

# Prevalence, Behaviours and Burden of Irritable Bowel Syndrome in Medical Students and Junior Doctors

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Accepted 14.1.21

**Keywords:** Irritable bowel syndrome, medical students, junior physicians, anxiety, depression

## ABSTRACT

### Background

Irritable bowel syndrome (IBS) is a common functional gastrointestinal disorder which can have a strong impact on patients' quality of life including influence on various social aspects and psychological ramifications. The aim of the study was to assess the prevalence and consequences of IBS in medical students and junior doctors in Malta.

### Method

An online survey was sent out to all medical students enrolled at University of Malta and all doctors training with the Malta Foundation Programme.

### Key Results

The prevalence of IBS was 17.7% (total number =192), with 6.2% being previously diagnosed with IBS and the rest (11.5%) having symptoms consistent with IBS according to the Rome IV criteria. There was no statistically significant difference in BMI and in activity level as determined by the Godin Leisure-Time Exercise Questionnaire between IBS and non-IBS group.

Absenteeism was significantly commoner in students/doctors with IBS (47.1%) than in those without IBS (9.5%;  $p=0.0001$ ). Of those previously diagnosed with IBS, 66.7% self-medicated compared to 45.4% of those diagnosed through the questionnaire. 71.6% of those in the IBS group tried dietary modification as to control their symptoms.

On the Kessler 6 Distress scale, 91.2% of the IBS group had a score  $\geq 6$ , with 44.1% having a score  $\geq 13$ . The mean Visceral Sensitivity Index Score was 40.1 (95% CI 33.6 - 46.6).

### Conclusion

IBS is prevalent, yet under-recognized, in medical students and junior doctors. Measures should be instituted for timely, confidential detection and management of IBS and its related psychological consequences.

## INTRODUCTION

Irritable bowel syndrome (IBS) is a common functional gastrointestinal disorder (FGD). A meta-analysis assessing 80 separate study populations encompassing 260,960 subjects revealed a pooled prevalence of 11.2% (95% CI, 9.8%–12.8%). The prevalence is higher for females when compared to males (OR, 1.67; 95% CI, 1.53–1.82).<sup>1</sup>

Like other FGDs, IBS is postulated to be a disorder of gut-brain interaction. The biopsychosocial conceptual model for FGDs encompasses psychosocial factors such as life stresses, personality traits and social support together with altered physiology involving motility, visceral hypersensitivity, immune dysfunction, altered microbiome and diet.<sup>2</sup>

A diagnosis of IBS is made through history-taking, examination and limited, yet relevant, investigations. As per the Rome IV Criteria, the diagnostic criteria for IBS are abdominal pain with at least two of the following: relation to defecation, association with a change in stool consistency and/or association with a change in stool frequency. Symptoms must be felt at least one day per week in the previous three months.<sup>3</sup> Though they do not improve the performance of the IBS diagnostic criteria,<sup>4</sup> the presence of alarm features (such as rectal bleeding, unintentional weight loss and/or positive family history of colorectal cancer) should be sought as they might point to organic disease<sup>5</sup>.

IBS can have a strong impact on quality of life (QOL) and social function. Patients with IBS report lower health-related QOL than the general population and patients with ulcerative colitis, asthma, GORD and migraine.<sup>6–8</sup> There is also an association with psychological-psychiatric conditions with levels of anxiety and depression being significantly higher in IBS patients when compared to healthy controls. A meta-analysis concluded that the prevalence rate of anxiety symptoms in IBS patients is about 39.1% whilst that of depressive symptoms is around 28.8%.<sup>9</sup>

Stress has been correlated both as trigger and an exacerbating factor for IBS.<sup>10</sup> Stress has been shown to affect the

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gastrointestinal system by altering gut permeability<sup>11</sup>, intestinal motility<sup>12</sup> and visceral hypersensitivity.<sup>13</sup> Stress can lead to either overactivity or underactivity along the hypothalamic-pituitary-adrenal axis and of the autonomic nervous system, metabolic system and immune systems. This results in altered brain-gut interactions, thus causing or exaggerating the symptoms of IBS.<sup>14</sup>

Medical students and junior doctors are a category of individuals exposed to high levels of stress due to heavy workloads and various responsibilities. In medical students and junior doctors prevalence of IBS ranges from 9.3% to 35.5%.<sup>15</sup>

