

Association Between Irregular Eating Behavior, High Fat Intake, and Dyspepsia Syndrome of Male Adolescents at Selected Senior High School in Yogyakarta

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ABSTRACT

Background. Dyspepsia syndrome is a group of symptoms consisting of epigastric discomfort, nausea, vomiting, bloating, early satiety, abdominal fullness, and belching. Dyspepsia syndrome is common in male adolescents. The causes of dyspepsia are multifactorial, one of the most common is diet and lifestyle changes.

Objective. The aim of this study is to determine the association between irregular eating behavior, high fat intake, and dyspepsia syndrome of male adolescents in Yogyakarta senior high school.

Methods. A cross-sectional study was performed among 255 male adolescents aged 15-19 years in Yogyakarta senior high school. The data were obtained using Gastrointestinal Symptoms (GIS) questionnaire, irregular eating behavior questionnaire, and Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ). Nominal variables were analyzed statistically by chi-square test and logistic regression test, numerical variables were analyzed by Mann-Whitney test and linear regression test.

Result. Dyspepsia syndrome is positive in 54.9% of the subject. Seventy-four percent of subjects with irregular eating behavior had dyspepsia, $p < 0.001$, OR 3.58 (CI 95%, 2.05-6.26). Seventy-five percent of subjects with high fat intake had dyspepsia, $p = 0.005$, OR 2.86 (CI 95%, 1.33-6.15). The median GIS score of the high fat and normal fat intake group are two to one ($p = 0.005$). Median GIS scores of irregular and regular eating behavior groups are two to zero ($p < 0.001$). The coefficient of determination (R^2) from multivariate analysis is 0.065.

Conclusion. There is a significant association between eating irregularities and high fat consumption patterns with the incidence of dyspepsia syndrome in male adolescents in Yogyakarta high school.

Keywords: dyspepsia syndrome, irregular eating behavior, high fat intake, male adolescent

Abstrak

Latar belakang. Sindrom dispepsia adalah kumpulan gejala yang terdiri dari rasa tidak nyaman di epigastrium, mual, muntah, kembung, rasa cepat kenyang, rasa perut penuh, sendawa. Sindrom dispepsia banyak terjadi pada remaja. Penyebab dispepsia bersifat multifaktorial, salah satunya adalah pola makan dan perubahan gaya hidup.

Tujuan penelitian. Mengetahui hubungan antara ketidakteraturan makan dan pola konsumsi tinggi lemak dengan kejadian sindrom dispepsia pada remaja putra di salah satu SMA Kota Yogyakarta yang terpilih.

Metode. Rancangan penelitian menggunakan cross sectional. Responden sebanyak 255 remaja putra di salah satu SMA Kota Yogyakarta yang memenuhi kriteria inklusi. Uji statistik untuk data kategorik dilakukan dengan uji chi-square dan regresi logistik, uji statistik untuk data numerik dilakukan dengan uji Mann-Whitney, uji Kruskal Wallis, dan regresi linier.

Hasil penelitian. Sebanyak 54,9% responden mengalami sindrom dispepsia. Responden dengan pola makan tidak teratur dan mengalami dispepsia sebanyak 74%, $p < 0,001$, OR 3,58 (IK 95%, 2,05-6,26). Responden dengan pola konsumsi makan tinggi lemak dan mengalami dispepsia sebanyak 75%, $p = 0,005$, OR 2,86 (IK 95%, 1,33-6,15).

Median skor Gastrointestinal Symptoms (GIS) pada kelompok konsumsi tinggi lemak dan cukup adalah dua berbanding satu ($p=0,005$). Median skor GIS pada kelompok tidak teratur makan dan teratur makan adalah dua berbanding nol ($p<0,001$). Analisis multivariat terhadap skor GIS didapatkan koefisien determinasi (R^2) 0,065.

Kesimpulan. Terdapat hubungan yang bermakna antara ketidakaturan makan dan pola konsumsi tinggi lemak dengan kejadian sindrom dispepsia pada remaja laki-laki di SMA Yogyakarta.

