An Epidemiologic Study of Irritable Bowel Syndrome in Adolescents and Children in China: A School-Based Study

Liu Dong, MD*; Li Dingguo, MD‡; Xu Xiaoxing, MD§; and Lu Hanming, MD‡

ABSTRACT. Objectives. To explore the prevalence of irritable bowel syndrome (IBS) and its distribution characteristics of adolescents and children in China and its contributing factors.

Methods. This study was a stratified, randomized study by clustering samples, which involved 5403 students whose age range was 6 to 18 years from 9 schools, and was conducted in Heilongjiang Province and Shanghai. All students studied were requested to fill in a questionnaire. IBS was diagnosed according to Rome II criteria.

Results. The prevalence of IBS according to Rome II criteria in adolescents and children in China was 13.25%. The ratio of boys to girls was 1:1.8. There was a higher prevalence (14.02%) of IBS in Heilongjiang province than that (11.72%) in Shanghai. The prevalence in children 12 years and younger was not statistically significantly higher than that of adolescents 13 years and older (11.86% and 11.44%, respectively). The prevalence of IBS in minority students (21.15%) was not statistically significantly higher than that in Han race students (16.08%).

Conclusion. IBS was a common disorder in adolescents and children in China. The prevalence of IBS in adolescents and children was different in different geographic areas. Our study indicated that IBS in adolescents and children might have possible relations with psychological factors, food habit, bad exterior environment, personal habits, and family conditions might be important contributing factors, and exposure to coldness (odds ratio: 2.83) is most prominent.

METHODS

Students

This study was a stratified, randomized study by clustering samples. We estimated by calculating sample formula that this study required 2800 students according to data of preliminary investigation in Shanghai. The provided prevalence of IBS was 12.5% with a permissible error of 5%, but we attempted to increase clustering samples to a total of 4200 students to lessen test error; finally, we recruited 5403 students to make the result more convincible. A total of 5403 students were from a town of Heilongjiang province and a section of Shanghai. Heilongjiang province is in the northeast of China, and Shanghai in southeast of China. Shanghai is a modern metropolis, and Heilongjiang province is more rural than Shanghai; the climate in Heilongjiang province is continental, and Shanghai is oceanic. In the addition, the 2 geographic areas are different in food habits and cultural background. The more of the school population in Shanghai can...
to go to college than that in Heilongjiang. According to the above, we chose to study the 2 areas. The sample size of each investigated area was in proportion to the population of that area. First, a town in Heilongjiang province and a section in Shanghai were chosen as primary sampling units, and, second, 9 schools were selected by drawing lots in the town and the section.

**Questionnaire**

In these schools, all of the students were required to fill in the questionnaire that was designed by us in terms of the official IBS questionnaire that was used in the United States, 8 IBS psychometrics9 and Rome II criteria10 (it is reasonable to use these criteria as our diagnostic measurement because we are comparing data with a control group). Meantime, the grade 7 through 12 students were assisted by the trained teachers to fill in the questionnaire, and the questionnaires for students in grades 1 through 6 were filled in by their parents. The questionnaire included demographic data, food habits, and some symptoms associated with IBS and other gastrointestinal tracts, a total of 50 items. We carefully checked these data in all returned questionnaires, and their reliability was 96.6%.

**Diagnosis Criteria**

The prevalence of IBS was period prevalence. We used Rome II criteria published to diagnose IBS, and students who had a diagnosis of IBS were suggested to visit a physician to excluded organic diseases. We excluded organic diseases according to the information in medical records.

**Statistics**

Descriptive statistics (frequencies, proportions, means, and SDs) were calculated for all items of the questionnaire, and confidence intervals for proportions were estimated by standard methods, with 5% error. Bivariate comparisons between study groups were evaluated with statistical tests appropriate to the level of measurement of the dependent variable, including $\chi^2$ and $t$ test. Multiple logistic regressions were used to test the contributing factors of IBS. All $P$ values are 2-tailed.