Various tools are available to assess the psychological repercussions of IBS. The Visceral Sensitivity Index (VSI) is a validated tool used to measure gastrointestinal specific anxiety (GSA) in IBS. It consists of 15 items with a six-point response scale (strongly agree to strongly disagree). The questions cover different aspects of fear, anxiety and hypervigilance related to gastrointestinal sensations and discomfort. The items on VSI are reverse scored (i.e. 1–6 becomes 5–0) and totalled to calculate the final score, with scores ranging from 0 (no GSA) to 75 (severe GSA).<sup>16,17</sup> The Kessler Psychological Distress Scale (K6) is a tool developed to assess risk of severe mental illness, with a score of 6 or greater being suggestive of mental distress and a score of 13 or more suggesting severe mental illness.<sup>18</sup>

## OBJECTIVE AND METHOD

The primary aim of the study was to assess the prevalence of IBS in medical students studying at the University of Malta and Foundation Doctors with the Malta Foundation Programme. The secondary aims were to assess anxiety and distress in IBS patients.

A cross-sectional study was carried out by sending an online questionnaire (Supplementary Material) to all medical students enrolled at University of Malta and all Foundation doctors training with the Malta Foundation Programme in March 2019. The timeframe was chosen to avoid the exam period. Participation was voluntary and no identifiable data was collected to ensure confidentiality.

## RESULTS

One hundred and ninety-two (n=192) participants completed the survey. One hundred and thirty-five participants (70.3%) were medical students. The rest (n=57; 29.7%) were Foundation doctors. Overall, the prevalence of IBS was 17.7% (n=34) with 6.2% being previously diagnosed with IBS and the rest (11.5%) having symptoms consistent with IBS according to the Rome IV criteria.

The number of females in the IBS group (76.5%) was slightly higher than the non-IBS group (60.7%; p= 0.11). The majority of respondents' age was between 18-24 years (79.4% for IBS group, 76.6% for non-IBS group). There was no statistically significant difference in Body Mass Index

(BMI) between IBS and non-IBS group. Similarly, there was no significant difference in smoking status, physical activity level as determined by the Godin Leisure-Time Exercise Questionnaire, with similar proportions being present in the active group. (Table 1)

**Table 1:** Demographics of the IBS and non-IBS cohort.

	IBS	Non-IBS
<b>Total Number</b>	34 (17.7%)	158 (82.3%)
<b>Female</b>	26 (76.5%)	96 (60.7%)
<b>Age</b>		
18-24	27 (79.4%)	121 (76.6%)
25-29	6 (17.6%)	29 (18.4%)
30-34	1 (2.9%)	8 (5.1%)
<b>BMI</b>		
<18.5	2 (5.9%)	6 (3.8%)
18.5-25	22 (64.7%)	102 (64.6%)
25-30	8 (23.5%)	37 (23.4%)
>30	2 (5.9%)	13 (8.2%)
<b>Smoking status</b>		
Non-smoker	27 (79.4%)	145 (91.8%)
Ex-smoker	5 (14.7%)	7 (4.4%)
Smoker	2 (5.9%)	6 (3.8%)
<b>Godin Scale Score</b>		
>24 (active)	22 (64.7%)	115 (72.8%)
14-23 (moderately active)	7 (20.6%)	25 (15.8%)
<14 (sedentary)	5 (14.7%)	18 (11.4%)

Of those previously diagnosed with IBS, 66.7% had been prescribed a medication, with the same amount also self-medicating with other medications. Antispasmodics were the commonest (66.7%) and were prescribed in all instances. Only one participant had been prescribed a Selective Serotonin Reuptake Inhibitor (SSRI). Participants also opted to self-medicate with a variety of medications, including proton pump inhibitors, probiotics, analgesics, laxatives, loperamide, anti-emetics, active carbon and peppermint oil.

In the group that were unaware of their IBS as diagnosed through the questionnaire, 42.9% of them had seen a specialist. In comparison, 22.7% of those unaware of their diagnosis had been prescribed a medication with 45.4% self-medicating. The use of antispasmodics was lower (22.7%) in this cohort. Of those who self-medicated the commonest

were: antispasmodic (40%), medication for pain relief including Paracetamol, Codeine or NSAID (40%), probiotics (30%) and medications intended for acid reflux (30%).

Dietary modification to control symptoms was slightly higher in those previously diagnosed with IBS (75%) than those diagnosed through the questionnaire (68.2%).

