



# 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

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**BACKGROUND:** Eating behavior and the use of social media are believed to affect the intake of energy-dense foods.

**AIM:** 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]. The external influence is not only from food, but can 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  $23.72 \pm 4.79 \text{ kg/m}^2$ , different from that of women, which was  $21.97 \pm 4.29 \text{ kg/m}^2$ . 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  $999,390 \pm 712,077$ . There was a difference in total energy-dense food between men and women. Men had a total energy-dense food of  $303.77 \pm 131.59 \text{ g/day}$ , bigger than women ( $199.08 \pm 87.48 \text{ g/day}$ ). 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  $2.60 \pm 0.60$ , higher than the male ( $2.32 \pm 0.71$ ). There was no difference between external eating, restrained eating, stress, and body image between genders. Subjects had a social media eating behavior score of  $38.03 \pm 9.01$ . The frequency of using social media for men was  $15.02 \pm 14.52 \text{ times/day}$ , greater than women ( $7.26 \pm 5.42 \text{ times/day}$ ). For the duration of using social media, the subjects spent an average of  $4.07 \pm 2.84 \text{ h/day}$ .

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 that external eating, eating behavior due to social media, frequency of social media use, and duration of social media use have a relationship with overall energy-dense food intake and non-sweet energy-dense food intake. 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

