107	0.487	209.693	0.135
Model 5: Overall model				
ANC compliance				
Quite obedient	Reference			
Less obedient	4.991	1.284	19.405	0.020
Anxiety				

Mild anxiety (score ≤ 17)	Reference			
Mild to moderate anxiety (score 18 – 24)	2.860	0.587	13.938	0.194
Moderate to severe anxiety (score ≥ 25)	2.321	0.846	6.372	0.102
MUAC				
Normal (≥ 23.5 cm)	Reference			
Malnutrition (< 23.5 cm)	0.370	0.101	1.358	0.134
Calcium intake				
Excessive (≥120%).	0.564	0.085	3.737	0.553
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	0.298	0.092	0.962	0.043
Phosphorus intake				
Excessive (≥120%).	7.170	0.916	56.135	0.061
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	2.174	0.120	39.401	0.599
Zinc intake				
Excessive (≥120%).	0.921	0.078	10.917	0.948
Adequate (90 - 119%)	Reference			
Inadequate (<90 %)	5.430	1.671	17.647	0.005

ANC: Ante Natal Care, MUAC: Mid-Upper Arm Circumference, aOR: adjusted Odds Ratio, CI: Confidence Interval

Multivariate logistic regression analysis between variables Data with p-value < 0.05 indicate statistically significant.

Factors associated with anemia

Based on the multivariate analysis in tables 2 and 3, univariate and multivariate logistic regression analysis were carried out to determine factors associated with anemia among pregnant women. We built 4 separate multivariate models predicting association of anemia (model 1 for sociodemographic, model 2 for obstetric status, model 3 for medical status, model 4 for nutrition factors) and an overall predicting model adjusting for all variables in model 5.

In model 2, less obedient of ANC compliance (aOR = 3.994, 95% CI: 1.212-13.158, p = 0.023), was independently predicted anemia among pregnant women. In model 4, excessive phosphorus intake (aOR = 9.135, 95% CI: 1.123-74.339, p = 0.039) and inadequate zinc intake (aOR = 5.924, 95% CI: 1.850-18.968, p = 0,003), were independently predicted anemia among pregnant women. In model 5, revealed a significant positive association of anemia among pregnant women with less obedient of ANC compliance (aOR = 4.991, 95% CI: 1.284-19.405, p = 0.020) and inadequate zinc intake (aOR = 5.430, 95% CI: 1.671-17.647, p = 0.005). On the other hand, inadequate calcium intake significantly appeared as a protective factor for anemia among pregnant women (aOR = 0.298, 95% CI: 0.092-0.962, p = 0.043).

Discussion

The estimated prevalence of anemia in this study was 14.3%, indicates that the problem in this study is a mild public health problem. The prevalence of anemia in this study was slightly lower than another previous research among pregnant women conducted in Semarang city, Indonesia, namely 15.82% of the 25.329 pregnant women examined [23]. While, the prevalence of anemia in this study was much lower than the prevalence of anemia in Indonesia, which was 48.9% [4]. Incidence of anemia with a 40% prevalence of the population is said to be a serious public health problem [24]. Compared to the prevalence of anemia reported during COVID-19 pandemic in other regions in Indonesia, the estimated prevalence in Semarang was higher than the prevalence reported in Deli Serdang (2%), but much lower than research in Samarinda (37.4%) and slightly lower than research in Yogyakarta (15.8%) and Jepara (17.1%) [25–28].

This study showed that pregnant women with less obedient to ANC compliance were about five times more likely to be anemic compared to those with quite obedient to ANC compliance. This study is in line with previous research in Pekanbaru, Indonesia [29]. Due to the current

COVID-19 pandemic, pregnant women are feared to be reluctant to visit health care facilities for fear of contracting the virus. In this research, 13 from 238 pregnant women were less obedient to ANC visits. Previous meta-analysis studies conducted during the COVID-19 pandemic showed a decrease in antenatal care attendance in several countries such as Bangladesh, Nigeria, South Africa and Ghana [30].

Adherence to ANC visits can detect maternal pregnancy conditions at risk early. This causes the intervention problems can be addressed immediately, including anemia. The Indonesian government has made a program to prevent anemia, namely the provision of 90 iron tablets during pregnancy. In ANC, pregnant women will receive various services such as checking hemoglobin levels, giving blood tablets, and counseling [29]. This study is also in line with research in Tanzania which showed that pregnant women with ANC visited more or equal to 4 times and received regular iron supplementation had a lower prevalence of anemia than mothers with fewer ANC visits [31].

Zinc is known to cause an increase in hemoglobin levels. This research showed that pregnant women with inadequate zinc intake were six times more likely to be anemic compared to adequate zinc intake. This research was in line with a previous study which stated that low levels of zinc in the blood are more significant in the anemia group than in the control group [32]. Research in New Zealand also stated that zinc is the only micronutrient that significantly influences on the risk of anemia [33]. Zinc has a function as a regulator of erythroid cell growth by modulating the expression of specific genes. Zinc has a role as a catalyst for heme iron metabolism by being part of the Growth Factor Independent 1B Transcriptional Repressor (GFi-1B) finger protein structure which is the main regulator of erythroid cell growth. In addition, zinc can also affect hemoglobin through a zinc-dependent enzyme system that fights oxidative stress and plays a role in cell integrity. The function of zinc in iron metabolism which allows the relationship of inadequate zinc intake to the incidence of anemia [32].

This research showed that subjects with excessive phosphorus intake were 9 folds more likely to be anemic than those with adequate phosphorus intake. This finding is consistent with other studies which showed high phosphorus were associated with mild and moderate anemia [34]. Phosphorus itself is known to be a factor inhibiting the production of red blood cells. Hyperphosphatemia is associated with inflammation and can affect normal cellular physiology such as erythropoiesis. In addition, high phosphorus can cause vascular calcification in the renal arteries, causing erythropoietin deficiency and anemia [34].

