

Irritable bowel syndrome in Chinese nursing and medical school students—Related lifestyle and psychological factors

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ABSTRACT

Background: Previous studies have shown that the prevalence of irritable bowel syndrome (IBS) is 10% - 15% in the general population. IBS is a functional gastrointestinal disorder characterized by abdominal pain, abdominal discomfort and disordered defecation associated with a stressful lifestyle. However, the cause of IBS has not been clarified yet. Based on a similar, previous study in Japan, this study investigated the prevalence of IBS and the relationship between IBS and stress, lifestyle and dietary habits among nursing and medical school students in China. **Methods:** Designed to investigate IBS symptoms, lifestyle, dietary intake, life events, anxiety and depression, a blank self-administrated questionnaire was used to survey 2500 nursing or medical students in China. Questionnaires were collected from 2141 students (85.6%) and responses obtained from 1934 students (90.3%) were analyzed. **Results:** On the whole, the prevalence of IBS was 32.1% in this study, 26.6% in males and 33.6% in females. In females, the IBS group showed a bedtime later than that in the non-IBS group, and the length of time asleep in the IBS group was shorter than that in the non-IBS group ($p < 0.001$, $p = 0.005$). In females, the IBS group showed a frequency for the intake of vegetables and potatoes that was lower than that of the non-IBS group ($p = 0.007$, $p = 0.023$). The prevalence of IBS among nursing and medical school students in China (32.1%) was significantly lower than that in Japan (35.5%). Especially, the number of females in the constipation dominant IBS subgroup in China (11.8%) was less than that found in Japan (20.4%). **Conclu-**

sions: The prevalence of IBS was high among nursing and medical students in China, but lower than that shown in Japan.

Keywords: China; Irritable Bowel Syndrome; Nursing School; Medical School; Lifestyle; Food Frequency; Dietary Habits

1. INTRODUCTION

A functional disorder of the gastrointestinal (GI) tract, irritable bowel syndrome (IBS) is associated with abdominal pain or discomfort, with a concurrent disturbance in bowel habits [1]. The mechanism and cause of IBS remain unknown. However, it has been clarified that most of the reported disorders, for example, dysregulation of the nervous system, altered intestinal motility, and increased visceral sensitivity, result from dysregulation of the bidirectional communication between the gut with its enteric nervous system and the brain (the brain-gut axis) [2]. The neural network of the brain that generates this stress response is called the central stress circuitry [3], and it receives input from the somatic and visceral afferent pathways and also from the visceral motor cortex. The output of this central stress circuit is known as the emotional motor system, and it includes the autonomic efferents, such as the hypothalamus-pituitary-adrenal axis and pain modulatory systems [3].

In Western countries, the prevalence of IBS is 15% - 24% in the general population, regardless of age or ethnicity, with a males/females ratio of 1:1.5 [4,5]. In most Asian countries, the prevalence of IBS is 5% - 10% [6], lower than that found in Western countries. The prevalence of IBS was found to be 5.7% in Korean college and university students [7], 10.4% in undergraduates in South-

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east China [8,9], and 7.9% in college and university students in North China [10]. The incidence rate per year is between 1% and 2% [11,12]. The frequency of young females with defecation problems has been increasing recently. In general, more females have IBS than males [14,15] and the prevalence of females with IBS is 1.5 to 2 times higher than that shown for males in many countries [7,15-17].

Reports have been published on IBS in China since 1990. The prevalence of IBS was reported to be 0.82% in 1996 [18], 5.6% in 2001 [19], and 20.2% in 2006 [20].

In a study conducted in Japan between 2006 and 2007 [21], we investigated the prevalence of IBS and the relationship between IBS and stress, lifestyle, and dietary habits in nursing and medical students, who were selected as the subjects of the study because they had a more stressful life than students with other majors or the general population due to their demanding schedule with the university curriculum and clinical practice. The results of that study showed that the prevalence of IBS was 35.5% on the whole, 25.2% in males and 41.5% in females. In addition, IBS was related to anxiety and depression, dietary habits including less intake of fish, fruit, milk and green-yellow vegetables, and much intake of retort food products, as well as with unhealthy lifestyles, including irregular meals and sleep disturbances [21].

