Paediatrica Indonesiana

p-ISSN 0030-9311; e-ISSN 2338-476X; Vol.62, No.4(2022). p.243-8; DOI: 10.14238/pi62.4.2022.243-8

Original Article

Functional gastrointestinal disorders and nutritional status in junior high school students

Fatima Safira Alatas[1], Khansa Salsabila[2], Nadira[2], Nasya Amalia[2], Gryselda Hanafi[2]

Abstract

Background The prevalence of functional gastrointestinal disorders (FGIDs) is increasing among students in Indonesia. More adolescents came to the clinic with symptoms of functional constipation (FC), irritable bowel syndrome (IBS), and functional dyspepsia (FD).

Objective To analyze the relationship between the nutritional status, dietary pattern, and physical activity with the incidence of the FGIDs among Indonesian junior high school students.

Methods A cross-sectional study, consisting of 292 students aged 11 to 14 years were recruited in March 2018. Questionnaires on the ROME Criteria for FGIDs, dietary patterns, and physical activity were distributed to the students' parents and returned in 24 hours.

Results The overall prevalence of FGIDs in this study was 26.4%. Among 292 junior high school students, 19.5% were diagnosed with FC, 6.2% with IBS, and 17.5% with FD. Overnourishment (overweight or obese) was found in 51.4% of the subjects. A significant association was found between FC and overnutrition (OR 2.27; 95%CI 1.21 to 4.28; P=0.011). Nutritional status did not affect the incidence of IBS nor FD. Rarely eating breakfast significantly increase the occurrence of FD (OR 4.80; 95%CI 1.61 to 13.25; P=0.004). No significant association between dietary patterns and physical activity with the prevalence of the other FGIDs.

Conclusion Nutritional status does not significantly affect the prevalence of IBS and FD. Overnourishment is associated with increased occurrence of FC. Eating breakfast twice weekly or more may reduce the probability of FD. Lack of healthy dietary pattern and physical activity are not correlated with other FGIDs.

[Paediatr Indones. 2022;62:243-8 DOI: 10.14238/pi62.4.2022.243-8].

Keywords: *functional constipation; functional dyspepsia; irritable bowel syndrome; nutritional status*

Functional gastrointestinal disorders (FGIDs) are common among patients referred to gastroenterologists, accounting for about 40% of polyclinic patients.[1] There are three types of FGIDs: functional constipation (FC), irritable bowel syndrome (IBS), and functional dyspepsia (FD). Typically, these FGIDs are diagnosed with the Rome criteria.[1,2] The FGIDs can result in decreased quality of life if they continue without an appropriate diagnosis and treatment plan.[2]

Constipation is defined as an incomplete, unsatisfactory, or difficult defecation while FC is constipation without any detectable secondary causes.[3] The prevalence of constipation in Indonesia has reached up to 10%, and FC accounts for the majority of those cases. Children with FC have neither anatomical nor hormonal abnormalities that might explain the constipation. It is common for children to suffer FC, which results in emotional and physical suffering that might have a long-term

From the Department of Child Health[1] and Faculty of Medicine[2], Universitas Indonesia, Jakarta, Indonesia.

Corresponding author: Fatima Safira Alatas. Department of Child Health, Cipto Mangunkusumo Hospital, Faculty of Medicine University of Indonesia. Jl. Salemba Raya No. 16, Jakarta 10430, Indonesia. Ph. +6221-1500135 (Ext 2112). Email: safiraalatas@gmail.com.

Submitted April 6, 2021. Accepted July 25, 2022.

impact on the child if left undiagnosed.[4,5] Moreover, in past decades, children were more prone to develop FC due to poor dietary habits and obesity resulting from a more sedentary lifestyle, increasing portion size, and decrease in physical activities.[6,7] Irritable bowel syndrome is another functional gastrointestinal disorder (FGID) characterized by altered bowel habits and abdominal pain. Other notable features are bloating, abdominal distention, constipation, and diarrhea.[8] A previous study on senior high school Indonesian students revealed that around 6% of senior high school students in Jakarta suffered IBS.[9] Subsequently, a review revealed that 24.8 to 42% of children with IBS were obese. However, the exact association between IBS and obesity remains controversial.[10] The third type of FGID is the FD, characterized by recurrent abdominal discomfort and pain. These symptoms are not related to bowel movements and have no organic nor biochemical etiology that can explain the occurrence of symptoms. The prevalence of FD in children is 3-27% based on ROME III criteria.[11,12] A previous study among adults in Jakarta found that 58.1% had dyspeptic syndrome and obesity might increase the risk of gastrointestinal symptoms.[13,14]

