Prevalence of irritable bowel syndrome in adolescents in Turkey: effects of gender, lifestyle and psychological factors

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Scarce data exist concerning the prevalence of irritable bowel syndrome in adolescence. Changes in lifestyle, presence of stressors and psychological vulnerability during this stage of life place adolescents in the risk group for irritable bowel syndrome. The aim of this study is to determine the prevalence of irritable bowel syndrome in adolescents who are about to begin their university studies and to identify lifestyle and psychological factors related to irritable bowel syndrome.

All students newly enrolled at Abant Izzet Baysal University during the 2005-2006 academic year were recruited. Questionnaires including the Rome II questionnaire, the Beck Depression Inventory and the State-Trait Anxiety Inventory were sent to the addresses of the eligible students before matriculation to the university.

A total of 2217 students completed the questionnaires, of which 2038 (91.9%) were regarded as valid. Irritable bowel syndrome prevalence was 10.8% and was significantly higher in females than in males (14.0% vs. 7.1%, $p<0.001$). In logistic regression analyses, gender (OR=2.48, 95% CI=1.68-3.66) and depression (OR=1.08, 95% CI=1.04-1.12) were significantly linked to irritable bowel syndrome.

The prevalence of irritable bowel syndrome in this adolescent population is similar to that reported in other studies. The association of irritable bowel syndrome with depression should guide preventive and therapeutic efforts for this specific age group.

Key words: adolescent, university, irritable bowel syndrome, depression, anxiety, physical activity, nutrition.

Irritable bowel syndrome (IBS) is a common disorder. Comorbid diseases, decreased quality of life and the economic burden entailed place IBS among the more important health problems faced by society[1]. Thus, prevalence data and conditions related to the disease are of great importance for clinicians. Most studies performed in Asia, Africa, North and South America and the European Union using Rome II criteria have reported IBS prevalence rates ranging from 2.6% to 32% in adults and 4.7% to 34% in adolescents[2-14].

Adolescence is a transition period between childhood and adulthood. Numerous life stressors and biological and hormonal alterations are present at this stage of life. Attending university, meeting academic demands, experiencing changes in social life, moving to a new environment and being separated from the family may add extra stress and increase the psychosocial problems of adolescents during their university education[15]. Emotional vulnerability contributes to psychological disorders in adolescents[15-17]. Comorbid

depression and anxiety are common both in IBS and in adolescence[18,19]. The interaction between these chronic health conditions and adolescence must be investigated in detail in order to design and provide appropriate preventive health services for adolescents.

The aim of this study is to determine the prevalence of IBS in adolescents who are about to begin their university studies and to identity lifestyle and psychological factors related to IBS.

Material and Methods

Study population and setting

Students newly enrolled in the four-year educational programs at Abant Izzet Baysal University during the 2005-2006 academic year constituted the study population. Eligible students were determined using the university database and self-administered questionnaires were sent to the home addresses along with university registration documents. Students were requested to fill in and return the questionnaires at the time of registration. Questionnaires were collected during the registration process.

Questionnaires

The questionnaires consisted of five parts: demographic data, the Rome II criteria for functional gastrointestinal disorders, the Beck Depression Inventory, the State-Trait Anxiety Inventory and dietary habits. The demographic section included questions about the geographic region in which the student had lived for the longest period during the first 12 years of his/her life. For this purpose, Turkey was divided into 5 geographical regions: the Marmara and Aegean coasts, Central Anatolia (Middle), the Black Sea coast (North), Eastern and Southeastern Anatolia (East), and the Mediterranean region (South) (Fig. I)[20]. Type of the longest place of residence (city, town, or village), chronic illnesses, analgesic usage and current height and weight were also noted. Smoking and alcohol use were investigated by asking whether students had ever smoked or used alcohol, with frequency of consumption noted. Students were also requested to specify whether they performed regular physical exercise, with the intensity of such exercise. "Regular" was defined as at least 30 minutes of exercise of moderate or higher intensity at least 2-3 times per week. Physical exercise sufficient to increase the heart rate and cause perspiration was considered to be moderate intensity.