Based on these results, we investigated the prevalence of IBS and the tendency in China, which is located close to Japan. In addition, we also chose nursing and medical students as the subjects of this study in order to compare the results with the Japanese study [21]. The purpose of this study was to clarify the prevalence of IBS and the relationship between IBS and stress, lifestyle and dietary habits in nursing and medical school students in China, and to compare the results obtained from the Chinese subjects with data obtained from our previous Japanese study [21]. Therefore, the hypothesis of this study was sufficiently different from the Japanese study [21].

2. METHODS

In order to compare the results obtained from the Chinese subjects with data previously obtained from our Japanese study [21], we used similar subjects and the same questionnaires (in Chinese, rather than Japanese), the same IBS definitions and the same assessment criteria as in the Japanese study [21]. From the copyright holder, we obtained permission to show the data in the previously published Japanese study [21] as the reference.

2.1. Study Population

Initially, questionnaires were issued to a total of 2500 students for participation in this study, selected from the

3169 university students majoring in nursing or medical technology at Zhengzhou University in Henan Province. A total of 2141 students answered the self-administered questionnaires. According to our eligibility criteria, under the age of 30 years old, no diagnosis of inflammatory bowel diseases, and no data inadequacy, 207 students were considered ineligible. Therefore, we analyzed questionnaires obtained from a total of 1934 students aged 16- to 24-year-old (19.7 ± 1.4), including 414 (21.4%) males and 1520 (78.6%) females.

Study participants were asked to sign an informed consent form before they participated in the study. This study was approved by the Ethical Board of Kyoto Prefectural University and Zhengzhou University. This was an observational and cross-sectional study conducted from October through November in 2007.

2.2. IBS Definitions

Patients with IBS were diagnosed with Rome II criteria [22]. Subjects were classified into three subgroups as follows: The diarrhea-predominant IBS (IBS-D), the constipation-predominant IBS (IBS-C), and the alteration type IBS (IBS-A). We used a modified Chinese version of the Rome II modular questionnaire, including 15 items compiled by Shinozaki *et al.* [23].

2.3. Questionnaire Information (Table 1)

In order to obtain a questionnaire suitable for our purpose, we combined well-known criteria with some original items. The questionnaire contained 67 items, with the

Table 1. The questionnaire information items (n).

Bowel habits (Rome II criteria)	15	
Psychological factors (HADS*)	14	
Stressful life events	1	
Lifestyle	Sleeping	1
	Habitation	1
	Drinking	1
	Smoking	1
	Desire to be thin	1
	Dieting experience	1
	Exercise frequency	1
	Exercise items	1
	Time spent sitting	1
Use of laxatives	1	
Dietary habits and food frequency	20	
Subjective factor for physical condition	1	
Physical characteristics	Sex	1
	Age	1
	Height	1
	Weight	1
	Hometown	1
Treatment of disease	1	
Total	67	

*Hospital anxiety and depression scale.

following sections; bowel habits (Rome II criteria) (15 items), psychological factors (Hospital anxiety and depression scale: HADS) (14 items), stressful life events (1 item), subjective physical condition factors (1 item), lifestyle (10 items), dietary habits and food frequency (20 items), physical characteristics (5 items), and treatment for disease (1 item).

There were six optional answers in the subjective physical condition factors section; stress, sleep, diet, irregular mealtimes, smoking and drinking.

2.4. Psychological Assessments

In order to evaluate the stress situation correctly, we assessed both the stress response and the stressor.