Psychological stress is linked with FGIDs and we believe that students are at risk of developing the disease.[15] Moreover, these days, the number of children who are overweight and obese keeps increasing due to the growing number of fast-food outlets and convenient transportation services, resulting in a more sedentary lifestyle. In Indonesia, studies about FGIDs have been limited, especially in pediatric populations.

Methods

This cross-sectional study took place at a local junior high school in Jakarta in March 2018. Following retrieval of written informed consent from parents or guardians, the subjects' heights and weights were measured using calibrated body weight (*Seca-Germany 703*) and height scales (*Seca-Germany 217*). Nutritional status was calculated with the following formula: weight for height (%) = [(weight of the subject)/ideal weight for height)] x 100% and classified into three categories: undernourished (≤90%), well-nourished (≥91-109%), and overnourished (overweight/obese; ≥110%).[16]

The subjects' parents were instructed to fill questionnaires consisting of three parts: the translated Rome questionnaire, adapted from the *Questionnaire on Pediatric Gastrointestinal Symptoms, Rome III Version* (*QPGS-RIII*) to evaluate FC, IBS, and FD,[17] dietary pattern, and physical activity status, adapted with modification from Intan's study.[18] The dietary pattern questionnaire had four parts: breakfast habit, snack habit, fast food habit, and fiber-rich food habits. In addition, physical activity included two questions, whether the subject routinely exercise and how many hours in a week the subject usually exercise. This study was approved by the Academic Writing Team, Faculty of Medicine, University of Indonesia. *SPSS ver. 24.0* was used for statistical analysis. Chi-square test was used to analyze for associations between FC/IBS/FD with the nutritional status and the dietary patterns.

Results

A total of 294 informed consent forms were distributed and returned. Two children were excluded due to the presence of chronic illness which might affect the overall results of the questionnaire. Hence, 292 subjects were included in the final analysis. The characteristics of subjects are summarized in **Table 1**. All students were aged between 11 and 14 years. There were slightly more female subjects (53.8%) than male subjects (46.2%). The school grades were similarly distributed between the two grades, with 50.7% in 7th grade and the remaining in 8th grade. Fifty-seven (19.5%) subjects fulfilled the Rome criteria for FC, while 18 (6.2%) subjects and 51 (17.5%) subjects fulfilled the IBS and FD criteria, respectively. Only 1 student had IBS and FD concurrently.

The majority of our subjects were overweight or obese (150 subjects; 51.4%), followed by normoweight (112 subjects; 38.4%), and undernourished (30 subjects; 10.2%). The analyses of FGIDs and nutritional status are shown in **Table 2**. Subjects with suspected FGIDs were mostly comprised of children with normoweight and overnourished children. Overnourishment was significantly associated with FC (P=0.011), whereas undernourishment was not. Despite the significant p-value of normal children (P=0.026), the OR value of 1.00 showed no significant association between FC and normoweight. On the other hand, IBS and FD did not have any significant associations with nutritional status.

Table 1. Demographic characteristics and prevalence of functional gastrointestinal disorders

Characteristics	(n=292)
Gender, n (%)	
Male	135 (46.2)
Female	157 (53.8)
Grade, n (%)	
7th grade	148 (50.7)
8th grade	144 (49.3)
Median age (range), years	13.0 (11.0-14.0)
FC, n (%)	
Yes	57 (19.5)
No	235 (80.5)
IBS, n (%)	
Yes	18 (6.2)
No	274 (93.8)
FD, n (%)	
Yes	51 (17.5)
No	241 (82.5)
Overlapped, n (%)	1 (0.3)

FC=functional constipation; IBS=irritable bowel syndrome; FD= Functional dyspepsia.

The analysis of FGIDs and dietary pattern is shown in **Table 3**. Subjects' habits of eating breakfast, consumption of vegetables/fruits and physical activity were not significantly associated with functional constipation (FC) nor with IBS. However, FD had a significant association with rarely eating breakfast.

