DOCTORAL DISSERTATION

Study of Irritable Bowel Syndrome and Lifestyles in Nursing and Medical School Students

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Chapter 1. Review of the Literature on Irritable Bowel Syndrome (IBS)

In Chapter 1, the background of irritable bowel syndrome (IBS) was described from the perspective of previous studies and the purpose of this study was explained.

1-1. The epidemiology and mechanism of irritable bowel syndrome

Irritable bowel syndrome (IBS) is a functional gastrointestinal disorder comprised of abdominal pain, abdominal discomfort, and disordered defecation [1]. The number of people with IBS has been increasing recently, especially in developed countries [2]. The prevalence of IBS is 10% - 15% and the incidence of IBS is 1% - 2 % per year in the general population [2]. IBS is the most common disorder in medical care for the digestive system [3, 4].

The prevalence of IBS is the highest among young people, and it also increases after the age of 70 among patients of all ages [5]. Ten percent of all Japanese high school students have IBS [6], and the symptoms are said to be one of the common reasons for truancy. However, there is still a lack of social awareness regarding IBS, and people are often less aware of their own diseases. In general, it is more common for females to have IBS than males [7, 8]. The rate of IBS between males and females is 1 : 1.5 - 3 [6, 9]. It has been said that androgen is related to inhibition of the pathogenesis of IBS [10].

In the 1960's, IBS was called irritable colon syndrome, and it included organic diseases like lactose intolerance and indolent diarrhea, etc [11]. After 1970, gastrointestinal motility became an active area of research in Europe and the United States. In the 1980's, research on IBS made dramatic progress due to the development of information science, but there was little consensus in the medical research field concerning the mechanisms involved in IBS and related medical care was not yet organized [12]. In 1978, however, Manning reported that IBS had a different pattern of symptoms from other organic diseases, such as bowel cancer or inflammatory bowel disease [13]. In September of 1988, the XII International Congress of Gastroenterology was held in Rome, Italy, and the diagnostic criteria for IBS were unified [1]. In 1992, the diagnostic criteria were released as the Rome I criteria, composed by a multinational working team led by Drossman in the United States [14]. In 1999, the Rome I criteria were reviewed again, and a new set of criteria called the Rome II criteria was announced [15]. Seven years of scientific validation of the Rome I criteria were reflected in the Rome II criteria [16].

In brief, the Rome II criteria are as follows: Abdominal discomfort or pain for a period of at least 12 weeks, which need not be consecutive, during the preceding 12 months that has two of the following three features (1) relief with defecation, (2) onset associated with a change in stool frequency, and/or (3) onset associated with a change in the form (appearance) of the stool [15, 16]. The following symptoms cumulatively support the diagnosis of IBS: Fewer than three bowel movements a week, more than three bowel movements a day. Hard or lumpy stools, loose (mushy) or watery stools, straining during bowel movements, urgency (rush to have a bowel movement), feeling of incomplete bowel movements, passing mucus during bowel movements, and abdominal fullness, bloating or swelling (Table 1-1). Subjects were classified into three subgroups as follows: diarrhea-predominant IBS (IBS-D), constipation-predominant IBS (IBS-C), and the alteration type of IBS (IBS-A) (Table 1-2) [15, 16]. Patients with IBS-D have frequent defecation (more than three times per day), loose stool/watery stool, or an urgent desire to evacuate the bowels. Patients with IBS-C have unfrequented defecation (less than three times per week), hard stool, or difficulty in

defecating. Patients with IBS-A have neither symptom and they have repeated episodes of diarrhea and constipation alternately.

In April of 2006, the Rome II criteria were revised and the new criteria were called the Rome III criteria (Table 1-3) [17]. The points of change were the time periods and the subgroup categories. According to the Rome III criteria, patients having symptoms more than three days per month in the span of the recent three months, which means that people who have these symptoms once a week can be classified as IBS patients. Subjects were classified into four subgroups as follows: Diarrhea-predominant IBS (IBS-D), Constipation-predominant IBS (IBS-C), Alteration type IBS (IBS-A), and Unclassified IBS (IBS-U) (Table 1-4) [17].

The mechanism of IBS remains unknown. However, it has been clarified that most of the reported disorders, like 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) [18, 19]. The neural network of the brain, which generates the stress response, is called the central stress circuitry [20]. 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 called the emotional motor system, and it includes the autonomic efferent nerves, such as the hypothalamus-pituitary-adrenal axis and the pain modulatory systems [20].

There are numerous neurotransmitters in the brain and gut that regulate GI activities, including 5-hydroxytryptamine (5-HT, serotonin), 5-HT3, 5-HT4 receptors and corticotrophin-releasing hormone (CRH) [19]. Mizuno, et al.[21] reported that variations of the serotonin transporter gene promoter region (5-HTTLPR) are associated with sensitivity to stress and associated with the activation of negative emotion. CRH is also a key mediator of the central stress response. Two CRH receptor subtypes, R1 and R2, have been described, which mediate increased colonic motor activity and slowed gastric emptying, respectively, in response to stress [20]. Many other neurotransmitters and neuroimmunomodulators are being evaluated for GI activities [19].

Functional aberration of these neurotransmitters and neuroimmunomodulators cause digestive disorders and influence brain function. Stress is not included in the criteria, but in the opinion of many doctors, stress can exacerbate the symptoms. Especially, anxiety disorders can easily appear when subjects feel stress, such as while at work or while commuting to and from work [6]. Moreover, IBS patients have reported that they experienced not only digestive symptoms, but also epigastric discomfort, upper abdominal complaints, headaches, frequent urination, myalgic pain, asomnia, etc. There are many patients who experience psychological complications, such as depression and anxiety. Therefore, IBS impairs the quality of life (QOL) remarkably, although it is said to include benign syndrome [22, 23]. Since the related economic losses due to IBS are not negligible now, this situation leads to a seismic shift for developed countries to establish economical treatments for IBS [24]. Thus, inexpensive treatment for IBS has important implications for many nations worldwide.

Table 1-1. Rome II criteria for IBS

Abdominal discomfort or pain for at least 12 weeks, which need not be consecutive,
during the preceding 12 months that has two of the following three features
(1) Relief with defecation,
(2) Onset associated with a change in stool frequency,
(3) Onset associated with a change in the form (appearance) of the stool.

Table 1-2. Subgroups of the Rome II criteria for IBS

	Diarrhea-predominant IBS (IBS-D)	Constipation-predominant IBS (IBS-C)
Frequency of defecation	more than 3 times per day	less than 3 times per week
State of stool	loose stool/watery stool	hard stool
Urge to defecate	urgent desire to evacuate the bowel	difficulty in defecating

More than one symptom in each subgroup and no symptoms in another subgroup.

Alteration type IBS (IBS-A) is applicable when the subject does not have Diarrhea-predominant IBS (IBS-D) or Constipation-predominant IBS (IBS-C).

Table 1-3. Rome III criteria for IBS

Abdominal discomfort or pain for at least 3 days a month, which need not be consecutive,
during the preceding 3 months that has two of the following three features
(1) Relief with defecation
(2) Onset associated with a change in stool frequency
(3) Onset associated with a change in the form (appearance) of the stool.
And these symptoms appeared more than 6 months ago.

Table 1-4. Subgroups of the Rome III criteria for IBS

Diarrhea-predominant IBS (IBS-D)
More than 25% of loose stool/watery stool and less than 25% of hard stool
Constipation-predominant IBS (IBS-C)
More than 25% of hard stool and less than 25% of loose stool/watery stool
Alteration type IBS (IBS-A)
More than 25% of hard stool and more than 25% of loose stool/watery stool
Unclassified IBS (IBS-U)
All other cases, except for the types noted above

1-2. The purpose of this study

Many Japanese researchers have studied IBS up to the present. However, very few studies have been conducted on the relationship between lifestyle, including dietary habits, and IBS, in spite of the fact that the intestinal functions are mainly digestion and absorption. In addition, no large scale studies have been conducted focused on the lifestyles of IBS patients or comparative studies between countries on the prevalence of IBS.

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 Japan and China, and to compare the results between the countries. In addition, to clarify the effectiveness of lifestyle intervention for improving the symptoms of patients with IBS was aimed.

1-3. The composition of this study

This study was composed of four parts.

Chapter 2 describes a study that was conducted in Kyoto prefecture in Japan. The prevalence of IBS and the relationship between IBS and stress, lifestyle, and dietary habits in nursing and medical students were investigated.

Chapter 3 describes a study that was conducted in Henan province in China. This study was conducted based on the results of the Japanese study. The prevalence of IBS and the tendency in China were investigated, as China is located close to Japan. In addition, nursing and medical students were chosen as the subjects of this study in order to compare the results with the Japanese study.

Chapter 4 describes an intervention study that was intended to clarify the effectiveness of lifestyle improvements on the symptoms of IBS. The subjects were female nursing students located in Japan. The method employed in the intervention study was self-monitoring of their daily lives.

Chapter 5 contains general discussion and conclusion sections that include a comparison of the studies conducted in Japan and China. The similar and different points between the two studies were discussed. The self-monitoring of the IBS subjects from both positive and negative viewpoints was also discussed, and the problems in these studies were considered.

1-4. References

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Chapter 2. Lifestyle and Psychological Factors Related to Irritable Bowel Syndrome in Nursing and Medical School Students in Japan

2-1. Introduction

Similar to the results of several foreign studies on IBS, Japanese studies have also revealed that the prevalence of IBS is higher in females than it is in males [1-3]. The main studies that targeted Japanese subjects were as follows. Shiotani *et al.* showed that the prevalence of IBS in university students was 10.7% [2]. They pointed out that IBS is strongly related to female sex and food sensitivity [2]. Omagari *et al.* found that the prevalence of the IBS in female university students was 12% [4]. They also reported that the IBS patients consumed less eggs and milk and were more physically active than the non-IBS patients. In addition, anxiety states were more common in the IBS participants [4]. Kumano *et al.* investigated adults aged 20- to 69-years-old also revealed the comorbidity of IBS and diseases related to anxiety [3].

On the basis of these earlier studies, this study was conducted to investigate the prevalence of IBS and the relationship between IBS and stress, lifestyle, and dietary habits in nursing and medical students.

2-2. Methods

Study population

A total of 2,639 students from 20 nursing schools located in Kyoto prefecture and medical schools for radiological technologists participated in this research. Out of 2,639 students, 2,365 students answered 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, 597 students were considered ineligible. Therefore, questionnaires supplied by a total of 1,768 students aged 18- to 29-years-old (20.2 ± 1.9), including 650 (37%) males (20.3 ± 1.7) and 1,118 (63%) females (20.1 ± 1.9), were analyzed.

Study participants were asked to sign an informed consent form before they participated in the study, and the study was approved by the Ethical Board of Kyoto Prefectural University and Kyoto First Red Cross Hospital. This was an observational and cross-sectional study conducted from October 2006 through June 2007.

IBS definitions

Patients with IBS were diagnosed based on the Rome II criteria [5]. Subjects were classified into three subgroups as follows: Diarrhea-predominant IBS (IBS-D), constipation-predominant IBS (IBS-C), and the alteration type IBS (IBS-A). A modified Japanese version of the Rome II Modular questionnaire, including 15 items complied by Shinozaki, *et al.* [6], was used.

Questionnaire information

In order to obtain a questionnaire suitable for the purpose of the study, well-known criteria were combined with some original items. The questionnaire contained 69 items, with the following sections; bowel habits (15 items), psychological factors (14 items), stressful life events (1 item), subjective physical condition factors (1 item), lifestyle (10 items), dietary habits and food frequency (23 items), physical characteristics (4 items), and treatment of disease (1 item) (Table 2-1).

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

Table 2-1. 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		23
Subjective factor for physical condition		1
Physical characteristics	Sex	1
	Age	1
	Height	1
	Weight	1
Treatment of disease		1
Total		69

: Hospital anxiety and depression scale

Psychological assessment

In order to evaluate stress situation correctly, both the stress response and the related stressors were assessed.

Stress response

The hospital anxiety and depression scale (HADS) [7] 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.

Stressors

Stressors are stressful life events that were given a Life Change Unit depending on how traumatic it was felt to be by the person involved. 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 from their own 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 in the questionnaire, such as the divorce of parents or a romantic breakup were provided.

Exercise assessment

The exercise guideline for health 2006 in Japan [8] 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.

Statistical analysis

Values were expressed as means ± SD, as appropriate, depending on whether the data were normally distributed. Analysis of proportions among the IBS diagnostic groups was performed by the Pearson’s chi-square test. Statistical analyses of 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 between the three groups. All statistical computations were performed using the statistical software SPSS version 11.5 for Windows. A two-sided *p* value of less than 0.05 was considered statistically significant.

2-3. Results

Prevalence of IBS

Out of 1,768 students, 164 (25.2%) males and 464 (41.5%) females were diagnosed as having IBS. The predominant types were IBS-A in males (13.8%) and IBS-C in females (20.4%) (Table 2-2).

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

		Males	Females	Total
IBS	Total	164 (25.2)	464 (41.5)	628 (35.5)
subgroup	IBS-D	42 (6.5)	74 (6.6)	116 (6.6)
	IBS-C	32 (4.9)	228 (20.4)	260 (14.7)
	IBS-A	90 (13.8)	162 (14.5)	252 (14.3)
Non-IBS		486 (74.8)	654 (58.5)	1,140 (64.5)
Total		650 (100.0)	1,118 (100.0)	1,768 (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

Characteristics of the subjects

There were no statistically significant differences in age, height, weight and BMI between the IBS and the non-IBS groups (age in males: $p = 0.364$, age in females: $p = 0.677$, height in males: $p = 0.464$, height in females: $p = 0.561$, weight in males: $p = 0.895$, weight in females: $p = 0.509$, BMI in males: $p = 0.866$, and BMI in females: $p = 0.453$). The female subjects in the IBS-D subgroup were older, compared with the other subgroups ($p = 0.036$).