2.5. Stress Response

The hospital anxiety and depression scale (HADS) [24] was employed, a scale proven to be reliable and valid when screening for mood disorders. HADS can be divided into a subscale for anxiety (HAD-A) and a subscale for depression (HAD-D). In either of the HAD subscales, a score above 10 indicates definite clinically significant anxiety or depression, respectively, up to a maximum score of 21. Respectively, a score of more than 11 points is regarded as a definite type, a score between 8 and 10 is doubtful and a score of less than 7 points indicates no mood disorder.

2.6. Stressor

A stressor is a life event considered to be a stressful and subjective event. The subjects were asked whether or not such an event had occurred within the past three months as defined in the IBS definitions and the HADS. They answered "YES" if they thought it was such a life event in their subjective viewpoint, because the form of perception is different from person to person. The subjects provided a free description of the content of the life event. Two examples of a life event were provided in the questionnaire, such as the divorce of parents or a romantic breakup.

2.7. Exercise Assessment

The exercise guideline for health in Japan published in 2006 [25] used "METS" as the unit for the intensity of exercise and "Exercise" as the amount of exercise. "METS" indicates a multiple number of 1 MET, which is the intensity of exercise in the resting state. "Exercise" is "METS" multiplied by time. The questionnaire asked about the kind of exercise done and the exercise time period. These items were calculated and "Exercise" was used as a unit.

2.8. Statistical Analysis

Values were expressed as mean \pm SD. An analysis of the proportions among the IBS diagnostic groups was performed using Pearson's chi-square test. Statistical analyses for significant differences in parameters were performed using the nonparametric Mann-Whitney *U* test between two groups. The Kruskal-Wallis test was used to measure differences among the three groups. All statistical computations were performed using SPSS (version 11.5 for Windows). A two-sided *p* value of less than 0.05 ($p < 0.05$) was considered statistically significant.

3. RESULTS

3.1. Prevalence of IBS

Out of 1934 students, 110 (26.6%) males and 511 (33.6%) females were diagnosed as having IBS. The predominant type was IBS-A in both males (14.5%) and females (12.5%) (**Table 2**). The prevalence of IBS and IBS-C in females was higher than that found in males (IBS: $p = 0.006$, IBS-C: $p < 0.001$) (**Table 2**).

3.2. Characteristics of the Subjects by IBS Status

In males, there were no statistically significant differences in age, height, weight, BMI or hometown between the IBS and the non-IBS groups (age: $p = 0.208$, height: $p = 0.752$, weight: $p = 0.944$, BMI: $p = 0.572$, hometown: $p = 0.294$). In females, age and height were higher in the IBS group than those in the non-IBS group (age: p

Table 2. IBS prevalence among nursing and medical school students in China.

		Males	Females	Total	<i>p</i> *
IBS subgroup	Total	110 (26.6)	511 (33.6)	621 (32.1)	0.006
	IBS-D	27 (6.5)	141 (9.3)	168 (8.7)	0.078
	IBS-C	23 (5.6)	180 (11.8)	203 (10.5)	<0.001
	IBS-A	60 (14.5)	190 (12.5)	250 (12.9)	0.284
Non-IBS subgroup		304 (73.4)	1009 (66.4)	1313 (67.9)	
Total		414 (100.0)	1520 (100.0)	1934 (100.0)	

Data are presented as n (%). IBS irritable bowel syndrome, IBS-D diarrhea predominant IBS, IBS-C constipation predominant IBS, IBS-A alteration type IBS, *Chi-square test (males vs. females).

< 0.001, height: $p = 0.021$). However, there were no statistically significant differences in weight, BMI or hometown between the IBS-group and the non-IBS group (weight: $p = 0.059$, BMI: $p = 0.697$, hometown: $p = 0.573$). The average weight for males subjects in the IBS-A subgroup was heavier, compared with the other subgroups ($p = 0.039$).