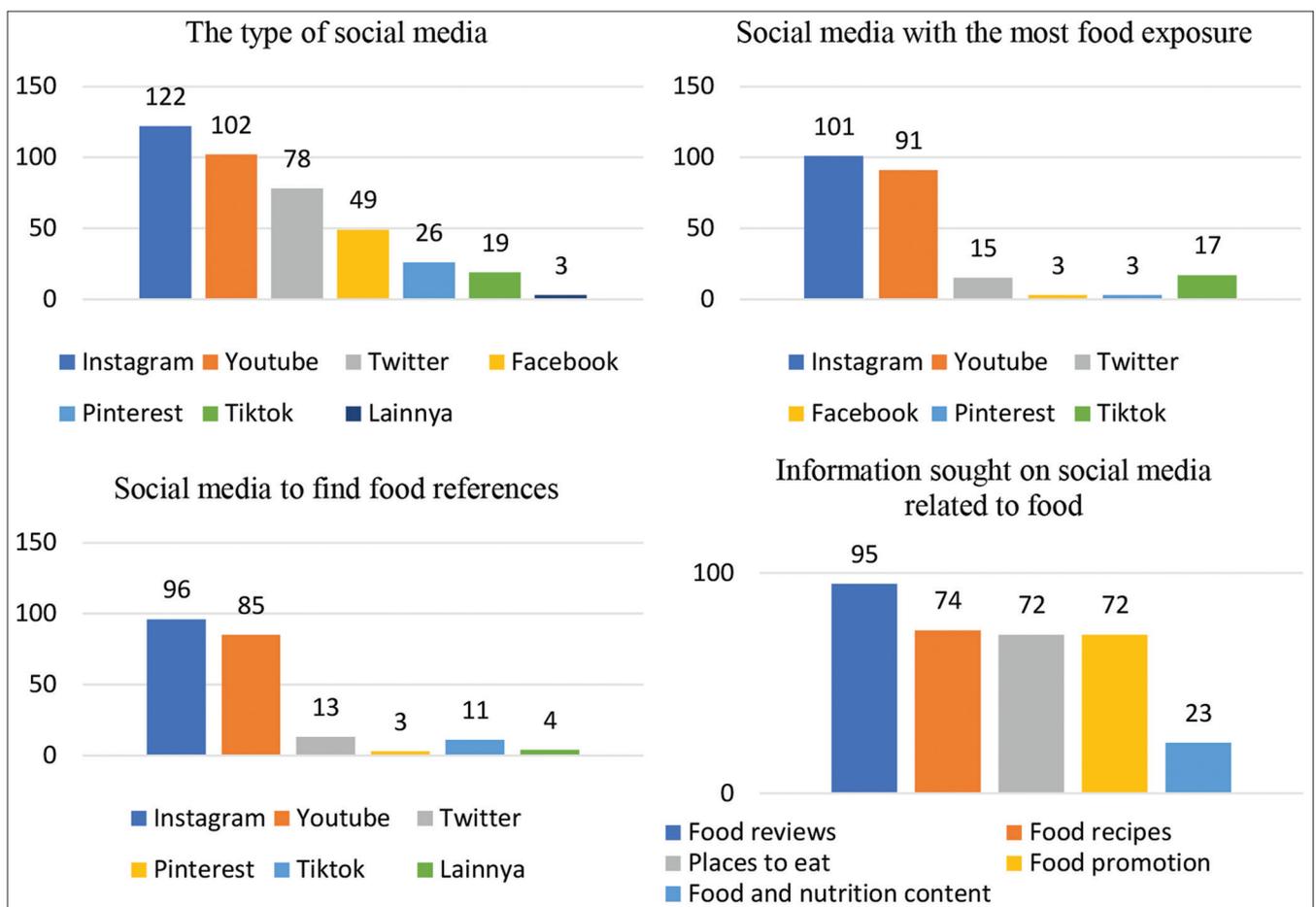


Figure 1: Overview of social media use among subjects

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 <sup>a,b</sup>
BMI (kg/m <sup>2</sup> )		22.85 ± 4.62		23.72 ± 4.79		21.97 ± 4.29	0.007 <sup>a,b</sup>
Food access							0.026 <sup>a,c</sup>
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	0.448 <sup>b</sup>
Energy-dense food intake (g/day)							
Total		251.85 ± 123.23		303.77 ± 131.59		199.08 ± 87.48	0.001 <sup>a,b</sup>
Sweet		68.11 ± 47.13		80.37 ± 51.25		55.65 ± 39.14	0.002 <sup>a,b</sup>
Non sweet		184.71 ± 94.79		225.21 ± 100.46		143.53 ± 67.76	0.001 <sup>a,b</sup>
Eating behaviour (score)							
Emotional eating		2.46 ± 0.67		1.32 ± 0.71		2.60 ± 0.60	0.027 <sup>a,b</sup>
External eating		3.27 ± 0.52		3.27 ± 0.54		3.27 ± 0.50	0.990 <sup>a</sup>
Restraint eating		2.43 ± 0.95		2.44 ± 0.99		2.43 ± 0.92	0.956 <sup>b</sup>
Use of social media							
Eating behaviour due to social media (score)		38.03 ± 9.01		37.39 ± 9.25		38.69 ± 8.79	0.426 <sup>a</sup>
Frequency of social media use (times/day)		11.17 ± 11.62		15.02 ± 14.52		7.26 ± 5.42	0.001 <sup>a,b</sup>
Duration of social media use (h/day)		4.07 ± 2.84		4.30 ± 3.01		3.84 ± 2.66	0.514 <sup>b</sup>
Number of social media (pieces)		3.24 ± 1.28		3.18 ± 1.31		3.31 ± 1.26	0.629 <sup>b</sup>
Stress (score)		17.64 ± 5.69		16.81 ± 5.64		18.49 ± 5.67	0.063 <sup>b</sup>
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	0.376 <sup>a</sup>
Positive	59 (48)		29 (46.8)		30 (49.2)		
Negative	64 (52)		33 (53.2)		31 (50.8)		

<sup>a</sup>p < 0.0, <sup>b</sup>Independent t-test, <sup>c</sup>Mann-Whitney U test, <sup>d</sup>Chi-square test. Description: The difference test between men and women. BMI: Body mass index.