**RESULTS**

**Demographic Characteristics of the Population Studied**

The age of 5403 students ranged from 6 to 18 years. In 5403 students, 2495 were 12 years and younger and 2908 were 13 years and older; 3604 were from Heilongjiang province, and 1799 were from Shanghai. The number of senior middle school students (grades 10–12) was 1579 (mean age: 15.60 ± 0.67 years), of junior middle school students (grades 7–9) was 1749 (mean age: 13.59 ± 1.32 years), and of primary school students (grades 1–6) was 2077 (mean age: 8.51 ± 1.79 years). The ratio of boys to girls was 1:1.02. More than 98.00% of the total students were of Han race (ethnic group), and <2% were minorities (ethnic group). A total of 94% to 98% of students lived in households with both parents.

**IBS in Adolescents and Children**

**Prevalence of IBS**

The prevalence of IBS in the adolescents and children studied was 13.25% (716 among 5403 students). The ratio of boys (11.56%) to girls (20.86%) was 1:1.8, and the difference between boys and girls had no statistical significance ($P > .05$).

**Age-Based Distribution Characteristics**

The prevalence of IBS in children who were 12 years and younger was not statistically significantly higher than that of adolescents who were 13 years and older (11.86% and 11.44%, respectively; $P > .05$). Figs 1 and 2 show the prevalence of IBS of each age span. Among them, the prevalence of the subgroup of children who were 8 to 9 years of age was the highest in children who were 12 years and younger (14.78%), and in adolescents who were 13 years and older, the prevalence of adolescents who were 15 to 16 years was the highest (17.35%). However, the prevalence of each age range had no statistical difference.

**Area-Based Distribution Characteristics**

There was a statistically significantly higher prevalence of IBS in Heilongjiang province (14.02%) than in Shanghai (11.72%; $P < .04$).

**Ethnic Group-Based Distribution Characteristics**

The prevalence of IBS in minority students (21.15%) was not statistically significantly higher than that in students of Han race (16.08%).

**Bowel Movement Habit and Frequency**

Among students who received a diagnosis of IBS, the prevalence of straining (33.25%) and urgency (23.75%) of defecation in students in grades 1 through 3 was statistically significantly higher than that of students in other grade ($P < .001$), the prevalence of the feeling of incomplete evacuation in students in grades 10 through 12 was the most prevalent (23.20%; $P < .001$). The prevalence of diarrhea in students in grades 1 through 3 (frequency >5 times every day and 3–5 times every day) was statistically significantly higher than that of students in other grades (2.11% and 4.75%, respectively; $P = .001$). The prevalence of constipation in students in...
grades 7 through 9 was 20.54% (1 time every other 3–5 days or 1 time in >5 days), and this was statistically significantly higher than that of students in other grades (P < .001).

**Physician Visits for IBS**

Among 716 students with IBS, 220 (30.72%) visited physicians, and 220 students who had IBS and visited doctors, organic diseases were excluded by medical techniques.

**Contributing Factors of IBS**

We explored contributing factors of IBS in adolescents and children by comparing the frequencies of these factors in the IBS group with those in the non–IBS group, using \( \chi^2 \), multiple logistic regressions. The data concerned are shown in Table 1. Our study indicated that IBS in adolescents and children might have possible relations with psychological factors (anxiety, depression, and introverted personality), food habits (excessive intake of pepper), personal habits (alcoholism and smoking), and bad exterior environment (history of dysentery, abdominal operation, abuse of antibiotics, exposure to coldness, and fatigue), family condition (poor care of only a single parent) etc. Among 22 factors, alcoholism (odds ratio [OR]: 1.25), smoking (OR: 1.44), excessive intake of pepper (OR: 1.13), history of dysentery (OR: 1.37), abdominal operation (OR: 1.63), abuse of antibiotics (OR: 1.93), exposure to coldness (OR: 2.83), fatigue (OR: 1.10), anxiety (OR: 1.07), depression (OR: 1.13), and introverted personality (OR: 1.05) might serve as important contributing factors (P < .05).

**Relationship of IBS in Adolescents and Children to Headaches, Backaches, and Insomnia**

We explored the relationship of IBS in adolescents and children to headaches, backaches, and insomnia by comparing their occurrence between the IBS group and the non–IBS group, using \( \chi^2 \) (the data concerned are shown in Table 2). The difference of their occurrence had statistical significance (P < .001).