This study revealed a protective effect of inadequate calcium intake. This finding is in line with the previous study. Calcium was known to inhibits iron absorption. Taking calcium supplements may reduce the total of absorbed iron, primarily by reducing the initial absorption of heme iron [35]. However, pregnant women still need to maintain the adequacy of calcium intake. Calcium during pregnancy has the function of reducing adverse pregnancy outcomes, reducing the risk of hypertension during pregnancy, which is associated with a large number of maternal deaths and a considerable risk of premature birth, the leading cause of early neonatal and infant mortality. Especially during the third trimester to meet the needs of the rapidly mineralized fetal skeleton. Poor pre-pregnancy bone mineral density, low calcium and vitamin D intake during pregnancy can lead to an increased risk of low bone mass and an increased risk of osteoporosis in the future [36].

This research had limitation that should be acknowledged. This study was conducted during pandemic COVID-19, so the intensity of data collection only at public health center and could not be done with visits the pregnant mother's residents. Nevertheless, researcher expected to contribute the reduction of anemia among pregnant women in developing countries by this study.

Conclusions

In Semarang, Indonesia, anemia among pregnant women was a mild public health problem. Less obedient of ANC compliance, excessive phosphorus intake, and inadequate zinc intake were found to be significantly associated with anemia among pregnant women during COVID-19 pandemic. These findings provide health services with insight into the importance of anemia management in pregnancy. Pregnant women are advised to pay attention to nutritional intake, especially zinc intake such as meat, nuts, tubers, milk, eggs, whole grains, fish, seafood and fulfilling daily intake completely. Compliance with ANC is also needed to monitor the condition of pregnant women and fetus to stay healthy and to get fulfilment of iron tablets at least 90 tablets to maintain normal hemoglobin levels. Further studies utilizing cohort design to study risk factors of anemia, including urban and sub-urban areas, should be considered to support the findings of this study.

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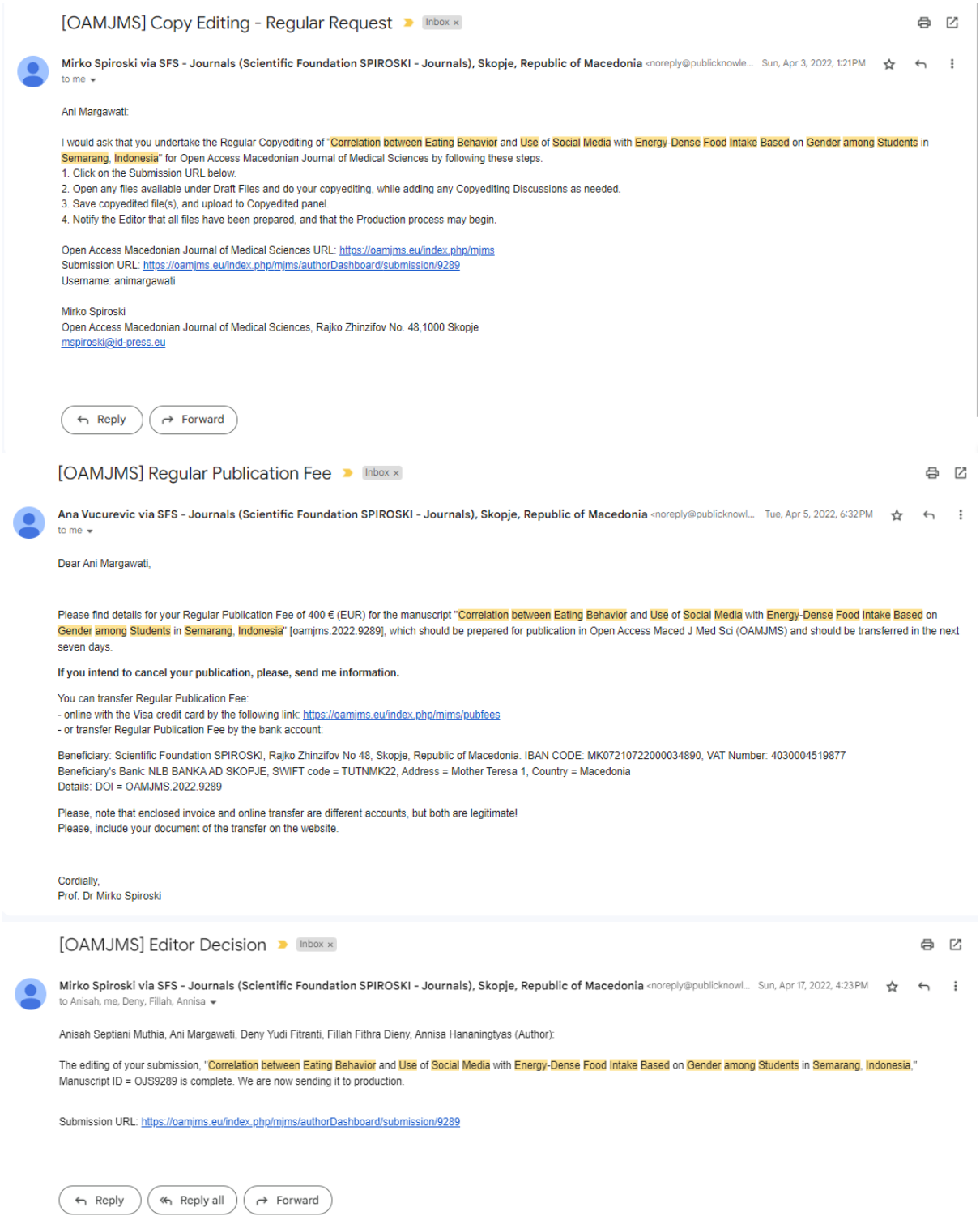

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Correlation between Eating Behavior and Use of Social Media with Energy-Dense Food Intake Based on Gender among Students in Semarang, Indonesia

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Abstract

BACKGROUND: Eating behavior and the use of social media are believed to affect the intake of energy-dense foods. This study aimed to determine the relationship between eating behavior and use of social media with energy-dense food intake in students by gender.