Absenteeism was significantly commoner in students/doctors with IBS (47.1%) than in those without IBS (9.5%;  $p=0.0001$ ). In the IBS group, though commoner, there was no significant difference in absenteeism in those aware of their diagnosis (58.3%) when compared to those diagnosed through the questionnaire (40.9%).

The mean VSI score was 40.1 (95% CI 33.6 - 46.6), with 32.3% scoring above 50. On the K6 scale, 91.2% of the IBS group had a score  $\geq 6$ , with 44.1% having a score  $\geq 13$ .

Out of the 34 participants found to have IBS, 10 were Foundation doctors (29.4%) and 24 (70.6%) were medical students. Only 1 doctor had been previously diagnosed by a specialist with IBS. There was no statistically significant difference between two cohorts regarding prescribed medication ( $p=0.52$ ), self-medication ( $p=0.82$ ) or dietary modification ( $p=0.96$ ). (Table 2). Though medical students had a tendency to higher VSI ( $p=0.19$ ) and Kessler scores ( $p=0.28$ ) as well as absenteeism ( $p=0.1$ ), this was not statistically significant.

**Table 2:** Comparison of Foundation Doctors and Medical Students diagnosed with IBS.

	Doctors	Medical students
Prescribed medication	3 (30%)	10 (41.7%)
Self-medicated	5 (50%)	13 (54.2%)
Modified diet	7 (70%)	17 (70.8)
Missed lectures/work	2 (20%)	12 (50%)
<b>VSI Score</b>		
>50	1 (10%)	10 (41.7%)
25-49	6 (60%)	10 (41.7%)
<24	3 (30%)	4 (1.7%)
<b>Kessler Score</b>		
>13	3 (30%)	12 (50%)
<13	7 (70%)	12 (50%)

## DISCUSSION

This study investigates IBS in medical students and junior doctors in Malta. The prevalence of IBS was higher (17.7%) than the quoted pooled rate of 11.2%.<sup>1</sup> A world-wide study covering 73,076 respondents published in 2020 estimated

the pooled prevalence rate of IBS to be even lower, with a rate of 4.1% (95% CI, 3.9%- 4.2%) in those answering an Internet based survey and 1.5% (95% CI, 1.3%- 1.7%) in those undergoing a household survey.<sup>19</sup>

A systematic review published in 2015 pertaining to prevalence rates and risk factors for IBS in medical students identified 16 studies on the topic. The prevalence rates ranged from 9.3% to 35.5%. However it is worth noting that none of the studies used the Rome IV criteria (previous versions of the Rome criteria were utilized) and none were performed in European countries.<sup>15</sup> More recent studies give prevalence rates of 14%- 29.3% with none of the studies being European<sup>20-24</sup>. Furthermore there was a wide variation in the prevalence rates, varying between 4.8%<sup>25</sup> and 61.7%<sup>26</sup>. Thus, the prevalence rate of IBS in our cohort was similar to the mean prevalence rates among studies, though higher than the general population.

In keeping with other studies, IBS was more prevalent in females than in males<sup>3</sup> with a male to female ratio of 1:3. This difference may be due to differences in pathophysiology (including hormonal factors, and alteration of cytokine and immune function) or in symptom type or burden.<sup>27</sup> The prevalence rate and this demographic feature support the validity of our study.

Out of our entire IBS cohort, only 35.3% were aware of their diagnosis. The remaining participants were unaware, though 42.9% of these had seen a specialist and 58.3% had been prescribed an antispasmodic. Communicating the diagnosis in IBS is one of the important pillars of its management. Doctors could be hesitant to deliver the diagnosis for various reasons, including worry over the reaction of the patient and uncertainty from the side of the doctor.

Our study failed to show an association between IBS and BMI, smoking status or physical exercise. A review on the relationship between obesity and IBS concluded that the association remains unclear, with some studies showing a link and others failing to do so.<sup>28-30</sup> Despite the known perils of smoking, a link with IBS has not been demonstrated though some studies have shown that smoking independently predicted the presence of IBS.<sup>31</sup> Exercise improves symptoms of IBS,<sup>32,33</sup> with physical activity being associated with improvement in gas transit and abdominal distension in healthy subjects.<sup>34</sup> The uptake of physical activity is, however, low, with patients with IBS seemingly having a more sedentary lifestyle<sup>35-38</sup> though not all studies support this finding.<sup>39</sup>

Nearly half (47.1%) of our IBS cohort missed classes or work because of gastrointestinal symptoms. Few studies have assessed IBS-related absenteeism in students. In studies with medical students, one study cited a prevalence of 2.3%<sup>24</sup> and another of 10.7%.<sup>37</sup> In a study conducted on university students in Germany found to have IBS, 79.5% did not miss a class because of gastrointestinal symptoms, 13.5% missed one day, 5.4% missed a full week and 1.5% missed





more than one week.<sup>40</sup> In our study, junior doctors had a tendency towards lower levels of absenteeism, suggesting either adaptation to their symptoms or a reluctance to take time off from work.