Discussion

The prevalence of FC, IBS, and FD in this study were 19.5%, 6.2%, and 17.5%, respectively. Our findings were similar with a study which observed constipation in 19.9% of the elementary school children in West Sumatera, Indonesia.[4] In contrast, we had fewer IBS subjects compared to a consensus on IBS management in 2013, in which 10.5% of subjects were suspected to have IBS.[19] A study in senior high school students in Palembang, South Sumatera, Indonesia, showed that 58/180 (32.2%) subjects were suspected to have IBS, which was notably higher than in our study.[9] Furthermore, a previous study showed that the prevalence of FD among 548 children ranging from 1- to 14-years-old was 70.73%, which was much higher compared to our population.[20] The discrepancies might be explained by the fact that our population was limited to junior high school students. Thus, the age homogeneity would not be representive of a wider age range.

A significant association was found between overweight/obese children and FC, similar to West and North Sumatera studies.[4,21] A study also found that 23% of obese children had constipation, and hyperglycemia was found to play an important role in the occurrence of constipation.[22] In addition, a previous study noted that obesity was one of the several factors contributing to dietary influence on IBS.[23] Functional dyspepsia was not significantly associated with nutritional status. A study among children with FGIDs (functional abdominal pain, IBS, and FD) found that obesity was associated with abdominal pain, higher pain frequency, pain intensity, school absenteeism, and interruptions in daily activities compared to non-obese subjects.[24] However, the lack of an association in our study which might have been due to the low prevalence of FD subjects.

There was no significant association between FC or IBS with any dietary pattern. This finding is interesting, as habits like eating breakfast are known to help initiate bowel movements due to activation of gastro-colic reflex, approximately 30 minutes after a meal. Surprisingly, we found that the highest proportion of children with FC (29.6%) ate breakfast at least 6 days per week, albeit non-significantly. We suggest further study on the content of the breakfast to further evaluate the cause of FC in this school setting. In addition, we found that subjects who consumed fiber-rich foods regularly dominated the FC-suspected group. Studies found a direct relationship between low fiber intake and childhood constipation. The fiber intake must be accompanied by adequate hydration to improve the stool pattern.[25,26] Another contributing factor was the fiber itself. Dietary fiber may be water-soluble or -insoluble. A review stated that only water-soluble fibers improve IBS symptoms.[27]

For subjects with suspected FD, we found a statistically significant association with rarely eating breakfast. A study in South China rural area found that 75% of patients with FD had poor dietary behaviors, especially irregular mealtimes. Subjects who did not eat breakfast complained of epigastric pain syndrome (EPS) and postprandial distress associated with FD more often.[28] Epigastric pain syndrome is one of the subtypes for FD. Manifestations of EPS fulfill one or both of the following symptoms: a. moderate degree pain or burning

Table 2. Analysis of nutritional status and FGIDs

Nutritional status	FC		OR	95% CI	P value	IBS		OR	95% CI	P value	FD		OR	95% CI	P value
	No (n=235)	Yes (n=57)				No (n=274)	Yes (n=18)				No (n=241)	Yes (n=51)			
Undernourished	22 (9.4)	8 (14.0)	2.36	0.93 to 6.03	0.072	29 (10.6)	1 (5.6)	0.74	0.08 to 6.57	0.785	24 (10.0)	6 (11.8)	1.1	0.41 to 2.92	1.098
Normal	83 (35.3)	29 (50.9)	1	REF	0.026*	107 (39.1)	5 (27.8)	1	REF	0.41	95 (39.4)	17 (33.3)	1	REF	0.709
Overnourished	130 (55.3)	20 (35.1)	2.27	1.21 to 4.28	0.011	138 (50.4)	12 (66.7)	1.86	0.64 to 5.44	0.257	122 (50.6)	28 (54.9)	0.78	0.403 to 1.508	0.46

FC=functional constipation; IBS=irritable bowel syndrome; FD=functional dyspepsia. *Statistically significant results