The relationship between psychological factors and IBS

In both males and females, the anxiety and depression scores were higher in the IBS group, compared with the non-IBS group (anxiety in males: $p < 0.001$, anxiety in females: $p < 0.001$, depression in males: $p = 0.037$, and depression in females: $p < 0.001$) (Figure 2-1). Males in the IBS-A subgroup ($p < 0.001$) and females in the IBS-D subgroup ($p < 0.001$) had higher anxiety scores than the subjects in the other subgroups. Females in the IBS-D subgroup had a higher depression score than the subjects in the other subgroups ($p < 0.001$). Consequently, for both males and females, the IBS group showed a more definite anxiety type, compared with the non-IBS group ($p < 0.001$, $p < 0.001$) and a more definite depression type in females ($p < 0.001$). Males in the IBS-A subgroup and females in the IBS-D subgroup showed a more definite anxiety type, and, for both males and females, the IBS-D subgroup showed a more definite depression type than the other subgroups.

In females, there were more life events in the IBS group than in the non-IBS group ($p = 0.002$) (Table 2-3). In females, the IBS-D subgroup had more life events than the other subgroups ($p = 0.013$).

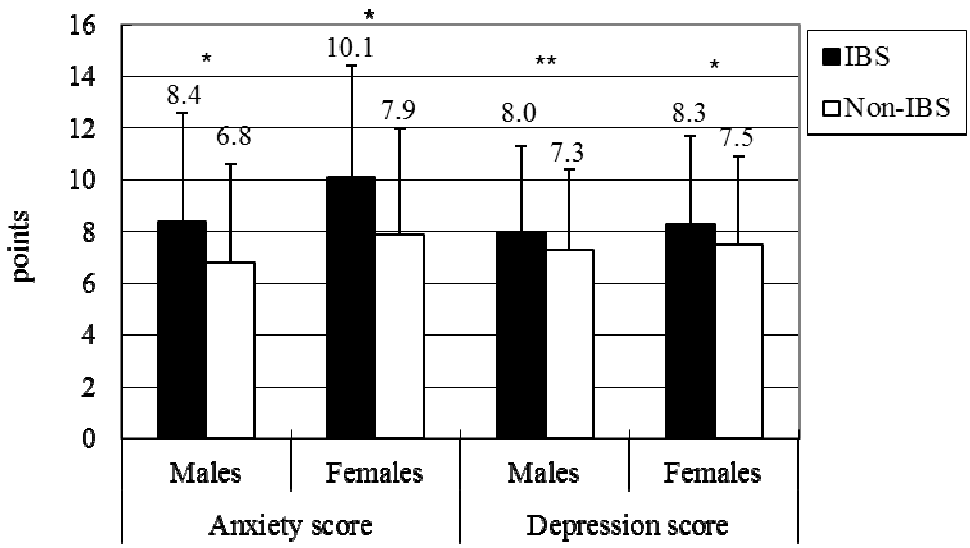

Figure 2-1. Anxiety and depression scores on the HADS in the IBS group and the non-IBS group in nursing and medical school students in Japan

*$p < 0.001$, **$p = 0.037$, Mann-Whitney *U* test

Table 2-3. Life events in the IBS group and the non-IBS group in nursing and medical school students in Japan

	Males			Females		
	IBS	Non-IBS	*p* *	IBS	Non-IBS	*p* *
Positive	33 (20.8)	77 (16.2)		153 (33.8)	162 (25.2)	
Negative	126 (79.2)	399 (83.8)		300 (66.2)	480 (74.8)	
Total	159 (100.0)	476 (100.0)	0.187	453 (100.0)	642 (100.0)	0.002

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

Lifestyle

In males, the IBS group had more sleep disorders than the non-IBS group ($p = 0.016$) (Figure 2-2). In females, the IBS-D subgroup woke up earlier and the IBS-C subgroup felt more difficulty in getting to sleep than the other subgroups ($p = 0.001$). In both males and females, the bedtime of the IBS group was later than that in the non-IBS group ($p = 0.005$, $p = 0.001$) (Table 2-4). In the subgroups, females in the IBS-C subgroup went to bed later than the subjects in the other subgroups ($p = 0.001$). In females, the number of sleeping hours in the IBS group was less than that in the non-IBS group ($p = 0.010$) and the IBS-C subgroup had less sleeping hours than that in the other subgroups ($p = 0.025$). In both males and females, the subjects in IBS group used more laxatives than the subjects in non-IBS group ($p < 0.001$, $p < 0.001$) (Figure 2-3). In males, the rate of students using laxatives more than one time a week was 7.9% in the IBS group and 2% in the non-IBS group. In females, it was 14% in the IBS group and 4.7% in the non-IBS group (Figure 2-3). Regarding the subgroups, females in the IBS-D subgroup used laxatives the most ($p < 0.001$) (Figure 2-3). In males, the subjects in the IBS group showed more time spent sitting per day than the subjects in the non-IBS group ($p < 0.001$) and the IBS-C subgroup had the most time spent sitting per day for both males and females ($p = 0.004$, $p = 0.033$). There were no statistically significant differences for either males or females between the IBS group and the non-IBS group in diet experience, drinking, smoking and exercise.

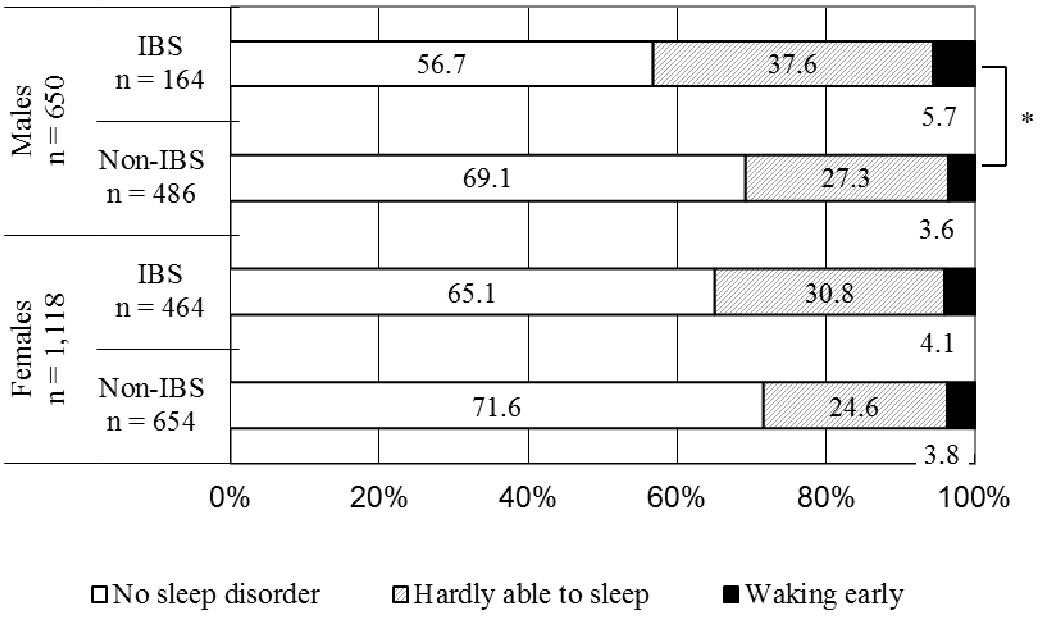

Figure 2-2. Sleep disorders in the IBS group and the non-IBS group among nursing and medical school students in Japan

*$p = 0.016$, Chi-square test

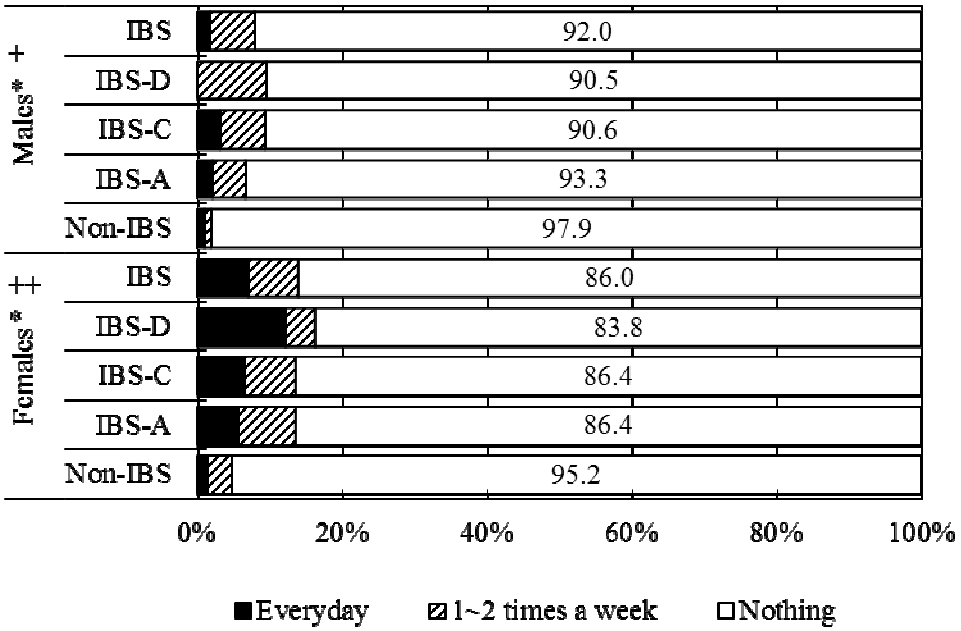

Figure 2-3. Use of laxatives in the IBS group and the non-IBS group among nursing and medical school students in Japan

*$p < 0.001$ (IBS vs. Non-IBS), +$p = 0.003$ (IBS-D, IBS-C vs. IBS-A), ++$p < 0.001$ (IBS-D, IBS-C vs. IBS-A), Chi-square test

Table 2-4. Time of sleep and exercise in the IBS group and the non-IBS group in nursing and medical school students in Japan

	Males (n=650)			Females (n=1,118)		
	IBS	Non-IBS	*p* *	IBS	Non-IBS	*p* *
Hours of sleep (h/day)	6.2 ± 1.3	6.4 ± 1.3	0.066	5.9 ± 1.2	6.0 ± 1.1	0.010
Bedtime (time (A.M.) ± min)	1:24 ± 72	1:06 ± 78	0.005	0:54 ± 72	0:42 ± 66	0.001
Amount of exercise (exercise/day)	3.7 ± 8.0	5.2 ± 16.8	0.126	4.2 ± 19.4	3.1 ± 14.0	0.789
Time spent sitting (h/day)	6.3 ± 3.5	5.2 ± 3.4	< 0.001	6.6 ± 2.8	6.3 ± 2.5	0.193

Data are presented as means ± SD
IBS irritable bowel syndrome
* Mann-Whitney *U* test

Dietary habits and the frequency of food intake

In the IBS group, females showed a habit to eat less fish, fruit, milk and green-yellow vegetables, and more retort food products than the female subjects in the non-IBS group ($p = 0.001$, $p = 0.002$, $p = 0.032$, $p = 0.037$, $p < 0.001$) (Table 2-5). Females in the IBS-D subgroup showed a habit to eat fish either more every day or less than once a week, when compared with the female subjects in the other subgroups ($p = 0.004$). In the IBS-C subgroup, females showed a habit to eat less fruit and more retort food products ($p = 0.012$, $p = 0.003$). Females in the IBS group had more irregular meals and skipped meals more frequently than the female subjects in the non-IBS group ($p = 0.013$, $p = 0.001$) (Figure 2-4, Figure 2-5). Especially in males, the rate of missing meals everyday was 29.2% in the IBS-A subgroup and 26.2% in the IBS-D subgroup.

