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The Association Between Demographic, Socio-Economic, Smoking Habits and Food Cravings in Adolescents

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ABSTRACT

Background: Food cravings are one of the factors that can increase the risk of being overweight in adolescents. Food cravings can be influenced by several factors, such as smoking habits and demographic and socio-economic conditions. **Objective:** Therefore, this study aims to see whether there is a relationship between demographic, socio-economic conditions, and smoking habits with the incidence of *food cravings* in adolescents. **Methods:** This study used a cross-sectional study and was conducted online in July-September 2021 involving 249 respondents from 2 senior high schools in Gunungkidul Regency. Data on demographic, socio-economic conditions, and smoking habits were collected using the Global Youth Tobacco Survey questionnaire, while data on food cravings were collected using the Food Cravings Questionnaire-Trait-reduced questionnaire. **Results:** From this study, it was found that the variables gender (*p value*: 0.000), age (*p-value*: 0.028), and smoking frequency (*p-value*: 0.045) were significantly related to the FCQ-Tr score. **Conclusions:** Demographic conditions (gender and age) and smoking habits (smoking frequency) are associated with the incidence of food cravings. However, further research is needed with a wider population to prove the results of this study.

Keywords: *Demographic; socio-economy; smoking habits; food cravings*

INTRODUCTION

Obesity is a problem often founded in teenagers and its prevalence continues to increase every year, both globally and in Indonesia. According to RISKESDAS in 2018, the prevalence of overweight in adolescents ranges from 9-11%, while the prevalence of obesity ranges from 4-5%. The high incidence of excess weight in teenagers needs special attention because it can affect the quality of life of teenagers in the future.

One of the factors that can increase the risk of being overweight in adolescents is food cravings^{1,2}. Food cravings are a multidimensional condition of cognitive, emotional, behavioural and physiological processes that cause a person to have an increased desire to consume certain foods³. Food cravings will encourage someone to consume "highly palatable" foods with high calorie, saturated fat and simple carbohydrate content in large or excessive amounts⁴.

Food craving is an intense and difficult-to-control desire to consume certain foods. That involved cognitive, emotional, behavioural and physiological aspects^{5,6}. Food craving is

different from general hunger conditions. In food cravings, a feeling of satisfaction will arise if you consume specific type of food, while hunger can be satisfied by consuming any type of food⁷. Based on the presence of environmental stimuli, there are two types of food cravings. Tonic craving is a condition that occurs temporarily without being influenced by environmental stimuli, while cue-induced craving is a condition that occurs acutely due to environmental stimuli in the form of sight, smell or taste. Cue-induced craving is usually also accompanied by an increase in physiological signals, such as increased salivation, gastric activity and heart rate. Based on the timing of occurrence, food cravings can be differed into state and trait craving. State craving is a condition that only lasts now, whether influenced by the presence of a stimulus or not, whereas trait craving is a condition that occurs generally, whether influenced by the presence of a stimulus or not⁸.

Food cravings can be triggered by lifestyle factors, such as smoking. Exposure to nicotine in cigarettes can cause physiological changes in the brain, thereby affecting the way the brain reacts to food and leading to food cravings^{9,10,11,12}. Exposure to nicotine since adolescence will disrupt the development and expression of nicotinic

acetylcholine receptors (nAChRs) or the nicotine receptors distributed in the brain, which play a role in releasing neurotransmitters, reward and cognitive processes in the brain¹³. As a result, there are changes in the amount and function of several neurotransmitters released in the brain, such as dopamine and serotonin, along with their receptor function and signalling system.

In addition, nicotine can cause changes to the system that controls the sense of taste and hunger, thereby suppressing appetite and reducing appetite in adolescent smokers^{14,15}. Other research states that there is a decrease in sensitivity and response in the brain when given a stimulus in the form of images of food in teenage smokers¹⁶. However, nicotine can also induce the release of stress hormones, such as corticotrophin-releasing factors and glucocorticoids, which increase food intake, especially foods that are highly palatable and high in energy¹⁷. Hence, smoking habits combined with unhealthy food choices not only can decrease cognitive abilities and academic achievement in adolescents, but also lead to depression and anxiety that would reduce attention and impulse control^{18,19,20}.

METHODS

Study Design and Participants

This research is analytical research with a cross-sectional study design. This research conducted online from July to September 2021. The target population in this study were teenagers in class X-XII high school in Gunungkidul Regency, Yogyakarta Special Province. The minimum sample for this research is 127 samples²¹. Subjects were selected using the convenience sampling method. Participants recruited at two high schools in Gunungkidul Regency, Yogyakarta Special Region Province. The inclusion criteria used were students who were willing and received permission from their parents to participate in the study. The exclusion criteria used were participants who did not complete the form.