Table 3. Analysis of dietary pattern and physical activity with FGIDs

Variables	FC		OR	95% CI	P value	IBS		OR	95% CI	P value	FD		OR	95% CI	P value
	Yes (n=57)	No (n=235)				Yes (n=18)	No (n=274)				Yes (n=51)	No (n=241)			
Breakfast*															
Rarely	2 (3.5)	16 (6.8)	0.54	0.12 to 2.48	0.538	2	16 (5.8)	2.15	0.43 to 10.67	0.295	8 (15.7)	10 (4.1)	4.80	1.61 to 13.25	0.004***
Sometimes	13 (22.8)	28 (11.9)	2.02	0.95 to 4.30	0.065	1	40 (14.6)	0.43	0.05 to 3.46	0.694	10 (19.6)	31 (12.9)	1.94	0.75 to 4.05	0.201
Often	8 (14.0)	43 (18.3)	0.81	0.35 to 1.88	0.623	5	46 (16.8)	1.87	0.61 to 5.74	0.33	7 (13.7)	44 (18.3)	0.95	0.35 to 2.20	0.772
Everyday	34 (29.6)	148 (63.0)	1.00	REF	0.155	10	172 (62.8)	1.00	REF	0.644	26 (51.0)	156 (64.7)	1.00	REF	0.190
Vegetables**															
Never	2 (3.5)	10 (4.3)	0.86	0.17 to 4.40	1.000	0	12 (4.4)	-	-	1.000	1 (2.0)	11 (4.6)	0.56	0.13 to 11.39	0.860
Rarely	15 (26.3)	66 (28.1)	0.88	0.40 to 1.95	0.751	5	76 (27.7)	0.73	0.21 to 2.52	0.622	18 (35.3)	63 (26.1)	1.61	0.30 to 2.69	0.837
Often	25 (43.9)	101(43.0)	0.96	0.47 to1.96	0.905	7	119 (43.4)	0.66	0.21 to 2.04	0.555	21 (41.2)	105 (43.6)	1.13	0.93 to 4.65	0.077
Everyday	15 (26.3)	58 (24.7)	1.00	REF	0.989	6	67 (24.5)	1.00	REF	0.440	11 (21.6)	62 (25.7)	1.00	REF	0.099
Fruits**															
Never	1 (1.8)	8 (3.4)	0.89	0.10 to 7.92	1.000	0	9 (3.3)	-	-	1.000	1 (2.0)	8 (3.3)	1.10	0.06 to 4.66	0.553
Rarely	13 (22.8)	42 (17.9)	1.93	0.81 to 4.62	0.134	1	53 (19.3)	0.43	0.09 to 2.16	0.482	7 (13.7)	48 (19.9)	1.12	0.55 to 3.35	0.501
Often	31 (54.4)	110(46.8)	1.76	0.85 to 3.65	0.124	9	132 (48.2)	0.78	0.28 to 2.17	0.633	33 (64.7)	108 (44.8)	2.35	0.39 to 2.10	0.821
Everyday	12 (21.1)	75 (31.9)	1.00	REF	0.362	7	80 (29.2)	1.00	REF	0.227	10 (19.6)	77 (32.0)	1.00	REF	0.317
Physical activity															
No	19 (33.3)	71(30.2)	1.19	0.64 to 2.21	0.584	4 (22.2)	86 (31.4)	0.62	0.20to 1.95	0.415	16 (31.4)	74 (30.7)	1.06	0.491 to 1.812	0.219
Yes	38 (66.7)	164 (69.8)				14 (77.8)	188 (68.6)				35 (68.6)	167 (69.3)			

*Breakfast classifications: rarely=once a week, sometimes=2-3 times a week, often=4-5 times a week, everyday=at least 6 times a week. **For eating fruits and vegetables: never=none/week, rarely=1-3x/week, often=4-6x/week, everyday=7x/week. ***Statistically significant result

centered in the upper abdominal at least once per week; b. the pain is intermittent; c. pain or burning are not originated from other abdominal or chest regions; d. defecation or passage of flatus cannot relieve symptoms; e. unsatisfied the criteria for gallbladder and sphincter of Oddi's disorders. Diets rich in fruits and vegetables should improve symptoms of FD, which was in contrast with our results. A Taiwan study of 4,275 subjects, observed significant improvement in subjects with fiber-rich dietary habits.[29]

We found no statistically significant association between the three FGIDs and physical activity. In a study involving 32,371 Hong Kong adolescents, constipation was more prevalent in subjects with insufficient physical activity.[30] Moreover, exercise should also benefit IBS patients as it might help intestinal gas transit. Mild and moderate physical activity were linked to reduction of IBS symptoms and increased intestinal gas clearance.[31] Physical activity may also benefit patients with FD through a similar mechanism.[32]

The limitation of this study was that it was conducted at one junior high school. A randomized sampling of several junior high schools throughout Jakarta would achieve better data representation. Further studies using questionnaires adapted from ROME IV criteria are recommended to update findings using the previous version.