Kata kunci. sindrom dispepsia, ketidakaturan makan, konsumsi tinggi lemak, remaja putra

Introduction

Dyspepsia syndrome is a health problem that affected many people. It is a group of symptoms consisting of epigastric discomfort, nausea, vomiting, bloating, early satiety, abdominal fullness, and belching. Based on the presence or absence of structural and biochemical pathological disorders as evidenced by conventional gastroenterology examination, dyspepsia is divided into two categories, organic dyspepsia, and functional dyspepsia.¹

Yogyakarta Special Region Health Profile showed that dyspepsia ranks 6th in hospital outpatient disease patterns in 2012.² Outpatient report at RSUP Dr. Sardjito Yogyakarta explained that patients who came with dyspepsia complaints reached 40% of cases.³ Based on data from the Sleman District Health Office, there was an increase in dyspepsia cases by 4% in 2010, with the highest age group of 15-19 years.⁴

The causes of functional dyspepsia are multifactorial, such as slowing gastric emptying, hypersensitivity to gastric distension, eating habit, psychological and environmental factors during growth period, excessive gastric acid secretion, *H. pylori* infection, genetic factors, and gastrointestinal infections. Eating habits are one of modifiable risk factors. Poor eating habits such eating some type of food and irregular eating habit can cause digestive disorders.⁵ Research by Reshetnikov and

Kurilovich shows that the gap between long meal schedules and eating irregularities is associated with symptoms of functional dyspepsia.⁶ The current study mentions the concept of visceral hypersensitivity to nutrition, mainly fat, as the etiology of functional dyspepsia. Digested foods are related to stimulation of digestive hormone secretion including cholecystokinin, Glucagon Like Peptide-1 (GLP-1), and YY peptides, and ghrelin suppression. These digestive peptides play roles in causing dyspepsia symptoms.⁷

Dyspepsia in male adolescents has not received much attention. At present there have been several studies on the effect of eating habits on functional dyspepsia in the female adolescent population, but no studies have been conducted on the male population. Research by Lopez-Colombo et al. showed that there were no significant differences in the incidence of functional dyspepsia in men and women.⁸

The aim of this study is to determine the association between irregular eating behavior, high fat intake, and dyspepsia syndrome of male adolescents in Yogyakarta senior high school.

Method

This research was a cross-sectional study conducted at SMAN 11 Yogyakarta from October 2017 and August 2018 until September 2018. The target population in this study was male adolescent students in Yogyakarta senior high school. The

inclusion criteria were male students aged 15-19 years who agreed to participate in the study. The exclusion criteria were diagnosed as organic dyspepsia, respondents with alarm symptoms in the form of gastrointestinal bleeding, persistent abdominal pain, unexpected weight loss, persistent vomiting, history of gastric ulcers, dysphagia, taking drugs that cause gastric irritation such as Non-Steroid Anti-Inflammatory Drug (NSAID), erythromycin, corticosteroids, tetracycline, bisphosphonates, iron, potassium supplements, acarbose, digitalis, and orlistat theophylline. The research instrument used was the Gastrointestinal Symptoms (GIS) questionnaire consisting of 10 questions with 4 Likert scales to assess the incidence of dyspepsia syndrome, a meal irregularity questionnaire consisting of 7 questions, and Semi-Quantitative Food Frequency Questionnaire (SQ-FFQ) to calculate the daily average of fat consumption. The basic characteristics of the research in the form of numerical data are presented in means and standard deviation. Chi-square test and logistic regression test were used to assess the association between variables of eating disorder and fat consumption on the incidence of dyspepsia syndrome. Mann-Whitney test and linear regression test were used to assess the association between variables of irregularity in eating and fat consumption on the score of Gastrointestinal Symptoms (GIS). The p -value <0.05 was determined to have statistical significance and calculated 95% confidence interval.

Results

Research data collection was conducted from October 2017 and August

to September 2018. The male students of SMAN 11 Yogyakarta who met the inclusion criteria were 260 students, but there were 4 students who were excluded from consuming NSAIDs, and 1 person who was excluded from consuming corticosteroids so the research subjects were 255 people. The basic characteristics of the study subjects described in table 1 consisted of age, classroom, body mass index (BMI), smoking habits, and alcohol consumption habits.