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  $r = 0-0.20$  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** <sup>a</sup>	0.190	0.143 <sup>b</sup>	0.422	0.001** <sup>a,b</sup>
External eating	0.338	0.008** <sup>a</sup>	0.250	0.052 <sup>b</sup>	0.323	0.011** <sup>a,b</sup>
Restraint eating	-0.145	0.265 <sup>a</sup>	0.024	0.855 <sup>b</sup>	-0.226	0.080 <sup>a</sup>
Eating behavior due to social media	0.415	0.001** <sup>a</sup>	0.224	0.083 <sup>b</sup>	0.408	0.001** <sup>a,b</sup>
Frequency of using social media	0.107	0.413 <sup>b</sup>	0.039	0.764 <sup>b</sup>	0.089	0.494 <sup>b</sup>
Duration of use of social media	0.027	0.838 <sup>b</sup>	-0.043	0.745 <sup>b</sup>	0.029	0.826 <sup>b</sup>
Number of social media	0.029	0.823 <sup>b</sup>	0.162	0.211 <sup>b</sup>	-0.110	0.401 <sup>b</sup>
Stress	0.081	0.536 <sup>a</sup>	0.123	0.347 <sup>b</sup>	-0.008	0.951 <sup>a</sup>
Body image	0.121	0.352 <sup>b</sup>	0.032	0.807 <sup>b</sup>	0.084	0.520 <sup>b</sup>
Economic status	-0.131	0.316 <sup>b</sup>	0.025	0.850 <sup>b</sup>	-0.210	0.104 <sup>b</sup>
Food access	0.018	0.892 <sup>a</sup>	0.009	0.946 <sup>b</sup>	0.053	0.684 <sup>a</sup>

<sup>a</sup> $p < 0.05$ , <sup>b</sup> $p < 0.01$ . <sup>a</sup>Pearson correlation test, <sup>b</sup>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, the Basic Health Research/Riskesdas in 2018 showed that 37.8% of subjects aged 20–24 years consumed sweet foods  $\geq$  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

**Table 5: Multivariate analysis on energy-dense food intake**

Variable	Energy-dense food							
	Total				Non-sweet			
	Beta (standardized coefficients)	p	Constant	Adjusted R <sup>2</sup>	Beta (standardized coefficients)	p	Constant	Adjusted R <sup>2</sup>
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  $p < 0.05$ .

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.

## References

1. Kementerian Kesehatan Republik Indonesia. [National Report of RISKESDAS 2018]. Lembaga Penelitian dan Pengembangan. Jakarta; 2018. p. 198. Available from: [http://labdata.litbang.kemkes.go.id/images/download/laporan/RKD/2018/Laporan\\_Nasional\\_RKD2018\\_FINAL.pdf](http://labdata.litbang.kemkes.go.id/images/download/laporan/RKD/2018/Laporan_Nasional_RKD2018_FINAL.pdf). [Last accessed on 2022 Feb 9]
2. Marcia N, Sucher KP, Lacey K, Roth SL. Nutrition Therapy and Pathophysiology. 2<sup>nd</sup> ed. Wadsworth: Cengage Learning; 2011.
3. Lopez-Cepero A, Frisard CF, Lemon SC, Rosal MC. Association between emotional eating, energy-dense foods and overeating in Latinos. *Eat Behav.* 2019;33:40-3. <https://doi.org/10.1016/j.eatbeh.2019.03> PMID:30889426
4. Grech A, Rangan A, Allman-Farinelli M. Social determinants and poor diet quality of energy-dense diets of Australian young adults. *Healthcare.* 2017;5(4):70. <https://doi.org/10.3390/healthcare5040070> PMID:28974029
5. Kontinen H, Männistö S, Sarlio-Lähteenkorva S, Silventoinen K, Haukkala A. Emotional eating, depressive symptoms and self-reported food consumption. A population-based study. *Appetite.* 2010;54(3):473-9. <https://doi.org/10.1016/j.appet.2010.01.014> PMID:20138944
6. Hallama J, Boswella RG, Devito EE, Kober H. Gender-related differences in food craving and obesity. *Yale J Biol Med.* 2016;89(2):161-73.
7. Camilleri GM, Méjean C, Kesse-Guyot E, Andreeva VA, Bellisle F, Hercberg S, *et al.* The associations between emotional eating and consumption of energy-dense snack foods are modified by sex and depressive symptomatology. *J Nutr.* 2014;144(8):1264-73. <https://doi.org/10.3945/jn.114.193177>