METHODS: This study used a cross-sectional method. The subjects were 123 people from one of university in Semarang, Indonesia, aged 18–24 years, taken using the consecutive sampling method. Energy-dense food intake was taken using the semi-quantitative food frequency questionnaire, eating behavior was using the Dutch Eating Behavior Questionnaire, and social media use was using the scale of effects of social media on eating behavior and self-identity questionnaire. Data were analyzed using Pearson's test, Spearman's rank test, and multiple linear regression.

RESULTS: The intake of energy-dense foods was higher in men than women. This study showed that there was a relationship between emotional eating ($p = 0.001$; $r = 0.408$), external eating ($p = 0.008$; $r = 0.338$), and eating behavior due to social media ($p = 0.001$; $r = 0.415$) and energy-dense food intake in women, and duration of social media use ($p = 0.003$; $r = 0.377$) with energy-dense food intake in men. Gender and eating behavior due to social media had an effect of 24.9% on energy-dense food intake.

CONCLUSION: In women, emotional eating, external eating, and eating behavior due to social media were related to the intake of energy-dense foods. In men, the duration of social media use was related to the intake of energy-dense foods. Gender and eating behavior due to social media were the most influential variables on energy-dense food intake.

Introduction

Overweight and obesity are nutritional problems that currently occur in many communities. In Indonesia, based on 2018 Basic Health Research (Riset Kesehatan Dasar/Riskesdas), the prevalence of overweight was 13.6% and obesity was 21.8% in the age group over 18 years [1]. Overweight and obesity can cause various health problems, especially degenerative diseases such as cardiovascular disease and diabetes mellitus. Weight gain is associated with unhealthy lifestyles such as excessive food intake which causes energy to enter beyond the body needs and low physical activity which results in little energy being released from the body [2].

One of the causes of energy intake exceeding the body needs is the result of consuming energy-dense foods because the energy in these foods has a major contribution to the amount of energy that enters each day. Energy-dense foods are foods that have more than 225 calories of energy per 100 g [3]. Energy-dense foods usually have high sugar, sodium, and saturated fat content and are low in nutrients [4]. Energy-dense foods can be divided into sweet foods and non-sweet or savory foods [5]. Based on gender, there are differences in energy-dense food preferences; men tend to choose savory or salty foods, while women prefer sweet foods [6]. Several studies have shown that energy-dense food intake is associated with eating behavior, namely emotional, external, and restrained eating [3], [7], [8], [9].

Emotional eating is a condition that occurs when there is an urge to eat due to negative emotions. The negative emotions that have been associated with emotional eating are depression, anxiety, anger, sadness, and stress [10], [11], [12], [13]. Students are a group with high stress due to college assignments, examinations, or time management that needs to be done. The stress experienced by these students can result in emotional eating [11]. When viewed by gender, women have a higher level of emotional eating than men. This could be because women have higher stress levels [14]. Research has shown that high emotional eating causes a high intake of energy-dense foods only in women [15].

Then, there is external eating which is an increased desire to eat as a result of external influences such as the appearance or smell of certain foods [16]. ~~Not only from food directly, external influences can also be indirectly through photos or food advertisements~~ [17], [18]. High exposure to food, especially in the form of photos or videos of food, it often happens to students, one of which is the result of the many photos or videos of food that are spread on social media [19], [20]. Compared to men, women have higher external eating scores [21]. This may be because women are more reactive to visual food stimuli as evidenced by increased brain activity in women when stimulated with food images [22]. External eating was found to be associated with sweet foods in one study of women and savory foods in another study with both men and women subjects [23], [24].

Then, there is restrained eating, namely eating behavior by limiting food intake [25]. In contrast to emotional and external eating, which are positively related to energy-dense food intake, restrained eating can result in decreased consumption of energy-dense foods, such as fast food and sweet foods [16], [23]. However, a person with unsuccessful restrained eating may thwart his or her diet efforts and experience an increase in food intake when confronted with tempting foods, such as energy-dense foods [26], [27]. Research has shown that university students score high on restrained eating, especially in adults with excess nutritional status or people with negative body image [9]. Women are known to have higher restrained eating scores than men. This can be caused by the tendency of women to have a slimmer body, so they choose to go on a diet to lose weight [25].

In addition to eating behavior, the use of social media may affect the intake of energy-dense foods. The use of social media is known to be associated with eating choices in several studies [20], [28], [29]. One of the what might cause this is the tendency of a person to follow what others are doing, including consuming energy-dense foods [30]. This is coupled with the high exposure to energy-dense foods on social media and the large number of food producers who use social media as a place to market their products [31], [32]. In Indonesia, social media is the reason most people use the internet with the most internet users being the age group of 15–24 years [33], [34]. Social media is known to be associated with eating behavior. Research shows that excessive use of social media is related to emotional eating and restrained eating [35]. In addition, the presence of photos or videos of food on social media can be a trigger for someone to eat, especially for people with external eating, because they have great attention to food cues [16].