The overall study subjects had a mean age of 16.3 ± 0.9 with the youngest age of 15 years and the oldest age of 19 years. Subjects with dyspepsia symptoms and not dyspepsia had an average age of 16.3 ± 0.9 and 16.3 ± 0.7 ($p = 0.827$). The research subjects in each class were 77 people (30.2%) in class X, 93 people (36.5%) in class XI, and 85 people (33.3%) in class XII. The study subjects were divided into three categories of body mass index (BMI) based on age, underweight if $BMI < 16.6 \text{ kg/m}^2$, normal if $BMI 16.6 - 23.7 \text{ kg/m}^2$, and overweight if $BMI > 23.7 \text{ kg/m}^2$. Most of the study subjects overall had a normal BMI (64.6%). Subjects with normal BMI that had dyspepsia symptoms were 54.9%, while subjects with normal BMI who did not have dyspepsia symptoms were 45.1%. There were 18 people (7.1%) of all research subjects who had smoking habits, and subjects with smoking habits who had dyspepsia symptoms were 44.4% ($p = 0.355$). Only 1 person (0.4%) has the habit of drinking alcohol. The results of the chi-square test analysis showed that there were no significant differences in classroom variables ($p = 0.164$), smoking habits ($p = 0.350$), alcohol consumption ($p = 0.451$), and BMI ($p = 0.610$).

Table 1. Basic characteristics of subjects

		Dyspepsia				p	OR	CI 95%	
		Yes		No					
		n	%	n	%				
Age (mean ± SD)		16.1 ± 0.7		16.4 ± 0.8		0.320*			
Classroom	X	49	63.6%	28	36.4%	0.164**			
	XI	45	49.5%	47	50.5%				
	XII	45	52.9%	40	47.1%				
Smoking habit	Smoker	8	44.4%	10	55.6%	0.350	0.598	0.20	1.76
	Nonsmoker	132	55.7%	105	44.3%				
Alcohol consumption	Yes	0	0.0%	1	100.0%	0.451	0.64	0.05	7.18
	No	140	55.1%	114	44.9%				
BMI	Underweight	10	58.8%	7	41.2%	0.610			
	Overweight	25	64.1%	14	35.9%				
	Normal	56	54.9%	46	45.1%				

*Mann Whitney test **Chi-Square test

The association between fat consumption and dyspepsia syndrome is shown in table 2. Overall, the study subjects had a normal amount of fat consumption (84.3%). There were 30 subjects (75%) with high fat consumption who suffered from

dyspepsia syndrome, while there were 110 subjects (51%) with sufficient fat consumption who suffered from dyspepsia syndrome. The chi-square test results obtained p-value 0.005. OR 2.86 (95% CI, 1.33 - 6.15).

Table 2. Bivariate analysis of fat consumption and dyspepsia syndrome

Fat consumption	Dyspepsia syndrome				p-value	OR (IK 95% min-max)
	Yes		No			
	N	%	N	%		
High	30	75	10	25	0.005	2.86 (1.33 – 6.15)
Normal	110	51	105	48		

The association between irregular eating pattern and dyspepsia syndrome is shown in table 3. Overall, the study subjects had a regular eating pattern (94.1%). There were 68 subjects (74%) with irregular eating patterns suffering

from dyspepsia syndrome, while there were 72 subjects (44%) with regular eating patterns suffering from dyspepsia syndrome. The results of the chi square test obtained p-value <0.001, OR 3.58 (95% CI, 2.05-6.26).

Table 3. Bivariate analysis of eating pattern and dyspepsia syndrome

Eating pattern	Dyspepsia syndrome				p-value	OR (IK 95% min-max)
	Yes		No			
	N	%	N	%		
Irregular	68	74	24	26	<0.001	3.58 (2.05-6.26)
Regular	72	44	91	56		

Multivariate analysis is used to test whether the probability of the occurrence of the dependent variable can be predicted

by the independent variable. Logistic regression analysis of the two variables is shown in table 4. The coefficient of

determination is equal to 0.141 which means that the variability of the dependent variable that can be explained by the

independent variable is 14.1 percent, while the remaining 85.9 percent is explained by other variables outside the model research.