Previously validated Turkish versions of the Beck Depression Inventory and the State-Trait Anxiety Inventory were used[21,22]. Depression, state and trait anxiety scores were calculated as has been described in the literature. A score of 17 or higher was considered to indicate depression.

Dietary habits were investigated by using a food frequency questionnaire for milk, fruits, vegetables, tea, coffee, soft drinks, meat and fruit juices. Food consumption frequencies were categorized as daily/every other day; once a week; and once a month or less.

Statistical analysis and ethics committee approval

Student's t-test and the Mann-Whitney U test were used to compare normally distributed and non-normally distributed continuous data, respectively, between students with and without IBS. Non-normally distributed continuous data was expressed as median and interquartile (25-75 percentiles) ranges. The chi-square test was used to compare categorical variables between study groups. Parameters related to IBS were selected for logistic regression analysis, and unadjusted odds ratios and 95% confidence intervals were calculated. Multivariate logistic regression analysis, adjusted for age and sex, was also performed. Prior to logistic regression analysis, multicollinearity among independent variables was controlled using correlation analysis. If there was high correlation ($r>0.6$) between independent variables, the variance inflation factor (VIF) was calculated using linear regression analysis. If VIF values were below 4, these independent variables were included in the final logistic regression analysis. The results of logistic regression analysis were presented as P values, Exp(B) (odds ratio), and 95% confidence interval values. $P<0.05$ was regarded as statistically significant. SPSS 15.0 was used for statistical analysis.

This study was approved by the clinical ethics committee of the Abant Izzet Baysal University Medical School.

Results

Demographics

A total of 2518 questionnaires were sent to

students in eight faculties and 30 schools; 2217 students (88.0%) completed the questionnaires, of which 2038 (80.9%) were regarded as valid. There were 1093 female (53.6%) and 945 male (46.4%) respondents. The median age of the students was 18.7 years (interquartile range, 18.1-19.5 years). All students were single (never married), with the exception of one divorced and two married individuals.

Percentage distribution of type of longest place of residence was: 43.4%, city; 40.9%, town; and 15.7%, village. Percentage distribution of the longest lived-in geographic region was: Marmara and Aegean coasts, 36.5%; Central Anatolia, 34.3%; Black Sea coast, 10.8%; Eastern and Southeastern Anatolia, 8.3%; and Mediterranean region, 10.1%.

There were 12 students (0.5%)—6 in the IBS group (2.7%) and 6 in the control group (0.3%)—who had previously been diagnosed with peptic ulcers. One student in the IBS group had previously been diagnosed with ulcerative colitis. She was in remission at the time of the study. Analgesic usage was more common in females than in males ($p<0.001$). The body mass index of males (21.4 [interquartile range 19.7-23.1]) was significantly higher than that of females (19.8 [interquartile range 18.4-21.6]) ($p<0.001$). The percentage of current smokers (20.8% of males vs. 6.6% of females, $p<0.001$) and alcohol users (32.8% of males vs. 25.0% of females, $p<0.001$) was higher for males than for females. More males than females (35.4% vs. 20.3%, $p<0.001$) engaged in regular physical activity of moderate intensity.

Psychiatric measures

1725 (84.6%) and 1751 (85.9%) students fully completed the Beck Depression Inventory and the State-Trait Anxiety Inventory, respectively. All statistical analyses involving these parameters were performed with fully completed questionnaires. With 17 points considered the cutoff, the prevalence of depression was 7.0% (n=120). Depression was significantly more common in males than in females (8.4% vs. 5.5%, p=0.01). However, there was no significant difference between the Beck scores of the two genders (the median Beck score for females was 6 [interquartile range 2.5-10], while the median Beck score for males was 5 [interquartile range 1-9.5], p=0.5). The state anxiety score was slightly higher for females than for males (36.0 [interquartile range 29-43] vs. 35.0 [interquartile range 28-42], p=0.046). There was no difference in trait anxiety scores.

Dietary habits

There were differences between males and females in the frequency of consumption of various food and drink groups (Table I).