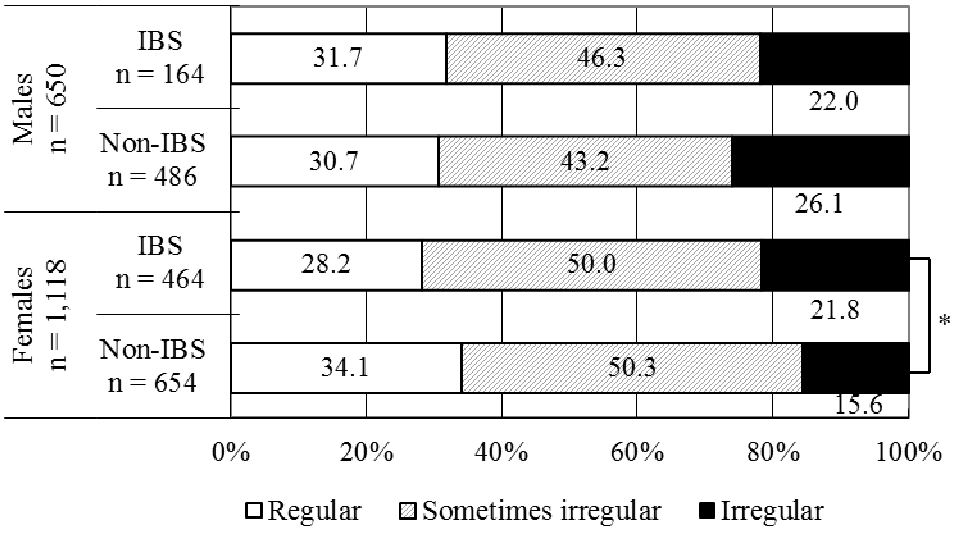

Figure 2-4. Mealtimes in the IBS group and the non-IBS group in nursing and medical school students in Japan
*p = 0.013, Chi-square test

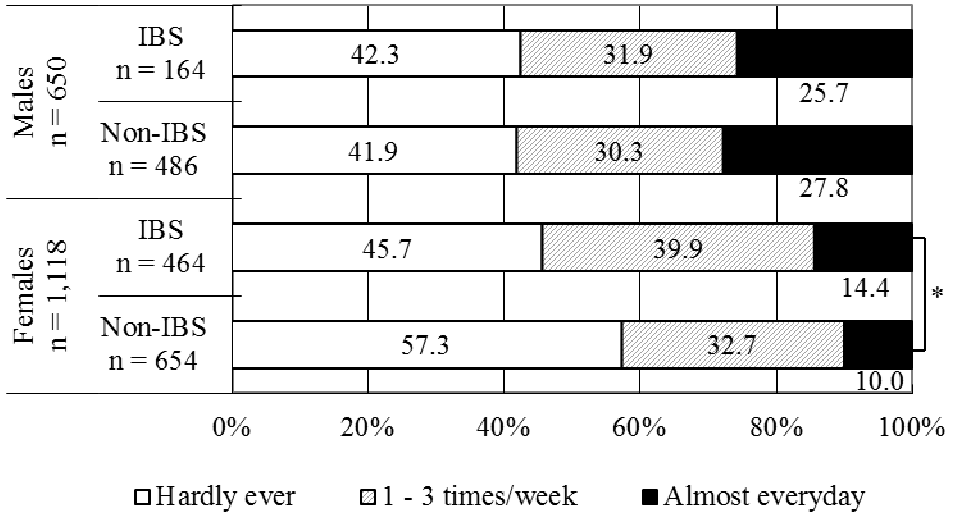

Figure 2-5. Skipping meals in the IBS group and the non-IBS group in nursing and medical school students in Japan
*p = 0.001, Chi-square test

Table 2-5. The frequency of food intake in the IBS group and the non-IBS group in nursing and medical school students in Japan

			Milk	Meat	Fish	Egg	Green-yellow vegetables	Fruit	Processed food products
Males	IBS	Everyday	41 (25.2)	62 (38.0)	7 (4.3)	43 (26.5)	46 (28.0)	18 (11.0)	14 (8.5)
		Some times a week	49 (30.1)	92 (56.4)	104 (63.4)	98 (60.5)	98 (59.8)	81 (49.4)	106 (64.6)
		Nothing	73 (44.8)	9 (5.5)	53 (32.3)	21 (13.0)	20 (12.2)	65 (39.6)	44 (26.8)
	Non-IBS	Everyday	158 (32.6)	144 (29.8)	20 (4.2)	137 (28.3)	156 (32.3)	49 (10.2)	45 (9.3)
		Some times a week	156 (32.2)	322 (66.7)	296 (61.5)	299 (61.8)	274 (56.7)	233 (48.6)	288 (59.8)
		Nothing	171 (35.3)	17 (3.5)	165 (34.3)	48 (9.9)	53 (11.0)	197 (41.1)	149 (30.9)
	p *		0.071	0.055	0.898	0.543	0.587	0.930	0.536
Females	IBS	Everyday	115 (25.2)	109 (23.7)	39 (8.5)	186 (40.6)	166 (36.2)	59 (12.8)	67 (14.7)
		Some times a week	119 (26.0)	312 (68.0)	277 (60.5)	232 (50.7)	251 (54.8)	230 (50.0)	225 (49.2)
		Nothing	223 (48.8)	38 (8.3)	142 (31.0)	40 (8.7)	41 (9.0)	171 (37.2)	165 (36.1)
	Non-IBS	Everyday	195 (30.0)	151 (23.3)	50 (7.8)	264 (40.5)	266 (41.0)	128 (19.8)	67 (10.3)
		Some times a week	189 (29.1)	455 (70.2)	457 (70.9)	340 (52.1)	347 (53.5)	329 (50.9)	269 (41.4)
		Nothing	266 (40.9)	42 (6.5)	138 (21.4)	48 (7.4)	35 (5.4)	189 (29.3)	314 (48.3)
	p *		0.032	0.492	0.001	0.685	0.037	0.002	< 0.001

Data are presented as *n* (%)

IBS irritable bowel syndrome
* Chi-square test

Subjective factors affecting the body condition

Each of the subjects chose the somatic factors that affected their body condition from six items; stress, sleeping time, irregular mealtime, food, smoking and drinking. In both males and females, more students in the IBS group thought that the somatic factor was stress, compared with those in the non-IBS group ($p = 0.008$, $p = 0.001$). In the IBS group, more females also worried about food and irregular mealtimes than those in the non-IBS group ($p = 0.001$, $p = 0.001$). More females in the IBS-C subgroup thought the somatic factors were stress, sleep, irregular mealtimes and food than others did ($p = 0.004$, $p < 0.001$, $p = 0.005$, $p = 0.005$).

2-4. Discussion

This study revealed that the general prevalence of IBS was 35.5% in nursing and medical school students, with 25.2% in males and 41.5% in females. Other studies in Japan have reported that the prevalence was 10-14% among the younger population [1-4, 9, 10]. Consequently, the prevalence shown in this study was higher than that shown in the other studies conducted in Japan. One of the reasons for this difference was that the subjects in this study were nursing and medical school students, who worked irregular hours due to their studies and practice schedules. Some studies have shown [11, 12] that there are a variety of stressors associated with clinical practice. Jimenez, *et al.* [13] identified three types of stressors (clinical, academic and external) and two categories of symptoms (physiological and psychological) linked to clinical practice. Students perceived clinical stressors more intensely than academic or external stressors. In general, most students do not have any experience in the clinical field. Timmins, *et al.* [14] reported that one third of the students felt some degree of stress in their relationships with their teachers and the staff in the ward, and that the clinical experience and the death of patients were independent sources of stress. Thus, the subjects of our study might have felt more stress than other students or people in general. Medical students in other countries also showed a high prevalence of IBS, 15.8% in Malaysia [15] 26% in Pakistan [16] and 26.1% in Nigeria [17].

Tan, *et al.* [15] studied Malaysian medical students and reported that students with IBS felt more anxiety and depression ($p = 0.002$, $p = 0.002$). Since this result corresponded with the results of our study, it can be inferred that anxiety and depression cause these symptoms. The PSLES score, indicating stressful life events, was higher in the IBS group ($p < 0.001$) in a study conducted by Pinto, *et al.* [18]. In our study, the females in the IBS group had more life events and were concentrated in the IBS-D subgroup. Alander, *et al.* [19] also reported that there were relationships between mental status and IBS.

In males, the IBS group had less exercise than the non-IBS group. Lustyk, et al. [20] reported that the IBS group had less exercise than the non-IBS group in the general population in America ($p = 0.05$). Kim, et al. [21] also reported that the IBS group tended to have less exercise time a week than the non-IBS group in Korean college students. In the IBS group in our study, both the males and the females went to bed later. The females got less sleep and males had more sleep disorders than the non-IBS group. Statistically, females in the IBS-D subgroup woke up earlier and those in the IBS-C subgroup experienced difficulty in falling asleep. There is an interaction between the sleeping state and abnormal defecation. It is said that peptides synthesized by intestinal bacteria act as a sleeping substance and bowel flora affects non-REM sleep [22]. A study reporting that a lack of sleep made IBS symptoms worse corresponded with the results obtained in this study. Females in the non-IBS group showed a tendency to live alone. However, the Korean college students in the IBS group were likely to live alone [21]. This difference might be due to the difference in the living environment between these countries. In the Korean study, a tendency was seen for the IBS group to spend more time sitting, compared with the non-IBS group. The struggling level in daily life is considered to be higher in the IBS-D subgroup than other subgroups because they have to deal with emergency situations. For example, they have to hold off a trip to the bathroom in class or while they are on a train. Females especially feel embarrassed to rush into bathrooms again and again. That could be why females in the IBS-D subgroup used laxatives more than the other subgroups. The Korean study also showed the same results for meal times [21]. In females, the IBS group tended to have meals irregularly and to skip meals frequently. It is said that skipping meals causes a loss of gastro-colonic reflex action and restrains defecation [22]. In this study, however, more males had a habit of eating meals irregularly and skipping meals, compared with the females. The results showed that 26.8% of the males and 12.2% of the females skipped meals almost every day, indicating that twice as many males skipped meals regularly, compared with the females. Rather than the food itself, it is more

important for IBS patients to regulate their lifestyles, including meal times, and this also applies to young males in general. The females in the IBS-D subgroup were older, compared with the females in the other subgroups in this study, but other studies did not show this tendency.

IBS is relevant to depression and many complicated factors can cause the symptoms. Sakata et al. [23] reported that the factors affecting IBS differed greatly in individuals. Furthermore, in a study about QOL [24], it was shown that how people accept situations is different between the races. For example, Swedish people considered disease more serious than the Greeks did, and it affected their mental health. Treatments are also different, depending on the individual, such as medical therapy, hypnotherapy, cognitive behavioral therapy, etc [25]. Thus, it is important to acknowledge that IBS consists of various factors.

There have been many large-scale research projects conducted on nursing and medical school students in recent years. This study made it clear that nursing and medical school students in Japan had a high prevalence of IBS. Kay, et al. [26] conducted a follow-up study on IBS patients five years after their original study, and they found that 95% of the patients were still having some IBS symptoms. It is important to provide support for these patients so they can change their lifestyles and teach them how to deal with their stress.

This study was limited in several respects. In the questionnaire, few students considered walking as exercise. There was also a difference in how people felt about life events, depending on the individual. These elements remain to be clarified. It was also reported that there were relationships between food allergies [27-29] or Helicobacter pylori infection [30] and IBS. Some studies have reported that *H.pylori* eradication improved the symptoms of IBS. However, I did not study IBS in that perspective in this study, which will remain a challenge for the future.

In conclusion, the prevalence of IBS in nursing and medical school students was higher than that shown in other reported studies. In both males and females, the IBS group had more psychological issues, such as anxiety and depression, than the non-IBS group. The lifestyles of the patients in the IBS group were more disordered, compared with the non-IBS group. However, the cause and effect relationship involved was not clear because this study was a cross-sectional study. Further intervention studies are needed to clarify the cause of IBS in the future.

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Chapter 3. Lifestyle and Psychological Factors Related to Irritable Bowel Syndrome in Nursing and Medical School Students in China

3-1. Introduction

Few large scale research studies have been conducted on IBS in China. One valuable study was conducted by Dong [1]. That study, using the Rome III criteria, revealed that 7.9% students had IBS in Chinese college and university students, and that IBS was related to high anxiety, high depression and low exercise [1]. Another Chinese study that targeted Chinese university students, including many medical college students [2], showed that 15.7% of the students studied had IBS and that females showed a higher tendency to have IBS, compared with the male subjects. Treatments for IBS are currently being explored in China and there is an original Chinese treatment, a Chinese herbal medicine. Chinese herbal medicines have shown unique progress as treatment for IBS and the effects are getting ascertained in China [3, 4]. However, the mechanism by which that treatment works on IBS has not been clarified.

The purpose of this study was to confirm the prevalence of the IBS in Chinese nursing and medical school students and to reveal the lifestyle and psychological factors related to irritable bowel syndrome. The same questionnaire that was used in the Japanese study was employed in order to compare the results between the two countries.

3-2. Methods

Study population

Questionnaires were issued to a total of 2,500 students for participation in this study, selected from the 3,169 university students majoring in nursing or medical technology at Zhengzhou University in Hunan Province. A total of 2,141 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, the questionnaires that were analyzed were obtained from a total of 1,934 students aged 16- to 24-years-old (19.7 ± 1.4), including 414 (21.4%) males and 1,520 (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.

IBS definitions

Patients with IBS were diagnosed based on the Rome II criteria [5]. 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). I used a modified Chinese version of the Rome IImodular questionnaire, including 15 items compiled by Shinozaki *et al*.[6]

Questionnaire information

In order to obtain a questionnaire suitable for the purpose of the study, well-known criteria were combined with some original items. The questionnaire contained 67 items, with the 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 of disease (1 item) (Table 3-1).

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

Table 3-1. 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

Psychological assessments

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

Stress response

The hospital anxiety and depression scale (HADS) [7] 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 a 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.

Stressors

Stressors are stressful life events that were given a Life Change Unit depending on how traumatic it was felt to be by the person involved. 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 from 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.

Exercise assessment

The exercise guideline for health in Japan published in 2006 [8] 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.

Statistical analysis

Values were expressed as means ± SD. An analysis of the proportions among the IBS diagnostic groups was performed using Pearson’s chi-square test. Statistical analyses of 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 between the three groups. All statistical computations were performed using the statistical software SPSS version 11.5 for Windows. A two-sided p value of less than 0.05 was considered statistically significant.

3-3. Results

Prevalence of IBS

Out of a total of 1,934 students, there were 414 males and 1,520 females. Respectively, 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 3-2). 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 3-2).

Table 3-2. IBS prevalence in nursing and medical school students in China

		Males	Females	Total	*p* *
	Total	110 (26.6)	511 (33.6)	621 (32.1)	0.006
IBS	IBS-D	27 (6.5)	141 (9.3)	168 (8.7)	0.078
subgroup	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)	1,009 (66.4)	1,313 (67.9)	
Total		414 (100.0)	1,520 (100.0)	1,934 (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)

Characteristics of the subjects between the IBS and the non-IBS group

In the 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 the females, age and height were higher in the IBS group, compared with the non-IBS group (age: $p < 0.001$, 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 ($p = 0.039$).