- PMid:24850627
8. Keller C, Siegrist M. Does personality influence eating styles and food choices? Direct and indirect effects. *Appetite*. 2015;84:128-38. <http://dx.doi.org/10.1016/j.appet.2014.10.003>  
PMid:25308432
  9. Yong C, Liu H, Yang Q, Luo J, Ouyang Y, Sun M, et al. The relationship between restrained eating, body image, and dietary intake among university students in China: A cross-sectional study. *Nutrients*. 2021;13(3):990. <https://doi.org/10.3390/nu13030990>  
PMid:33808609
  10. Liu H, Yang Q, Luo J, Ouyang Y, Sun M, Xi Y, et al. Association between emotional eating, depressive symptoms and laryngopharyngeal reflux symptoms in college students: A cross-sectional study in Hunan. *Nutrients*. 2020;12(6):1595. <https://doi.org/10.3390/nu12061595>  
PMid:32485841
  11. Bennett J, Greene G, Schwartz-Barcott D. Perceptions of emotional eating behavior. A qualitative study of college students. *Appetite*. 2013;60(1):187-92. <http://dx.doi.org/10.1016/j.appet.2012.09.023>  
PMid:23046706
  12. Altheimer G, Urry HL. Do emotions cause eating? The role of previous experiences and social context in emotional eating. *Curr Dir Psychol Sci*. 2019;28(3):234-40.
  13. Van Strien T, Cebolla A, Etchemendy E, Gutiérrez-Maldonado J, Ferrer-García M, Botella C, et al. Emotional eating and food intake after sadness and joy. *Appetite*. 2013;66(2013):20-5. <http://dx.doi.org/10.1016/j.appet.2013.02.016>  
PMid:23470231
  14. Tan CC, Chow CM. Stress and emotional eating: The mediating role of eating dysregulation. *Pers Individ Dif*. 2014;66:1-4. <http://dx.doi.org/10.1016/j.paid.2014.02.033>
  15. Lu Q, Tao F, Hou F, Zhang Z, Ren LL. Emotion regulation, emotional eating and the energy-rich dietary pattern. A population-based study in Chinese adolescents. *Appetite*. 2016;99:149-56. <http://dx.doi.org/10.1016/j.appet.2016.01.011>  
PMid:26792769
  16. Hou R, Mogg K, Bradley BP, Moss-Morris R, Peveler R, Roefs A. External eating, impulsivity and attentional bias to food cues. *Appetite*. 2011;56(2):424-7. <https://doi.org/10.1016/j.appet.2011.01.019>  
PMid:21256908
  17. Brignell C, Griffiths T, Bradley BP, Mogg K. Attentional and approach biases for pictorial food cues. Influence of external eating. *Appetite*. 2009;52(2):299-306. <https://doi.org/10.1016/j.appet.2008.10.007>  
PMid:19027808
  18. Van Strien T, Peter Herman C, Anschutz D. The predictive validity of the DEBQ-external eating scale for eating in response to food commercials while watching television. *Int J Eat Disord*. 2012;45(2):257-62. <https://doi.org/10.1002/eat.20940>  
PMid:21560138
  19. Freeman B, Kelly B, Vandevijvere S, Baur L. Young adults: Beloved by food and drink marketers and forgotten by public health? *Health Promot Int*. 2016;31(4):954-61. <https://doi.org/10.1093/heapro/dav081>  
PMid:26276799
  20. Vaterlaus JM, Patten EV, Roche C, Young JA. Getting healthy: The perceived influence of social media on young adult health behaviors. *Comput Human Behav*. 2015;45:151-7. <https://doi.org/10.1016/j.chb.2014.12.013>
  21. Ohara K, Mase T, Kouda K, Miyawaki C, Momoi K, Fujitani T, et al. Association of anthropometric status, perceived stress, and personality traits with eating behavior in university students. *Eat Weight Disord*. 2019;24(3):521-31. <https://doi.org/10.1007/s40519-018-00637-w>  