Measures

The independent variables used in this research are demographic conditions (including gender, age, and learning methods at school), socio-economic conditions (including family economic conditions and parents' education level), and smoking habits (including age at first trying cigarettes, smoking status, number of cigarettes, smoking frequency, and smoking cessation history). The dependent variable used in this research is the food cravings score. This study used the Global Youth Tobacco Survey questionnaire to determine the characteristics of respondents and measure smoking habits, as well as the Food Cravings Questionnaire-Trait-reduced (FCQ-T-r) questionnaire to measure the incidence of food cravings with 15 question items²². In the original version of the FCQ-T questionnaire developed by Cepeda-Benito et al. (2000) and FCQ-T-r developed by Meule et al. (2014), answer choices are expressed on a 6 Likert Scale consisting of a score of 1 (never) to 6 (always). Meanwhile in this study, the answer choices for the FCQ-T-r questionnaire were expressed on a Likert Scale with a

score range of 1 (never) to 5 (always). Both questionnaires have been translated into Indonesian and distributed online via surveymonkey.

Data Analysis

Data analyses were performed using the IBM SPSS version 26.0 program. Categorical data includes age, gender, learning methods at school, family economic conditions, educational level of parents, age at first trying smoking, history of smoking, number of cigarettes consumed, and frequency of smoking in the last 30 days, as well as the incidence of food cravings presented in the form of amount (n) and percentage (%). Then, a normality test was carried out using the Kolmogorov-Smirnov test for food craving scores. The results showed a significance of 0.000 (p-value <0.05), which indicated that the food craving score data were not normally distributed. Therefore, food craving score data is presented in the form of median, minimum value and maximum value. The differences in median food cravings scores were analyzed using the Mann-Whitney test for two categories variables, the Kruskal-Wallis test for three categories variables, and the one-way ANOVA test for more than three categories variables. Meanwhile, the relationship between demographic, socioeconomic, smoking habits, and food cravings scores were analyzed using the Spearman correlation test. P-values less than 0.05 were considered statistically significant.

RESULTS

The total number of respondents who filled out the questionnaire was 375 people, but only 281 respondents filled out the questionnaire completely. Then, data cleaning was carried out for ambiguous data so that the final total of respondents used as samples in this study was 249 people. Out of a total of 249 respondents, the majority were male (61.0%), aged 15-16 years (55.4%), and studied online at school (92.4%). In addition, the majority of the respondent's parents were only one of them who worked (58.6%) with the highest education level of the father was Elementary School (SD) (38.6%), while the mother's highest education level was High School (SMA) (34.9%). The summary of the demographic and socio-economic characteristics of the

Table 1. Respondent Characteristics Based on Demographic and Socio-Economic Conditions

Respondent Characteristics	n (%)
Gender	
Male	152 (61,0%)
Female	97 (39,0%)
Age	
13-14 years old	2 (0,8%)
15-16 years old	138 (55,4%)
17-18 years old	109 (43,8%)
School Method	
Online	230 (92,4%)
Hybrid (Online and On-site)	19 (7,6%)
On-site	0 (0,0%)
Family Economic Condition	
Both parents are working	88 (35,3%)
Only mom/dad is working	146 (58,6%)
Both parents are unemployed	15 (6,0%)
Highest Education Level (Father)	
Elementary School	96 (38,6%)
Middle School	54 (21,7%)
High School	85 (34,1%)
Higher Education	14 (5,6%)
Highest Education Level (Mother)	
Elementary School	84 (33,7%)
Middle School	66 (26,5%)
High School	87 (34,9%)
Higher Education	12 (4,8%)

respondents can be seen in **Table 1**.

From 15 question items in the FCQ-T-r, the lowest

respondent's score range was 15, while the highest score was 75 with a median of 32. Most of the respondents in this study did not experience food cravings (75.1%). The

Table 2. Food Cravings Occurrence

Food Cravings Occurrence	n (%)
Experience food cravings	62 (24,9%)
Didn't experience <i>food cravings</i>	187 (75,1%)

summary of food craving occurrence can be seen in **Table 2**.

Based on FCQ-T-r scores, gender and age variables have significant median differences between categories (p -value < 0.05). Meanwhile, the variables of age, learning methods, family economic conditions, and the highest education level of the father and mother did not show significant median differences. The summary of the median comparison of FCQ-T-r scores based on demographic and socio-economic conditions can be seen in **Table 3**.