3.3. The Relationship between Psychological Factors and IBS

In females, the anxiety scores were significantly higher in the IBS group, compared with the non-IBS group ($p < 0.001$) (Figure 1). Females in the IBS-C subgroup had higher anxiety scores than the other subgroups ($p = 0.015$) and the average scores were over 10 points. Consequently, for females, the IBS group showed a more definite anxiety type, compared with the non-IBS group ($p < 0.001$). Females in the IBS-C subgroup showed a more definite anxiety type than the other subgroups.

In both males and females, there were more life events in the IBS group than in the non-IBS group (males: $p = 0.015$, females: $p = 0.013$) (Table 3). In males, the IBS-C subgroup had more life events than the other subgroups ($p = 0.012$).

3.4. Lifestyle

In females, the IBS group had more sleep disturbances than the non-IBS group ($p < 0.001$) (Figure 2). In females, the bedtime of the IBS group was later than shown for the non-IBS group ($p < 0.001$) (Table 4). In females, the number of sleeping hours in the IBS group was less than that shown in the non-IBS group ($p = 0.005$). In females, the IBS-C subgroup used more laxatives than the other subgroups ($p = 0.030$) (Figure 3). In males, the rate of students using laxatives more than one time a week was 5.4% in the IBS group and 1.9% in the non-IBS group. In females, it was 3.5% in the IBS group

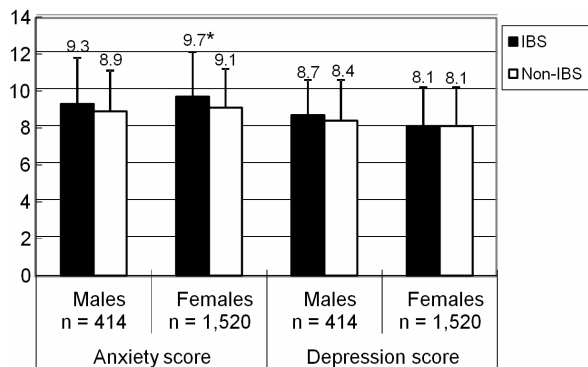


Figure 1. Anxiety and depression scores on the hospital anxiety and depression scale (HADS) in the IBS group and the non-IBS group among nursing and medical school students in China. * $p < 0.001$, Mann-Whitney *U* test.

Table 3. Life events in the IBS and the non-IBS groups among nursing and medical school students in China.

	Males		p^*	Females		p^*
	IBS	Non-IBS		IBS	Non-IBS	
Positive	17 (15.7)	23 (7.6)	0.015	63 (12.3)	84 (8.3)	0.013
Negative	91 (84.3)	278 (92.4)		924 (91.7)	448 (88.7)	
Total	108 (100.0)	301 (100.0)		1008 (100.0)	511 (100.0)	

Data are presented as n (%). IBS irritable bowel syndrome, * Chi-square test.

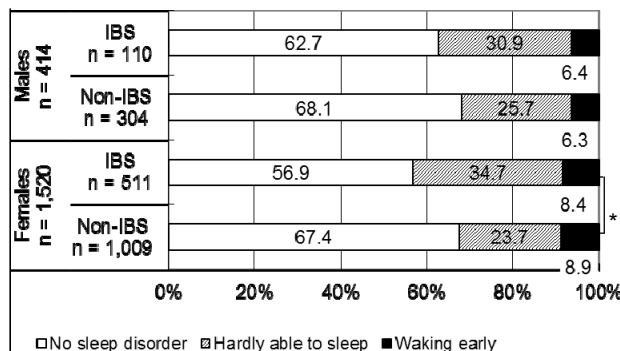


Figure 2. Sleep disorder in the IBS group and the non-IBS group among nursing and medical school students in China. * $p < 0.001$, Chi-square test.

and 2.6% in the non-IBS group. In females, the IBS group had more diet experiences than the non-IBS group ($p < 0.001$). There were no statistically significant differences shown for either males or females between the IBS group and the non-IBS group in drinking, smoking, exercise and time spent sitting.