There are differences in the results of the relationship between eating behavior and energy-dense food intake by gender in previous studies, and there is no research in Indonesia that links eating behavior, and social media use with energy-dense food intake, researchers want to find out how the relationship between eating behavior and the use of social media with energy-dense food intake in Indonesian students and analyze the possible influence of gender on the relationship.

Methods

This research is included in the scope of community nutrition with a cross-sectional research design. The research was conducted online from August to September 2021. The research subjects were 123 people based on the calculation of the minimum sample size with the correlative analytical formula. Subjects were taken using consecutive sampling method. The subjects of this study were students from one of the universities in Semarang, Indonesia, aged 18–24 years who were in Semarang, Indonesia, at the time of the study, had at least one social media account in the form of Instagram, Twitter, Facebook, Pinterest, or YouTube, opened social media at least once a day, followed at least one account about food, not being sick or having been sick in the past month, and not resigning during the research process.

The dependent variable in this study was the intake of energy-dense foods in the last 1 month. The instrument used is the Semi-Quantitative Food Frequency Questionnaire which contains a list of energy-dense foods with energy >225 kcal/100 g. The analysis was carried out by adding up the total food consumed in grams/day, then grouped into total energy-dense foods, sweet energy-dense foods, and non-sweet energy-dense foods. Total energy-dense foods are the overall energy-dense foods intake, sweet energy-dense foods are energy-dense foods that have a sweet taste, while non-sweet energy-dense foods is energy-dense foods that has a taste other than sweet, such as salty, savory, or spicy.

The independent variables in this study were eating behavior, use of social media, and gender. Eating behavior consists of emotional eating, external eating, and restrained eating. The questionnaire used to collect eating behavior data were the Dutch Eating Behavior Questionnaire (DEBQ) with a total of 32 questions [36]. Social media use was seen from eating behavior due to social media, frequency of use of social media, duration of use of social media, and number of social media. Eating behavior due to social media was taken using the Scale of Effects of Social Media on Eating Behavior (SESMEB) questionnaire with a total of 17 questions [37]. The frequency of social media use is the number of times the subject opens social media in one day. The duration of social media use was the number of hours to open social media in one day. The number

of social media was the number of social media owned by the subject. These three things were taken through a self-identity questionnaire. DEBQ and SESMEB were questionnaires with a 5-point Likert scale, namely 1 (never) to 5 (always). Gender was divided into men and women who were taken through a self-identity questionnaire.

The confounding variables in this study were stress, body image, access to food, and economic status. Stress was taken with a Perceived Stress Scale (PSS) questionnaire with a total of 9 questions in the form of a 5-point Likert scale, namely (0) never to (4) always [38]. Stress categories were divided into mild (score 0-9), moderate (score 10 – 22), and weight (score 23 – 36). Body image was taken using the Body Shape Questionnaire 8C (BSQ 8C) questionnaire with a total of 8 questions in the form of a 6-point Likert scale, namely (1) never to (6) always [39]. Body image categories were divided into positive (score < 25) and negative (score ≥ 25). Access to food and economic status were taken from self-identity questionnaire. Access to food was divided into buying food and cooking by yourself, while economic status was the amount of income (Rupiah) for each subject in the last month that can be obtained from pocket money, salary, or other income.

Energy-dense foods intake data were collected through Google meets or zoom with the help of a food photo book, while for all questionnaires through a Google form. The results of the questionnaires were analyzed by calculating the average score for each question for DEBQ and calculating the total score for each question for SESMEB, PSS, and BSQ8C. Before starting the study, the validity and reliability of the DEBQ, SESMEB, PSS, and BSQ 8C questionnaires were tested on 44 students outside the research university held with the same criteria as the subjects of this study. The results of the test are emotional eating, external eating, and BSQ 8C questionnaires that get Cronbach's alpha values of 0.916, 0.819, and 0.910, respectively. Meanwhile, the restrained eating questionnaires, SESMEB, and PSS were reduced by one question each and got Cronbach's alpha values of 0.946, 0.906, and 0.784, respectively.

Data were tabulated with a computer program and analyzed using SPSS. Univariate analysis was conducted to determine the characteristics and describe the data. Independent T-Test, Mann–Whitney, and Chi-square were used to analyze differences based on gender [15]. Bivariate analysis was used to determine the relationship between variables. Previously, the normality of the data was tested using Kolmogorov–Smirnov. Pearson correlation test was used to analyze the variables of emotional eating, external eating, restrained eating, eating behavior due to social media, and stress with total energy-dense foods and non-sweet energy-dense foods in women. In addition to these variables, the correlation test was using spearman rank. Multivariate analysis was used to determine the predictor variables of energy-dense foods intake using multiple linear regression tests on all subjects. The research was received ethical approval for conducting research from the Medical/Health Research Bioethics Commission, Faculty of Medicine, Sultan Agung Islamic University, Semarang, Indonesia, with letter number 198/VII/2021/Bioethics Commission.

Results

Characteristics of research subjects based on gender are listed in Table 1. The subjects of this study were 123 people with 62 men (50.4%) and 61 women (49.6%). The BMI of male subjects was 23.72 ± 4.79 kg/m^2, different from that of women, which was 21.97 ± 4.29 kg/m^2. In access to food, there are differences between men and women. Compared to women (23%), more men buy food (43.5%). The average economic status seen from monthly income was IDR 999,390 ± 712,077. There was a difference in total energy-dense food between men and women. Men had a total energy-dense food of 303.77 ± 131.59 g/day, bigger than women (199.08 ± 87.48 g/day). Both men and women consumed more non-sweet energy-dense food than sweet energy-dense food. There was a difference in emotional eating between men and women. Women had a score of 2.60 ± 0.60, higher than the male (2.32 ± 0.71). There was no difference between external eating, restrained eating, stress, and body image between genders. Subjects had a social media eating behavior score of 38.03 ± 9.01. The frequency of using social media for men was 15.02 ± 14.52 times/day, greater than women (7.26 ± 5.42 times/day). For the duration of using social media, the subjects spent an average of 4.07 ± 2.84 h/day.

