

## Prevalence and risk factors of irritable bowel syndrome in adolescents

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### Abstract

**Background** Irritable bowel syndrome (IBS) is a common gastrointestinal disorder in children and adults. The IBS is diagnosed by symptoms that fulfill the Rome IV criteria. This condition can impact quality of life, especially in adolescents.

**Objectives** To investigate the prevalence of IBS in high school students and analyze its risk factors.

**Methods** This cross-sectional study was done with e-questionnaires from *Rome IV Diagnostic Questionnaire on Pediatric Functional Gastrointestinal Disorders (R4PDQ)*. Students from high school and occupational schools age 14 to 18-years-old in Jakarta were included in this study. Possible risk factors for IBS were analyzed using Fisher's exact test for bivariate analysis and logistic regression for multivariate analysis.

**Results** Of 210 adolescents, 10 (4.8%) had IBS. The IBS-M and IBS-C subtypes were more common than IBS-D. Gastrointestinal infection history was significantly associated with IBS (OR 7.1; 95%CI 1.7 to 29.3; P=0.013). Other factors such as gender, corporal punishment, asthma, spicy and fatty food consumption, as well as socioeconomic status were not significantly associated with IBS (P>0.05).

**Conclusion** The prevalence of IBS in adolescents is 4.8%. History of gastrointestinal infection is a risk factor for IBS. [Paediatr Indones. 2021;61:299-305 ; DOI: 10.14238/pi61.6.2021.299-305].

**Keywords:** adolescents; irritable bowel syndrome; risk factors; Rome IV criteria; prevalence

Irritable bowel syndrome (IBS) is a common recurrent abdominal pain disorder in adults and children with a global prevalence of 11.2%.<sup>1</sup> The pathogenesis and pathophysiology of IBS are not well understood. The biopsychosocial model of dysfunctional homeostasis between the gut and brain is the most accepted theory to explain IBS.<sup>2</sup> However, some risk factors can increase the prevalence of IBS, such as age, gender, family history, and economic status.<sup>3</sup> The IBS can be diagnosed using the Rome criteria from the *Rome Foundation*, the latest criteria of which was released in 2016 (Rome IV).<sup>4</sup> To our knowledge, studies on IBS prevalence using the Rome IV criteria have not been done in Indonesia.

Although IBS is not a life-threatening disease, its impact on children's and adolescents' daily life, education, and quality of life is significant.<sup>5</sup> Jakarta is the capital city of Indonesia and the major center of education. Almost all high schools in Jakarta have high accreditation,<sup>6</sup> which causes high academic pressure on students. Psychological factors, in addition to

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other possible biological and social risk factors, may elevate the prevalence of IBS in Jakarta high schools. Therefore, this study was done to assess the prevalence of IBS in high school students in Jakarta and possible corresponding risk factors.

## Methods

An observational study with cross-sectional design was done in high school and occupational high school students in Jakarta from August to September 2020 using electronic questionnaires (e-questionnaire). Students aged 14 to 18 years were included by a convenience sampling method; those who did not provide informed consent were excluded. The minimum required sample size was 209 subjects. The Research Module of the Medical Ethics Committee of the Universitas Indonesia Faculty of Medicine approved this study.

The IBS section of the “Rome IV Diagnostic Questionnaire on Pediatric Functional Gastrointestinal Disorders (R4PDQ) – Child: Self-report form for Children and Adolescents (10 years and older)” was translated into Indonesian. The translation steps were done according to guidelines from the Rome Foundation.<sup>7</sup> The questionnaire was used in a pilot study of 30 subjects.<sup>8</sup> Cronbach’s alpha score was used to test the reliability of the translated questionnaire.

Respondents answered the questionnaire for diagnosing IBS using an online survey platform. Informed consent and questions about possible factors that could increase the risk of IBS, such as gender, corporal punishment (as parent’s form of discipline at home), history of gastroenteritis infection, history of asthma, spicy and fatty food consumption, and socioeconomic status, were included in the questionnaire. Data from respondents were processed using SPSS 20 program and analyzed for descriptive information. Chi-square and Fisher’s exact tests were used to analyze the prevalence of IBS and each of the factors. Factors with a P value below 0.2 in bivariate analysis were analyzed by multivariate logistic regression test. Results were shown as odds ratios of IBS risk factors with 95% confidence intervals.