PMid:30656613
  22. Chao AM, Loughhead J, Bakizada ZM, Hopkins MC, Geliebter A, Gur RC, et al. Sex/gender differences in neural correlates of food stimuli: A systematic review of functional neuroimaging studies. *Obes Rev*. 2018;18(6):687-99. <https://doi.org/10.1111/obr.12527>  
PMid:28371180
  23. Kakoschke N, Kemps E, Tiggemann M. External eating mediates the relationship between impulsivity and unhealthy food intake. *Physiol Behav*. 2015;147:117-21. <http://dx.doi.org/10.1016/j.physbeh.2015.04.030>  
PMid:25911264
  24. Paans NP, Gibson-Smith D, Bot M, van Strien T, Brouwer IA, Visser M, et al. Depression and eating styles are independently associated with dietary intake. *Appetite*. 2019;134:103-10. <https://doi.org/10.1016/j.appet.2018.12.030>  
PMid:30583007
  25. Polivy J, Herman CP, Mills JS. What is restrained eating and how do we identify it? *Appetite*. 2020;155:104820. <https://doi.org/10.1016/j.appet.2020.104820>  
PMid:32768601
  26. Keller C, Siegrist M. Successful and unsuccessful restrained eating. Does dispositional self-control matter? *Appetite*. 2014;74:101-6. <https://doi.org/10.1016/j.appet.2013.11.019>  
PMid:24333943
  27. Polivy J, Herman CP. Restrained eating and food cues: Recent findings and conclusions. *Curr Obes Rep*. 2017;6(1):79-85. <https://doi.org/10.1007/s13679-017-0243-1>  
PMid:28205156
  28. Adiba C, Pradigdo SF, Kartasurya MI. Association between social media exposure to food and beverages with nutrient intake of female adolescents. *Kesmas*. 2020;15(4):191-8.
  29. Masitah R, Sulistyadewi NP. Utilization of the contents of Instagram and the behavior of choosing snacks among teenagers. *Gizi Indones*. 2020;43(2):77-86.
  30. Hawkins LK, Farrow C, Thomas JM. Do perceived norms of social media users' eating habits and preferences predict our own food consumption and BMI? *Appetite*. 2020;149:104611. <https://doi.org/10.1016/j.appet.2020.104611>  
PMid:31958481
  31. Barre L, Cronin K, Thompson A. What people post about food on social media. *J Nutr Educ Behav*. 2016;48(7):S52. <https://doi.org/10.1016/j.jneb.2016.04.141>
  32. Vassallo AJ, Kelly B, Zhang L, Wang Z, Young S, Freeman B. Junk food marketing on Instagram: Content analysis. *JMIR Public Health Surveill*. 2018;4(6):e54. <https://doi.org/10.2196/publichealth.9594>  
PMid:29871854
  33. Indonesia APJII. Internet Survey Report of APJII 2019-2020 (Q2). Jakarta: 2020.
  34. Indonesia APJII. Penetration Survey Report and Behavioral Profile of Indonesian Internet Users 2018. Jakarta; 2019.
  35. Murray M, Maras D, Goldfield GS. Excessive time on social networking sites and disordered eating behaviors among undergraduate students: Appearance and weight esteem as mediating pathways. *Cyberpsychol Behav Soc Netw*. 2016;19(12):709-15. <https://doi.org/10.1089/cyber.2016.0384>  
PMid:27925798
  36. Van Strien T, Bergers GP, Defares PB. The Dutch Eating Behavior Questionnaire (DEBQ) for assessment of restrained, emotional, and external eating behavior. *Int J Eat*. 1986;5(2):295-314.
  37. Keser A, Bay A, Kutlu H, Öztürk E. Development of the scale of