An overview of social media use is shown in Figure 1. Instagram was the most widely owned social media by subjects (99%). Instagram was also the social media that is considered to have the most exposure to food content (82%) and used by 78% of the subjects to search for food references. Food-related things that are often searched on social media were food reviews (77%), food recipes (60%), places to eat (58%), food promotions (58%), and food and its nutritional content (19%).

The results of the bivariate analysis on the total subjects are presented in Table 2. ~~Table 2 shows external eating, eating behavior due to social media, frequency of social media use, and duration of social media use have a relationship with total intake of energy-dense food and non-sweet energy-dense food.~~ A positive relationship indicates that the higher the external eating score and eating behavior due to social media, the more frequent the use of social media, and the longer the duration of social media use, the higher the total intake of energy-dense food and non-sweet

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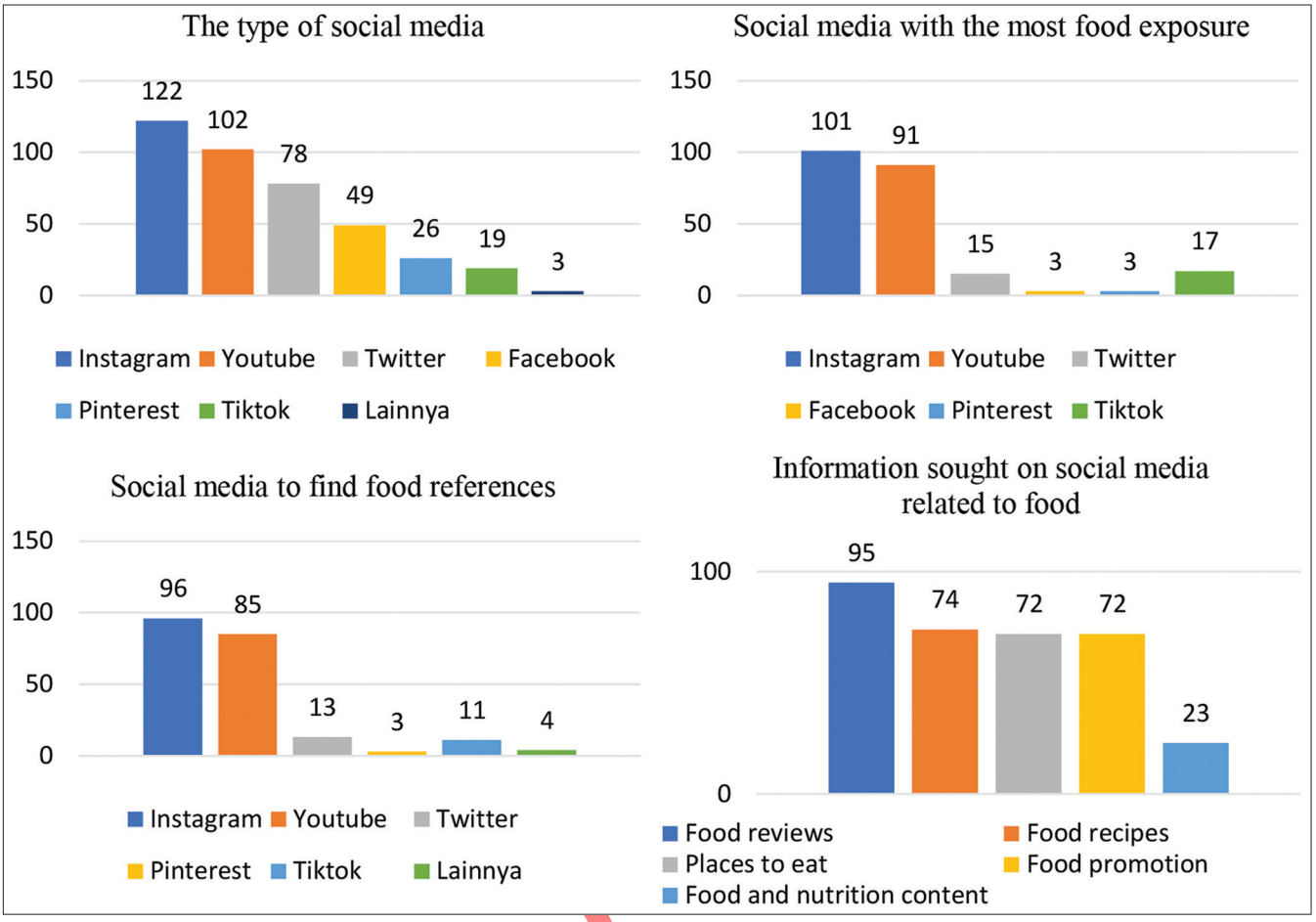