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 3-1). Females in the IBS-C subgroup had higher anxiety scores, compared with 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, compared with the other subgroups. In both the males and females, there were more life events in the IBS group, compared with the non-IBS group (males: $p = 0.015$, females: $p = 0.013$) (Table 3-3). In the males, the IBS-C subgroup had more life events than the other subgroups ($p = 0.012$).

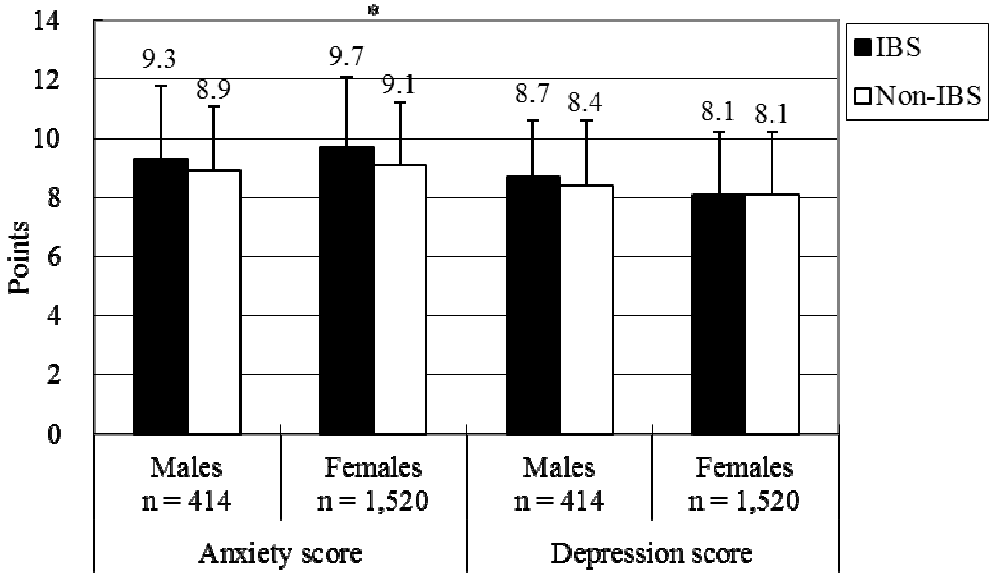

Figure 3-1. Anxiety and depression scores on the hospital anxiety and depression scale (HADS) in the IBS group and the non-IBS group in nursing and medical school students in China.
*p < 0.001, Mann-Whitney U test

Table 3-3. Life event in the IBS group and the non-IBS group in nursing and medical school students in China

	Males			Females		
	IBS	Non-IBS	*p* *	IBS	Non-IBS	*p**
Positive	17 (15.7)	23 (7.6)	0.015	63 (12.3)	84 (8.3)	0.013
Negative	91 (84.3)	278 (92.4)		448 (88.7)	924 (91.7)	
Total	108 (100.0)	301 (100.0)		511 (100.0)	1,008 (100.0)	

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

Lifestyle

In the females, the IBS group had more sleep disturbances than the non-IBS group ($p < 0.001$) (Figure 3-2), and the bedtime of the IBS group was later than that shown for the non-IBS group ($p < 0.001$) (Table 3-4). In the females, the number of sleeping hours in the IBS group was less than that shown in the non-IBS group ($p = 0.005$), and the IBS-C subgroup used more laxatives than the other subgroups ($p = 0.030$) (Figure 3-3). In the 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 the females, the rate was 3.5% in the IBS group and 2.6% in the non-IBS group. In the 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.

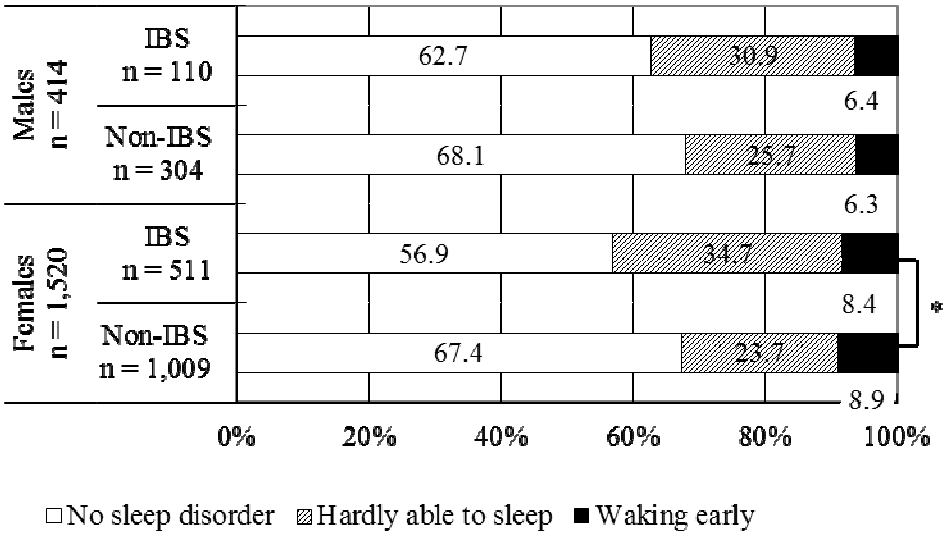

Figure 3-2. Sleep disorders in the IBS group and the non-IBS group in nursing and medical school students in China

*p < 0.001, Chi-square test

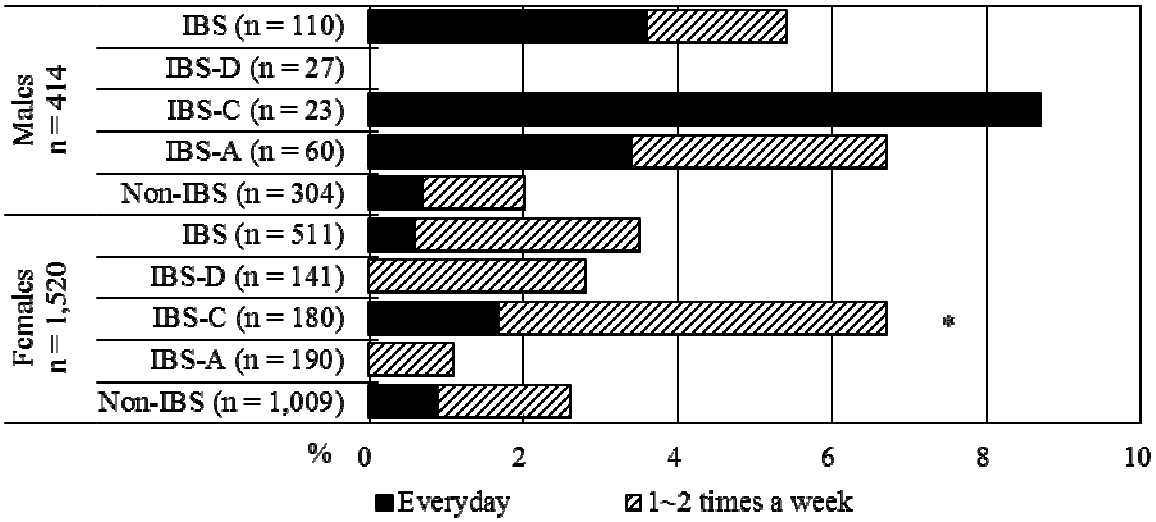

Figure 3-3. Use of laxatives in the IBS group and the non-IBS group in nursing and medical school students in China

* p =0.030 (IBS-D, IBS-C vs. IBS-A), Chi-square test

Table 3-4. Time of sleep and exercise in the IBS group and the non-IBS group in nursing and medical school students in China

	Males (n = 414)			Females (n = 1,520)		
	IBS	Non-IBS	*p* *	IBS	Non-IBS	*p* *
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 exercise (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

Data are presented as means ± SD
IBS irritable bowel syndrome
* Mann-Whitney *U* test

Dietary habits and the frequency of food intake

In the females, the intake of 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 3-5). 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, compared with the non-IBS group ($p = 0.002$, $p = 0.018$) (Figure 3-4, Figure 3-5). Especially in males, the rate of missing meals almost every day was 33.3% in the IBS-D subgroup.

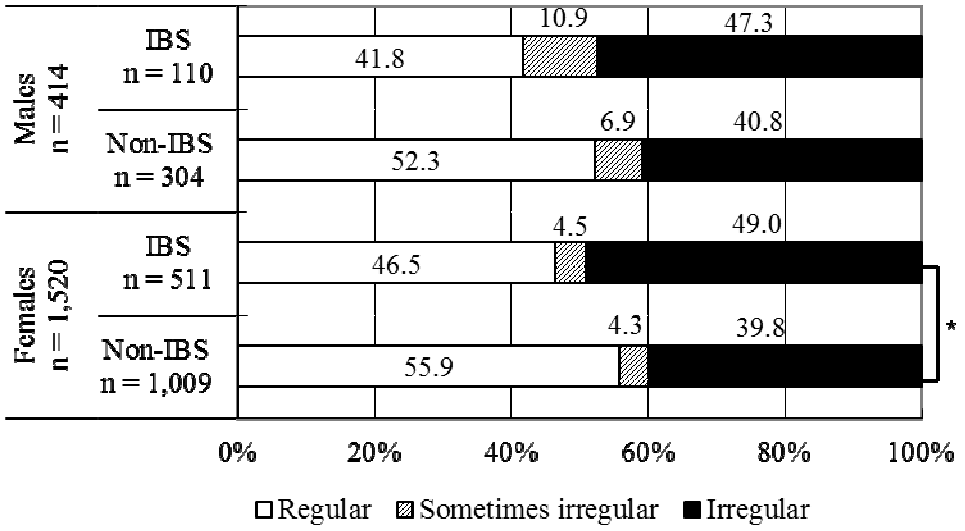

Figure 3-4. Mealtimes in the IBS group and the non-IBS group in nursing and medical school students in China

*p = 0.002, Mann-Whitney U test

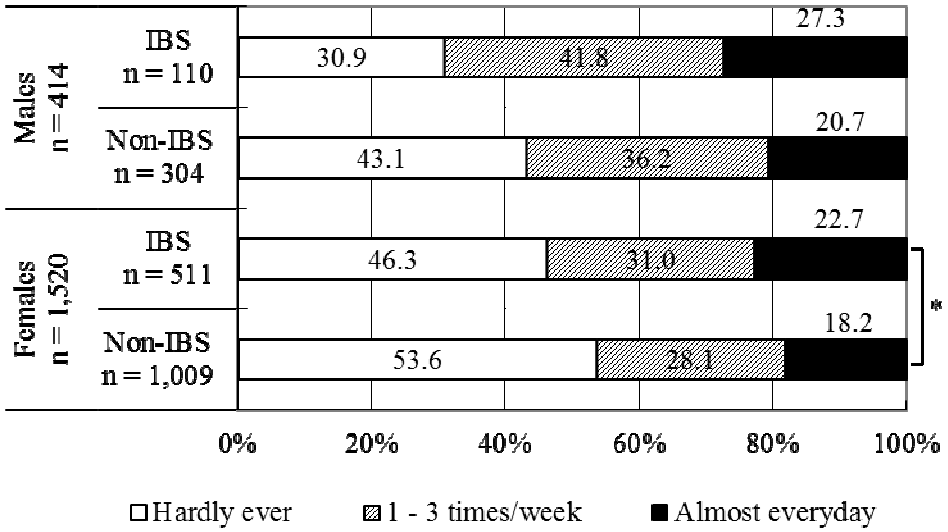

Figure 3-5. Skipping meals in the IBS group and the non-IBS group in nursing and medical school students in China

*p = 0.018, Chi-square test

Table 3-5. The frequency of food intake in the IBS group and the non-IBS group in nursing and medical school students in China

			Milk	Meat	Fish	Eggs	Leafy vegetables	Other vegetables and potatoes
Males	IBS	everyday	12 (10.9)	33 (30.0)	4 (3.6)	32 (29.1)	68 (61.8)	60 (54.5)
		1-5 times/week	27 (24.5)	52 (47.3)	26 (23.6)	56 (50.9)	38 (34.5)	40 (36.4)
		nothing	71 (64.5)	25 (22.7)	80 (72.7)	22 (20.0)	4 (3.6)	10 (9.1)
	Non-IBS	everyday	39 (13.0)	91 (30.4)	12 (4.0)	105 (35.1)	177 (59.2)	160 (53.5)
		1-5 times/week	80 (26.8)	139 (46.5)	99 (33.1)	149 (49.8)	104 (34.8)	124 (41.5)
		nothing	180 (60.2)	69 (23.1)	188 (62.9)	45 (15.1)	18 (6.0)	15 (5.0)
	p *		0.728	0.925	0.163	0.362	0.782	0.234
Females	IBS	everyday	48 (9.5)	38 (7.5)	6 (1.2)	90 (17.8)	208 (41.1)	185 (36.6)
		1-5 times/week	109 (21.5)	182 (35.9)	101 (19.9)	261 (51.5)	251 (49.6)	283 (55.9)
		nothing	350 (69.0)	287 (56.6)	400 (78.9)	156 (30.8)	47 (9.3)	38 (7.5)
	Non-IBS	everyday	95 (9.5)	83 (8.3)	26 (2.6)	192 (19.2)	493 (49.3)	433 (43.3)
		1-5 times/week	228 (22.8)	357 (35.7)	196 (19.6)	507 (50.8)	415 (41.5)	483 (48.3)
		nothing	676 (67.7)	559 (56.0)	777 (77.8)	300 (30.0)	91 (9.1)	83 (8.3)
	p *		0.821	0.803	0.184	0.773	0.007	0.023

Data are presented as *n* (%)

IBS irritable bowel syndrome

* Chi-square test

Subjective factors affecting the body condition

Each of the subjects chose the somatic factors that affected their body condition from six items; stress, sleeping time, irregular mealtime, food, smoking and drinking. In the females, more students in the IBS group thought that the somatic factors 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 somatic factor was food, compared with the other subgroups (p = 0.005). More females in the IBS-C subgroup thought the factor of somatic symptoms was stress, compared with the other subgroups (p = 0.025).