IBS demographics

The prevalence of IBS was 10.8% (n = 220) overall, and was significantly higher in females than in males (14.0% vs. 7.1%, $p<0.001$). Irritable bowel syndrome was not related to type of longest place of residence or geographic regions (Fig. 1). Female students with IBS had significantly more frequent analgesic usage ($p<0.001$). Body mass index did not differ between students with and without IBS. Current smoking was not associated with IBS in the study population overall. However, IBS was more common in female smokers than in female non-smokers (24.3% vs. 13.3%, p=0.01). In male adolescents, the reverse was true; IBS was more common in non-smokers than in smokers (8.0% vs. 4.2%, p=0.09). Irritable bowel syndrome was also more common in female alcohol users than in female non-users (19.7% vs. 12.2%, p=0.003). Alcohol use was not associated with IBS in males. Males without IBS were more likely to perform regular, moderate physical activity than were males with IBS (36.2% vs. 24.2%, p=0.06).

IBS and psychiatric measures

Beck depression scores were significantly higher in students with IBS than in healthy students (median score 9 [interquartile range 5-14] vs. median score 5 [interquartile range 2-9], $p<0.001$). This relationship was true for both genders. The prevalence of depression was 12.3% in adolescents with IBS and 6.5% in adolescents without IBS (p=0.008). However, depression prevalence was related to IBS only in males; depression was present in 21.8% of males with IBS, compared to 7.6% of males without IBS (p=0.002). Depression was present in 7.8% of females with IBS, compared to 5.4% of females without IBS (p=0.3). The state anxiety score was higher in students with IBS (39 [interquartile range 32-45] vs. 35 [interquartile range 28-41], $p<0.001$). The trait anxiety score was also higher in students

Table I. Food Consumption Frequencies According to Gender

Gender	Milk			Soft drinks			Fruit juice			Tea			Coffee			Meat			Fruit			Vegetable		
	A (%)	B (%)	C (%)	A (%)	B (%)	C (%)	A (%)	B (%)	C (%)	A (%)	B (%)	C (%)	A (%)	B (%)	C (%)	A (%)	B (%)	C (%)	A (%)	B (%)	C (%)	A (%)	B (%)	C (%)
Female	24.6	39.2	36.2	42.7	42.6	14.7	37.4	48.1	14.5	87.8	4.4	7.8	36.6	38.7	24.7	27.7	55.5	16.8	88.4	8.8	2.8	88.3	9.4	2.3
Male	21.9	40.6	37.5	63.0	31.6	5.4	43.0	47.6	9.4	93.4	3.4	3.2	37.3	42.3	20.4	39.1	53.6	7.4	79.4	17.1	2.5	80.2	15.2	4.6
P value	0.2			<0.001			<0.001			<0.001			0.1			<0.001			<0.001			<0.001		

The chi-square test was used to compare frequencies between the groups. A: Every day/every other day, B: Once a week, C: Once a month.

with IBS (44 [interquartile range 39-50] vs. 41 [interquartile range 36-47], p<0.001). The state and trait anxiety scores were higher in both genders in students with IBS. This difference was more pronounced in females (for females, for both tests p <0.001; for males, for state anxiety p=0.004, and for trait anxiety p=0.02).

IBS and diet

In males, the presence of IBS was related to lower coffee consumption; 24.6% of males with IBS drank coffee daily/every other day, compared to 38.8% of males without IBS (p=0.04). No other relationship between IBS and diet was noted.

Logistic regression analyses

Parameters associated with IBS in analyses of the entire study group were gender, coffee consumption, Beck depression score, and state and trait anxiety scores. Before logistic regression analysis, multicollinearity among the independent variables was controlled using correlation analyses. Only the Beck depression score and the state and trait anxiety scores appeared to be closely correlated with each other in analyses of the entire group (Beck score vs. state anxiety score r=0.59, Beck score vs. trait anxiety score r=0.6, state anxiety score vs. trait anxiety score r=0.69). Multicollinearity was not detected between these variables. In univariate logistic regression analysis, only gender and depression scores were found to be related to IBS (Table II). In multivariate logistic regression analysis adjusted for gender and age, the odds ratio for the Beck depression score was found to be 1.08 (1.05-1.10).