**DISCUSSION**

In the world, IBS is a common disorder, and its prevalence tends to be higher in Western countries (~10%) than that of Asian countries (~5%); moreover, its prevalence was not uniform in different areas, ages, genders, races, occupations, and educational levels. Here, psychological factors, food habits, bad exterior environment, and family condition were considered to be contributing factors of IBS. According to the common understanding of adult IBS, some investigators from Hartford University Medical School conducted an epidemiologic study including the prevalence rate of IBS and its contributing factors in adolescents. However, studies about IBS in adolescents and children of China were meager in China. Our study has a significance of filling in the missing epidemiologic data about IBS in adolescents and children of China.

Our study found that the prevalence of IBS in adolescents and children studied was 13.25%, and the ratio of boys (11.56%) to girls (20.86%) was 1:1.8 (P > .05). The above results coincided with those of a study done by Reshetnikov et al in Moscow.

In China, there are 56 ethnic groups, including Han race and other 55 races; the Han population totals 1.04 billion, which is the largest among them, and the other 55 races were called minorities. We also found that the prevalence in minorities (21.15%) was statistically significantly higher than that of the Hans (16.08%). We thought that the reason might be that the minorities and Hans lived together in the same region and were exposed to the same living environment.

The prevalence of IBS between children who were 12 years and younger and adolescents who were 13

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**TABLE 1. Logistic Analysis of Important Contributing Factors in IBS**

<table>
<thead>
<tr>
<th>Contributing Factors</th>
<th>B</th>
<th>SE</th>
<th>( \chi^2 )</th>
<th>P Value</th>
<th>OR</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcoholism</td>
<td>0.22</td>
<td>0.12</td>
<td>3.49</td>
<td>.04</td>
<td>1.25</td>
<td>0.94–1.22</td>
</tr>
<tr>
<td>Smoking</td>
<td>0.36</td>
<td>0.30</td>
<td>1.46</td>
<td>.05</td>
<td>1.44</td>
<td>0.95–0.99</td>
</tr>
<tr>
<td>Pepper</td>
<td>0.12</td>
<td>0.06</td>
<td>4.26</td>
<td>.04</td>
<td>1.13</td>
<td>0.66–0.87</td>
</tr>
<tr>
<td>Dysentery</td>
<td>0.32</td>
<td>0.06</td>
<td>32.22</td>
<td>.00</td>
<td>1.37</td>
<td>0.71–0.81</td>
</tr>
<tr>
<td>Abdominal operation</td>
<td>0.49</td>
<td>0.24</td>
<td>4.20</td>
<td>.04</td>
<td>1.63</td>
<td>0.89–0.97</td>
</tr>
<tr>
<td>Antibiotics</td>
<td>0.66</td>
<td>0.21</td>
<td>10.31</td>
<td>.00</td>
<td>1.93</td>
<td>0.78–0.87</td>
</tr>
<tr>
<td>Coldness</td>
<td>1.04</td>
<td>0.10</td>
<td>101.87</td>
<td>.00</td>
<td>2.83</td>
<td>0.49–0.58</td>
</tr>
<tr>
<td>Fatigue</td>
<td>0.10</td>
<td>0.05</td>
<td>3.82</td>
<td>.04</td>
<td>1.10</td>
<td>0.31–0.45</td>
</tr>
<tr>
<td>Anxiety</td>
<td>0.10</td>
<td>0.06</td>
<td>2.46</td>
<td>.01</td>
<td>1.07</td>
<td>0.34–0.49</td>
</tr>
<tr>
<td>Depression</td>
<td>0.07</td>
<td>0.06</td>
<td>4.47</td>
<td>.03</td>
<td>1.13</td>
<td>0.33–0.47</td>
</tr>
<tr>
<td>Introverted personality</td>
<td>0.05</td>
<td>0.07</td>
<td>0.55</td>
<td>.02</td>
<td>1.05</td>
<td>0.82–1.02</td>
</tr>
</tbody>
</table>

CI indicates confidence interval.