Comparison between Japan and China

The prevalence of IBS in nursing and medical school students in China (32.1%) was lower than that found in Japan (35.5%) [9] (p = 0.028) (Figure 3-6). More Japanese female subjects had IBS than their Chinese counterparts (p < 0.001). In the females, the prevalence of the IBS-D subgroup was higher in China than that shown in Japan (p = 0.014), and the prevalence of the IBS-C subgroup in China was lower than that found in Japan (p < 0.001). In the males, there were no statistically significant differences shown between China and Japan in the prevalence of IBS or the subgroups.

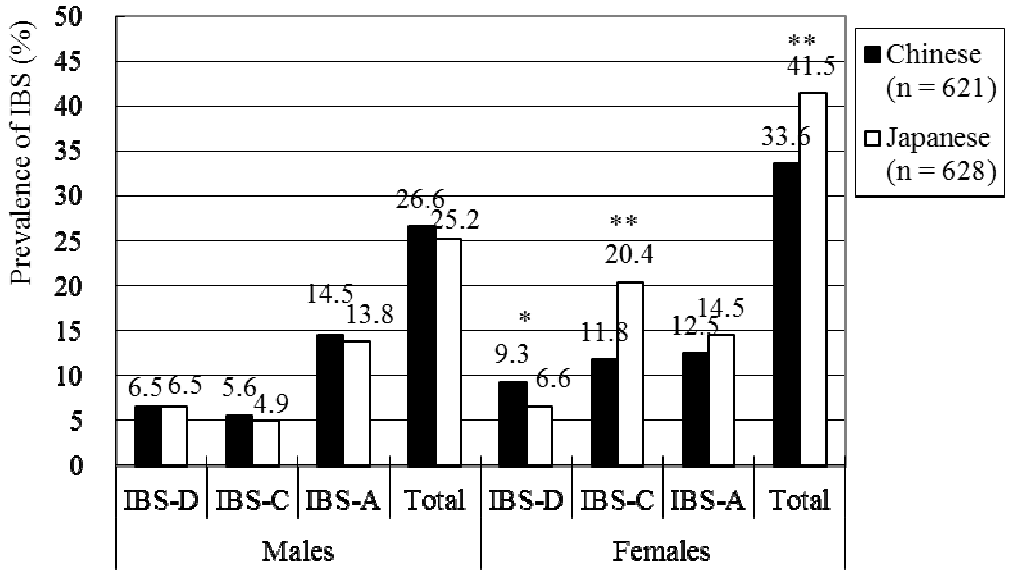

Figure 3-6. Prevalence of IBS (%) between nursing and medical school students in China and those in Japan [9]
*p = 0.014, **p < 0.001, Chi-square test

3-4. Discussion

The results of this study showed that the general prevalence of IBS was 32.1% in nursing and medical school students in China, with 26.6% in the males and 33.6% in the females. Two major findings were revealed, as follows. The prevalence of IBS was relatively high, and secondly, the prevalence of IBS in the females was higher than that shown in males.

First, the prevalence of IBS among medical school students in China was higher than that shown in other Asian studies, including other Chinese studies [1, 2, 10-13]. This tendency for a higher prevalence of IBS in nursing and medical school students was similar to that shown in the study conducted in Japan [9]. Just like the study in Japan, it is assumed that Chinese nursing and medical school students also worked irregular hours due to their studies and clinical practice schedules. Some studies in China [14, 15] have shown oppressive study and work conditions. However, the reason why the prevalence shown in this study was so high compared with the other studies that also targeted Chinese medical college students [1, 2] is unclear.

The prevalence of IBS in nursing and medical school students in Japan [9] and China were both higher than that found in other countries. Prior to the recent studies, almost no large-scale research studies had been conducted using nursing and medical school students as subjects. 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.* [10] 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.

Secondly, the prevalence of IBS in females was higher than that shown in males. This result was consistent with other studies [1, 9-13, 16, 17]. The difference between China and Japan [9] was the prevalence of the IBS-C subgroup in females (China: 11.8%, Japan: 20.4%), showing that Japanese females were more constipated than Chinese females. When the intake of 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 pouch foods, confectionery, juice, coffee and tea than Chinese females [9]. 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 1,403 (92.4%) in China and 192 (17.3%) in Japan and, the number of females living in a home of their own was 105 (6.9%) in China and 608 (54.6%) in Japan ($p < 0.001$).

The Japanese study [9] showed that students with IBS felt more anxiety than those without IBS, which was consistent with the findings of other studies [1, 9, 18]. 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 [2, 19-21]. In addition, Drossman [22] reported that psychological factors themselves influence motor abdominal functions, the sensory threshold and the stress reactivity of the intestines.

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, the females went to bed later, had less sleeping time and more experienced difficulty in falling asleep than the females in the non-IBS group. This tendency was the same as that shown in the study conducted in Japan [9]. The reason why there is a relationship between the sleeping status and IBS is assumed to be the peptides synthesized by intestinal bacteria [23], the

neuroendocrine levels during sleep [24] and the sympathetic/parasympathetic nervous system balance across sequential non-REM periods and REM cycles [25]. 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 study conducted in Japan [9], the females in the IBS group also showed a lack of fruit and vegetables. Especially, the 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 [25] and the Korean study [11] showed the same results for meal times. In the 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 [23]. Regardless of the IBS, this study revealed that about 20% of the students skipped meals almost every day. Recently, it has been said that young people show a lack in the intake of fruit and vegetables [26, 27]. Not only for IBS patients, but also for the Chinese general 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 of somatic symptoms, compared with those in the non-IBS group. This result shows that they recognized their current situation. It is well-known that IBS is associated with many complicated factors.

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. In addition, the number of females was more than three times than that of males, because nursing students are mostly females. All of the data were analyzed 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 the female subjects, subjects in the IBS group showed more anxiety than those in the non-IBS group. In both the males and females, subjects in the IBS group experienced more life events than those in the non-IBS group. In the females, the IBS group had more sleep disturbances, showed more irregular and skipped meals, and the intake of leafy vegetables, other vegetables, and potatoes was less than that in the non-IBS group. However, the cause and effect relationship was not clarified because this study was a cross-sectional study. Further intervention studies are needed to clarify the cause of IBS in the future.

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Chapter 4. An Intervention Study Employing Lifestyle Self-monitoring for Irritable Bowel Syndrome in Female Nursing School Students

4-1. Introduction

As described above in Chapter 2 and Chapter 3, comparative studies on lifestyles and IBS for nursing and medical school students were conducted. The diagnosis of IBS was based on Rome II criteria. The results of those studies showed that the prevalence of the IBS was 25.2% in males and 41.5% in females in Japan, and 26.6% in males and 33.6% in females in China. In both countries, more females had IBS than males. In addition, relationships were shown between IBS and anxiety, depression, sleep disorders, skipping meals and irregular meal times. In the females of both countries, the IBS group showed a lower frequency for the intake of vegetables, compared with the non-IBS group. Based on these results, we focused on lifestyle, including the daily habits of students with IBS. Accordingly, this study was conducted in order to intervene in the daily lives of the subjects and assess the effect of the intervention on the improvement of IBS symptoms.

Treatment methods for patients with IBS vary widely, depending on the individual subject concerned, due to individual character, genetics and environment differences [1-7]. How matters related to IBS and its symptoms are perceived results in a considerable disparity in the treatment of IBS, since IBS is a representative disorder of the brain-gut axis [8].

On the other hand, self-monitoring has been widely recognized as an important self-health management method, including the recording of weight, steps, blood pressure, the number of cigarettes smoked, and so on, because it is an easy and economical method [9-14]. Even for IBS patients, self-monitoring has gathered wide spread attention due to this cost-saving benefit [15, 16]. Some studies have already reported the effect of self-monitoring for IBS, but most of those studies were fundamentally based on medication, and the self-monitoring was supplementary [17-19]. In addition, the self-monitoring was focused on the mental side of the patients in those studies. Accordingly, this study was conducted to verify the effect of lifestyle self-monitoring for the improvement of IBS.

4-2. Methods

Study population

A total of 116 female freshmen at nursing schools in Kyoto prefecture participated in this study. Among these 116 students, two classes (39 and 38 students) were randomly chosen as the two-month and four-month intervention groups. Another class (39 students) was assigned as a control group. Among the 116 students, a total of 111 students (control group; n = 36, two-month intervention group; n = 37, four-month intervention group; n = 38) answered self-administered questionnaires (95.7%) after submitting a written informed consent form. According to our eligibility criteria, no males, subjects with no diagnosis of inflammatory bowel disease, and no data inadequacy, 103 students (control group; n = 34, two-month intervention group; n = 34, four-month intervention group; n = 35) aged 18- to 26-years-old (mean ± SD: 18.6 ± 1.3) were considered ineligible (88.8%).

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.

Questionnaire information

In order to obtain a questionnaire suitable for the purpose of the study, well-known criteria were combined with some original items. The self-recording questionnaire contained 65 items, with the following sections; bowel habits (15 items), QOL related to gastrointestinal symptoms (15 items), psychological factors (14 items), dietary habits and lifestyle (16 items), physical characteristics (4 items) and treatment of disease (1 item). The time required to complete the questionnaire was 10 minutes. After all of the subjects answered the questionnaires, and the two intervention groups monitored their own lifestyles for two or four months. After the intervention, all of the study subjects answered the same questionnaire again.

IBS definitions

IBS definition was the primary outcome measure. Patients with IBS were diagnosed with Rome IIcriteria [20]. Subjects were classified into three subgroups as follows: Diarrhea-predominant IBS (IBS-D), constipation-predominant IBS (IBS-C), and alteration type IBS (IBS-A). We used a Japanese version of the Rome II modular questionnaire, including 15 items compiled by Shinozaki *et al* [21].

QOL definitions

QOL points related to gastrointestinal disorders were applied according to the Gastrointestinal Symptom Rating Scale (GSRS) criteria [22]. The QOL of the subjects was assessed in five subscales of symptoms, acid reflux, abdominal pains, dyspepsia, diarrhea and constipation. The points applied for each of the items was the average point of the symptoms; for acid reflux it was the average of heartburn and regurgitation, for abdominal pains it was the average of epigastralgia, hunger pains and nausea, for dyspepsia it was it was the average of borborygmus, the feeling of fullness, eructation and abdominal wind, for diarrhea it was the average of a multitude of bowel movements, loose bowel movements, and urgent bowel movements, for constipation it was the average of few bowel movements, hard bowel movements and the feeling of incomplete evacuation, and for QOL related to gastrointestinal symptoms, it was the average point of these five subscales of symptoms. In each subscale, the minimum score of 1 indicated that the symptom did not affect the QOL at all. The maximum score of 7 indicated that the symptom had a harmful influence on the QOL. A modified Japanese version of the GSRS, including 15 items complied by Hongo *et al* [23], was used.

Psychological factors

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 a 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.

Contents of intervention

Self-monitoring

Subjects in the intervention groups recorded their daily habits every day for two or four months, including the contents of breakfast (staple dish, main dish and side dish), their awakening time, bedtime, hours of sleep, frequency of bowel movements, and mood of the day.

Group work

In order to enhance the effectiveness of the self-monitoring, a fifteen-minute group work session was conducted every week as one of the basic subjects of the nursing course. The members of the group work session were the same 3 or 4 students for the intervention period. Each student set a goal to improve her lifestyle every week and wrote some messages in the self-monitoring sheet for the other members. Some groups made a presentation about their goals. After one week, they circulated the sheet in the group and assessed each other. The assessment points were as follows; "Have you remembered your goal for this week?", "Have you made any efforts to accomplish that goal?", "What percentages did you accomplish for your goal?".

Figure 4-1 shows a flow chart for the intervention. Each intervention group continued the cycle of self-monitoring and the group work activity for two or four months. On the other hand, the control group did not conduct self-monitoring or group work activity.