Figure 1: Overview of social media use among subjects

Table 1: Characteristics of subjects

Variable	Total (n = 123)		Men (n = 62)		Women (n = 61)		p
	n (%)	Mean ± SD	n (%)	Mean ± SD	n (%)	Mean ± SD	
Age (years)		21.37 ± 1.04		20.81 ± 3.97		21.23 ± 0.99	0.041*,b
BMI (kg/m^2)		22.85 ± 4.62		23.72 ± 4.79		21.97 ± 4.29	0.007*,b
Food access							0.026*,c
Buying food	41 (33.3)		27 (43.5)		14 (23)		
Cooking by yourself	82 (66.7)		35 (56.5)		47 (77)		
Economic status (Rupiah)		999.39 ± 712.08		1048.39 ± 719.86		949.59 ± 706.52	0.448b
Energy-dense food intake (g/day)							
Total		251.85 ± 123.23		303.77 ± 131.59		199.08 ± 87.48	0.001*,b
Sweet		68.11 ± 47.13		80.37 ± 51.25		55.65 ± 39.14	0.002*,b
Non sweet		184.71 ± 94.79		225.21 ± 100.46		143.53 ± 67.76	0.001*,b
Eating behaviour (score)							
Emotional eating		2.46 ± 0.67		1.32 ± 0.71		2.60 ± 0.60	0.027*,b
External eating		3.27 ± 0.52		3.27 ± 0.54		3.27 ± 0.50	0.990a
Restraint eating		2.43 ± 0.95		2.44 ± 0.99		2.43 ± 0.92	0.956b
Use of social media							
Eating behaviour due to social media (score)		38.03 ± 9.01		37.39 ± 9.25		38.69 ± 8.79	0.426a
Frequency of social media use (times/day)		11.17 ± 11.62		15.02 ± 14.52		7.26 ± 5.42	0.001*,b
Duration of social media use (h/day)		4.07 ± 2.84		4.30 ± 3.01		3.84 ± 2.66	0.514b
Number of social media (pieces)		3.24 ± 1.28		3.18 ± 1.31		3.31 ± 1.26	0.629b
Stress (score)		17.64 ± 5.69		16.81 ± 5.64		18.49 ± 5.67	0.063b
Light	10 (8.1)		7 (11.3)		3 (4.9)		
Currently	93 (75.6)		49 (79)		44 (72.1)		
Heavy	20 (16.3)		6 (9.7)		14 (23)		
Body image (score)				26.06 ± 9.01		24.67 ± 8.34	0.376a
Positive	59 (48)		29 (46.8)		30 (49.2)		
Negative	64 (52)		33 (53.2)		31 (50.8)		

*p < 0.0, [a]Independent t-test, [b]Mann–Whitney U test, [c]Chi-square test. Description: The difference test between men and women. BMI: Body mass index.

energy-dense food. In addition, the number of social media has a relationship with sweet energy-dense food. A positive relationship indicates the more social media you have, the higher the sweet energy-dense food intake will be. The r = 0—0.20 indicates that the relationship between variables is very weak, while the r = 0.21–0.40 is weak.

The results of the bivariate analysis for men are presented in Table 3. For men, it was found that there was a relationship between the duration of social media use with total energy-dense food and non-sweet energy-dense food. A positive relationship indicates the higher the duration of social media use, the higher the total intake of energy-dense food and non-sweet

energy-dense food in men. The r = 0.21–0.40 indicates that the relationship between variables is weak.

Table 2: Bivariate analysis in total subjects

Variable	Energy-dense food					
	Total		Sweet		Non-sweet	
	r	p	r	p	r	p
Emotional eating	0.108	0.235	0.013	0.887	0.130	0.152
External eating	0.254	0.005**	0.164	0.070	0.218	0.016*
Restraint eating	−0.082	0.369	−0.084	0.356	−0.051	0.578
Eating behavior due to social media	0.241	0.007**	0.093	0.307	0.245	0.006**
Frequency of social media use	0.202	0.025*	0.079	0.386	0.224	0.013*
Duration of social media use	0.208	0.021*	0.083	0.363	0.199	0.028*
Number of social media	0.111	0.221	0.185	0.040*	0.029	0.748
Stress	0.081	0.376	0.084	0.356	0.039	0.669
Body image	0.103	0.256	−0.072	0.426	0.129	0.155
Economic status	0.017	0.848	−0.013	0.887	0.029	0.753
Food access	−0.108	0.233	0.057	0.529	−0.152	0.093

Spearman rank correlation test *p < 0.05, **p < 0.01.

Table 3: Bivariate analysis in men subjects

Variable	Energy-dense food					
	Total		Sweet		Non-sweet	
	r	p	r	p	r	p
Emotional eating	0.077	0.550	−0.037	0.773	0.129	0.317
External eating	0.172	0.180	0.105	0.418	0.113	0.382
Restraint eating	−0.068	0.601	−0.204	0.111	0.033	0.800
Eating behavior due to social media	0.151	0.240	0.003	0.982	0.187	0.145
Frequency of using social media	0.095	0.464	−0.033	0.799	0.135	0.297
Duration of use of social media	0.377	0.003**	0.181	0.160	0.380	0.002**
Number of social media	0.079	0.540	0.099	0.443	0.077	0.552
Stress	0.230	0.073	0.126	0.330	0.218	0.089
Body image	0.035	0.787	−0.223	0.081	0.116	0.368
Economic status	0.108	0.402	−0.102	0.431	0.196	0.126
Food access	−0.010	0.939	0.244	0.055	−0.135	0.294

Spearman rank correlation test * p < 0.05, **p < 0.01.

The results of the bivariate analysis on women are presented in Table 4. In women, there was a relationship between emotional eating, external eating, and eating behavior due to social media with the total intake of energy-dense food and non-sweet energy-dense food. A positive relationship indicates the higher the score for emotional eating, external eating, and eating behavior due to social media, the higher the total intake of energy-dense food and non-sweet energy-dense food in women. The r = 0.21–0.40 indicates that the relationship between variables is weak, while the r = 0.41–0.60 is sufficient.