## Results

The translation project for the IBS questionnaire began on 4 February 2020. The Rome Foundation approved and licensed the questionnaire on 28 July 2020. From 30 subjects of a pilot study, the translated questionnaire was analyzed for reliability, with a Cronbach’s alpha score of 0.89. Thus, the Indonesian version of the IBS questionnaire for children and adolescents had good reliability.

The e-questionnaire was distributed from 22 August 2020 until 4 September 2020. From 240 respondents, 210 students fulfilled the inclusion criteria. **Table 1** shows the demographic characteristics of the study subjects. Irritable bowel syndrome was found in 10 subjects, with an IBS prevalence of 4.8% (95%CI 2.3 to 8.6). The symptom distribution of IBS subjects is shown in **Table 2**.

Possible risk factors for IBS were analyzed using Fisher’s exact test, as none of them fulfilled the requirement for Chi-square test. Bivariate analysis revealed that history of gastroenteritis infection was significantly higher in the IBS group than in the non-IBS group ( $P=0.013$ ) (**Table 3**).

History of asthma ( $P=0.189$ ) and monthly family income ( $P=0.189$ ) were adjusted for the history of gastroenteritis infection in multivariate logistic regression analysis. Multivariate analysis revealed that the history of gastroenteritis infection was still a significant risk factor for IBS, with an odds ratio of 7.1 (95%CI 1.7 to 29.3;  $P=0.007$ ) (**Table 4**).

**Table 1.** Demographic characteristics of subjects

Characteristics	(N=210)
Gender, n (%)	
Female	162 (77.1)
Male	48 (22.9)
Mean age (SD), years	16.53 (0.83)
School district, n (%)	
East Jakarta	119 (56.7)
South Jakarta	27 (12.9)
Central Jakarta	21 (10.0)
West Jakarta	17 (8.1)
North Jakarta	1 (0.5)
Seribu Archipelago	25 (11.9)
Monthly family income, n (%)	
<Rp1,200,000	17 (8.1)
Rp1,200,000-Rp4,690,000	86 (41.0)
Rp4,690,000-Rp14,528,000	69 (32.9)
>Rp14,528,000	38 (18.1)

**Table 2.** Symptom distribution in subjects with IBS

IBS symptoms	Subject number									
	1	2	3	4	5	6	7	8	9	10
Symptoms above the navel										
4 days per month or more often	-	-	√	√	-	√	√	√	√	√
Duration: 2 months or longer	-	√	√	√	-	√	√	√	√	√
Associated with defecation*	-	-	√	√	-	-	-	-	-	√
Stool consistency is mushy or watery*	-	-	√	√	-	√	√	-	√	√
Stool consistency is harder or lumpier*	-	√	-	√	-	-	-	-	√	√
Increased defecation frequency*	-	√	√	√	-	√	√	-	-	-
Decreased defecation frequency*	-	√	-	√	-	√	-	√	-	√
Symptoms around and below the navel										
4 days per month or more often	√	√	√	√	√	√	√	√	√	√
Duration: 2 months or longer	√	√	√	√	√	√	√	√	√	√
Associated with defecation*	√	-	√	√	-	-	√	-	-	-
Stool consistency is mushy or watery*	-	-	-	√	√	√	√	-	√	-
Stool consistency is harder or lumpier*	√	-	-	√	√	-	-	-	√	-
Increased defecation frequency*	-	√	√	√	-	-	√	-	-	-
Decreased defecation frequency*	√	√	-	√	-	√	-	√	-	-

\*symptoms occurred sometimes or more often

**Table 3.** Bivariate analysis of possible risk factors of IBS

Variables	IBS (n=10)	Non-IBS (n=200)	OR (95%CI)	P value
Gender, n (%)				
Female	9	153 (76.5)	2.8 (0.3 to 22.4)	0.461*
Male	1	47 (23.5)		
Corporal punishment, n (%)				
Yes	2	36 (18)	1.1 (0.2 to 5.6)	1.000*
No	8	164 (82)		
History of gastroenteritis infection, n (%)				
Yes	4	18 (9)	6.7 (1.7 to 26.1)	0.013*
No	6	182 (91)		
History of asthma, n (%)				
Yes	2	15 (7.5)	3.1 (0.6 to 15.8)	0.189*
No	8	185 (92.5)		
Spicy food consumption, n (%)				
4 times or more/week	7	100 (50)	2.3 (0.6 to 9.3)	0.333*
3 times or less/week	3	100 (50)		
Fatty food consumption, n (%)				
4 times or more/week	5	129 (64.5)	0.6 (0.2 to 2.0)	0.501*
3 times or less/week	5	71 (35.5)		
Monthly family income, n (%)				
<Rp 1,200,000	2	15 (7.5)	3.1 (0.6 to 15.8)	0.189*
≥Rp 1,200,000	8	185 (92.5)		

