ARTICLE | OPEN ACCESS

Medical Science

To Cite:
Elnawasany S, Alawad SS, Alnafaie ZM. Functional gastrointestinal symptoms among university students in Al Madinah and their association with perceived stress. *Medical Science* 2025; 29: e2ms3505 doi: https://doi.org/10.54905/disssi.v29i155.e2ms3505

Authors' Affiliation:
[1]Assistant Professor, Department of Tropical Medicine, Tanta University, Tanta, Egypt
[2]Associate Professor, Clinical Sciences Department, Al-Rayan National College of Medicine, Madinah, Saudi Arabia
[3]Lecturer, Basic Sciences Department, Al-Rayan National College of Health Sciences and Nursing, Al-Madinah, Saudi Arabia
[4]Assistant Professor, Clinical Sciences Department, Al-Rayan National College of Medicine, Madinah, Saudi Arabia

[*]**Corresponding Author**
Assistant Professor, Department of Tropical Medicine, Tanta University, Tanta, Egypt, Associate Professor, Clinical Sciences Department, Al-Rayan National College of Medicine, Madinah, Saudi Arabia
Email: sally.elnawasany@med.tanta.edu.eg
ORCID: 0000-0002-7146-4238

Peer-Review History
Received: 23 October 2024
Reviewed & Revised: 26/October/2024 to 30/December/2024
Accepted: 02 January 2025
Published: 09 January 2025

Peer-review Method
External peer-review was done through double-blind method.

Medical Science
pISSN 2321–7359; eISSN 2321–7367

DISCOVERY SCIENTIFIC SOCIETY

Functional gastrointestinal symptoms among university students in Al Madinah and their association with perceived stress

Sally Elnawasany[1,2*], **Samia Saeed Alawad**[3], **Zayed Mohammad Alnafaie**[4]

ABSTRACT

Background: Functional gastrointestinal disorders FGIDs are common chronic illnesses. Multiple risk factors have been connected to the development of FGIDs, such as stress. Perceived stress is a public problem that commonly affects academic students. *Aim:* To assess the percentage of gastrointestinal symptoms among Al-Rayan Colleges students and the association between perceived stress and functional gastrointestinal disorders (FGIDs). *Methods:* A cross-sectional descriptive study was carried out on 229 students at Al-Rayan colleges. Data was collected through an electronic form that included general information, as well as a validated questionnaire of the Perceived Stress Scale (PSS) and 16-item ROME II criteria for FGIDS. *Results:* FGIDs were recorded in 146 (63.8%) participating students, upper dysmotility symptoms recorded a high prevalence rate where postprandial fullness was 70 (30.57%), Early satiety 46 (20.09%), then bloating 44 (19.21%). 26(15.2%) female students recorded significantly high perceived stress levels. There was a positive correlation between PSS and FGIDs ($r = 0.333$, $p < 0.01$). Good predictors for FGIDs were BMI ($p = 0.048$, OR = 1.061), smoking status ($p = 0.016$, OR = 2.958), and female gender ($p = 0.011$, OR = 2.600). *Conclusion:* FGIDs occur frequently among university students. Upper dysmotility symptoms were the most presented symptoms. There is a significant association between FGIDs and perceived stress. BMI, smoking, and female gender are good predictors of FGIDs.

Keywords: Functional, Gastrointestinal symptoms, perceived stress, university students

1. INTRODUCTION

Gastrointestinal symptoms are a highly prevalent problem among healthcare visitors. Most of them are organically free, and they are diagnosed with

functional gastrointestinal disorders (FGIDs) (Black et al., 2020). These disorders impact daily life, job performance, and social activities, making them a public health problem (Talley, 2008). FGIDs were reported in about 40% of patients referred to gastrointestinal doctors (Talley et al., 1992). These include many functional symptoms such as abdominal pain, heartburn, dysphagia, early satiety, dyspepsia, irritable bowel syndrome (IBS), bloating, and fecal incontinence (Drossman, 2016). FGIDs are alterations in normal gastrointestinal functions in the absence of organic diseases. They are attributed to gut-brain interaction disorders.