IBS has been shown to impact work productivity and work attendance, resulting in reduced quality of life and cost to the employer. Self-reported rates of presenteeism (loss of work productivity) range from 31.4%-86.6% whilst those of absenteeism (absence from work) are 5.6%-24.3%.<sup>41-43</sup> Respondents with IBS-diarrhoea predominant incurred an estimated \$2486 more in indirect costs than controls.<sup>44</sup>

A 2001 study showed that IBS affected personal relationships, with 19% of patients in a relationship stating that their partners experienced difficulties in having a physical relationship with them and 45% stating that IBS interfered with their sex life. Apart from presenteeism and absenteeism, the study also revealed that, because of IBS, 12% of patients did not work at all and 32% did not apply for a new job involving a lot of presentations /meetings.<sup>45</sup>

Several studies have evaluated the effect of stress on IBS in medical students, all showing that symptoms of anxiety and depression were more common in the IBS cohort than the non-IBS.<sup>22,23,38,39,46-48</sup> Various questionnaires and tools were used, making pooling of data difficult. Only one study utilized the VSI in university students. This study was a validation of the Japanese version of the VSI and the mean score for patients with IBS was 25.1 (95% CI 20.2 – 30.1).<sup>49</sup> Typical mean VSI values in IBS patients in the general population range between 27.8-38.<sup>17,50,51</sup> Our study has demonstrated significant levels of GSA with a mean VSI score of 40.1. There is also substantial mental distress with 91.2% of the IBS group having a score  $\geq 6$  and 44.1% having a score  $\geq 13$  on the K6. These scores might actually be higher to due participants reluctance to answer truthfully over fear of responses being traced back to them, with the associated stigma. These figures are worrying as medical students and junior doctors are already under constant stress due to exams, studying and hospital workloads including night duties. Furthermore, our IBS cohort will be studying and training for a number of years, thus having to cope with their condition for a prolonged period of time. Interestingly, our study showed a tendency for medical students to have higher stress scores than junior doctors, possibly due to tension caused by academic demands.

The study has shed light on prevalence, risk factors and ramifications of IBS amongst medical students and junior doctors. Limitations of the study are the possibility of response bias, nonresponse bias and recall bias. In order to reduce the response bias, it was made clear that the questionnaire would be anonymous. To ensure participants felt safe answering the questionnaire, no data that could be traced back to the participants was collected. Our response rate was 27.4%. Responses for online surveys are known to be low. Using a margin of error of 10% and a confidence level of 99%, our sample size should have been 135. We collected

192 responses. Furthermore, it has been demonstrated that response rates of 20% are as accurate as those with a higher response rate (50 % to 70% response rate).<sup>52,53</sup> Recall bias should be low as the questions pertained to symptoms or events that had occurred recently.

## CONCLUSION

IBS is prevalent in medical students and junior doctors, yet it is not always recognized and treated, possibly due to underplaying of symptoms or stigma against the condition. In those suffering from IBS, high levels of distress, absenteeism and various lifestyle modifications were documented. The K6 and VSI scores were significantly and worryingly elevated. Measures should be instituted for timely, confidential detection of IBS and its related psychological consequences, possibly by screening questionnaires. This will allow participants to receive appropriate treatment not only for IBS but also for the accompanying psychological distress.