Conflict of interest

None declared.

Acknowledgements

We would like to acknowledge Labschool, Jakarta, for supporting this study.

References

1. Lacy BE, Patel NK. Rome criteria and a diagnostic approach to irritable bowel syndrome. J Clin Med. 2017;6:99. DOI: 10.3390/jcm6110099.
2. Drossman DA. The functional gastrointestinal disorders and the Rome III process. Gastroenterology. 2006;130:1377-90. DOI: 10.1053/j.gastro.2006.03.008.
3. Longo D, Fauci A. Harrison's gastroenterology and hepatology. New York: McGraw-Hill; 2010. p.54.
4. Putri WH, Jurnalis DY, Edison. Hubungan status gizi dengan kejadian konstipasi pada siswa SD di kecamatan Padang Barat, Sumatera Barat, Indonesia. CDK. 2015;42:807. DOI: 10.55175/cdk.v42i11.941.
5. Levy EI, Lemmens R, Vandenplas Y, Devreker T. Functional constipation in children: challenges and solutions. Pediatric Health Med Ther. 2017;8:19-27. DOI: 10.2147/PHMT.S110940.
6. Kiefte-de Jong JC, de Vries JH, Escher JC, Jaddoe VW, Hofman A, Raat H, *et al.* Role of dietary patterns, sedentary behaviour and overweight on the longitudinal development of childhood constipation: the Generation R study. Matern Child Nutr. 2013;9:511-23. DOI: 0.1111/j.1740-8709.2011.00395.x.
7. Sahoo K, Sahoo B, Choudhury AK, Sofi NY, Kumar R, Bhadoria AS. Childhood obesity: causes and consequences. J Family Med Prim Care. 2015;4:187-92. DOI: 10.4103/2249-4863.154628.
8. Ford AC, Talley NJ. Irritable bowel syndrome. BMJ. 2012;345:e5836. DOI: 10.1136/bmj.e5836.
9. Fillekes L, Prayogo A, Alatas FS, Hegar B. Irritable bowel syndrome and its associated factors in adolescents. Paediatr Indones. 2014;54:344-50. DOI: 10.14238/pi54.6.2014.344-50.
10. Pickett-Blakely O. Obesity and irritable bowel syndrome: a comprehensive review. Gastroenterol Hepatol (NY). 2014;10:411-16. PMID: 25904828.
11. Mayer EA. Functional gastrointestinal disorders: irritable bowel syndrome, dyspepsia, chest pain of presumed esophageal origin, and heart burn. In: Goldman L, Schafer AI, editor. Goldman Cecil Medicine. Philadelphia: Goldman-Cecil Medicine; 2016. p.852-6.
12 Moray G, Tezcaner T, Akdur A, Özçay F, Sezgin A, Kırnap M, *et al.* Results of pediatric liver transplant: A single-center experience. Exp Clin Transplant. 2015;13:59-63. PMID: 25894129.
13. Simadibrata M, Abdullah M, Syam AF, Fauzi A, Makmun D, Manan C, *et al.* Dyspeptic syndrome in urban population in Jakarta. Ina JGHE. 2010;10:66-70. DOI: 10.24871/112201066-70.
14. Ho W, Spiegel BMR. The relationship between obesity and functional gastrointestinal disorders: causation, association, or neither? Gastroenterol Hepatol (NY). 2008;4:572-78. PMID: 21960939.
15. Suarez K, Mayer C, Ehlert U, Nater UM. Psychological stress and self-reported functional gastrointestinal disorders. J Nerv Ment Dis. 2010;198:226-29. DOI: 10.1097/