3.5. Dietary Habits and Food Frequency of Intake

In females, the intake of less leafy vegetables, other vegetables, and potatoes was less in the IBS group, compared with the non-IBS group ($p = 0.007$, $p = 0.023$) (Table 5). Females in the IBS-C subgroup ate less beans or bean products, and mushrooms, and drank less milk ($p = 0.012$, $p = 0.006$, $p = 0.005$). Females in the IBS group had more irregular meals and skipped meals more frequently than the non-IBS group ($p = 0.002$, $p = 0.018$) (Figures 4 and 5). Especially in males, the rate of missing meals almost everyday was 33.3% in the IBS-D subgroup.

3.6. Subjective Factors Affecting the Body

In females, more students in the IBS group thought that the factors affecting their bodies were stress, food, and sleeping time, compared with those in the non-IBS group ($p = 0.043$, $p = 0.032$, $p = 0.006$). More males in the IBS-C subgroup thought the factor affecting their bodies was food, compared with the other subgroups ($p = 0.005$). More females in the IBS-C subgroup thought the factor

Table 4. Sleep time and exercise in the IBS and the non-IBS groups among nursing and medical school students in China.

	Males (n = 414)			Females (n = 1520)		
	IBS	Non-IBS	<i>p</i> [*]	IBS	Non-IBS	<i>p</i> [*]
Hours of sleep (h/day)	6.9 ± 0.8	7.0 ± 0.9	0.617	7.0 ± 0.8	7.1 ± 0.9	0.005
Bedtime (time (AM) ± min)	23:43 ± 55	23:39 ± 52	0.254	23:11 ± 50	23:01 ± 57	<0.001
Amount of exercisen (exercise/day)	8.8 ± 7.2	9.4 ± 7.6	0.591	6.6 ± 6.2	6.1 ± 5.7	0.264
Time spent sitting (h/day)	8.2 ± 2.7	8.6 ± 2.5	0.222	8.4 ± 2.2	8.2 ± 2.3	0.139

IBS: irritable bowel syndrome. Data are presented as mean ± SD, *Mann-Whitney *U* test.

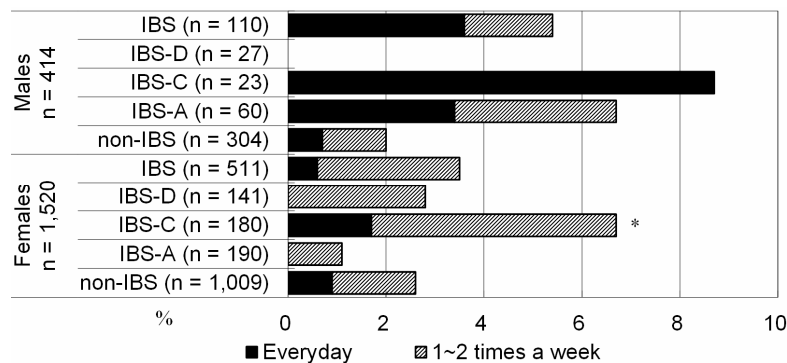


Figure 3. Use of laxatives in the IBS group and the non-IBS group among nursing and medical school students. **p* = 0.030 (IBS-D, IBS-C vs. IBS-A), Chi-square test.

Table 5. Frequency of intake in the IBS and the non-IBS groups among nursing and medical school students in China.