These disorders are associated with changes in intestinal microbiota and mucosal abnormality, as well as alterations in motility and nervous system control (Drossman, 2016). There is a structural connection between the nervous system and the myenteric plexus to gut smooth muscles with subsequent effects on sensation, motility, and secretory physiology (Morgan et al., 2005). Consequently, any mental or somatic stress can affect gut motility, evacuation, secretion, and pain sensation. Meanwhile, disorders in gut functions and intestinal microbiota augment gut-brain signals and hence alter brain function, and result in psychological stress. This relationship is called the brain-gut axis (Drossman, 2016; Appleton, 2018). Perceived stress is the person's feeling or idea about his load for a certain period or fear of losing the ability to control life. It is not related to the number of stressful events, but it depends on the way that the person thinks about his success in overcoming the stress (Phillips, 2016).

Perceived stress is common worldwide, especially among academic students, mainly medical science students (Jamshidi et al., 2017). Psychological instability symptoms were reported in 50% of PhD students. Moreover, the risk of anxiety and/or depression threatened one-third of the students (Levecque et al., 2017; Pavlin et al., 2013). A Canadian study investigated GI symptoms in university students. Of 1149 participants, 61.7% had GI symptoms (Thompson et al., 2002). Another Korean study demonstrated a high percentage of FGIDs in nursing students strongly related to perceived stress (Lee et al., 2011). This study aims to assess the rate of gastrointestinal symptoms among university students in Madina and to find the association between perceived stress and FGIDs.

2. METHODS

A cross-sectional descriptive study was carried out on 229 students (above 18 years) at Al-Rayan colleges in July 2024. Students diagnosed with organic GI diseases or any chronic or psychological diseases or who refused to participate in the study were excluded.

Data collection

Data was collected through an electronic form of a validated questionnaire. The students received the questionnaire by email, after agreement on the consent statement at the beginning of the form, they anonymously reported their responses on the electronic form questionnaire. The questionnaire included general information, the Perceived Stress Scale (PSS), and the GI Symptoms questions. General information included gender, age, Grade Point Average (GPA), daily time staying at college, living arrangements, smoking, subjective health status, height, and weight.

Perceived stress

Perceived stress was assessed by a Perceived Stress Scale (PSS) of 10 items that describe symptoms over the past month. The scale consists of 5 points from never (0) to very often (4). Cohen and Williamson tested reliability and validity, Cronbach's alpha in this sample was 0.75 (Cohen and Williamson, 1988; Ali et al., 2021). FGIDs were assessed using the 16-item ROME II criteria which measure the frequency of FGIDs over the past three months including abdominal pain, esophageal, upper dysmotility, and bowel symptoms. The scale is composed of 5 points, from not at all (0) to very often (4). The response options often and very often were used to identify a symptom as present. Reliability and validity testing was done by (Bytzer et al., 2001). Cronbach's alpha in this sample was 0.83.

Sampling technique

The population number is 564 students, which is the total number of students in the clinical years at AL-Rayan College. Calculated by Kerjcie & Morgan equation (Krejcie and Morgan, 1970).

$$s = X^2 NP(1-P) \div d^2(N-1) + X^2 P(1-P).$$

s = required sample size., X2 = the table value of chi-square for 1 degree of freedom at the desired confidence level (3.841), N = the population size. *P* = the population proportion (assumed to be .50 since this would provide the maximum sample size), and *d* = the degree of accuracy expressed as a proportion (0.05).

Consent

The consent of participants was obtained by agreement on the consent statement at the beginning of the Google form after clarifying the aim and method of the study and informing the participants that their participation is voluntary without adverse consequences for refusal.

The anonymity and confidentiality of the subjects

The study was carried out under full measures of confidentiality and all data was anonymous. The written consent in the electronic form questionnaire was taken from each participant before participation in the study. The Ethical Committee of AL Rayan College approved the study.

Statistical analysis

Data was analyzed using IBM SPSS Statistics, Windows version 20. For descriptive analysis, data were expressed as frequency and percentage. The Chi-square test and Fisher's exact tests were conducted to compare the categorical variables. Pearson correlation (Point-Biserial Correlation) to find the correlation between the GI and PSS. The predictors of FGIDs were detected by using Logistic regression analysis. Significance was determined at p-value ≤ 0.05 in all tests.

