

## Prevalence of irritable bowel syndrome in Chinese college and university students assessed using Rome III criteria

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risk for IBS. The mean score of IBS patients was  $74.2 \pm 4.242$  on the IBS-QOL.

**CONCLUSION:** The prevalence of IBS is 7.85% in Chinese college and university students according to the Rome III criteria. Low exercise level and anxiety may be the risk factors for IBS.

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**Key words:** Irritable bowel syndrome; Prevalence; College and university students

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### Abstract

**AIM:** To estimate the prevalence of irritable bowel syndrome (IBS) in college and university students of North China and certain related factors for IBS.

**METHODS:** A total of 2500 students from Shandong University in North China were asked in February-March 2009 to complete questionnaires, including the Rome III questionnaire, hospital anxiety and depression scale, and IBS-quality of life questionnaire (IBS-QOL).

**RESULTS:** Among the 2126 students with complete data, the prevalence of IBS was 7.85% according to the Rome III criteria, with a female/male ratio of 1.78:1. Most students had the IBS-constipation subtype (36.5%), followed by IBS-diarrhea subtype (31.1%) and IBS-mixed subtype (23.9%). The students with IBS had a higher anxiety and depression score than those without IBS. Low exercise level and anxiety indicated a high

### INTRODUCTION

Irritable bowel syndrome (IBS) is a common, costly and potentially functional gastrointestinal disorder characterized by abdominal pain or discomfort with altered bowel habits, but without any organic damages to the intestine such as tumor or inflammation<sup>[1]</sup>. Men and women at all ages may have this disease.

The prevalence of IBS is 15%-24% in the general population of Western countries, regardless of sex, age or ethnicity, with a male/female ratio of 1:1.5<sup>[2,3]</sup>. The prevalence of IBS in most Asian communities is 5%-10%<sup>[4]</sup>, which is lower than that in Western countries. The prevalence of IBS is 5.7% in Korean college and university

students<sup>[5]</sup>, and 10.4% in undergraduates of Southeast China<sup>[6,7]</sup>. The prevalence of IBS has not been investigated in students of North China.

It has been shown that some factors, especially psychological factors<sup>[8]</sup>, dietary habits<sup>[9]</sup>, and frequency of exercise, are associated with the onset and course of IBS<sup>[5,10]</sup>. Many college and university students have psychological problems such as anxiety and depression<sup>[11,12]</sup>, which can be predictive of IBS. Research is needed to compare IBS patients and healthy controls and the 3 IBS subtypes classified by bowel movement disturbance. Furthermore, many patients with IBS have a history of chronic recurrent abdominal pain from childhood<sup>[13]</sup>.

The symptoms of IBS greatly affect the quality of life of patients. It was reported that the score of mental health and social function domains in patients with IBS is very low<sup>[14]</sup>. A questionnaire on health-related quality of life is an important measure to assess the impact of this chronic disease on the quality of life of IBS patients<sup>[15]</sup>.

The Rome III criteria were established in 2006 by the Rome III Committee<sup>[1]</sup>. The Committee simplified the IBS subtype classification using the criteria for stool consistency, which is closest to the clinical criteria and increases the accurate diagnosis of IBS<sup>[1]</sup>.

The prevalence of IBS has been reported most frequently in general populations, but not often in Chinese college and university students, especially in those of North China. Our study was to investigate the prevalence of IBS in college and university students of North China according to Rome III criteria and the factors associated with IBS.

## MATERIALS AND METHODS

### Study setting

This investigation was carried out from February to March 2009 in Shandong University, located in North China.

### Sample size

It has been reported that the prevalence of IBS in Chinese college and university students is 10%-25%. According to the established formula for sample size, we used a minimum sample size of 1800 to achieve a precision of  $\pm 2\%$  with a 95% confidence interval (CI)<sup>[16]</sup>. Therefore, 2500 participants were enrolled in this study.

### Participants

A total of 2500 college and university students, randomly recruited from 3 areas of study (liberal arts, science, medicine), were asked to voluntarily complete questionnaires during their regularly scheduled class time. Trained staff answered any questions about the questionnaire. The study was approved by the Ethics Committee of Qilu Hospital of Shandong University, China.