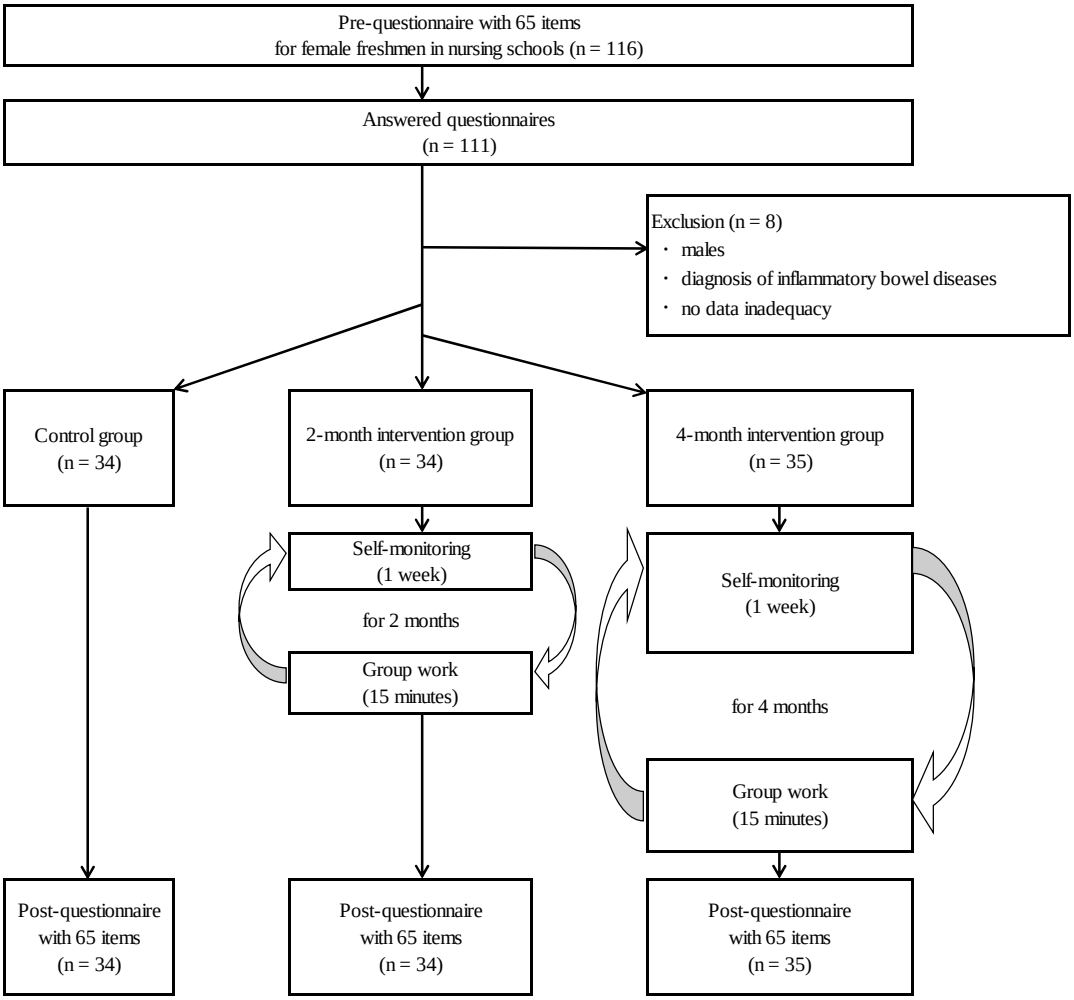

Figure 4-1. Flow chart of the intervention study for IBS in nursing schools

Statistical analysis

All statistical computations were performed using the statistical software SPSS version 18 for windows. Wilcoxon's signed-rank test or McNemar's test was used to compare values obtained before and after intervention in each group. The Kruskal-Wallis test was used for comparisons between the three groups. Intention-to-Treat (ITT) analyses were employed for all of the analyses. A two-sided *p* value of less than 0.05 was considered statistically significant.

4-3. Results

Characteristics of the subjects

There were no statistically significant differences in age, height, weight and BMI between the three groups (Table 4-1).

Table 4-1. Characteristics of the subjects in the intervention and the control groups

	Control group n=34	Intervention group (2 months) n=34	Intervention group (4 months) n=35	*p* [1]
Age	18.3 ± 0.6	18.9 ±1.5	18.5 ± 1.5	0.09
Height (cm)	158.3 ± 4.4	158.7 ± 6.4	157.6 ± 5.1	0.72
Weight (kg)	51.6 ± 6.0	50.6 ± 5.7	51.1 ± 5.5	0.79
BMI	20.6 ± 2.5	20.3 ± 1.9	20.6 ± 2.3	0.97

Data are presented as means ± SD

BMI: weight (kg) / height $(m)^2$

1: Kruskal-Wallis test

Prevalence of IBS

There was an 11.8 point decrease in the IBS prevalence in the two-month intervention group (Figure 4-2). Meanwhile, there was only an 8.9 point decrease in the control group and a 5.8 point decrease in the four-month intervention group. In regard to the IBS-C subgroups, there were decreases of 8.8 and 2.8 points in the two-month and four-month intervention groups, respectively, but no change in the control group (Figure 4-3).

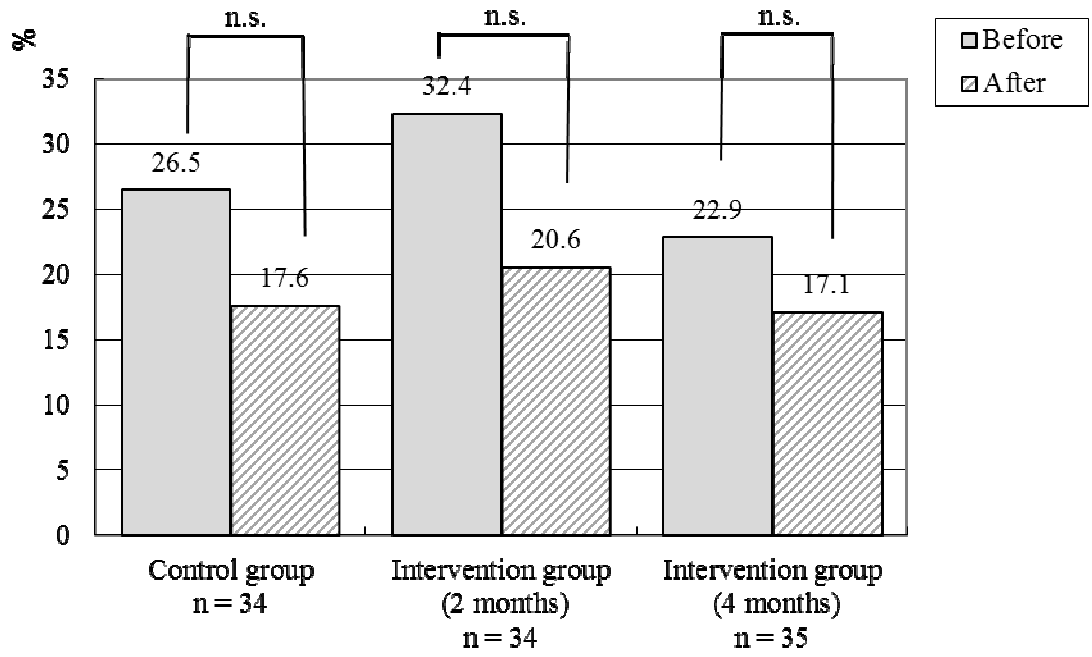

Figure 4-2. The prevalence of IBS in the intervention and the control groups
IBS irritable bowel syndrome
n.s.: not significant, McNemar's test

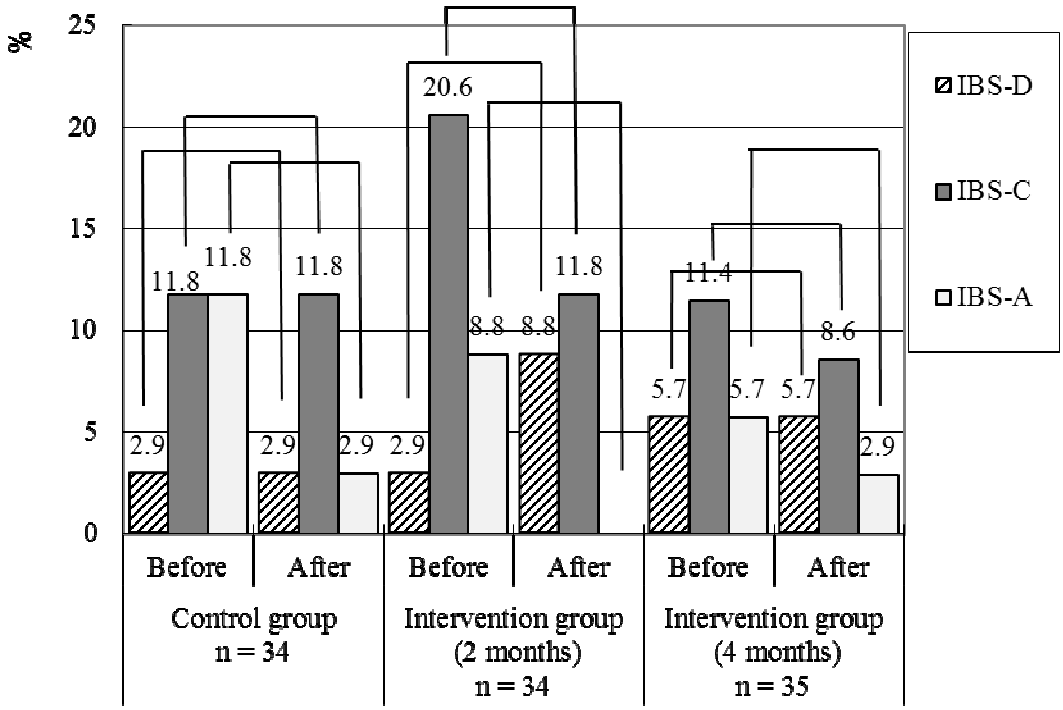

Figure 4-3. The prevalence of IBS subgroups in the intervention and the control groups
IBS-D diarrhea predominant IBS, *IBS-C* constipation predominant IBS, *IBS-A* alteration type IBS
All comparisons were n.s. (not significant), McNemar's test

The relationship between psychological factors and IBS

The anxiety scores decreased 1.1 points in the two-month intervention group ($p = 0.02$) and 2.0 points in the four-month intervention group ($p < 0.01$), although there was only a 0.2 point decrease in the control group (Figure 4-4).

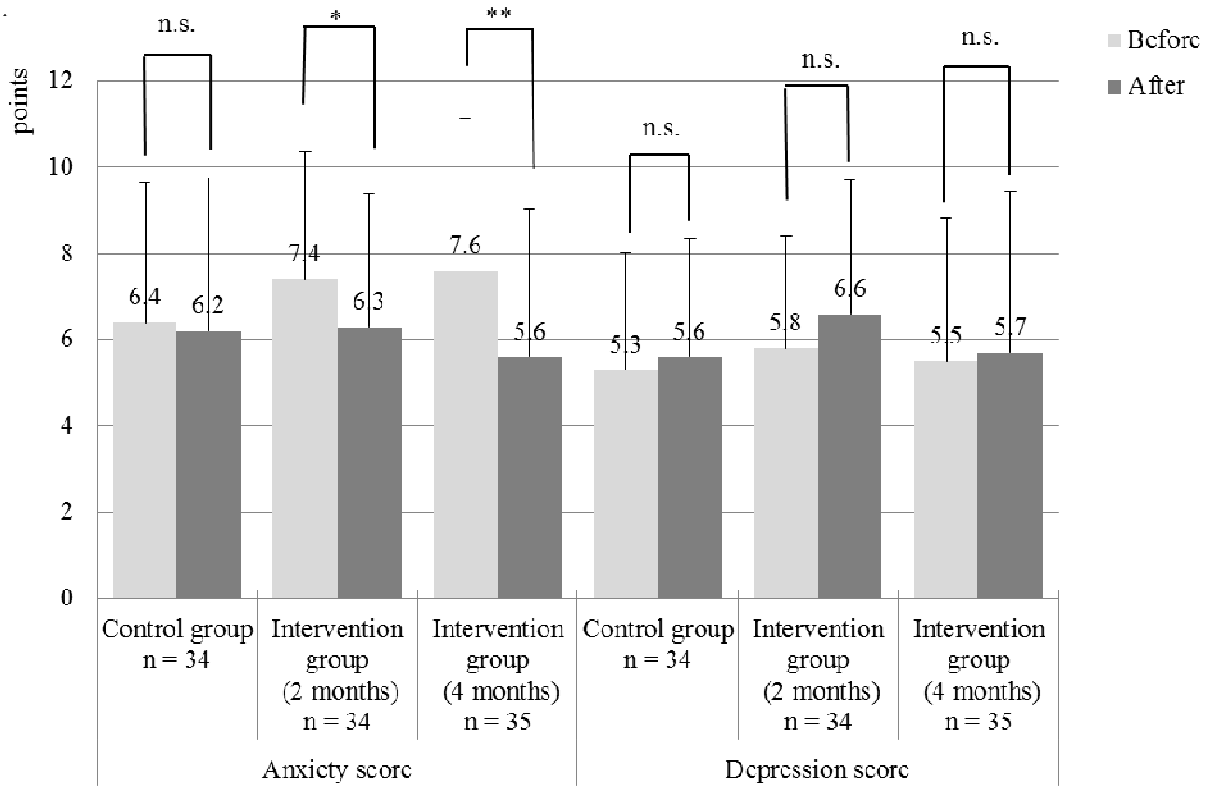

Figure 4-4. Anxiety and depression scores in the intervention and the control groups
Bars and lines are presented as mean and SD respectively
*: $p = 0.02$, **: $p < 0.01$, n.s.: not significant
Wilcoxon's signed-rank test

Sleep time, defecation habits, dietary habits and contents of meals

In the two-month intervention group, the time of sleep became irregular after the intervention ($p = 0.01$), since the awakening time ($p < 0.01$) and bedtime ($p < 0.01$) became irregular after the intervention (Table 4-2). In the four-month intervention group, the percentage of students using laxatives decreased 17.2 percentage points after the intervention ($p = 0.01$), although there were just 8.8 point and 5.9 point decreases in the control group and the two-month intervention group, respectively.