\*Fisher's exact test; significant if P value<0.05

**Table 4.** Multivariate analysis of history of gastroenteritis infection and IBS

Risk factor	IBS (n=10)	Non-IBS (n=200)	Adjusted OR* (95%CI)	P value
History of gastroenteritis infection, n (%)				
Yes	4	18 (9)	7.1 (1.7 to 29.3)	0.007
No	6	182 (81)		

\*adjusted from the history of asthma and monthly family income factors

## Discussion

In this study, the prevalence of IBS (diagnosed by Rome IV criteria) in high school and occupational high school students in Jakarta was 4.8% (95%CI 2.3 to 8.6). Other studies in Jakarta using Rome III criteria reported IBS prevalences of 6% (95%CI 3.3 to 9.9)<sup>3</sup> and 2% (95%CI 1.4 to 2.8).<sup>9</sup> A meta-analysis of IBS epidemiology in Asia reported a pooled prevalence of IBS in children and adolescents of 12.4%, varying from 2.8% to 25.7% among countries.<sup>10</sup> The prevalence of IBS varies because of differences in geographical location, population, and diagnostic criteria used in each study.<sup>11</sup>

This study has similar prevalence and confident interval with the study by Fillekes et al.<sup>3</sup> Both studies have similar age distribution and gender ratio. Meanwhile, the difference in IBS prevalence of this study from the study in Jakarta by Oswari *et al.*<sup>9</sup> may be due to several reasons. First, the subject gender ratio differed among studies. Our study had more females, which is an IBS risk factor based on a meta-analysis.<sup>10</sup> Second, we used the Rome IV criteria for diagnosing IBS, which is looser than the Rome III criteria. Using the Rome IV criteria, IBS can be diagnosed with only one of the following symptoms associated with defecation: stool consistency changes or defecation frequency changes.<sup>4</sup> As a result, the prevalence of IBS in our study was higher than the prevalence in a similar previous study (2%).<sup>9</sup>

Out of the ten IBS subjects, four subjects had IBS-constipation subtype (IBS-C), three subjects had IBS-mixed subtype (IBS-M), and three subjects had IBS-diarrhea subtype (IBS-D). There are more IBS patients with constipation symptoms rather than mixed and diarrhea symptoms. Subtypes of IBS differ among studies because clinical symptoms of IBS may change over time and are different for each individual.<sup>10</sup>

Potential risk factors of IBS were analyzed in this study. Female gender had an odds ratio of 2.8 for risk

of IBS compared to male gender, though the result was not significantly different. Two other Indonesian studies in Jakarta<sup>3</sup> and Palembang, South Sumatera,<sup>12</sup> by reported similar findings. This result may be due to varying populations and unequal gender ratio of the subjects analyzed. However, the prevalence ratio of IBS in females compared to that of males was 2.6:1. Similarly, a meta-analysis of IBS in Asian children and adolescents noted that the prevalence of IBS was higher in females than males.<sup>10</sup> Females may be at higher risk of IBS because of hormonal influence and stress.<sup>12</sup>

The psychosocial factor is an important part of the biopsychosocial model in the etiology of IBS. We analyzed corporal punishment as one such psychosocial stressor, but found no significant association between corporal punishment and IBS. However, a school-based study in Jakarta reported a significant association between corporal punishment and IBS (P=0.034).<sup>3</sup> Other school-based studies in Palembang, South Sumatera<sup>12</sup> and Korea<sup>13</sup> also found that psychosocial factors such as behavior problems and stress were connected to IBS. A mental health review of the school environment revealed many stressors that can affect children's mental health.<sup>14</sup> As such, school closure because of the COVID-19 pandemic may have decreased the prevalence of IBS in this study.