### Measures

**Chinese version of Rome III questionnaire:** The Rome III criteria have been widely used in the diagnosis of

functional gastrointestinal disorders. We used the Chinese version of the previously validated Rome III diagnostic questionnaire. The diagnosis of IBS was based on the presence of abdominal pain or discomfort for at least 3 mo in the previous 6 mo, with 2 or more of the following symptoms: pain improved after defecation, symptoms associated with a change in frequency of stool, and symptoms associated with a change in the form (appearance) of stool. Subjects with IBS were divided into constipation-predominant type (IBS-C), diarrhea-predominant type (IBS-D), and mixed type with IBS (IBS-M) according to the proportion of lumpy and hard stools. Other students who could not be classified into the 3 subtypes were considered a subtype without IBS (non-IBS).

**Hospital anxiety and depression scale:** The hospital anxiety and depression scale (HADS), a specifically reliable scale developed by Zigmond and Snaith<sup>[17]</sup>, was used in estimating the emotional disorder of anxiety and depression.

The HADS is a short, self-reporting questionnaire consisting of 14 questions with two 7-item subscales for anxiety and depression assessment. The items are coded on a 4-point scale from 0 to 3 scores. Moreover, anxiety and depression scores are summed separately. For each subscale, the scores can be divided into 0-7 (normal cases), 8-10 (borderline cases), and over 11 (cases).

**Daily lifestyle factors:** Some questions about the daily lifestyle of college and university students, such as dietary habits, exercise frequency, and alcohol consumption, were included in the questionnaire. For dietary habits, we obtained information on the intake of dairy products and cold dishes, which may be associated with the onset of IBS.

**Red-flag items:** Referring to the guidelines for IBS recommended by the American Gastroenterological Association, there are 7 red-flag items used to distinguish organic intestinal disease from IBS. Participants who chose one or more of the 7 items were included into a special "others" group: drastic weight loss, a history of organic bowel disease, a history of digestive surgery, blood in stool, awakening due to abdominal pain during night, anemia, fever or arthralgia.

**Negative life events in childhood:** A life event scale was used in this study<sup>[18]</sup>. Considering the specific situations of college and university students in China, we assessed 5 of the most stressful events in childhood (occurred under the age of 12 years) on the scale, including death of a close family member or divorced parents, extreme financial difficulty, major natural disaster, experiencing serious illness or major surgery, and other major setbacks. Whether students with IBS have recurrent abdominal pain in childhood was also assessed.

**Quality of life of patients with IBS:** The quality of life of patients with IBS (QOL-IBS patients), a self-reported

quality-of-life measure specific to people with IBS, was used to assess the impact of IBS on the quality of life of IBS patients. The questionnaire consists of 34 items, each with a 5-point response scale. The scores are summed and averaged for a total score and then transformed to a 0-100 scale for ease of interpretation. The score of the quality-of-life scale is a general parameter reflecting the healthy status of IBS patients, with some questions about health care-seeking behavior.

**Baseline information:** The remaining questions were about the sociodemographic characteristics, such as age, sex, schooling level, place of birth, health condition, and family information.

### Statistical analysis

All eligible questionnaires were coded. Data analysis was performed using the SPSS 12.0 (SPSS Inc., Chicago, IL). Distributions of sex and lifestyle factors were analyzed by Pearson's  $\chi^2$  or Fisher's exact test. For each of the lifestyle factors and psychological measures, the choice or scores of participants were divided into 3 degrees. Analysis of variance was used to compare the anxiety and depression levels between groups. Possible risk factors were assessed by logistic regression analysis. Odds ratio (OR) with 95% confidence interval (CI) was calculated. Data are presented as mean  $\pm$  SD. All calculated *P*-values were two-tailed and *P* < 0.05 was considered statistically significant.

## RESULTS

### Response rate and characteristics of subjects

Of the 2500 enrolled participants, 2376 completed the questionnaires. Valid responses were obtained from 2126 participants, with a response rate of 89.48%. Of the 2376 participants, 917 (43.1%) were males and 1209 (56.9%) were females, with a mean age of  $20.79 \pm 1.590$  years and  $20.53 \pm 1.587$  years, respectively. The average college grade of the students was  $2.58 \pm 0.368$ . Of the 2376 participants, 1768 (74.4%) were natives of Shandong Province. The characteristics of participants are listed in Table 1. The non-IBS group included healthy subjects and the "others" group (participants with other gastrointestinal disorders excluded).