The percent of students taking meals regularly decreased after the intervention in the control group and the four-month intervention group (Table 4-2). In both of the intervention groups, the percent of students having three dishes at breakfast increased after the intervention. On the other hand, students having three dishes at lunch decreased significantly after the intervention in the four-month intervention group ($p = 0.01$)

Table 4-2. Sleep time, defecation habits, dietary habits and contents of meals in the intervention and the control groups

	Control group					Intervention group (2 months)					Intervention group (4 months)				
	before		after		p^1	before		after		p^1	before		after		p^1
	n=34		n=34			n=34		n=34			n=35		n=35		
Awakening time					0.69					0.01*					0.45
Regular	27	(79.4)	29	(85.3)		32	(94.1)	23	(67.6)		29	(82.9)	26	(74.3)	
Irregular	7	(20.6)	5	(14.7)		2	(5.9)	11	(32.4)		6	(17.1)	9	(25.7)	
Bedtime					1.00					< 0.01**					0.58
Regular	19	(55.9)	19	(55.9)		25	(73.5)	16	(47.1)		18	(51.4)	15	(42.9)	
Irregular	15	(44.1)	15	(44.1)		9	(26.5)	18	(52.9)		17	(48.6)	20	(57.1)	
Time of sleep					0.55					< 0.01**					0.55
Regular	21	(61.8)	18	(52.9)		25	(73.5)	17	(50.0)		21	(60.0)	18	(51.4)	
Irregular	13	(38.2)	16	(47.1)		9	(26.5)	17	(50.0)		14	(40.0)	17	(48.6)	
Use of laxatives					0.10					0.16					0.01*
Nothing	26	(76.5)	29	(85.3)		29	(85.3)	31	(91.2)		27	(77.1)	33	(94.3)	
Sometimes	7	(20.6)	5	(14.7)		5	(14.7)	3	(8.8)		7	(20.0)	1	(2.9)	
Everyday	1	(2.9)	0	(0)		0	(0)	0	(0)		1	(2.9)	1	(2.9)	
Time of meal					0.16					0.16					0.01*
Regular	11	(32.4)	9	(26.5)		7	(20.6)	7	(20.6)		14	(40.0)	8	(22.9)	
Sometimes irregular	21	(61.8)	21	(61.8)		23	(67.6)	19	(55.9)		16	(45.7)	20	(57.1)	
Irregular	2	(5.9)	4	(11.8)		4	(11.8)	8	(23.5)		5	(14.3)	7	(20.0)	
Contents of breakfast					0.32					0.41					0.71
Three dishes	1	(2.9)	1	(2.9)		6	(17.6)	8	(23.5)		2	(5.7)	3	(8.6)	
One or two dishes	31	(91.2)	32	(94.1)		27	(79.4)	25	(73.5)		31	(88.6)	28	(80.0)	

No breakfast or only confectionaries	2	(5.9)	1	(2.9)		1	(2.9)	1	(2.9)		2	(5.7)	4	(11.4)	
Contents of lunch					0.66					0.26					0.01*
Three dishes	20	(58.8)	20	(58.8)		17	(50.0)	21	(61.8)		16	(45.7)	8	(22.9)	
One or two dishes	14	(41.2)	13	(38.2)		17	(50.0)	12	(35.3)		19	(54.3)	26	(74.3)	
No lunch or only confectionaries	0	(0)	1	(2.9)		0	(0)	1	(2.9)		0	(0)	1	(2.9)	
Contents of dinner					0.16					0.05					0.48
Three dishes	22	(64.7)	20	(58.8)		27	(79.4)	23	(67.6)		21	(60.0)	20	(57.1)	
One or two dishes	12	(35.3)	14	(41.2)		7	(20.6)	11	(32.4)		13	(37.1)	13	(37.1)	
No dinner or only confectionaries	0	(0)	0	(0)		0	(0)	0	(0)		1	(2.9)	2	(5.7)	

Data are presented as the number of cases (%)

*: $p < 0.05$, **: $p < 0.01$

1: McNemar's test (for two categories) or Wilcoxon's signed-rank test (for three or more categories)

QOL related to gastrointestinal symptoms

In the four-month intervention group, the QOL points related to all gastrointestinal disorders decreased after the intervention. Especially, the points for acid reflux ($p = 0.01$), abdominal pains ($p = 0.01$) and dyspepsia ($p < 0.01$) decreased significantly after the intervention. Due to these subscales, the average points decreased 0.3 points ($p < 0.01$) in the four-month intervention group (Table 4-3)

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Table 4-3. QOL related to gastrointestinal symptoms in the intervention and the control groups

	Control group			Intervention group (2 months)			Intervention group (4 months)		
	before	after	p^1	before	after	p^1	before	after	p^1
	n = 34	n = 34		n = 34	n = 34		n = 35	n = 35	
Reflux of acid	1.4 ± 0.7	1.2 ± 0.4	0.08	1.3 ± 0.5	1.3 ± 0.6	0.72	1.6 ± 0.7	1.3 ± 0.6	0.01*
Abdominal pains	1.7 ± 1.0	1.6 ± 0.7	0.41	1.6 ± 0.8	1.7 ± 0.8	0.83	2.0 ± 0.9	1.6 ± 0.7	0.01*
Dyspepsia	1.9 ± 0.8	1.8 ± 0.6	0.27	2.2 ± 1.1	2.1 ± 0.9	0.27	2.1 ± 0.8	1.7 ± 0.6	< 0.01**
Diarrhea	1.8 ± 1.1	1.6 ± 1.0	0.10	1.7 ± 1.0	1.7 ± 0.8	0.34	1.9 ± 1.3	1.7 ± 1.1	0.21
Constipation	2.0 ± 1.1	1.9 ± 1.1	0.39	2.0 ± 1.1	2.1 ± 1.2	0.83	2.2 ± 1.2	2.1 ± 1.1	0.59
QOL related to gaestrinintestinal symptoms	1.8 ± 0.7	1.6 ± 0.5	0.05	1.8 ± 0.6	1.8 ± 0.6	0.84	2.0 ± 0.7	1.7 ± 0.7	< 0.01**

Data are presented as means ± SD

*: $p < 0.05$, **: $p < 0.01$

1: Wilcoxon's signed-rank test

4-4. Discussion

The characteristics of this study were as follows. First, this study was a school-based study, and not only students with IBS, but also students without IBS participated in the study. Furthermore, the contents of the intervention were self-monitoring and group work activities focused on lifestyle. Some studies [25-28] investigated the effects of self-monitoring focused on the emotions and feelings of the subjects. However, in this study, we employed lifestyle intervention using the self-monitoring method because a relationship between disordered lifestyles and IBS was revealed in previous studies. This study was the first to investigate the effects of lifestyle self-monitoring on the symptoms of IBS. Employing this method, we were able to observe not only changes in the symptoms and QOL, but also changes in the lifestyles of the subjects after the intervention.

The results of this study showed that the prevalence of IBS decreased after the intervention in all groups, but there were no statistically significant differences between the intervention groups and the control group. Especially, the prevalence of IBS decreased in the IBS-C subgroup after the intervention in both of the intervention groups, but not in the control group.

In regard to the psychological factors, the anxiety scores decreased significantly in both of the intervention groups. This result showed the effectiveness of self-monitoring and group work for the relief of anxiety. Sugaya *et al*. [28] reported that severe anxiety sensitivity in individuals with IBS was related to their symptom-related cognition, and that the altered cognition increased anxiety. It is assumed that anxiety comes from cognition and the way the subjects think about themselves.

In regard to lifestyle, the meal, sleep, and defecation times became more irregular after the intervention in all of the groups. The reason for this might be because this study was conducted with first-year college students as the subjects. When the subjects were high school students, they regularly spent time studying for their college entrance examinations, but their lifestyles changed after entering college. At college, they can choose the classes they take themselves, and most of the subjects worked part-time after classes. Their meal, sleeping, and defecation times tended to be very irregular along with these changes in lifestyle. The number of students who took three dishes at lunch decreased significantly after the intervention in the four-month intervention group. The number of students who took three dishes at dinner also decreased after the intervention in all of the groups. The reason for this is because most of the students started to live alone and cook for themselves. On the other hand, the contents of breakfast improved after the intervention in both of the intervention groups. This means that they recognized the importance of breakfast and were more aware of that importance due to the self-monitoring and the group work activities. The frequency of using laxatives decreased significantly in the four-month intervention group.

The QOL points related to gastrointestinal symptoms decreased 0.4 points after the intervention in the four-month intervention group. This depended on three items, acid reflux, abdominal pain and dyspepsia.

Previous studies [26, 27] conducted psychoeducation for patients with IBS, showing a direct effect on global IBS symptom improvement and improvement in QOL, independent of its effects on distress [27]. In this study, there was improvement of QOL related to gastrointestinal symptoms, but not any significant reduction in the prevalence of the IBS. Moss-Morris *et al*. [29] showed that symptomatic relief due to self-management was observed after an intervention and that the relief continued until six months later. They also reported that a clinically significant change in the IBS severance score was observed six months later. Kennedy *et al*. [17] also reported that the effect of cognitive behavioral therapy, in addition to the intake of mebeverine, continued until six month later.

These studies showed the possibility that the effects of self-management continued for a while after the intervention or that it became visible some months after the intervention.

This study was limited for the following reasons. First, the persons who conducted this study were not specialists in self-monitoring. Second, we could not compare self-monitoring with other therapeutic approaches in this study. Third, the subjects of this study also included students who did not have any IBS symptoms. On the whole, there were only 28 students identified with IBS versus 75 students without before intervention. The more severe the symptoms of IBS are, the more rapidly the effects of improvement surface [30]. Considering this fact, it was difficult to obtain a rapid response to the self-monitoring in this school-based study. Fourth, we did not follow up on the subjects until sometime after the intervention. And lastly, this study was conducted with first-year college students as the subjects in spring. The intervention was conducted during a time period when the lifestyle of students undergoes a lot of change.

This study might be regarded as an exploratory research study, since the number of subjects was adjusted according to the number of classes and there were several primary outcome measures (Rome II, HADS and GSRS). These limitations must be considered in future research studies. Future research should also include long-term follow-up studies of IBS patients treated with self-monitoring, and it might be more appropriate if the subjects were in the sophomore or junior year of college.

Overall, this study showed that lifestyle self-monitoring intervention for two or four months did not reduce the prevalence of the IBS significantly, but related to gastrointestinal symptoms, it did decrease anxiety and improved the QOL.

4-5. References

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Chapter 5. General Discussion and Conclusion

In Chapter 1, the previous studies on IBS conducted in the U.S and European countries were examined [1, 2]. It has been reported that the prevalence of IBS is increasing [2], that young people tend to be in the IBS group [3], and that stress is related to IBS [4, 5], although the mechanism of IBS remains unclear. Furthermore, no large-scale studies on IBS have been conducted in Asian countries. In addition, it is said that the most prevalent digestive disorders are IBS [6, 7]. Accordingly, this study was conducted to unravel the prevalence of IBS and the relevant factors using epidemiological methods. Nursing and medical school students were adopted as the subjects of this study because it was clarified that IBS is most prevalent among young people [3]. Previously, nursing and medical school students were employed as the subjects for earlier studies that reported associations between stress and IBS [4, 5].

In Chapter 2, questionnaires, including the definition of IBS, as well as questions related to stress status and lifestyles, were employed in nursing and medical school students in Kyoto prefecture of Japan. The results showed that the prevalence of IBS was 35.5%, 25.2% for males and 41.5% for females, which was higher than that for students in other developed countries. In this study, IBS was associated with anxiety and depression in both sexes and the students in the IBS group experienced more life events, showing that the relationship between stress and IBS already observed in other developed countries [4, 5] can also be applied to the Japanese population. Next, the lifestyles of the subjects, related to IBS were examined, which was unique to this study. Consequently, males in the IBS group experienced more sleeping disorders, such as awakening early in the morning or difficulties of sleep at night. Bed time in the IBS group was later than that in the non-IBS group for both sexes. Subjects in the female IBS group skipped meals more often and had meals more irregular than the subjects in the non-IBS group. In regard to the intake of food frequency, the IBS group had less milk, green-yellow vegetables, and fruit and had more processed food products than the non-IBS group, in females. Furthermore, for both sexes, the IBS group used more laxatives than the non-IBS group.

In Chapter 3, the characteristics of Japanese and Asian IBS cases were clarified by examining and comparing the results with those obtained in another large-scale study in China, based on the results obtained in Japan. In order to compare the results obtained in China with those from the Japanese study, the subjects in China were also nursing and medical school students and the number of students who participated in this study was set to be almost same as that in the Japanese study. The results of the study in China showed that the prevalence of IBS was 32.1%, 26.6% for males and 33.6% for females, which was higher than that shown in previous studies, which was similar to the results of the Japanese study. An association between anxiety and IBS was shown in the females, and an association between the life events and IBS was demonstrated in both sexes. In regard to the lifestyles of the subjects, the female IBS group showed more sleeping disorders, like difficulties in sleeping at night and awakening early in the morning, compared with the non-IBS group. The Chinese females showed the same tendency as Japanese females in regard to their eating habits, since the IBS group also showed more irregular meals and skipped meals more than the non-IBS group. Chinese females in the IBS group showed less intake of leafy vegetables, other vegetables and potatoes than the non-IBS group. Chinese females in the IBS group also took laxatives more frequently than the non-IBS group.