Table 4. Multivariate analysis to dyspepsia syndrome

Variables		p	OR	CI 95%		R ²
Constanta		- 0.369	0.028	0.691		
Fat consumption	High	0.013	2.72	1.24	6.00	0.141
	Normal					
Eating pattern	Irregular	<0.001	3.50	1.99	6.16	
	Regular					

The incidence of dyspepsia syndrome in this study was measured by a GIS questionnaire with a range of values from 0 to 40. The classification of the categories of dyspepsia and not dyspepsia has a range that is so far that the statistical analysis of the value of GIS is done to find out in more detail how much influence the independent variables have on the change in scores. The association between fat consumption and the median GIS score is shown in Table 5. The results of the normality test with the Kolmogorov-Smirnov test produce an abnormal

distribution of data so that the Mann-Whitney non-parametric test is selected. Subjects with fat consumption had a median value of 2 versus 1 in subjects with normal fat consumption ($p = 0.005$). Subjects with irregular eating patterns had a median value of 2 versus 0 in subjects with a regular eating patterns ($p < 0.001$). Other characteristics such as smoking habits, alcohol consumption, and BMI did not have a significant difference in the significant GIS score ($p = 0.699$; 0.317 ; 0.109).

Table 5. Bivariate analysis of GIS score

		Dyspepsia					p
		Mean	SD	Median	Min	Max	
Fat consumption	High	3,62	4.87	2.00	0.00	24.00	0.005
	Normal	1.93	2.84	1.00	0.00	14.00	
Eating pattern	Irregular	3.01	3.39	2.00	0.00	14.00	<0.001
	Regular	1.73	3.14	0.00	0.00	24.00	
Smoking habit	Smoker	1.94	2.86	0.00	0.00	11.00	0.699
	Nonsmoker	2.21	3.32	1.00	0.00	24.00	
Alcohol consumption	Yes	0.00	.	0.00	0.00	0.00	0.317
	No	2.20	3.29	1.00	0.00	24.00	
BMI	Underweight	2.88	3.67	2.00	0.00	11.00	0.109
	Overweight	1.62	2.13	1.00	0.00	10.00	
	Normal	3.08	3.67	2.00	0.00	13.00	

Linear regression analysis of fat consumption variables and eating patterns on GIS scores are shown in table 6 with the results of the coefficient of determination

0.065. The magnitude of the figures shows that the pattern of eating irregularities and fat consumption influences the GIS score of 6.5%.

Table 6. Multivariate analysis of GIS score

Variables		B	p-value	CI 95%		R ²
Constant		7.036	<0.001	4.683	9.39	
Fat intake	High	-1.574	0.005	-2.65	-0.48	
	Normal					0.065
Eating pattern	Irregular	-1.185	0.005	-2.00	-0.36	
	Regular					

Discussion

The basic characteristics of respondents showed that 54.9% of the population of male student in SMAN 11 Yogyakarta had dyspepsia syndrome when compared with similar studies conducted by Dohan the prevalence rate in girls was higher at 75%.⁹ This is consistent with research conducted by Reshetnikov and Kurilovich where girls suffered more functional dyspepsia than men (27% versus 16%).⁶ The prevalence of dyspepsia varies in several studies. A systematic review conducted by Boronat et al. showed that of the 26 studies from 2005-2016 the prevalence of functional gastrointestinal disorders in adolescents varied from 9.9% to 87%.¹⁰ This was due to differences in operational definitions and tools used in diagnosing dyspepsia syndrome. This study uses a GIS score that has a range of scores between 0-40. Dyspepsia syndrome is defined if the research subject has a minimum value of 1 in GIS. A far range of score values can explain why the incidence of dyspepsia syndrome in this study is higher than in other studies. The Bhatia et al. study used the Rome III questionnaire to determine the prevalence of dyspepsia in 1115 children in India, the result was as many as 10% suffered from dyspepsia.¹¹ The reason why this study did not use the Rome III questionnaire was that the components of the question were more complex and took longer for respondents to

fill out. The Rome III questionnaire has also been studied on respondents in the Dr. Sardjito Hospital polyclinic by Husna, but the results showed that the questionnaire could not be applied to diagnose uninvestigated dyspepsia because it had a sensitivity of 68.75% and specificity of 56.25%.¹²