3. RESULTS

The study included 171 (74.67%) females and 58 (25.33%) males. The age ranges from 18 to 42, with a mean age of 23.07 ± 3.71 years. 196 (65.55%) of the participants live with their parents, 26 (8.70%) live alone in a private apartment, and 7 (3.06%) in student housing at the university. 45(19.65%) were smokers. 176 (76.87 %) of the students evaluated their health state as good, 46 (20.09%) as fair, and 7 (3.06%) as poor. BMI of the participants, 40 (17.47%) were underweight, 77 (33.62%) were normal, 37 (16.15%) were overweight, and 75 (32.75%) were obese. The mean GPA was 4.07±0.63 ranging from 1.75 to 5.00. Academic grading, A+ was reported in 37 (16.16%), A at 64 (27.94%), B+ at 61 (26.64%), B at 28 (12.23%), C+ 22 (9.61%), C at 10 (4.37%), D+ 5 (2.18%), and D at 2 (0.87%) (Table 1).

Table 1 General criteria

General criteria		**N (%)**
Gender	Female	171 (74.67%)
	Male	58 (25.33%)
Age (years)	<20	9 (3.93%)
	20-24	190 (82.97%)
	≥25	30 (13.10%)
Living arrangements	With their parents	196 (65.55%)
	Alone in a private apartment	26 (8.70 %)
	Housing at the university	7 (3.06%)
Smoking	Yes	45 (19.65%)
	No	184 (80.35%)
Self-evaluation of health state	Good	176 (76.87 %)
	Fair	46 (20.09%)
	Poor	7 (3.06%)
BMI	Underweight	40 (17.47%)
	Normal	77 (33.62%)

	Overweight	37 (16.15%)
	Obese	75 (32.75%)
Grade point average (GPA)		4.07±0.63
Academic grade	A+	37 (16.16%)
	A	64 (27.94%)
	B+	61 (26.64%)
	B	28 (12.23%),
	C+	22 (9.61%)
	C	10 (4.37%)
	D+	5 (2.18%)
	D	2 (0.87%)

The presence of FGIDs

FGIDs were detected in 146 (63.8%) participating students. Among the GI symptoms that the students experienced in the previous three months, upper dysmotility symptoms recorded a high prevalence rate where postprandial fullness was 70 (30.57%), Early satiety 46 (20.09%), then bloating 44 (19.21%). Abdominal pain and Self-reported Diarrhoea/constipation were reported in 43 (18.78 %) of the participants (Table 2).

Table 2 Functional gastrointestinal symptoms

	Not at all	**Sometimes/Rarely**	**Often/very often**
	N (%)	**N (%)**	**N (%)**
Abdominal Pain	53 (23.14%)	133 (58.08%)	43 (18.78 %)
Oesophageal symptoms			
Dysphagia	162 (70.74%)	59 (25.76%)	8(3.49%)
Heartburn	96 (41.92%)	105 (45.85%)	28(12.22%)
Upper dysmotility symptoms			
Early satiety	65 (28.38%)	118 (51.53%)	46 (20.09%)
Postprandial fullness	52 (22.71%)	107 (46.72%)	70 (30.57%)
Bloating	83 (36.24%)	102 (44.54%)	44 (19.21%)
Nausea	91 (39.74%)	107 (46.72%)	31 (13.53%)
Vomiting	165 (72.05%)	60 (26.20%)	4 (1.75%)
Bowel symptoms			
Self-reported Diarrhoea/constipation	90 (39.30%)	96 (41.92%)	43 (18.78%)
>3bowel each day	130 (56.77%)	81 (35.37%)	18 (7.86%)
Loose or watery stool	111 (48.47%)	101 (44.10%)	17 (7.42%)
Urgency	138 (60.26%)	82 (35.81%)	9 (3.93%)
<3 bowel each week	129 (56.33%)	76 (33.19%)	24 (10.48%)
Hard or lump stool	100 (43.67%)	106 (46.29%)	23 (10.04%)
Anal blockage	197 (86.03%)	25 (10.92%)	7 (3.06%)
Faecal incontinence	183 (79.91%)	38 (16.59%)	8 (3.49%)

A higher percentage of students 83 (36.24%) suffered one or two symptoms. While 64 (27.95%) reported three or more symptoms, and 82 (35.81%) had no symptoms. Regarding the type of FGIDs, upper dysmotility, and oesophageal symptoms represented the high prevalence, where 97 (42.36%) and 66 (28.82%) recorded one or two symptoms, respectively. On the other hand, 24 (10.48%) of the students reported more than three bowel symptoms, and 18 (7.86%) suffered more than three upper dysmotility symptoms (Table 3).