Discussion

In this descriptive study, the prevalence of IBS was found to be 10.8% in adolescents who are about to enter university. Gender and depression score were found to be related to IBS in adolescents.

There have been few studies concerning IBS prevalence in our country, and all except one were performed in adults[23-27]. In three population studies, IBS prevalence in Turkey varied from 6.3% to 19.1% (Fig.1)[23,24,26]. When these studies' youngest participant groups (15 to 30 years) were separately examined, IBS prevalence ranged from 7.4% to 26.2%. Another study, which was performed in 32 primary care settings in city centers throughout the country,

Table II. Logistic Regression Analysis for Factors Associated with Irritable Bowel Syndrome

	Significance	Exp(B)	95% CI for Exp(B)**	
			Lower	Upper
Gender (female)	<0.001	2.487	1.689	3.662
Beck depression score	<0.001	1.085	1.046	1.126
Coffee consumption*	0.433	0.861	0.592	1.252
State anxiety score	0.899	0.998	0.973	1.024
Trait anxiety score	0.802	0.996	0.962	1.030

*The categorical group selected as the indicator comprised students with high coffee consumption (e.g. every day/every other day coffee drinkers). **Unadjusted odds ratios [Exp(B)] and 95% confidence interval (CI)

reported a prevalence of 33.5%[25]. In a tertiary medical center, IBS prevalence in children and adolescents (4-18 years) was reported to be 22.6%[27]. However these two studies included mostly patients with gastrointestinal symptoms or children/adolescents being admitted to the hospital for various reasons, causing a selection bias, and thus do not represent the true prevalence of this disorder.

The prevalence of irritable bowel syndrome according to Rome II criteria varies from 2.6% to 32% of adults in Asia, Africa, North and South America and the European Union. The pooled prevalence of IBS was found to be 9.4% when Rome II criteria were used to define IBS[2]. The Consensus Statement of the World Gastroenterology Organization Summit Task Force on Irritable Bowel Syndrome noted that IBS seemed to be most common among young adults and thereafter either declined in prevalence or showed no age-related change[28]. This makes adolescence an important period of life in terms of the natural history and association of IBS with lifestyle and psychological factors.

Adolescent IBS studies are rare worldwide. The prevalence of adolescent IBS varies from 4.7% to 34% [3-14]. Most studies have shown female gender to be associated with IBS, as in adults[3,4,6-8,11,13]. Numerous explanations, from hormone-related differences to lower pain thresholds in females, have been suggested for this variation[29,30]. Some studies have shown that the frequency of IBS symptoms increases from early to late adolescence[12,13]. In our study, female gender was found to be the most important factor related to IBS in adolescents. Moreover, the 10.8% overall prevalence we found is comparable to other studies in different parts of the world.

Studies in Turkish university students have shown that anxiety and depression are common[15-17,31,32]. Risk factors found for depression were rural background and low economic status[15], a family history of depression, smoking and alcohol consumption[16]. Risk factors for anxiety were difficulties in adapting to university life, difficulties in problem solving and negative life experiences[17]. Anxiety and depression scores were shown to increase between the first and second year of medical education in medical faculty students[31]. Depression rates among university students were above 20% in several studies[16,32]. In a previous study carried out in 2004 at Abant Izzet Baysal University, the prevalence of depression was found to be 19.8% in freshmen and 17.8% in senior students (unpublished MPH thesis study, Nuket Guler Baysoy). In our study, the prevalence of depression was 6.9% in students newly enrolled at the university. Additionally, the prevalence of depression is lower in pre-university students in our country. In a recent study, the prevalence of any form of depressive disorder was 3.3% in children 9-12 years of age and 5.6% in adolescents 13-16 years of age[33]. All these results cause us to believe that the depression rate increases with age from early adolescence to late adolescence. This progressive increase might be a risk factor for the appearance or persistence of IBS during university education. There is a bidirectional relationship between depression/anxiety and IBS via the brain-gut axis[34]. Gastrointestinal complaints and IBS are common in patients with depressive symptoms