Most of the respondents who filled out the questionnaire had never tried cigarettes (60.6%) and had not smoked in the last 30 days (81.9%). Meanwhile, the smoking frequency for respondents who had smoked was mostly less than a month (14.1%) and the average number of cigarettes was not more than ten cigarettes per day (19.3). Most of the respondents who had smoked had also tried to quit smoking in the last 30 days (19.3%) and had stopped smoking during the Covid-19 pandemic (12.4%) The summary of the respondents' smoking habits can be seen in **Table 4**.

Based on smoking history in the last 30 days, there was no significant difference in the median FCQ-T-r score between respondents who had smoked and those who had never

smoked (p -value > 0.05). A summary of the median FCQ-T-r scores comparison based on respondents' smoking history can be seen in **Table 5**.

When observed from the median FCQ-T-r score, there is a significant difference in the median for the variable smoking frequency in the last 30 days (p -value < 0.05). Meanwhile, there was no significant difference in the median for age at first smoking, average number of cigarettes in the last 30 days, and changes in smoking cessation history in the last 30 days. The summary of the comparison of median FCQ-T-r scores based on respondents' smoking habits can be seen in **Table 6**.

DISCUSSION

This study aims to see whether there is a relationship between demographic, socioeconomic, and smoking habits with food craving scores in adolescents in Gunungkidul Regency. From the results of the analysis discussed in the previous section, several points can be drawn: 1) The number of respondents who experienced food cravings in this study was only 24.9%; 2) There was no significant difference in food cravings scores between smokers and non-smokers; 3) Only the variables of gender and age (for all respondents), as well as the frequency of smoking

Table 3. FCQ-T-r Score Median Comparison Based on Demographic and Socio-Economic Conditions

Variabel	n	Median (min-max)	p value
Gender			
Male	152	30,0 (15-75)	0,000
Female	97	37,0 (15-75)	
Age			
13 to 14 years old	2	54,5 (48-61)	0,028
15 to 16 years old	138	33,0 (15-75)	
17 to 18 years old	109	31,0 (15-72)	
School Method			
Online	230	32,0 (15-75)	0,629
Hybrid (Online and On-site)	19	34,0 (15-61)	
Family Economic Condition			
Both parents are working	88	31,5 (15-75)	0,607
Only mom/dad is working	146	33,0 (15-75)	
Both parents are unemployed	15	28,0 (15-51)	
Highest Education Level (Father)			
Elementary School	96	31,0 (15-75)	0,947
Middle School	54	34,5 (15-75)	
High School	85	32,0 (15-75)	
Higher Education	14	32,5 (20-42)	
Highest Education Level (Mother)			
Elementary School	84	31,0 (15-61)	0,448
Middle School	66	33,0 (15-72)	
High School	87	32,0 (15-75)	
Higher Education	12	31,5 (20-49)	

Table 4. Respondent Characteristic Based on Smoking Habits

Respondent Characteristics	n (%)
Age When First Smoking	
Under 7 until 11 years old	28 (11,2%)
12 until 16+ years old	70 (28,1%)
Never tried smoking	151 (60,6%)
Smoking History in the Last 30 Days	
Have smoked in the last 30 days	45 (18,1%)
Have never smoked in the last 30 days	204 (81,9%)
Smoking Frequency in the Last 30 Days	
Never smoked in the last 30 days	201 (80,7%)
1 to 29 days in a month	35 (14,1%)
30 days in a month	13 (5,2%)
Number of Cigarettes Smoked per Day in the Last 30 Days	
0 cigarettes per day	199 (79,9%)
Less than 1 to 10 cigarettes per day	48 (19,3%)
11 to 20 cigarettes per day	2 (0,8%)
Smoking Cessation History in the Last 30 Days	
Have never smoked in the last 30 days	184 (73,9%)
Have tried to stop smoking in the last 30 days	48 (19,3%)
Have never tried to stop smoking in the last 30 days	17 (6,8%)

Table 5. FCQ-T-r Score Median Comparison Based on Smoking History in the Last 30 Days

Variabel	n	Median (min-max)	p value
Smoking History in the Last 30 Days			
Have smoked in the last 30 days	45	31,0 (15-58)	0,438
Have never smoked in the last 30 days	204	33,0 (15-75)	

Table 6. FCQ-T-r Score Median Comparison Based on Smoking Habits (For Smokers)