Based on these studies that investigated the prevalence of IBS, and the lifestyles and psychological factors in two Asian countries, the prevalence of IBS and the relative factors of the IBS between the two countries were compared. First, the prevalence of IBS in these two countries

was both higher than the values shown in any of the other studies. It was considered that the subjects, who were nursing and medical school students, were the cause of this result. There is no doubt that stress, that is, anxiety and life events, were frequently observed in the IBS group and it was reported that students hoping to work in medical facilities were quite stressed from their studies and daily activities [8-11]. On the other hand, the main difference between the two countries was the prevalence of IBS in the female subjects, especially the prevalence of IBS-C, which was higher in the Japanese female subjects, compared with the Chinese female subjects. Although more research is required for an understanding of this phenomenon, It was regarded this difference as being due to the differences in their eating habits, because the Japanese female subjects ate less beans, bean products, vegetables and fruit, and they also ate more meat, eggs, milk, milk products, processed food products, instant noodles, confectionery, soft-drink and coffee. It was assumed that this difference in the dietary habits lead to the difference in their dietary fiber intake. Therefore, it is considered that one of the factors that initiated the high prevalence of IBS, especially IBS-C in the Japanese female subjects, was the lack of dietary fiber intake.

These results made us speculate that an improvement in the eating habits of the subjects would improve the IBS symptoms, and a lifestyle intervention study was conducted aiming for improvements in the IBS symptoms in Chapter 4. However, standardizing the intervention methods employed was unrealistic because, first, there were three subgroups, and secondly, stress and sleeping disorders were the main triggers of IBS for some people, not dietary habits or the frequency of food intake. Thus, self-monitoring was adopted as the method employed in the intervention study, which was introduced by Prof. Takakuwa in his study on "stool watching," which he called, "BEN WATCHING," for constipated young females [12]. Although self-monitoring did not decrease the prevalence of IBS after two or four months, it alleviated both anxiety and the quality of life of the subjects related to digestive disorders. In this study, some limitations were found, first, that the intervention period was relatively short considering the definition of IBS, and secondly, students who did not have IBS symptoms were included in the study. These limitations should be addressed in future studies, in which the subjects of the intervention should only be IBS students. Furthermore, the intervention method employed for the three subgroups should be considered because the symptoms in the three groups are so different. Finally, it would be better if the period of the intervention had been extended to more than one year, considering the definition of IBS. This should also be addressed in the future.

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Accomplishments

Published papers

1) Okami, Y., Kato, T., Nin, G., Harada, K., Aoi, W., Wada, S., Higashi, A., Okuyama, Y., Takakuwa, S., Ichikawa, H., Kanazawa, M. & Fukudo, S. (2011) Lifestyle and psychological factors related to irritable bowel syndrome in nursing and medical school students. *J Gastroenterol.*, 46 (12), 1403-1410

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学位論文要旨

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題目：Study of irritable bowel syndrome and lifestyles in nursing and medical school students.
（看護・医療系学生の過敏性腸症候群と食・生活習慣に関する研究）

Chapter 1. Review of the literature on irritable bowel syndrome (IBS).
（過敏性腸症候群(IBS)に関する文献レビュー）

過敏性腸症候群（Irritable Bowel Syndrome: IBS）は、腸に器質的異常がないにもかかわらず、腹痛や腹部不快感をともなう下痢や便秘を繰り返す、慢性的な機能性消化管障害の一つである。1990 年代頃から、先進諸国をはじめ、我が国においても IBS が増加傾向にあり、一般内科受診患者において約 20～30％に達し、男性と比較して女性の頻度が高いことが報告されている。IBS は、RomeⅡ診断基準により「腹痛、腹部不快感が過去 12 ヶ月中の 12 週間以上を占め、その症状が、①排便によって軽快する、②排便頻度の変化で始まる、③便性状の変化で始まる、のうち 2 つ以上の症状を伴うもの。」と定義されており、15 項目から成る自記式質問票によって診断される。IBS と診断された場合、下痢型、便秘型及び混合型の 3 つのサブグループに分類される。

IBS の主要な病態は、消化管の運動異常、消化管の知覚過敏及び心理的異常の 3 つである。これらの病態は、中枢神経系と腸管神経叢系が自律神経系を介して関連する、脳腸相関の異常によるものである。そのため、IBS と心理的要因との関連を検討した報告は多い。一方、消化器疾患であるにもかかわらず、食生活との関連を明らかにした報告はほとんどない。また、医療系学生において IBS の有病割合が高いことがマレーシア、パキスタン及びナイジェリア等で報告されているが、日本や東アジアからの報告はない。そこで、本研究は、過密なカリキュラムや病院実習等でストレスが多く、食・生活習慣に問題が多い看護・医療系学生を対象に、食・生活習慣や不安、抑うつ等の心理的要因と IBS との関連を、横断研究により明らかにすることを目的とした。

第 2 章では日本人、第 3 章では中国人を対象とし、東アジアの看護・医療系学生の IBS と生活習慣との関連を明らかにした。これらの結果を踏まえ、第 4 章では、セルフモニタリングによる食・生活習慣の改善が IBS の改善に寄与するとの仮説を設定し、食・生活習慣への介入研究を実施した。

Chapter 2. Lifestyle and psychological factors related to irritable bowel syndrome in nursing and medical school students in Japan.

（日本の看護・医療系学生の過敏性腸症候群と食・生活習慣及び心理的要因との関連）

本研究では、日本人の看護・医療系学生を対象として、IBS と食・生活習慣や心理的要因との関連を明らかにすることを目的とした。

京都府内の全看護・医療系大学及び専門学校 20 校に調査を依頼し、同意が得られた学生 2,639 名を対象とし、RomeⅡ診断基準に準拠した腹部症状、不安・抑うつ尺度（Hospital Anxiety and Depression Scale：HAD）、ストレスや主観的健康感、食物摂取頻度、食・生活習慣、身体特性に関する無記名自記式アンケートを実施した。調査に協力が得られた 2,365 名（協力率 89.6%）から、30 歳以上の者、器質的疾患がある者、性、年齢及び IBS の診断項目に不備がある者を除いた 1,768 名（平均年齢±標準偏差；20.2±1.9 歳、最小～最大；18～29 歳）を解析対象とした。RomeⅡ診断基準により IBS 群と非 IBS 群に分類し、上記の項目を比較した。データの解析には、SPSS Ver.11.5 を用い、2 群間の平均値の差には Mann-Whitney *U* 検定を、3 群間の平均値の差には Kruskal Wallis 検定を、カテゴリカルデータの分布の差には χ^2 検定を行った。有意水準は 5%とした。実施にあたり、京都府立大学倫理委員会の承認を得た。

解析対象 1,768 名（男性 650 名、女性 1,118 名）のうち、IBS と判定されたのは男性 164 名（25.2%）、女性 464 名（41.5%）、計 628 名（35.5%）であった。サブグループの割合は、男性は混合型（13.8%）、女性は便秘型（20.4%）が最も高かった。男性において、不安点数は IBS 群 8.4 点、非 IBS 群 6.8 点（$p < 0.01$）（以下、IBS 群、非 IBS 群の順に記載）、睡眠障害のある割合は 43.3%、30.9%（$p = 0.02$）であった。食物摂取頻度については差がなかった。一方、女性において、不安点数は 10.1 点、7.9 点（$p < 0.01$）、食物摂取頻度について「毎日食べる」と回答した割合は、牛乳 25.2%、30.0%（$p = 0.03$）、果物 12.8%、19.8%（$p < 0.01$）、緑黄色野菜 36.2%、41.0%（$p = 0.04$）、レトルト食品・半調理食品 14.7%、10.3%（$p < 0.01$）であった。毎日欠食する割合は 14.4%、10.0%（$p < 0.01$）、食事時間が不規則である割合は 21.8%、15.6%（$p = 0.01$）であった。

以上の結果より、IBS 群は男女ともに不安点数が高く、男性において睡眠障害が多いこと、女性において牛乳、果物、緑黄色野菜の摂取頻度が低く、欠食が多く食事時間が不規則であることが明らかとなった。

Chapter 3. Lifestyle and psychological factors related to irritable bowel syndrome in nursing and medical school students in China.

（中国の看護・医療系学生の過敏性腸症候群と食・生活習慣及び心理的要因との関連）

本研究では、中国人の看護・医療系学生を対象に第 2 章と同様の調査を行い、IBS 有病割合および食・生活習慣、心理的要因と IBS との関連を明らかにし、日本人と比較検討することを目的とした。

中国河南省鄭州大学医学部の看護・医療系学生 3,169 名を対象とし、日本人と同様のアンケート調査を中国語に翻訳して実施した。一部の食物摂取については、中国の現状に合わせた。調査に協力が得られた 2,141 名（協力率 85.6%）から、第 2 章の除外条件と同様の条件の者を除いた 1,934 名（19.7±1.4 歳、16〜24 歳）を解析対象とした。実施にあたり、京都府立大学ならびに鄭州大学倫理委員会の承認を得た。

解析対象 1,934 名（男性 414 名、女性 1,520 名）のうち IBS と判定されたのは、男性 110 名（26.6%）、女性 511 名（33.6%）、計 621 名（32.1%）であった。サブグループの割合は、男女ともに混合型が最も高かった（男性 14.5%、女性 12.5%）。男性において、すべての項目で IBS 群と非 IBS 群において有意な差はみられなかった。一方、女性において、不安点数は IBS 群 9.7 点、非 IBS 群 9.1 点（$p < 0.01$）（以下、IBS 群、非 IBS 群の順に記載）、睡眠障害のある割合は 43.1%、32.6%（$p < 0.01$）、食物摂取頻度について「毎日食べる」と回答した割合は、葉菜 41.1%、49.3%（$p < 0.01$）、果菜と芋 36.6%、43.3%（$p = 0.02$）であった。毎日欠食する割合は 22.7%、18.2%（$p = 0.02$）、食事時間が不規則である割合は 49.0%、39.8%であった（$p < 0.01$）。

中国人と日本人を比較したところ、男性において、IBS の有病割合、食・生活習慣及び心理的要因において有意な差はみられなかった。一方、中国人女性は日本人女性と比較して、IBS 有病割合が 7.9 ポイント（$p < 0.01$）、特に便秘型 IBS が 8.6 ポイント低かった（$p < 0.01$）。対象者全体において、中国人女性は、日本人女性より肉類、卵、牛乳・乳製品、インスタント・レトルト食品、菓子及びジュースの摂取頻度が低く、豆・豆製品、野菜及び果物の摂取頻度が高かったことから、中国人女性は日本人女性より食物繊維の摂取量が高いと推察され、これらの食習慣が IBS 有病割合の差に影響しているものと考えられた。

Chapter 4. An intervention study employing lifestyle self-monitoring for irritable bowel syndrome in female nursing school students.

（看護女子学生を対象とした過敏性腸症候群の改善をめざした食・生活習慣のセルフモニタリングによる介入研究）

第 2、3 章において、欠食、不規則な食事時間、食物摂取頻度及び睡眠障害などの食・生活習慣が IBS と関連していることが明らかとなった。そこで本章は、食・生活習慣を自己記録するセルフモニタリング（Self-Monitoring: SM）とクラス単位のグループワークを通して、自己の生活習慣を認識させ、クラスの IBS の有病割合を改善させることを目的とした。対象者は、グループダイナミックスの効果を期待し、IBS 有病者だけでなくクラス全体とした。

同意を得た京都府内の看護学生 111 名を、クラス毎に 4 ヶ月間の介入群 35 名（18.5±1.5 歳）（以下、4 ヵ月群）、2 ヶ月間の介入群 34 名（18.9±1.5 歳）（以下、2 ヶ月群）、対照群 34 名（18.3±0.6 歳）にクラスター割付した。介入群には、4 ヶ月間または 2 ヶ月間、排便回数、便性状、食事内容、食事時刻、就寝時刻、起床時刻及び睡眠時間を毎日記録する SM

シートを週 1 回配布し、記録に基づいた 15 分間のグループワークを週 1 回実施した。対照群には、これらの介入を行わなかった。介入前後に Rome Ⅱ 診断基準、HAD、Gastrointestinal Symptom Rating Scale ; GSRS にもとづいた腹部症状に関するアンケート調査を実施し、3 群間で比較した。実施にあたり、京都府立大学倫理委員会の承認を得た。その結果、3 群ともに、介入前後で IBS の有病割合及び食・生活習慣に有意な改善はみられなかった。一方、不安点数は、介入後に 4 ヶ月群で 2.3 点（$p = 0.01$）、2 ヶ月群で 1.4 点（$p = 0.02$）低下した。また、GSRS の平均点数は、4 ヵ月群で 0.3 点（$p < 0.01$）、対照群で 0.2 点（$p = 0.05$）低下した。以上の結果より、4 ヶ月または 2 ヵ月の食・生活習慣の SM によって、不安や腹部症状の改善がみられることを明らかにした。

Chapter 5.　General discussion and conclusion. （総括と結論）

本研究では、日本と中国の看護・医療系学生の IBS の有病割合は、それぞれ 35.5%、32.1%と高く、特に両国とも女性は男性と比較して IBS の有病割合が高いことを報告した。日本人女性の IBS 群では牛乳、果物、緑黄色野菜の摂取頻度が低く、中国人女性の IBS 群では葉菜、果菜、芋の摂取頻度が低いこと、また、両国とも IBS 群では欠食が多く食事時間が不規則であることを明らかにした。さらに、横断研究の結果を踏まえ、食・生活習慣に関するセルフモニタリングによる介入研究を行った結果、不安や腹部症状の改善がみられることを明らかにした。

これらの結果は、看護・医療系学生の健康管理、及び臨床における IBS の治療において、食・生活習慣指導の重要性を示唆するものである。