Table 4: Bivariate analysis in women subjects

Variable	Energy-dense food					
	Total		Sweet		Non-sweet	
	r	p	r	p	r	p
Emotional eating	0.408	0.001**, [a]	0.190	0.143[b]	0.422	0.001**,[a]
External eating	0.338	0.008**, [a]	0.250	0.052[b]	0.323	0.011*,[a]
Restraint eating	−0.145	0.265[a]	0.024	0.855[b]	−0.226	0.080[a]
Eating behavior due to social media	0.415	0.001**, [a]	0.224	0.083[b]	0.408	0.001**,[a]
Frequency of using social media	0.107	0.413[b]	0.039	0.764[b]	0.089	0.494[b]
Duration of use of social media	0.027	0.838[b]	−0.043	0.745[b]	0.029	0.826[b]
Number of social media	0.029	0.823[b]	0.162	0.211[b]	−0.110	0.401[b]
Stress	0.081	0.536[a]	0.123	0.347[b]	−0.008	0.951[a]
Body image	0.121	0.352[b]	0.032	0.807[b]	0.084	0.520[b]
Economic status	−0.131	0.316[b]	0.025	0.850[b]	−0.210	0.104[b]
Food access	0.018	0.892[b]	0.009	0.946[b]	0.053	0.684[b]

*p < 0.05, **p < 0.01, [a]Pearson correlation test, [b]Spearman rank correlation test.

Based on the bivariate results on the total subjects, the variable with p < 0.25 was included in the multivariate test (Table 5). In the total energy-dense food multivariate analysis, the variables included are gender, emotional eating, external eating, eating behavior due to social media, frequency of use of social media, duration of use of social media, number of social media, and access to food. The results of the analysis show that gender and eating behavior due to social media are predictors of total energy-dense food by 24.9%. Men have a total energy-dense food intake of 3.643 g greater than women, and every one point of increase in eating behavior score due to social media will increase the total energy-dense food intake by 0.959 g.

In the multivariate analysis of non-sweet energy-dense food, the variables included are gender, emotional eating, external eating, eating behavior due to social media, frequency of use of social media, duration of use of social media, body image, and access to food (Table 5). The results of the analysis showed that gender, eating behavior due to social media, and emotional eating were predictors of non-sweet energy-dense food by 26.8%. Men have a non-sweet energy-dense food intake which is 3.368 g greater than women, every one point of increase in eating behavior score due to social media will increase non-sweet energy-dense food intake by 0.861 g, and every one point of increase in emotional eating score will increase non-sweet energy-dense food intake by 0.861 g, 2,587 g.

Discussion

This study shows that men have a higher energy-dense food intake than women. This study was in line with research conducted in China [15]. Men have a higher food intake than women because men have greater energy requirements as a result of their larger body size and higher metabolic rate. In addition, men have a tendency to eat fatty foods or salty foods, while women prefer vegetables or fruit [40]. The same thing was revealed by another study which stated that men tend to eat more fast food than women because women are more likely to eat fast food practice healthy eating habits than men [41]. This study also revealed that the intake of non-sweet foods was higher than the intake of sweet foods. This study was in line with previous research which shown the average of sensory liking scores were higher for salt (3.77) and fat (3.79) than sweet (3.73) in non-obese adult group [42]. However,

Table 5: Multivariate analysis on energy-dense food intake

Variable	Energy-dense food							
	Total				Non-sweet			
	Beta (standardized coefficients)	p	Constant	Adjusted R^2	Beta (standardized coefficients)	p	Constant	Adjusted R^2
Gender	3.643	0.001			3.368	0.001		
Eating behaviour due to social media	0.959	0.024	3.665	0.249	0.861	0.022	2.187	0.268
Emotional eating					2.587	0.045		

Multiple linear regression analysis test, significant if p < 0.05.

the Basic Health Research/Riskesdas in 2018 showed that 37.8% of subjects aged 20–24 years consumed sweet foods ≥ one times per day, lower than the consumption of fatty foods (41.8%) but higher than the consumption of salty foods (30.2%) [1].

The results of this study showed there was a relationship between eating behavior and energy-dense food intake. Emotional eating was related to total energy-dense food intake and not sweet energy-dense food only in women. This study was in line with research conducted in China which showed that the relationship between emotional eating and intake of energy-dense foods was only found in women [15]. This study was also in line with research conducted in the Netherlands, where no relationship was found between emotional eating and intake of sweet foods [24]. However, the results of this study was contradict with other studies which stated that emotional eating is associated with the intake of sweet and non-sweet foods in both sexes [5], [7]. Emotional eating is known to cause higher energy-dense food intake because energy-dense food usually contains fat high and added sugar, so it has a high palatability. Eating foods with high palatability can reduce negative mood in a short time [7]. Consuming energy-dense food can also decrease the endocrine stress response by influencing hypothalamic–pituitary–adrenal axis, which characterized by low cortisol levels. In addition, eating foods with high carbohydrate and low protein content can increase the level of tryptophan in the blood that will result in increased activity of the serotonergic brain system. Serotonin is a neurotransmitter associated with mood [43]. The relationship between emotional eating and energy-dense food only found in women and not in men could be because women tend to consume energy-dense food in response to emotions [15]. Research before showed the difference scores in emotional eating between gender with women have higher emotional eating values than men [7], [15].

This study showed that external eating was related to total energy-dense food and non-sweet energy-dense food. This study was in line with a study in the Netherlands which found an association between external eating and intake of non-sweet foods and not with intake of sweet foods [24]. However, this study was not in line with other studies that have found an association between external eating and intake of sweet foods and did not find an association with intake of non-sweet foods in female subjects [23]. External eating was associated with a greater attentional bias towards food cues [17]. When compared with low-energy foods, energy-dense food was rated as more attention-grabbing due to greater activation of reward pathways in the brain when exposed to energy-dense food [44]. When viewed by gender, the relationship between external eating and energy-dense food intake was only found in women. Women are more reactive to visual food stimuli as evidenced by increased brain activity in women when stimulated with food images [22]. A study also stated that although there was no difference in external eating scores between men and women, the relationship between external eating and eye movements are found in women only. The study found that the higher the external eating level, the more often women were fixated on sugary, high-calorie foods [45].