Variabel	n	Median (min-max)	p value
Age When First Smoking			
Under 7 until 11 years old	5	30,0 (19-45)	0,480
12 until 16+ years old	40	31,5 (15-58)	
Smoking Frequency in the Last 30 Days			
1 to 29 days in a month	33	32,0 (15-58)	0,045
30 days in a month	12	28,0 (15-42)	
Number of Cigarettes Smoked per Day in the Last 30 Days			
Less than 1 to 10 cigarettes per day	43	31,0 (15-58)	0,408
11 to 20 cigarettes per day	2	37,0 (32-42)	
Smoking Cessation History in the Last 30 Days			
Have tried to stop smoking in the last 30 days	31	32,0 (15-55)	0,403
Have never tried to stop smoking in the last 30 days	14	30,5 (15-58)	

(smokers in particular) showed a significant difference in the median food cravings score.

The results of this study indicate that the number of respondents who experienced food cravings was only 24.9% with median food cravings score of 32.0. The low occurrence of food cravings can be influenced by the cut-off value for the FCQ-T-r questionnaire used in this study. The cut-off value in this study, which is equal to 42, is an adaptation of research conducted by Meule because it has a research population with the youngest age range compared to other studies and is close to the age of the respondents in this study²³. However, the actual cut-off number used for the FCQ-T-r questionnaire may vary depending on the geographical area and the characteristics of the respondents. Another study conducted by Innamorati et al. (2015)²⁴ used the number 57.5 as the cut-off value of the FCQ-T-r score in the adult population who are overweight or obese in Italy. Meanwhile, research by Haghighejad found that the FCQ-T-r score cut-off value for the adult population in Persia is 32.5²⁵.

However, when compared based on the FCQ-T-r score, the mean FCQ-T-r score for the population in Germany (31.5) and Persia (30.2) is not much different from the median value in this study (32.0). Therefore, it can be concluded that the results in this study are in line with previous studies which have almost similar characteristics of the respondents.

Apart from being influenced by the cut-off value, the low number of respondents who experienced food cravings could also be influenced by the location and food availability at that place. Gunungkidul Regency is a rural area with the lowest socioeconomic level among other regencies/cities in the Special Region of Yogyakarta Province²⁶. From previous research, it is known that people living in rural areas tend to have lower energy intake than residents in urban areas, even though the consumption of vegetables and fruit is higher. This can be due to limited access to and exposure to popular foods, such as fast food, which is usually the desired food choice when someone experiences food cravings, which are less compared to urban areas^{27,28,29}. For this reason, it is necessary to conduct further research to see whether there are differences in the incidence of food cravings between residents in urban and rural areas, the factors that may influence these differences,

as well as certain types of food that residents in rural areas usually crave when experiencing food cravings.

In this study, food craving scores between respondents who had smoked and those who had never smoked in the last 30 days were not significantly different. However, respondents who do not smoke have a slightly higher median food cravings score than respondents who smoke. This result differs from previous research that stated active smokers have a higher tendency to experience food cravings than smokers who have quit and people who have never smoked. In addition, this study also found a significant difference in median food craving scores based on smoking frequency, specifically among smokers. Respondents who smoked with a frequency of less than a month had a higher median food cravings score compared to those who smoked for a month. This difference could be due to the nicotine content in cigarettes affecting appetite and food craving scores. When someone is given nicotine in stable doses for a long time, nicotine levels in the blood will remain high and have the effect of reducing appetite. However, when smokers are exposed to nicotine in small amounts for a short time, it can increase the ghrelin hormone, which plays a role in increasing appetite, so that people will more easily experience food cravings^{30,31}. From this explanation, we can conclude that although the food cravings score for respondents who do not smoke is higher than for respondents who smoke, exposure to nicotine can affect food cravings, even though it is not immediately visible. The increase in food craving scores in smokers will be more visible when the effects of nicotine begin to decrease, like when a smoker reduces the frequency or stops smoking.

Then, in this study, female respondents had higher median food cravings score than men. This is in line with the results of research conducted by Meule and Hormes, which also found that the incidence of trait-type food cravings was more common in women. Furthermore, based on the subscales in the questionnaire, this research is also in line with the research conducted by Hormes. From the results of different tests according to gender, female respondents had higher food craving scores for 12 question points from the five subscales contained in the questionnaire (p-value <0.05). The five subscales are "desire and plans to consume food" (questions number 3 and 6), "thoughts about food" (questions number 4, 5, 10, 12, 13), subscale "emotions felt before or while craving or eating" (questions number 7 and

14), “lack of control over eating” (questions number 8 and 9), and the subscale “stimuli that can trigger food cravings” (question number 15).