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**TABLE 2. Relationship of IBS to Some Symptoms in Adolescents and Children**

<table>
<thead>
<tr>
<th></th>
<th>Headache</th>
<th>Backache</th>
<th>Insomnia</th>
</tr>
</thead>
<tbody>
<tr>
<td>IBS group, %</td>
<td>32.68</td>
<td>22.21</td>
<td>5.95</td>
</tr>
<tr>
<td>Non-IBS group, %</td>
<td>14.32</td>
<td>9.26</td>
<td>2.05</td>
</tr>
<tr>
<td>P value</td>
<td><code>&lt;.001</code></td>
<td><code>&lt;.001</code></td>
<td><code>&lt;.001</code></td>
</tr>
</tbody>
</table>

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years and older had no statistically significant difference. This reason might be ascribed to changes in their physiologic and biological states.

Moreover, the prevalence of diarrhea in students in grades 1 through 3 was significantly higher than that in students in other grades. The prevalence rate of constipation in students in grades 7 through 9, however, was significantly higher than that in students in other grades ($P < .001$). Hence, we could deduce that students in grades 1 through 3 might take on diarrhea-predominant IBS but that students in grades 7 through 9 possibly take on constipation-predominant IBS.

It was generally thought that there was a different prevalence of IBS in different areas. Consequently, we also conducted area-based distribution characteristics of IBS in adolescents and children and found that there was a higher prevalence rate of IBS in Heilongjiang province (14.02%) than that in Shanghai (11.72%; $P < .05$). Multiple factors might be responsible for it, including different geographic and climatic conditions, food habits, and different cultural background in China with an immense terrain. However, the stress of school work of adolescents and children in Heilongjiang province seemed to be heavier that in Shanghai. The rate of college admission was $\sim 60\%$ in Heilongjiang province versus $85\%$ in Shanghai; therefore, the stress of competition for going on to college was heavier in Heilongjiang province. In short, IBS in a school-based adolescents and children of China is a common disorder that deserves more attention.

In exploring the contributing factors of IBS in adolescents and children, we analyzed that the relationship between psychological factors (anxiety, depression, and introverted personalities; stress of school work; parents living in household; and parents’ disciplinary forms to their children, including scolding and corporal punishment) and IBS and found that the frequencies of anxiety, depression, and introverted personalities were higher in the IBS group ($P < .05$); nevertheless, our study failed to find a possible relationship of stress of school work and parents’ disciplinary forms with IBS.

We found that $18.16\%$ of students with IBS had a history of dysentery 6 to 12 weeks before presenting IBS symptoms. Under a bad exterior environment—involved abdominal operation, abuse of antibiotics (ie, use of antibiotics for whatever reason without the prescription), exposure to coldness (ie, low-temperature environmental conditions), fatigue, and personal habits involving alcoholism (alcoholism is a disease that is manifested by the uncontrollable drinking of the victim, who is known as an alcoholic in China) and smoking, the prevalence of IBS in adolescents and children had a tendency to increase. Exposure to coldness (OR: 2.83) is most prominent, whose reason might be that smooth muscle in the gastrointestinal tract is hypersensitive for low temperature, and this leads to hyperanacinesia of smooth muscle in the gastrointestinal tract. This tendency would be consistent with observations in adults suggesting that gastroenteritis predisposes to development of IBS.

Our study also found that excessive intake of pepper and cold food was an important contributing factor of IBS in adolescents and children. The pepper and the cold food were especially prevalent food habits in the northern areas of China. This might be 1 of many reasons for different the prevalence in the north and south of China. It was also noted that adolescents and children who lived in a single-parent household had a higher prevalence of IBS, and this may be attributable to abnormality of personality in such household circumstances.

Recently, several studies suggested a higher prevalence of headaches, backaches, and insomnia in adolescents with IBS. We also noted that $32.68\%$ of students with IBS in our study had headaches, $22.21\%$ had backaches, and $5.95\%$ had insomnia. The rates were statistically significantly higher in adolescents and children with IBS ($P < .001$), but our study could not confirm that these were concomitant symptoms with IBS in adolescents and children or just the same as its contributing factors.

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