### No acknowledgements

### No funds were received

### No disclosures

### The authors report no declarations of interest

## REFERENCES

1. Lovell RM, Ford AC. Global prevalence of and risk factors for irritable bowel syndrome: a meta-analysis. *Clin Gastroenterol Hepatol*. 2012; **10(7)**: 712-21. e4 doi: 10.1016/j.cgh.2012.02.029
2. Drossman DA. Functional gastrointestinal disorders: history, pathophysiology, clinical features and Rome IV. *Gastroenterology*. 2016; **150(6)**: 1262-79.
3. Lacy BE, Mearin F, Chang L, Chey WD, Lembo AJ, Simren M, *et al*. Bowel disorders. *Gastroenterology*. 2016; **150(6)**: 1393-1407.
4. Ford AC, Bercik P, Morgan DG, Bolino C, Pintos-Sanchez MI, Moayyedi P, *et al*. Validation of the Rome III criteria for the diagnosis of irritable bowel syndrome in secondary care. *Gastroenterology*. 2013; **145(6)**: 1262-70.
5. Patel P, Bercik P, Morgan DG, Bolino C, Pintos-Sanchez MI, Moayyedi AC. Prevalence of organic disease at colonoscopy in patients with symptoms compatible with irritable bowel syndrome: cross-sectional survey. *Scand J Gastroenterol*. 2015; **50(7)**: 816-23.
6. 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(4)**: 675-89.
7. Akehurst RL, Brazier JE, Mathers N, O'Keefe C, Kaltenthaler E, Morgan A, *et al*. Health-related quality of life and cost impact of irritable bowel syndrome in a UK primary care setting. *Pharmacoeconomics*. 2002; **20(7)**: 455-62.
8. Seres G, Kovács Z, Kovács A, Kerékgyártó O, Sárdi K, Demeter P, *et al*. Different associations of health related quality of life with pain, psychological distress and coping strategies in patients with irritable bowel syndrome and inflammatory bowel disorder. *J Clin Psychol Med Settings*. 2008; **15(4)**: 287-95.
9. Zamani M, Alizadeh-Tabari S, Zamani V. Systematic review with meta-analysis: the prevalence of anxiety and depression in patients with irritable bowel syndrome. *Aliment Pharmacol Ther*. 2019; **50(2)**: 132-43.
10. Moloney RD, Johnson AC, O'Mahony SM, Dinan TG, Greenwood-Van Meerveld B, *et al*. Stress and the microbiota-gut-brain axis in visceral pain: relevance to irritable bowel syndrome. *CNS Neurosci Ther*. 2016; **22(2)**: 102-17.