		Milk	Meat	Fish	Eggs	Leafy vegetables	Other vegetables and potatoes
Males	IBS	12 (10.9)	33 (30.0)	4 (3.6)	32 (29.1)	68 (61.8)	60 (54.5)
		27 (24.5)	52 (47.3)	26 (23.6)	56 (50.9)	38 (34.5)	40 (36.4)
		71 (64.5)	25 (22.7)	80 (72.7)	22 (20.0)	4 (3.6)	10 (9.1)
	Non-IBS	39 (13.0)	91 (30.4)	12 (4.0)	105 (35.1)	177 (59.2)	160 (53.5)
		80 (26.8)	139 (46.5)	99 (33.1)	149 (49.8)	104 (34.8)	124 (41.5)
		180 (60.2)	69 (23.1)	188 (62.9)	45 (15.1)	18 (6.0)	15 (5.0)
<i>p</i> [*]		0.728	0.925	0.163	0.362	0.782	0.234
Females	IBS	48 (9.5)	38 (7.5)	6 (1.2)	90 (17.8)	208 (41.1)	185 (36.6)
		109 (21.5)	182 (35.9)	101 (19.9)	261 (51.5)	251 (49.6)	283 (55.9)
		350 (69.0)	287 (56.6)	400 (78.9)	156 (30.8)	47 (9.3)	38 (7.5)
	Non-IBS	95 (9.5)	83 (8.3)	26 (2.6)	192 (19.2)	493 (49.3)	433 (43.3)
		228 (22.8)	357 (35.7)	196 (19.6)	507 (50.8)	415 (41.5)	483 (48.3)
		676 (67.7)	559 (56.0)	777 (77.8)	300 (30.0)	91 (9.1)	83 (8.3)
<i>p</i> [*]		0.821	0.803	0.184	0.773	0.007	0.023

Data are presented as n (%). IBS irritable bowel syndrome, *Chi-square test.

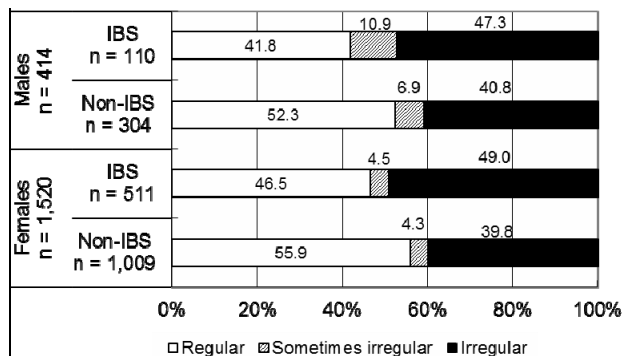


Figure 4. Meal time in the IBS group and the non-IRS group among nursing and medical school students in China. * $p = 0.002$, Mann-Whitney U test.

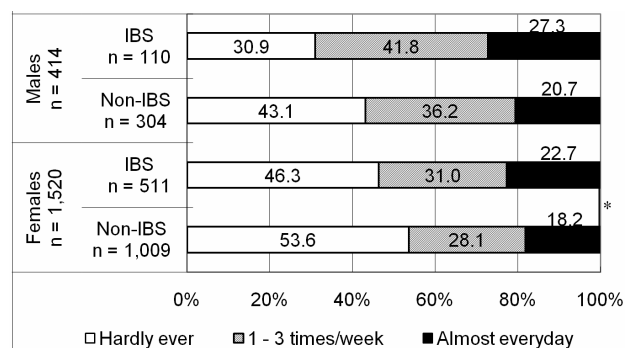


Figure 5. Skipping meals in the IBS group and the non-IRS group among nursing and medical school students in China. * $p = 0.018$, Chi-square test.

affecting their bodies was stress, compared with the other subgroups ($p = 0.025$).

3.7. Comparison between Chinese and Japanese (Figure 6)

The prevalence of IBS among nursing and medical school students in China (32.1%) was lower than that found in Japan (35.5%) [21] ($p = 0.028$). More Japanese females' subjects had IBS than their Chinese counterparts ($p < 0.001$). In females, the prevalence of the IBS-D subgroup was higher in China than that in Japan ($p = 0.014$), and the prevalence of the IBS-C subgroup in China was lower than that in Japan ($p < 0.001$). In males, there were no statistically significant differences between China and Japan in the prevalence of IBS or the subgroups.

4. DISCUSSION

The results of this study showed that the general prevalence of IBS was 32.1% in nursing and medical school students in China, 26.6% in males and 33.6% in females. Two major findings were revealed in the results.