### Prevalence of IBS

Of the 2126 participants, 167 fulfilled the Rome III criteria for IBS with a male/female ratio of 1.78:1. The prevalence of IBS was 7.85%, with no statistically significant difference among areas of study or schooling level. Sixty-one cases were IBS-C (36.5%), 51 were IBS-D (31.1%), 40 were IBS-M (23.9%), and 25 were non-IBS cases (8.5%).

### Daily lifestyle factors

The daily lifestyle factors, including dietary habits and exercise frequency, were compared between IBS and non-IBS groups (Table 2). No difference was found in measures related to the intake of dairy products, cold dishes and alcohol between the two groups, but a difference was

**Table 1** Characteristics of students with or without irritable bowel syndrome *n* (%)

	Total ( <i>n</i> = 2126)	IBS ( <i>n</i> = 167)	Non-IBS ( <i>n</i> = 1959)	$\chi^2$	<i>P</i> value
Sex					
Male	917 (43.1)	60 (6.5)	857 (93.5)	3.835	0.05
Female	1209 (56.9)	107 (8.9)	1102 (91.1)		
Branch of learning					
Liberal arts	701 (33.0)	43 (6.1)	658 (93.9)	5.119	0.077
Science	697 (32.8)	56 (8.0)	641 (92.0)		
Medicine	728 (34.2)	68 (9.3)	660 (90.7)		
Schooling level					
Lower	1425 (67.0)	117 (8.2)	1308 (91.8)	0.754	0.385
Upper	701 (33.0)	50 (7.1)	651 (92.9)		

IBS: Irritable bowel syndrome; Non-IBS: Subjects without IBS.

observed in exercise level, indicating that a low exercise level is a high risk factor for IBS.

### QOL-IBS patients and health care-seeking behavior

The mean score of students with IBS was  $74.2 \pm 4.242$  on the health quality questionnaire, indicating that the occurrence of IBS can influence their quality of life and daily health.

Of the participants with IBS, 38.3% did not seek for medical advice on their abdominal discomfort, 1.2% received long-term treatment, and 3.0% worried about their health. No difference was found in seeking for help from physicians between medical students and others.

### HAD scores and negative life events in childhood

The anxiety and depression scores were significantly higher for students with IBS than for those without IBS (Table 3), especially for those with normal scores (0-7) than for those with abnormal scores (> 11). Of the participants with IBS, 65.9% believed that their discomfort was related to the negative moods.

The mean anxiety score was  $6.52 \pm 4.036$ ,  $6.78 \pm 4.912$ , and  $5.82 \pm 4.545$ , respectively, for IBS-C, IBS-D, and IBS-M ( $F = 0.373$ ,  $P = 0.773$ ). The mean depression score was  $6.92 \pm 3.822$ ,  $6.88 \pm 4.097$ , and  $6.90 \pm 4.787$ , respectively, for IBS-C, IBS-D, and IBS-M ( $F = 0.008$ ,  $P = 0.999$ ). No difference was found in anxiety and depression scores between the 3 subtype groups.

Of the participants with IBS, 47.3% had a recurrent abdominal pain in childhood.

### Risk factors for IBS

After univariate analysis, multivariable logistic regression analysis was adjusted by sex. Anxiety ( $P = 0.031$ ) but not depression ( $P = 0.329$ ) was independently associated with IBS (Table 4).