11. Piche T, Barbara G, Aubert P, Bruley des Varannes S, Dainese R, Nano JL, *et al.* Impaired intestinal barrier integrity in the colon of patients with irritable bowel syndrome: involvement of soluble mediators. *Gut*. 2009; **58**(2): 196–201.
12. Venkova K, Johnson AC, Myers B, Greenwood-Van Meerveld B. Exposure of the amygdala to elevated levels of corticosterone alters colonic motility in response to acute psychological stress. *Neuropharmacology*. 2010; **58**(7): 1161–7.
13. Tramullas M, Dinan TG, Cryan JF. Chronic psychosocial stress induces visceral hyperalgesia in mice. *Stress*. 2012; **15**(3): 281–92.
14. Qin HY, Cheng CW, Tang XD, Bian ZX. Impact of psychological stress on irritable bowel syndrome. *World J Gastroenterol*. 2014; **20**(39): 14126–31.
15. Ibrahim, N. K. A systematic review of the prevalence and risk factors of irritable bowel syndrome among medical students. *Turk J Gastroenterol*. 2016; **27**(1): 10–6.
16. Labus JS, Bolus R, Chang L, Wiklund I, Naesdal J, Mayer EA, *et al.* The Visceral Sensitivity Index: development and validation of a gastrointestinal symptom-specific anxiety scale. *Aliment Pharmacol Ther*. 2004; **20**(1), 89–97.
17. Labus JS, Mayer EA, Chang L, Bolus R, Naliboff BD. The central role of gastrointestinal-specific anxiety in irritable bowel syndrome: further validation of the visceral sensitivity index. *Psychosom Med*. 2007; **69**(1): 89–98.
18. Kessler RC, Barker PR, Colpe LJ, Epstein JF, Gfroerer JC, Hiripi E, *et al.* Screening for serious mental illness in the general population. *Arch Gen Psychiatry*. 2003; **60**(2): 184–9.
19. Sperber AD, Bangdiwala SI, Drossman DA, Ghoshal UC, Simren M, Tack J, *et al.* Worldwide prevalence and burden of functional gastrointestinal disorders, results of Rome Foundation Global Study. *Gastroenterology*. 2020; **160**(1): 99–114.
20. Wani FA, Almaeen AH, Bandy AH, Thirunavukkarsu A, Al-Sayer TA, Flah A, *et al.* Prevalence and risk factors of ibs among medical and nonmedical students in the jouf university. *Niger J Clin Pract*. 2020; **23**(4): 555–60.
21. AlButaysh, O., AlQuraini, A., Almukhaitah, A., Alahmadi, Y. & Alharbi, F. Epidemiology of irritable bowel syndrome and its associated factors in Saudi undergraduate students. *Saudi J Gastroenterol*. 2020; **26**(2): 89–93.
22. Wang Y, Jin F, Chi B, Duan S, Zhang Q, Liu Y, *et al.* Gender differences in irritable bowel syndrome among medical students at Inner Mongolia Medical University, China: a cross-sectional study. *Psychol Heal Med*. 2016; **21**(8): 964–74.
23. Alaqeel MK, Alowaimier NA, Alonezan AF, Almegbel NY, Alaujan FY. Prevalence of irritable bowel syndrome and its association with anxiety among medical students at King Saud bin Abdulaziz University for health sciences in Riyadh. *Pak J Med Sci*. 2017; **33**(1): 33–6.
24. Sehonou J, Dodo LR. [Clinical profile and factors associated with irritable bowel syndrome among medical students in Cotonou (Benin)]. *Pan Afr Med J*. 2018; **31**:123. doi: 10.11604/pamj.2018.31.123.16336.
25. Perveen I, Parvin R, Saha M, Bari MS, Huda MN, Ghosh MK. Prevalence of irritable bowel syndrome (ibs), migraine and co-existing ibs-migraine in medical students. *J Clin Diagn Res*. 2016; **10**(11): OC08-OC13. doi: 10.7860/JCDR/2016/20900.8832.
26. Pozos-Radillo E, Preciado-Serrano L, Plascencia-Campos A, Morales-Fernández A, Valdez-López R. Predictive study of academic stress with the irritable bowel syndrome in medicine students at a public university in Mexico. *Libyan J Med*. 2018; **13**(1): 1479599. doi: 10.1080/19932820.2018.1479599.
27. Kim YS, Kim N. Sex-gender differences in irritable bowel syndrome. *J Neurogastroenterol Motil*. 2018; **24**(4): 544–8.
28. Akhondi N, *et al.* General and abdominal obesity in relation to the prevalence of irritable bowel syndrome. *Neurogastroenterol Motil*. 2019; **31**(4): e13549. doi: 10.1111/nmo.13549.
29. Guo Y, Niu K, Momma H, Kobaashi Y, Chujo M, Otomo A, *et al.* Irritable bowel syndrome is positively related to metabolic syndrome: a population-based cross-Sectional study. *PLoS One*. **9**(11): e112289. doi: 10.1371/journal.pone.0112289
30. Pickett-Blakely O. Obesity and irritable bowel syndrome: a comprehensive review. *Gastroentero Hepatol (NY)*. 2014; **10**(7): 411–6.
31. Sirri L, Grandi S, Tossani E. Smoking in irritable bowel syndrome: a systematic review. *J Dual Diagn*. 2017; **13**(3): 184–200.
32. Johannesson E, Simrén M, Strid H, Bajor A, Sadik R. Physical activity improves symptoms in irritable bowel syndrome: a randomized controlled trial. *Am J Gastroenterol*. 2011; **106**(5): 915–22.
33. Daley AJ, Grimmett C, Roberts L, Wilson S, Fatek M, Roalfe A, *et al.* The effects of exercise upon symptoms and quality of life in patients diagnosed with irritable bowel syndrome: a randomised controlled trial. *Int J Sports Med*. 2008; **29**(9): 778–82.
34. Dainese R, Serra J, Azpiroz F, Malagelada JR. Effects of physical activity on intestinal gas transit and evacuation in healthy subjects. *Am J Med*. 2004; **116**(8): 536–9.
35. Sadeghian M, Sadeghi O, Hassanzadeh Keshteli A, Daghighzadeh H, Esmailzadeh A, *et al.* Physical activity in relation to irritable bowel syndrome among Iranian adults. *PLoS One*. 2018; **13**(10): e0205806. doi: 10.1371/journal.pone.0205806.
36. Lustyk KM, Jarrett ME, Bennett JC, Heitkemper MM. Does a physically active lifestyle improve symptoms in women with irritable bowel syndrome? *Gastroenterol Nurs*. 2001; **24**(3): 129–37.
37. Costanian C, Tamim H, Assaad A. Prevalence and factors associated with irritable bowel syndrome among university students in Lebanon: findings from a cross-sectional study. *World J Gastroenterol*. 2015; **21**(9): 3628–39.
38. Okami Y, Kato T, Nin G, Harada K, Aoi W, Wada S, *et al.* Lifestyle and psychological factors related to irritable bowel syndrome in nursing and medical school students. *J Gastroenterol*. 2011; **46**(12): 1403–10.
39. Ibrahim NK, Battarjee WF, Almeahadi SA. Prevalence and predictors of irritable bowel syndrome among medical students and interns in King Abdulaziz University, Jeddah. *Libyan J Med*. 2013; **8**(1): 21287. doi: 10.3402/ljm.v8i0.21287.
40. Gulewitsch MD, Enck P, Hautzinger M, Schlarb AA. Irritable bowel syndrome symptoms among German students: prevalence, characteristics, and associations to somatic complaints, sleep, quality of life, and childhood abdominal pain. *Eur J Gastroenterol Hepatol*. 2011; **23**(4): 311–6.
41. Paré P, Gray J, Lam S, Balshaw R, Khorasheh S, Barbeau M, *et al.* Health-related quality of life, work productivity, and health care resource utilization of subjects with irritable bowel syndrome: Baseline results from LOGIC (Lngitudinal Outcomes Study of Gastrointestinal Symptoms in Canada), a naturalistic study. *Clin Ther*. 2006; **28**(10): 1726–35.
42. Frändemark Å, Törnblom H, Jakobsson S, Simrén M. Work productivity and activity impairment in irritable bowel syndrome (ibs): a multifaceted problem. *Am J Gastroenterol*. 2018; **113**(10): 1540–9.
43. Dean BB, Aguilar D, Barghout V, Kahler KH, Frech F, Groves D, *et al.* Impairment in work productivity and health-related quality of life in patients with IBS. *Am J Manag Care*. 2005; **11**(1 Suppl): S17–26.
44. Buono JL, Carson RT, Flores NM. Health-related quality of life, work productivity, and indirect costs among patients with irritable bowel syndrome with diarrhea. *Health Qual Life Outcomes*. 2017; **15**(1): 35. doi: 10.1186/s12955-017-0611-2.
45. Silk DB. Impact of irritable bowel syndrome on personal relationships and working practices. *Eur J Gastroenterol Hepatol*. 2001; **13**(11):