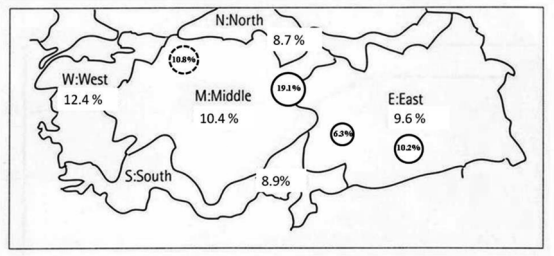

Fig. 1. Prevalence of IBS according to geographic region in Turkey.IBS prevalence in adolescents from different geographic regions is shown as percentages on the map. The dashed circle gives the overall prevalence in this study. The solid circles show the results of three other population studies. W: West (Marmara and Aegean coasts), M: Middle (Central Anatolia), N: North (Black Sea coast), E: East (Eastern and Southeastern Anatolia), and S: South (Mediterranean region)

and anxiety disorders in both clinical and community samples[18,35]. Depression has been shown to be associated with IBS in adolescents [8,11,14]. Adolescent depression is also known to persist into adulthood[36,37]. The close association of depression with IBS and the continuance of adolescent depression into adulthood might help to produce treatment opportunities by using behavioral approaches/interventions in university students.

Other studies performed in adolescents have shown that general anxiety and visceral anxiety are also associated with IBS[6,8,9,12,14]. We found that both state and trait anxiety scores were higher in adolescents with IBS; however, this relationship did not reach significance in logistic regression analysis. We did demonstrate that depression and anxiety are highly correlated; thus, the relationship between anxiety and IBS might actually be confounded by depression.

Irritable bowel syndrome is associated with multiple lifestyle factors[38,39]. In adolescent IBS studies, sleep disturbances[10], analgesic abuse, air swallowing and gastrointestinal infection[11] were found to be related to IBS. On the other hand, alcohol and smoking[8,14] and dietary habits and exercise[7,14] were not found to be related to IBS. We could not find a lifestyle factor that was associated with IBS. Physical activity has been shown to decrease both the severity of IBS and depressive symptoms in adults[40,41]. We also demonstrated that adolescents without IBS were more likely to perform regular, moderate physical activity than were adolescents with IBS; however, the difference was not significant. Thus, it would be interesting to study the effect of different forms of physical activity on IBS.

It has been suggested that certain foods in the diet may increase IBS symptoms. However, studies have not found dietary intake differences between individuals with IBS and healthy people[42]. In spite of this, dietary modifications are often used to decrease symptoms in patients[43]. Carbohydrate-rich and fiber-, lactose-, fructose-, and sorbitol-containing foods, as well as coffee, alcohol and spices have been considered by IBS patients to produce gastrointestinal symptoms[44,45]. Although we did not ask directly whether certain foods increased symptoms in patients, we found that male adolescents with IBS consumed coffee less frequently than their healthy counterparts. However, in logistic regression analysis coffee consumption frequency was not found to be associated with IBS.

One of the strengths of this study is the large sample size. However, response rates for some items in the anxiety and depression questionnaires were low, resulting in difficulties in interpreting the results. The specific age group was intentionally selected because adolescence is thought to be an important transition period between childhood and adulthood. Age-specific characteristics, such as vulnerability to depression, might be important in connection with IBS. But because of this focus on a specific age group, the results could not be generalized to the entire community. Lastly, logistic regression analysis showed that some seemingly close relationships, such as that between anxiety and IBS, were not necessarily present in fact.

Irritable bowel syndrome is a chronic condition significantly affecting the quality of life. Life stressors are especially common in adolescents attending university, in addition to the typical depression-prone characteristics of this age group. These factors make adolescence an important period in terms of IBS. Preventive and therapeutic efforts for both IBS and associated conditions should focus on this specific age group.

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