## DISCUSSION

To our knowledge, this is the first school-based investigation on the epidemiology of IBS in college and university students of North China. The prevalence rate of IBS was

**Table 2** Dietary and lifestyle factors in irritable bowel syndrome and non-irritable bowel syndrome groups *n* (%)

Variables	Categories	Total ( <i>n</i> = 2126)	IBS ( <i>n</i> = 167)	Non-IBS ( <i>n</i> = 1959)	$\chi^2$	<i>P</i> value
Dairy produce	Almost everyday	676 (31.8)	57 (8.4)	619 (91.6)	0.456	0.796
	Sometimes	1305 (61.4)	99 (7.6)	1206 (92.4)		
	Almost never	145 (6.8)	11 (7.6)	134 (92.4)		
Cold dish	Percentage per day				0.512	0.774
	< 25%	1650 (77.6)	132 (8.0)	1518 (92.0)		
	25%-75%	468 (22.0)	34 (7.3)	434 (92.7)		
	> 75%	8 (0.4)	1 (12.5)	7 (87.5)		
Alcohol	No	1912 (89.9)	149 (7.8)	1763 (92.2)	0.102	0.750
	Yes	214 (10.1)	18 (8.4)	196 (91.6)		
Exercise frequency					9.823	0.007
	Almost everyday	160 (7.5)	11 (6.9)	149 (93.1)	0.121	0.728
	Sometimes	1039 (48.9)	64 (6.2)	975 (93.8)	1.479	0.224
	Almost never	927 (43.6)	92 (9.9)	835 (90.1)	9.505	0.002

IBS: Irritable bowel syndrome; Non-IBS: Subjects without IBS.

**Table 3** Univariate analysis of some factors in irritable bowel syndrome and non-irritable bowel syndrome groups *n* (%)

Factors	Categories	Total ( <i>n</i> = 1902)	IBS ( <i>n</i> = 167)	Non-IBS ( <i>n</i> = 1735)	$\chi^2$	<i>P</i> value
Anxiety					60.431	0.000
	0-7	1496 (78.7)	103 (6.9)	1393 (93.1)	2.864	0.091
	8-10	253 (13.3)	25 (9.9)	228 (90.1)	61.053	0.000
	≥ 11	153 (8.0)	39 (25.5)	114 (74.5)	17.493	0.000
Depression					35.597	0.000
	0-7	1357 (71.3)	94 (6.9)	1263 (93.1)	2.549	0.110
	8-10	326 (17.2)	31 (9.5)	295 (90.5)	35.894	0.000
	≥ 11	219 (11.5)	42 (19.2)	177 (80.8)	10.557	0.001
Negative life events in childhood	Normal	967 (50.8)	99 (10.2)	868 (89.8)	6.282	0.987
	Mild	626 (32.9)	48 (7.7)	578 (92.3)		
	Moderate	273 (14.4)	19 (7.0)	254 (93.0)		
	Severe	36 (1.9)	1 (2.8)	35 (97.2)		

IBS: Irritable bowel syndrome; Non-IBS: Subjects without IBS.

**Table 4** Evaluation of risk factors for irritable bowel syndrome by multivariate logistic regression analysis

Variables	$\beta$	Standard error	Wald	Odds ratio	95% CI		<i>P</i> value
					Lower	Upper	
Anxiety	0.106	0.027	15.383	1.112	1.054	1.172	0.031
Depression	0.028	0.029	0.951	1.028	0.972	1.088	0.329

CI: Confidence interval.

7.85% and more female students suffered from IBS than male students, which is similar to that in previous studies<sup>[2,3]</sup>.

The prevalence of IBS varied greatly among different investigations, which may be due to the differences such as varied study population from different countries and different diagnostic criteria used. Rome II criteria have been used to examine a 12-wk period of time in the past 12 mo, which is less than a continuous 6-mo period, thus expanding the scope of diagnosis<sup>[19]</sup>. Furthermore, IBS is a functional disease with organic intestinal damage excluded. The usual method of using questionnaires for a large population without any further examination is too simple to judge the accuracy of diagnosis.

In the general population, IBS of the diarrhea-dominant type is more frequent than the constipation-dominant type<sup>[1]</sup>. However, the results of our study are opposite. Most college and university students have irregular eating habits and bedtimes and are also burdened with jobs or school work.

In the present study, the anxiety and depression score was high in IBS group, indicating that anxiety is a predictor of IBS diagnosis and psychological factors play an important role in development of IBS<sup>[8,11,12,19]</sup>. It has been shown that although IBS symptoms influence negative moods such as anxiety and depression, psychological factors themselves influence motor abdominal functions, sensory threshold and stress reactivity of the intestine<sup>[20]</sup>.