In this study, there was no relationship between restrained eating and energy-dense food intake for both men and women. This was not in line with research in the Netherlands, which showed restrained eating was negatively associated with intake of sweet foods [24]. This difference in results could be due to differences in nutritional status, wherein in this study, the subjects had normal nutritional status, whereas in the Dutch study, the subjects had excess nutritional status. People with overweight nutritional status have a higher tendency to restrict eating [9]. In addition, people with nutritional status are more likely to have higher restrained eating scores [46]. People with successfully engage in restrained eating will have lower energy-dense food intakes, whereas people with not succeed in restrained eating will frustrate their diet efforts when dealing with tempting foods such as energy-dense food. The success of restrained eating depends on self-control. A person with a higher level of self-control is more likely to succeed in restrained eating. When dealing with energy-dense food, people with restrained eating and good self-control will be able to resist the food [26].

This study found a relationship between eating behavior due to social media, frequency of social media use, and duration of social media use with a total of energy-dense food and non-sweet energy-dense food and the number of social media with a sweet energy-dense food. Research in America showed that using social media can affect eating choices, increase the desire to eat even though they are not hungry, cause a person to not be aware of time so that mealtimes can be missed, which then ends up eating easy-to-eat foods such as fast food and playing social media while eating can also lead to more food intake because they are not aware of the amount of food consumed [20]. The use of social media can influence eating choices due to product marketing or the influence of other social media users. Social media is an ideal medium used by food producers to interact with young adults. Social media allows an advertisement to be more easily spread to reach more consumers [47]. Endorsement is one of the marketing strategies that is currently being carried out by many food producers, including food producers [48]. In addition, the marketing of a product is also indirectly assisted by most young adults because of their habit of using social media to show the foods they consume [47]. Young adults reveal that they pay more attention and are motivated to make purchases of products recommended by their friends

on social media [49]. The use of social media can affect energy-dense food intake due to the large amount of energy-dense food exposure on social media. A study revealed that 75% of the food shared by students on social media is unhealthy food [31]. Unhealthy food advertisements in social media are easier to remember, and celebrities are more likely to promote unhealthy foods will increase eating preferences for these foods [50].

The relationship between the frequency and duration of social media use with a total energy-dense food, and non-sweet energy-dense food can be caused by the use of social media with a more frequent frequency, and a longer duration will increase the possibility of being exposed to photos and food advertisements more. A study revealed that the longer and more frequent exposure to food advertisements causes the advertisements to be easier to remember so that the tendency to consume these foods will increase [50]. Research in Semarang also revealed that the duration of exposure to food content on social media will affect eating choices, but the relationship between frequency of exposure and dietary preferences was not found in this study [28]. Other studies have also found an association of high duration of social media use with unbalanced food intake. The study also revealed that the subjects often consumed sweet, salty, and fatty foods. The study also found a relationship between the number of social media they had and their sweet energy-dense food [51].

When viewed by gender, the relationship between eating behavior due to social media with total energy-dense food and non-sweet energy-dense food was only found in women. One of the reasons that could cause this is that women are more likely to be influenced by social influences than men [52]. Whereas the relationship between the duration of social media use with total energy-dense food and non-sweet energy-dense food was only found in men could be due to men have a higher average duration of social media use than women. In this study, it was also found that Instagram was the most widely used social media by subjects. Instagram is a photo-based social media, this causes Instagram to be considered easier to use because it allows users to use a little effort to think [49]. On Instagram, many uploads are found about food, one of the hashtags, namely #foodporn, around 71 million uploads in 2015 [47].

The multivariate test showed that gender and eating behavior due to social media were the biggest predictors of total energy-dense food. In addition, gender, eating behavior due to social media, and emotional eating were the biggest predictors of non-sweet energy-dense food. Gender was a predictor because there was a significant difference in energy-dense food intake between men and women, with men having more energy-dense food intake.

Conclusions

In women, it was found that there was a relationship between emotional eating, external eating, and eating behavior due to social media with total energy-dense food and energy-dense food was not sweet. In men, it was found that the relationship between the duration of social media use and the total energy-dense food and energy-dense food was not sweet. Gender and eating behavior due to social media were the biggest predictors of total energy-dense food. In addition, gender, eating behavior due to social media, and emotional eating were the biggest predictors of non-sweet energy-dense food.

Efforts are needed to reduce energy-dense food intake by increasing self-control, learning to manage emotions, avoiding places filled with food, and reducing the use of social media or limiting viewing food content on social media for women and limiting the duration of social media use for men. Paying attention to energy-dense food intake from a young age is important to avoid various non-communicable diseases in the future, such as diabetes, hypertension, heart disease, and others.

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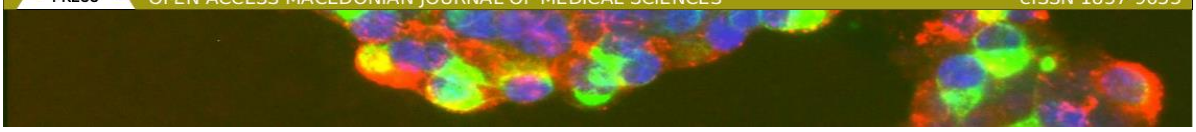

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