First, the prevalence of IBS was higher than that

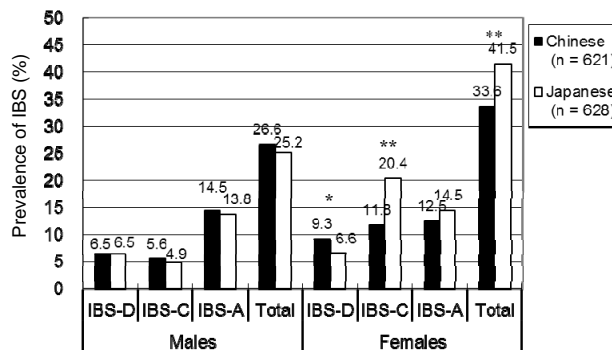


Figure 6. Prevalence of IBS (%) between nursing and medical school students in China and those in Japan [21] (printed with permission). * $p = 0.014$, ** $p < 0.001$, Chi-square test.

shown in other Asian studies [6-10]. One of the reasons for this difference was that the subjects were nursing and medical school students, who worked irregular hours due to their studies and clinical practice schedules. Some studies [26,27] have shown that there are a variety of stressors in clinical practice. Jimenez *et al.* [28] identified three types of stressors (clinical, academic and external) and two categories of symptoms (physiological and psychological) linked to clinical practice. The subjects of the study perceived clinical stressors more intensely than academic or external stressors. In general, most students don't have any practical experience in the clinical field. Timmins *et al.* [29] reported that one third of the students in their study felt some degree of stress in their relationships with teachers and staff in the ward, and that the clinical experience and the death of patients were independent sources of stress. Thus, these students might feel more stress than other students or people in general. In support of this hypothesis, other studies that targeted nursing or medical school students also showed a high prevalence of IBS, 35.5% in Japan [21], 15.8% in Malaysia [15], 26.0% in Pakistan [30], and 26.1% in Nigeria [31]. Especially, the prevalence of IBS in nursing and medical school students in Japan [21] and China were both higher than that found in other countries. Prior to recent studies, no large-scale research studies on nursing and medical school students have been conducted. These recent studies have made it clear that nursing and medical school students in the Asian region have a high prevalence of IBS. However, Chang *et al.* [6] reported that more than 90% of nurses have very limited knowledge in regard to IBS, and are unable even to explain it clearly. It is important to expand their knowledge of their own symptoms.

Second, the prevalence of IBS in females was higher than that shown in males. This result was consistent with other studies [4-10,21]. The difference between China and Japan was the prevalence of the IBS-C subgroup in females (China: 11.8%, Japan: 20.4%), showing that Ja-

panese females were more constipated than Chinese females. When the food frequency was compared between Chinese females and Japanese females, each food study showed significant differences. Chinese females ate more beans, bean products, and fruit than Japanese females. On the other hand, Japanese Females ate more meat, eggs, milk, dairy products, mushrooms, instant noodles, retort products, confectionery, juice, coffee and tea than Chinese females. These results indicate that the consumption of fiber prevents Chinese females from having constipation. However, in addition to dietary habits, other elements could also be factors in this difference. For example, the number of females living in a dormitory was 1403 (92.4%) in China and 192 (17.3%) in Japan and, the number of females living at a home of their own was 105 (6.9%) in China and 608 (54.6%) in Japan ($p < 0.001$).

The Japanese study [21] showed that students with IBS felt more anxiety than those without IBS, which was consistent with the findings of other studies [10,15,21]. Therefore, it can be inferred that anxiety is a predictor of IBS diagnosis, and that psychological factors play an important role in the development of IBS [32-35]. In addition, Drossman [36] reported that psychological factors themselves influence motor abdominal functions, the sensory threshold and the stress reactivity of the intestines. The PSLES score, indicating stressful life events, was higher in the IBS group ($p < 0.001$) in a study conducted by Pinto *et al.* [37]. Furthermore, in that study, both males and females in the IBS group had more life events than the non-IBS group.