It was reported that cold diets, such as ice water and cold dishes, can induce IBS onset by influencing visceral hypersensitivity<sup>[21]</sup>. However, we did not find any significant correlation between intake of cold dishes and IBS in college and university students which may be due to the change in dietary habits in young Chinese people who are accustomed to a cold diet in childhood. In this study, about 50% of the IBS patients complained of pediatric recurrent abdominal pain, which is similar to the reported findings<sup>[13]</sup>.

No research prior to this study has directly assessed the important role of exercise frequency in development of IBS. In this study, the students with a low exercise level were more likely to have IBS symptoms. Nowadays, many college and university students are too busy to do physical exercises. Some students with IBS are restrained in their desire to do physical exercise, perhaps because of chronic abdominal pain or discomfort. A positive association between exercise level and course of IBS should be interpreted with caution.

Although many patients with IBS do not seek for medical advice on discomfort, they have significant demands. It was reported that medical students are more likely to see physicians for their discomfort, perhaps because they worry more about their health<sup>[22]</sup>, which is not consistent with the findings in our study. The psychological factors we describe may be responsible for such a behavior.

IBS is not a life threatening disease, but as a functional intestinal disease, its chronic symptoms greatly influence their daily life<sup>[3,14,23]</sup>, which is consistent with the finding in this study. Most students with IBS have more or less troubles with their health.

Although this investigation provided some new insights into IBS in Chinese college and university students, it was based on only the self-reporting questionnaires, without any further examinations to exclude organic intestinal diseases.

The public and university students in China are not informed about digestive health and IBS. Considering some predictive factors for the onset of IBS, more attention must be paid to the primary prevention of IBS in the public and university students.

In conclusion, the prevalence of IBS in college and university students of North China is 7.85%. A low exercise level and anxiety are the risk factors for IBS. IBS greatly influences the quality of life of students.

## COMMENTS

### Background

Irritable bowel syndrome (IBS) is a common functional gastrointestinal disorder characterized by abdominal pain or discomfort with altered bowel habits. Its prevalence is 15%-24% in the general population of Western countries.

### Research frontiers

Many studies focused on the related factors for the prevalence of IBS, such as age, gender, family history, negative mood and daily lifestyle.

### Innovations and breakthroughs

This is the first school-based investigation on the epidemiology of IBS in college

and university students of North China. The prevalence rate of IBS was 7.85% using the Rome III criteria, which is consistent the previous findings.

### Applications

The questionnaire used in the program was a comprehensive Chinese version. It will be useful in the future.

### Terminology

IBS is a common, costly and potentially functional gastrointestinal disorder characterized by abdominal pain or discomfort with altered bowel habits, but without any organic damages to the intestine such as tumor or inflammation.

### Peer review

The authors investigated the prevalence of IBS in Chinese college and university students using the Rome III criteria, and found that a low exercise level and anxiety are the risk factors for IBS. This article is well written with excellent readability.