The incidence of food cravings between men and women can be different because of several factors, such as sexual hormones. Research conducted by Parker found that the levels of the hormone estradiol in teenage girls were directly proportional to the incidence of food cravings and loss of control over food, but this was not the case with the levels of the hormone progesterone in teenage girls or the hormone testosterone in teenage boys. In addition to sexual hormones, differences in perception between men and women regarding cravings can also affect the food cravings score. Men tend to see cravings as a negative condition compared to women so the incidence of food cravings reported by men tends to be rarer and lower in intensity and will affect the final score of the food cravings questionnaire³².

Apart from gender, the age variable also shows significant differences in median food cravings scores between age groups. In this study, food craving scores tended to decrease with increasing age. Even though in this research all respondents were still classified as teenagers, the results of the analysis carried out were still in line with the research conducted by Abdella and Dang, which found that the incidence of food cravings tends to decrease with increasing age. However, the age variable is also influenced by a gene related to fat mass and obesity or the FTO gene rs9939609⁵. Other genes, such as the mu-opioid receptor (MOR) and dopamine receptor 2 (DR2) genes, are also associated with food cravings, but are not related to age^{33,34}.

In addition, increasing age can cause changes in brain activity, thereby affecting a person's response to food stimuli. Adolescents and adults tend to be able to control their desire to eat better than children, resulting in a decrease in the incidence of food cravings^{5,35}. However, in this study, the difference in medians could also be caused by the small number of respondents aged 13-14 years.

This research has several advantages. First, this research is novel in terms of the topic raised, namely regarding food cravings and in terms of the research population used, namely the group of adolescents. Previous research about food cravings is conducted in the adult population and has not been studied much before in Indonesia. Second, the number of respondents who filled out the questionnaire was more than the minimum number of samples required.

On the other hand, this research also has some weaknesses. First, the Food Cravings Questionnaire-Trait-reduced (FCQ-T-r) questionnaire used in this study was translated into Indonesian for the first time and the process of translating the questionnaire was done by the researchers rather than professionals. However, the process of translating the questionnaire was carried out by researchers who had sufficient proficiency in English and had been tested for validity and reliability by 20 validation participants who came from members of the research team. The results of the validity and reliability test of the questionnaire are pretty

good as evidenced by the Pearson coefficient values for all questions close to 1 and a significance level of less than 0.05.

Second, due to the peak of the pandemic, the sample selection method used in this study was convenience sampling to make it easier to find research respondents. The convenience sampling method has weaknesses, one of which is that the selected sample is not representative of the wider population. An example in this study is the proportion of male and female respondents is not balanced because the research was conducted in a vocational school where the majority of students were male.

Third, the research was conducted online due to an increase in COVID-19 cases from June to August 2021. Online research has a weakness because researchers cannot directly supervise the process of filling out the questionnaires, which can affect the accuracy of the data collected. However, this weakness can be minimized by having a Whatsapp group for respondents, which can be used as a forum for asking questions directly to researchers.

Fourth, this research is part of the main research entitled “Mapping of Youth Smokers Based on Integrated Non-Communicable Disease Development Posts (Posbindu PTM) Primary Services in Middle Schools”. Therefore, when filling out the questionnaire, it is very likely that the respondent's attention will focus more on questions related to smoking than on questions related to food cravings. This can affect the respondents' answers when answering questions in the questionnaire so it affects the total score of the questionnaire and the data on the incidence of food cravings in this study.

Further research is needed after the COVID-19 pandemic ends with a wider population or using a random sampling method to obtain more representative results. In addition, it is necessary to explain the concept of food cravings before the research so that all respondents have the same perception when filling out the questionnaire and can fill out the questionnaire more accurately.

This research also has several implications for policy in schools. First, smoking prevention programs for children are needed to reduce the number of adolescent and child smokers, such as providing counselling on the dangers of smoking to children and their parents. Second, schools can also hold counselling related to nutrition to increase the knowledge and understanding of adolescents and parents of the importance of eating patterns and choosing healthy food ingredients for adolescents. Third, schools can provide canteen facilities with healthy snacks for students after offline learning is implemented again to direct adolescents to choose healthy foods from an early age and reduce the tendency to choose unhealthy foods due to food cravings.

CONCLUSION

Based on demographic and socio-economic conditions, there are differences in median food cravings scores and significant relationships for gender and age variables. In addition, there was no median difference or significant

relationship between smoking history and food cravings scores. However, there is a significant difference in the median food cravings score based on the smoking frequency, especially for smoker respondents.

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