Table 3 Number of functional gastrointestinal symptoms

	Item	Non	1-2	More than 3
		N (%)	N (%)	N (%)
GI symptoms	16	-	-	-
Abdominal pain	1	186 (81.22%)	43 (18.78%)	-
Oesophageal Symptoms	2	163 (71.19%)	66 (28.82%)	-
Upper dysmotility symptoms	5	114 (49.78%)	97 (42.36%)	18 (7.86%)
Bowel symptoms	8	157 (68.56%)	48 (20.96%)	24 (10.48%)
Self-reported diarrhea or constipation	1	186 (81.22%)	43 (18.78%)	-
diarrhoea	3	200 (87.34%)	27 (11.79%)	2 (0.87%)
Constipation	3	192 (83.84%)	34 (14.85%)	3 (1.31%)
Faecal incontinence	1	221 (96.51%)	8 (3.49%)	-

We tried to analyze the presence of FGIDs concerning the general characteristics of the study. However, no significant differences ($p>0.05$) were observed for all general criteria. Insignificantly higher prevalence of FGIDs was detected in female students 114 (66.7%), among students aged between 20-24 years 125 (65.8%), smokers 33 (73.3%), obese 45 (72%), and 4 (80%) of the students whose grade was D+ (Table 4).

Table 4 The presence of functional gastrointestinal symptoms by general data

		Without GI symptoms	With GI symptoms	X2	P
Gender	Female (171)	57 (33.3%)	114 (66.7%)	2.48	0.116
	Male (58)	26 (44.8%)	32 (55.2%)		
Age	<20 (9)	6 (66.7%)	3 (33.3%)	4.13	0.127
	20-24 (190)	65 (34.2%)	125 (65.8%)		
	≥25 (30)	12 (40%)	18 (60%)		
Living with parents	Yes (195)	69 (35.4%)	126 (64.6%)	0.42	0.52
	No (34)	14 (41.2%)	20 (58.8%)		
Smoking	Yes (45)	12 (26.7%)	33 (73.3%)	2.22	0.136
	No (184)	71 (38.6%)	113 (61.4%)		
Health state	Good (176)	66 (37.5%)	110 (62.5%)	0.92	0.630
	Fair (46)	14 (30.4%)	32 (69.6%)		
	Poor (7)	3 (42.9%)	4 (57.1%)		
BMI	Underweight (40)	13 (32.5%)	27 (67.5%)	4.690	0.196
	Normal (77)	33 (42.9%)	44 (57.1%)		
	Overweight (37)	16 (43.2%)	21 (56.8%)		
	Obesity (75)	21 (28.0%)	45 (72%)		
Academic grade	A+(37)	14 (37.8%)	23 (62.2%)	5.11+	0.646
	A (64)	22 (34.4%)	42 (65.6%)		
	B+(61)	22 (36.1%)	39 (63.9%)		
	B (28)	12 (42.9%)	16 (57.1%)		
	C+(22)	7 (31.8%)	15 (68.2%)		
	C (10)	3 (30%)	7 (70%)		
	D+(5)	1 (20%)	4 (80%)		
	D (2)	2 (100%)	0 (0%)		

In this study, 23 (10%) students had mild stress, 178 (77.7%) reported moderate stress, and 28 (12%) experienced high stress. Mean PSS was 10.83±1.83, 20.69±3.42, and 28.36±1.34, respectively. Regarding perceived stress among general criteria, only there was a significant gender difference (X211.05, p<0.01). 26 (15.2%) female students recorded high levels of perceived stress (Table 5).