NMD.0b013e3181d106bc.
16. Waterlow JC. Classification and definition of protein-calorie malnutrition. Br Med J. 1972;3:566-69. DOI: 10.1136/bmj.3.5826.566.
17. Walker LS, Caplan A, Rasquin A. Rome III diagnostic questionnaire for the pediatric functional GI disorders [Internet]. [cited 2018 Jul 5]. Available from: http://www.drmdk.com/Constipation/pediatricq.pdf.
18. Intan NR. Faktor-faktor yang berhubungan dengan obesitas berdasarkan persen lemak tubuh pada remaja di SMA Islam terpadu. Fakultas Kesehatan Masyarakat Universitas Indonesia [Internet]. [cited 2018 Jul 7]. Available from: http://lib.ui.ac.id/file?file=digital/123610-S-5435-Faktor%20faktor-Lampiran.pdf.
19. Perkumpulan Gastroenterologi Indonesia (PGI). Syam AF, Aulia C, Makmun D, Renaldi K, Simadibrata M, Abdullah M, *et al*., editors. Konsensus penatalaksanaan irritable bowel syndrome di Indonesia. Jakarta: PGI; 2013. p.3.
20. Spiroglou K, Paroutoglou G, Nikolaides N, Xinias I, Giouleme O, Arsos G, *et al.* Dyspepsia in childhood. Clinical manifestations and management. Ann Gastroenterol. 2004;17:173-80.
21. Nasution BB. Hubungan status gizi dengan kejadian konstipasi fungsional pada anak. [cited 2018 Jul 7]. Available from: http://repositori.usu.ac.id/handle/123456789/33857.
22. Fishman L, Lenders C, Fortunato C, Noonan C, Nurko S. Increased prevalence of constipation and fecal soiling in a population of obese children. J Pediatr. 2004;145:253-4. DOI: 10.1016/j.jpeds.2004.04.022.
23. Teitelbaum JE, Sinha P, Micale M, Yeung S, Jaeger J. Obesity is related to multiple functional abdominal diseases. J Pediatr. 2009;154:444-6. DOI: 10.1016/j.jpeds.2008.09.053.
24. Bonilla S, Wang D, Saps M. Obesity predicts persistence of pain in children with functional gastrointestinal disorders. Int J Obes (Lond). 2011;35:517-21. DOI: 10.1038/ijo.2010.245.
25. Childs AA, John RM. Pooping shouldn't be this hard: using nutrition to address constipation in primary care. Infant Child Adolesc Nutr. 2015;7:287-302. DOI: 10.1177/1941406415601193.
26 Sujatha B, Velayutham DR, Deivamani N, Bavanandam S. Normal bowel pattern in children and dietary and other precipitating factors in functional constipation. J Clin Diagnostic Res. 2015;9:SC12-5. DOI: 10.7860/JCDR/2015/13290.6025.
27. El-Salhy M, Ystad SO, Mazzawi T, Gundersen D. Dietary fiber in irritable bowel syndrome. Int J Mol Med. 2017;40:607-13. DOI: 10.3892/ijmm.2017.3072.
28. Xu JH, Lai Y, Zhuang LP, Huang CZ, Li CQ, Chen QK, et al. Certain dietary habits contribute to the functional dyspepsia in South China rural area. Med Sci Monit Basic Res. 2017;23:3942-51. DOI: 10.12659/msm.902705.
29. Chang FY, Chen PH, Wu TC, Pan WH, Chang HY, Wu SJ, *et al.* Prevalence of functional gastrointestinal disorders in Taiwan: questionnaire-based survey for adults based on the Rome III criteria. Asia Pac J Clin Nutr. 2012;21:594-600. PMID: 23017318.
30. Huang R, Ho S, Lo W, Lam T. Physical activity and constipation in Hong Kong adolescence. PLoS One. 2014;9:e90193. DOI: 10.1371/journal.pone.0090193.
31. Heiman DL, Lishnak TS, Trojian TH. Irritable bowel syndrome in athletes and exercise. Curr Sports Med Rep. 2008;7:100-3. DOI: 10.1097/01.CSMR.0000313396.10064.09.
32. Matsuzaki J, Suzuki H, Masaoka T, Tanaka K, Mori H, Kanai T. Influence of regular exercise on gastric emptying in healthy men: a pilot study. J Clin Biochem Nutr. 2016;59:130-3. DOI: 10.3164/jcbn.16-29.