## REFERENCES

- 1 **Drossman DA**, Corazziari E, Delvaux M, Spiller RC, Talley NJ, Thompson WG, Whitehead WE. Rome III: The Functional. Gastrointestinal Disorders. 3rd ed. McLean, VA: Degnon, 2006
- 2 **Agr  s L**, Sv  rdsudd K, Nyr  n O, Tibblin G. Irritable bowel syndrome and dyspepsia in the general population: overlap and lack of stability over time. *Gastroenterology* 1995; **109**: 671-680
- 3 **Frank L**, Kleinman L, Rentz A, Ciesla G, Kim JJ, Zacker C. Health-related quality of life associated with irritable bowel syndrome: comparison with other chronic diseases. *Clin Ther* 2002; **24**: 675-689; discussion 674
- 4 **Chang FY**, Lu CL. Irritable bowel syndrome in the 21st century: perspectives from Asia or South-east Asia. *J Gastroenterol Hepatol* 2007; **22**: 4-12
- 5 **Kim YJ**, Ban DJ. Prevalence of irritable bowel syndrome, influence of lifestyle factors and bowel habits in Korean college students. *Int J Nurs Stud* 2005; **42**: 247-254
- 6 **Dai N**, Cong Y, Yuan H. Prevalence of irritable bowel syndrome among undergraduates in Southeast China. *Dig Liver Dis* 2008; **40**: 418-424
- 7 **Dong L**, Dingguo L, Xiaoxing X, Hanming L. An epidemiologic study of irritable bowel syndrome in adolescents and children in China: a school-based study. *Pediatrics* 2005; **116**: e393-e396
- 8 **Faresj   A**, Grodzinsky E, Johansson S, Wallander MA, Timpka T, Akerlind I. Psychosocial factors at work and in every day life are associated with irritable bowel syndrome. *Eur J Epidemiol* 2007; **22**: 473-480
- 9 **Saito YA**, Locke GR 3rd, Weaver AL, Zinsmeister AR, Talley NJ. Diet and functional gastrointestinal disorders: a population-based case-control study. *Am J Gastroenterol* 2005; **100**: 2743-2748
- 10 **Jeong JJ**, Choi MG, Cho YS, Lee SG, Oh JH, Park JM, Cho YK, Lee IS, Kim SW, Han SW, Choi KY, Chung IS. Chronic gastrointestinal symptoms and quality of life in the Korean population. *World J Gastroenterol* 2008; **14**: 6388-6394
- 11 **Hazlett-Stevens H**, Craske MG, Mayer EA, Chang L, Naliboff BD. Prevalence of irritable bowel syndrome among university students: the roles of worry, neuroticism, anxiety sensitivity and visceral anxiety. *J Psychosom Res* 2003; **55**: 501-505
- 12 **Gros DF**, Antony MM, McCabe RE, Swinson RP. Frequency and severity of the symptoms of irritable bowel syndrome across the anxiety disorders and depression. *J Anxiety Disord* 2009; **23**: 290-296
- 13 **Pace F**, Zuin G, Di Giacomo S, Molteni P, Casini V, Fontana M, Porro GB. Family history of irritable bowel syndrome is the major determinant of persistent abdominal complaints in young adults with a history of pediatric recurrent abdominal pain. *World J Gastroenterol* 2006; **12**: 3874-3877
- 14 **El-Serag HB**. Impact of irritable bowel syndrome: prevalence and effect on health-related quality of life. *Rev Gastroenterol*

- Disord* 2003; **3** Suppl 2: S3-S11
- 15 **Huang WW**, Zhou FS, Bushnell DM, Diakite C, Yang XH. Cultural adaptation and application of the IBS-QOL in China: a disease-specific quality-of-life questionnaire. *Qual Life Res* 2007; **16**: 991-996
- 16 **Wang JL**. Clinical epidemiology. 2nd ed. Shanghai: Shanghai Science & Technology Press, 2001
- 17 **Zigmond AS**, Snaith RP. The hospital anxiety and depression scale. *Acta Psychiatr Scand* 1983; **67**: 361-370
- 18 **Matthews KA**, Shumaker SA, Bowen DJ, Langer RD, Hunt JR, Kaplan RM, Klesges RC, Ritenbaugh C. Women's health initiative. Why now? What is it? What's new? *Am Psychol* 1997; **52**: 101-116
- 19 **Shen L**, Kong H, Hou X. Prevalence of irritable bowel syndrome and its relationship with psychological stress status in Chinese university students. *J Gastroenterol Hepatol* 2009; **24**: 1885-1890
- 20 **Drossman DA**. Presidential address: Gastrointestinal illness and the biopsychosocial model. *Psychosom Med* 1998; **60**: 258-267
- 21 **Zuo XL**, Li YQ, Shi L, Lv GP, Kuang RG, Lu XF, Li JM, Desmond PV. Visceral hypersensitivity following cold water intake in subjects with irritable bowel syndrome. *J Gastroenterol* 2006; **41**: 311-317
- 22 **Jafri W**, Yakoob J, Jafri N, Islam M, Ali QM. Frequency of irritable bowel syndrome in college students. *J Ayub Med Coll Abbottabad* 2005; **17**: 9-11
- 23 **El-Serag HB**, Olden K, Bjorkman D. Health-related quality of life among persons with irritable bowel syndrome: a systematic review. *Aliment Pharmacol Ther* 2002; **16**: 1171-1185

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