1327–32.

46. Tan YM, Goh KL, Muhidayah R, Ooi CL, Salem O. Prevalence of irritable bowel syndrome in young adult Malaysians: a survey among medical students. *J Gastroenterol Hepatol*. 2003; **18(12)**: 1412–6.
47. 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(12)**: 1885–90.
48. Naeem SS, Siddiqui EU, Kazi AN, Memon AA, Khan ST, Ahmed B. Prevalence and factors associated with irritable bowel syndrome among medical students of Karachi, Pakistan: a cross-sectional study. *BMC Res Notes*. 2012; **5**: 255. doi: 10.1186/1756-0500-5-255.
49. Saigo T, Tayama J, Hamaguchi T, Nakaya N, Tomiie T, Bernick PJ, *et al*. Gastrointestinal specific anxiety in irritable bowel syndrome: validation of the Japanese version of the visceral sensitivity index for university students. *Biopsychosoc Med*. 2014; **8(1)**: 10. doi: 10.1186/1751-0759-8-10.
50. Tončić SP, Tkalčić MA. Measure of suffering in relation to anxiety and quality of life in ibs patients: preliminary results. *Biomed Res Int*. 2017; 2017:2387681. doi:10.1155/2017/2387681
51. Jerndal P, Ringstrom G, Agerforz P, Karpefors M, Akkermans, LM, Bayati A, *et al*. Gastrointestinal-specific anxiety: an important factor for severity of GI symptoms and quality of life in IBS. *Neurogastroenterol Motil*. 2010; **22(6)**: 646-e179. <https://doi.org/10.1111/j.1365-2982.2010.01493.x>
52. Visser PS, Krosnick JA, Marquette J, Curtin M. Mail surveys for election forecasting? an evaluation of the columbus dispatch poll. *Public Opin Q*. 1996; **60(2)**: 181-227.
53. Keeter S, Kennedy C, Dimock M, Best J, Craighill P. Gauging the impact of growing nonresponse on estimates from a National RDD Telephone Survey. *Public Opin Q*. 2006; **70(5)**: 759–79.