- effects of social media on eating behaviour: A study of validity and reliability. *Public Health Nutr.* 2020;23(10):1677-83. <https://doi.org/10.1017/S1368980019004270>  
PMid:32200764
38. Cohen S, Kamarck T, Mermelstein R. A global measure of perceived. *J Health Soci.* 2013;24:385-96.
39. Evans C, Dolan B. Body shape questionnaire: Derivation of shortened "alternate forms". *Int J Eat Disord.* 1993;13(3):315-21. [https://doi.org/10.1002/1098-108x\(199304\)13:3<315:aid-eat2260130310>3.0.co;2-3](https://doi.org/10.1002/1098-108x(199304)13:3<315:aid-eat2260130310>3.0.co;2-3)  
PMid:8477304
40. Herman CP, Polivy J. Sex and gender differences in eating behavior. In: *Handbook of Gender Research in Psychology.* Canada: Springer Science; 2010. p. 455-69.
41. Lee J, Allen J. Gender differences in healthy and unhealthy food consumption and its relationship with depression in young adulthood. *Community Ment Health J.* 2020;57(2021):898-909. <https://doi.org/10.1007/s10597-020-00672-x>  
PMid:32602082
42. Lampuré A, Castetbon K, Deglaire A, Schlich P, Péneau S, Hercberg S, *et al* Associations between liking for fat, sweet or salt and obesity risk in French adults : A prospective cohort study. *Int J Behav Nutr Phys Act.* 2016;13(74):1-15. <https://doi.org/10.1186/s12966-016-0406-6>
43. Macht M, Simons G. Emotional eating. In: *Emotional Regulation and Well Being.* New York: Springer; 2011. p. 281-95.
44. Doolan K, Breslin G, Hanna D, Gallagher A. Attentional bias to food-related visual cues : Is there a role in obesity? In: *Proceedings of The Nutrition Society.* Belfast: Queen's Univeristy Belfast Research Portal; 2015. p. 37-45.
45. Hummel G, Ehret J, Zerweck I, Winter SS, Stroebele-Benschop N. How eating behavior, food stimuli and gender may affect visual attention – An eye tracking study. *Eat Behav.* 2018;31:60-67. <https://doi.org/10.1016/j.eatbeh.2018.08.002>
46. Varela C, Andres A, Saldana C. The behavioral pathway model to overweight and obesity: Coping strategies, eating behaviors and body mass index. *Eat Weight Disord.* 2020;25(4):35-49.
47. Dunlop S, Freeman B, Jones SC. Marketing to youth in the digital age: The promotion of unhealthy products and health promoting behaviours on social media. *Media Commun.* 2016;4(3):35-49.
48. Kusumasondjaja S, Tjiptono F. Endorsement and visual complexity in food advertising on Instagram. *Internet Res.* 2022;29(4):659-87.
49. Chen H. College-aged young consumers' perceptions of social media marketing: The story of instagram. *J Curr Issues Res Advert.* 2021;39(1):22-36. <https://doi.org/10.1080/10641734.2017.1372321>
50. Kucharczuk A, Oliver T, Dowdell EB. Social media's influence on adolescents' food choices: A mixed studies systematic literature review. *Appetite.* 2021;168(3):1-12.
51. Karmila S, Aritonang EY, Sudaryanti E. The relationship of the duration of social media instagram usage and student's eating behavior in university of sumatera utara. *Britain Int Humanit Soc Sci.* 2020;2(1):289-95.
52. Robinson E. Perceived social norms and eating behaviour : An evaluation of studies and future directions. *Physiol Behav.* 2015;152(2015):397-401. <https://doi.org/10.1016/j.physbeh.2015.06.010>