This research was conducted in high schools to get homogeneous research subjects living in the same environment. Other alternative research sites such as campuses or universities have a higher possibility of differences in the living environment because the research subjects can come from Yogyakarta and outside the city. Research conducted by Merlisia shows that there is a significant difference between adolescent eating habits based on the origin of their residence. Teenagers in cities more often have eating frequency habits less than 3 times per day, consume more snacks, and have abnormal body mass index (thin or obese) compared to teenagers in the village.¹³ Study by Rahayu showed that deviant eating behavior is influenced by socio-economic status, where higher incidence is experienced by adolescents with upper socio-economic status.¹⁴

The results showed that 36.1% of the population of male students in SMAN 11 Yogyakarta experienced eating pattern irregularities, while in the female population the prevalence is 71.8%. The results of the Chi-Square analysis showed an OR value of

3.58, when compared with the results of Dohan study, the OR value of the irregular eating pattern variable in female student respondents was higher (OR 13.29).⁹ Deviant eating behaviors tend to occur more frequently in young women where growth toward adulthood is accompanied by increased social life participation and activities that have an impact on eating habits, as well as a tendency to diet for a long time.¹⁵ Differences in eating patterns between female and male adolescents were influenced by many things. Women are more concerned about issues related to food and self-image, while psychological factors play a role in eating disorders in both women and men.¹⁶ Research by Utami showed that male adolescents with depressed emotional conditions experience a decreased desire to eat.¹⁷ Other factors that influence eating irregularities in adolescents mentioned by Birch and Fisher include peer group influence, the availability of food around, and the practice of feeding habits when children.¹⁸

There were 24 research subjects (26%) with irregular eating patterns who did not experience symptoms of dyspepsia, this could be due to several things as explained by Dohan study. First, even though the respondents had irregular eating habits, some of them were accustomed to eating snacks between the time so that stomach acid production was not excessive. Second, some respondents experienced mild excess production of stomach acid, which has not caused complaints.⁹

There were 40 research subjects (15.69%) who had a high-fat consumption, this figure was lower than female adolescents with a prevalence of 31.46%.⁹ This difference in numbers was influenced by differences in operational definitions in

determining high-fat consumption, where in this study the cut-off limit for fat consumption is 83 grams per day, while 59 grams per day is used in the female adolescent study. The study by Puruhita explains that the average fat consumption rate for male adolescents aged 16-18 years is higher when compared to female adolescents, which is 64.54 ± 24.15 grams per day compared to 52.37 ± 20.48 grams per day but there was no significant difference between the two groups ($p > 0.005$).¹⁹ Based on the results of the statistical analysis there was a significant association ($p < 0.005$) between high-fat consumption and the incidence of dyspepsia syndrome with OR 2.86 (95% CI, 1.33-6.15). According to Almatier fatty foods can reduce the pressure of the lower esophageal sphincter, slow gastric emptying, and extend the period of gastric distention, thereby facilitating acid reflux. There are two hormones that influence the occurrence of dyspepsia syndrome, cholecystokinin and YY peptides.²⁰ Some points in the GIS questionnaire can describe abnormalities in slowing down gastric emptying that may occur due to consumption of high fat, which produces symptoms like bloating and early satiety after eating.

Research on female adolescents showed no significant association between high-fat consumption with dyspepsia syndrome in high school girls in Yogyakarta City ($p = 0.457$).⁹ One of the things that can explain these different results is related to the use of questionnaires in measuring fat consumption patterns. The limitation of the questionnaire method is that it is very dependent on memory, food identification, and understanding of the portion of food consumed. The second limitation is the risk

of food reporting that is not in accordance with reality. Several studies have shown that food consumption is not properly reported by 20-25% of research subjects, especially by women.¹⁹ Researchers have tried to minimize bias and errors in filling data by explaining the standard size into household sizes that are easily understood by the research subjects.