As mentioned above, more than ninety percent of the subjects of this study were living in a dormitory at the university and they took their meals in the dormitory dining room. Thus, the lifestyles of the subjects were similar. That could be the reason why the results were similar for hometown and habitation between the IBS group and the non-IBS group, despite the fact that lifestyles in the urban and rural areas in China are so different.

In the IBS group, females went to bed later, had less sleeping time and more experienced difficulty in falling asleep than the females in the non-IBS group. It is said that peptides synthesized by intestinal bacteria act as a sleeping substance and bowel flora affects non-REM sleep [38]. On the other hand, Burr *et al.* [39] reported that differences in neuroendocrine levels during sleep were great between the IBS group and the non-IBS group in females. Jarrett *et al.* [40] also reported that the sympathetic/parasympathetic nervous system balance across sequential non-REM periods and REM cycles was modulated differently among the subgroups. The results of these studies inferred that there is an interaction between the sleeping state and abnormal defecation, especially in

females.

Compared with the non-IBS group, in females, the intake of leafy vegetables, other vegetables, and potatoes was less in the IBS group. In the Japanese study [21], females in the IBS group also showed a lack of fruit and vegetables. Especially, females in the IBS-C group showed a lack of fruit. These results were consistent with the results shown in this study. Furthermore, both the Japanese study [40] and the Korean study [7] showed the same results for meal times. In females, the IBS group tended to have meals irregularly and to skip meals frequently. It is said that skipping meals causes a decrease in the gastro-colonic reflex and restrains defecation [38]. Regardless of the IBS, this study revealed that about 20% of the students skipped meals almost everyday. Recently it has been said that young people show a lack in the intake of fruit and vegetables [41,42]. Not only for IBS patients, but also for young students, it is important to regulate their lifestyles, including meal times and the content of meals. More females in the IBS-group chose food as their subjective factors affecting the body, compared with those in the non-IBS group. This result shows that they recognized their current situation. IBS is associated with many complicated factors. Sakata *et al.* [43] reported that the factors affecting IBS differed greatly in individuals. Furthermore, in a study on QOL [44], it was shown that the manner in which people accept situations is different between the races. For example, people in Switzerland considered disease to be more serious than people in Greece did, and it affected their mental health. Treatments are also different, depending on the individual, such as medical therapy, hypnotherapy, cognitive behavioral therapy, and so on.

This study was limited in three respects. First, it is difficult to view the results of the study as being valid for the whole country, because this questionnaire was conducted in one university. Another limitation was the fact that the students were not living in a general environment, since most of them were living in a dormitory at the university. Thirds, the number of females was more than three times than that of males, because nursing students are mostly females. We analyzed all data by sex.

In conclusion, the prevalence of IBS in nursing and medical school students in China was high, and almost the same as that found in Japan. In females, subjects in the IBS group showed more anxiety than those in the non-IBS group. In both males and females, subjects in the IBS group experienced more life events than those in the non-IBS group. In females, the IBS group had more sleep disturbances, showed more irregular and skipped meals, and intake of leafy vegetables, other vegetables, and potatoes was less than that in the non-IBS group. Because this study was a cross-sectional study, however, the cause and effect relationship was not clarified. Fur-

ther intervention studies are needed to clarify the cause of IBS in the future.

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Abbreviations

BMI: body mass index;
 HADS: hospital anxiety and depression scale;
 HAD-A: subscale for anxiety;
 HAD-D: subscale for depression;
 GI: gastrointestinal;

IBS: irritable bowel syndrome;
 IBS-A: alteration type IBS;
 IBS-C: constipation-predominant IBS;
 IBS-D: diarrhea-predominant IBS;
 METS: metabolic equivalents;
 SD: standard deviation.