Previous studies found a significant association between asthma and IBS.<sup>15,16</sup> The mechanism between asthma and IBS is not yet agreed upon, but some models suggest that mast cell secretion caused hyperresponsivity in asthma patients, which also affects enteric nerves and smooth muscles in the colon. Furthermore, asthma patients have increased enteric permeability compared to healthy persons, making them more prone to IBS symptoms.<sup>17</sup> In our study, no significant difference in asthma was found between the IBS and non-IBS groups, even though the odds ratio was quite high at 3.1 in patients with a history of asthma. This result was similar to a meta-analysis that reported a pooled IBS odds ratio in adults to be

2 (95%CI 1.5 to 2.8).<sup>17</sup> Another study also found that children with atopic diseases like asthma had an increased risk of developing IBS.<sup>18</sup>

Clinical guidelines from the British Dietetic Association recommend changes in food and lifestyle to treat IBS. Spicy and fatty foods should be avoided by IBS patients,<sup>19</sup> as those foods can worsen symptoms of IBS.<sup>20</sup> Capsaicin in chili peppers can affect the transient receptor potential vanilloid (TRPV) receptor, causing stomachaches, while fat can stimulate intestinal motility. A study of adolescent girls reported that spicy and fried foods had a significant association with IBS prevalence, with ORs of 5.28 and 1.65, respectively.<sup>21</sup> Another study also found a significant association between spicy food and IBS with OR 1.85.<sup>22</sup> Spicy food consumption did not have a significant influence on IBS in our study.

In our study, dietary habits was not significantly different between the IBS and non-IBS groups. Another Jakarta study also did not find a significant difference between drinking milk, coffee, and energy drinks between IBS and non-IBS groups of students.<sup>3</sup> Indonesian food is typically full of spices with rice as the main staple. An Asian diet containing rice and chili was found to reduce symptoms of functional gastrointestinal disorders.<sup>23</sup> Moreover, one study compared capsulated pepper powder with placebo in IBS patients and found that a long duration of pepper powder capsule consumption could reduce IBS symptoms.<sup>24</sup> Hence, Indonesian habits of eating rice and spicy food may have reduced the risk of IBS in this study.

A meta-analysis using data up to 2011 found no significant association between socioeconomic status and the prevalence of IBS,<sup>1</sup> similar to a previous study in Jakarta<sup>3</sup> and our findings. However, the socioeconomic status in our study was quite high at OR 3.1 (95%CI 0.6 to 15.8). A previous study reported that lower socioeconomic status in childhood can affect IBS.<sup>25</sup> Furthermore, a study in adolescents in Lagos, Nigeria found a similar result. People with low socioeconomic status are more prone to IBS because of poor hygiene that leads to gastrointestinal infections.<sup>26</sup>

Acute gastroenteritis infection was the strongest risk factor for IBS development, consistent with post-infectious IBS (PI-IBS).<sup>27</sup> In a prospective cohort of acute gastroenteritis patients, 25.7% developed IBS within 6 months.<sup>28</sup> The prevalence of PI-IBS gastroenteritis infection is estimated at 3-36%. One

in ten IBS patients believed that their symptoms started from a gastrointestinal infection.<sup>29</sup> Indeed, we found a significant relationship between the history of gastrointestinal infection and IBS. The adjusted OR of patients with gastrointestinal infection was 7.1 (P=0.007). Nevertheless, our results are not quite precise because of the wide confidence interval, probably due to our small sample size.

There were several limitations in our study. The population sampling was done by a convenience method, so there was no random in subject selection. Thus, the gender ratio is not equally distributed. Female participants were more likely to respond to this online survey. Furthermore, our sample size was too small to obtain robust results. The COVID-19 pandemic situation and school closure also limited the study, as indirect data collection using e-questionnaires reduced the response rate of the respondents. Further study should use a random sampling method, such as cluster sampling, with a larger sample size. Direct data collection, such as interviews, is also recommended. The effects of the pandemic, such as school closure and online learning, on children's gastrointestinal health should be further studied. Last but not least, a cohort study is needed to confirm the history of gastrointestinal infection as a risk factor of IBS.

In conclusion, the prevalence of IBS in adolescents in Jakarta using Rome IV criteria is 4.8% (95%CI 2.3 to 8.6). The IBS-M and IBS-C are more common than IBS-D. The history of gastrointestinal infection is a significant risk factor for IBS, with OR 7.1 (95% CI 1.7 to 29.3).

## Conflict of Interest

None declared.

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