The GIS value of the respondents has an abnormal distribution; therefore, the Mann-Whitney non-parametric test is used. The results of the analysis showed a significant difference between the variable irregularities in eating and fat consumption of the GIS values ($p < 0.001$; $p = 0.005$). Although there were statistically significant differences, it was seen that the difference in median GIS values in the variable feeding disorder and the variable diet high in fat were not great (2: 0; and 2: 1). Other basic characteristics such as smoking habits, alcohol consumption habits, and BMI did not have a significant difference in GIS values ($p = 0.699$; $p = 0.317$; $p = 0.109$). Furthermore, multivariate analysis with linear regression was carried out on the two variables, and the results of the coefficient of determination were 0.065. The coefficient of determination is the amount of diversity (information) in the dependent variable that can be given by the regression model obtained. The greater the coefficient of determination, the better the regression model obtained.²¹ In this study it was found that the pattern of irregularities in eating and consumption of fat influenced the GIS score of 6.5%, while the rest were influenced by other factors not analyzed.

Several other risk factors that can cause dyspepsia complaints in adolescents have been studied previously. Schwimmer et al. conducted a retrospective review of

742 bodies of children who underwent an autopsy from 1993 to 2003. Fatty liver was defined as the presence of hepatocytes containing macrovesicular fat $\geq 5\%$. The study shows that fatty liver is a liver disorder that most often occurs in children aged 2 to 19 years. The prevalence rate increases with age with the highest ratio at the age of 15-19 years at 17.3%. The prevalence increased in obese children (38%), while most races were Hispanics (11.8%) and Asians (10.2%).²² Research by Naisali et al. towards student respondents in Malang showed as many as 54.3% of smokers aged 21-25 years had gastritis ($r = 0.905$, $p = 0.00$).²³ Research by Oshima et al. on 643 family clusters in America showed a significant association between having a relative first-degree with dyspepsia syndrome (OR = 1.8, 95% CI 1.05–3.0).²⁴ Research by Ariani showed the incidence of *Helicobacter pylori* infection in adolescents aged 12 to 18 years in outpatient clinic of Dr Sardjito General Hospital was 3.7%, but it was concluded that the diagnostic value of dyspepsia symptoms was less useful in diagnosing *Helicobacter pylori* infection.²⁵ Nagina et al. examined the picture of gastric biopsy in 160 children and adolescents in Pakistan. The results showed that drug-induced gastritis was the main contributor to dyspepsia (36.2%)²⁶ Research by Rosalina showed a significant difference ($p < 0.05$) between dyspepsia syndrome and gender, frequency of eating, order meals, meal breaks, breakfast, soda drink consumption habits, spicy food consumption habits, acidic food consumption habits, stress levels.²⁷ Research by Waas showed the association between depressive symptoms and dyspepsia syndrome in Lombok high school students with the number of respondents experiencing depression

symptoms as much as 6.14% of the total number of respondents who complained of dyspepsia.²⁸ The study by Khotimah and Araini showed stress levels had the greatest influence on dyspepsia syndrome (OR = 10.06; $p = 0.009$) than the pattern of irregular eating and irritating food/drinks for Universitas Sumatera Utara (USU) students.²⁹ The stress experienced by a person can cause anxiety that is closely related to lifestyle. Abnormalities of gastric accommodation in the form of decreased ability of gastric relaxation response to food are shown in a study with the results of 47% of teenage respondents having abnormalities in electrogastrogram. Other studies have shown that dyspepsia syndrome occurs in 24% of subjects as sequelae of bacterial gastroenteritis infections. Adolescents with atopic predisposition who were exposed to milk showed increasing eosinophils and mast cells in the lamina propria of gaster and manifested as dyspepsia syndrome.³⁰

Conclusion

There is a significant association between eating irregularities and high fat consumption patterns with the incidence of dyspepsia syndrome in male adolescents in Yogyakarta high school.

This study has limitations; therefore, the researcher suggests further research with a cohort or experimental design to better know the causative association between eating irregularities and high-fat consumption patterns with dyspepsia syndrome. Other causes of dyspepsia such as psychosomatic disorders, irritating food, or drink, gastrointestinal dysmotility, genetic factors, *Helicobacter pylori* infection, and secondary diseases such as

fatty liver and a history of atopy need to be investigated further.

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