Table 5 PSS in general criteria

		PSS			X2	P
		Mild	Moderate	High		
Gender	Female (171)	12 (7.0%)	133 (77.8%)	26 (15.2%)	11.05	0.004*
	Male (58)	11 (19.0%)	45 (77.6%)	2 (3.4%)		
Age	<20 (9)	0 (0.0%)	8 (88.9%)	1 (11.1%)	1.53	0.820
	20-24 (190)	19 (10.0%)	147 (77.4%)	24 (12.6%)		
	≥25 (30)	4 (13.3%)	23 (76.7%)	3 (10.0%)		
Living with parents	Yes (195)	19 (9.7%)	151 (77.4%)	25 (12.8%)	0.511	0.775
	No (34)	4 (11.8%)	27 (79.4%)	3 (8.8%)		
Smoking	Yes (45)	5 (11.1%)	35 (77.8%)	5 (11.1%)	0.121	0.941
	No (184)	18 (9.8%)	143 (77.7%)	23 (12.5%)		
Health state	Good (176)	18 (10.2%)	136 (77.3%)	22 (12.5%)	2.751	0.600
	Fair (46)	4 (8.7%)	38 (82.6%)	4 (8.7%)		
	Poor (7)	1 (14.3%)	4 (57.1%)	2 (28.6%)		
BMI	Underweight (40)	5 (12.5%)	32 (80.0%)	3 (7.5%)	1.788	0.938
	Normal (77)	8 (10.4%)	58 (75.3%)	11(14.3%)		
	Overweight (37)	4 (10.8%)	28 (75.7%)	5 (13.5%)		
	Obesity (75)	6 (8.0%)	60 (80.0%)	9 (12.0%)		
Academic grade	A+(37)	4 (10.8%)	27 (73.0%)	6 (16.2%)	7.588	0.910
	A (64)	6 (9.4%)	51(79.7%)	7 (10.9%)		
	B+(61)	7 (11.5%)	47 (77.0%)	7 (11.5%)		
	B (28)	5 (17.9%)	21 (75.0%)	2 (7.1%)		
	C+(22)	0 (0.0%)	19 (86.4%)	3 (13.6%)		
	C (10)	1 (10.0%)	7 (70.0%)	2 (20.0%)		
	D+(5)	0 (0.0%)	4 (80.0%)	1 (20.0%)		
	D (2)	0 (0.0%)	2 (100%)	0 (0.0%)		

*P<0.05

We utilized Pearson correlation to find the relationship between PSS and the presence of FGIDs. A moderate positive correlation, r =0.333, p<0.01, was noticed, indicating that higher stress scores were associated with FGIDs. There was no significant correlation between GPA and PSS (r = -0. 014, P >0.05), and no significant correlation between FGIDs and GPA (r = 0.044, P >0.05). In this work, we tried to find predictors of FGIDs. The logistic regression model included age, BMI, living arrangement, GPA, smoking status, gender, and health state as predictors. Significant predictors of the FGIDs are BMI (p = 0.048, OR = 1.061), smoking status (p = 0.016, OR = 2.958), and gender (p = 0.011, OR = 2.600). Non-significant predictors included age, living arrangements, GPA, and health status (Table 6).

Table 6 Logistic regression analysis for students with FGIDs

Predictors	B	S.E.	Wald	p	OR Exp(B)	95 % CI
Age	-0.051	0.040	1.677	0.195	0.950	0.879-1.027
BMI	0.060	0.030	3.920	0.048*	1.061	1.001-1.126
Living arrangements	0.140	0.439	0.102	0.750	1.150	0.487-2.718
GPA	0.291	0.238	1.492	0.222	1.338	0.839-2.135
Smoking	1.085	0.449	5.832	0.016*	2.958	1.227-7.134
Gender	0.956	0.376	6.452	0.011*	2.600	1.244-5.436
Self-reported Health state	-0.152	0.285	0.287	0.592	0.859	0.492-1.500

*P<0.05 S. E. standard error CI Confidence interval

4. DISCUSSION

FGIDs are common chronic illnesses that impact up to 40% of people worldwide (Black et al., 2020). The development of FGIDs has been linked to several risk factors, including lifestyle, sleeping, and psychological disorders, such as depression and anxiety (Tran et al., 2023). Several studies investigated the relationship between stress and FGIDs (Jamshidi et al., 2017; Levecque et al., 2017; Pavlin et al., 2013; Thompson et al., 2002; Lee et al., 2011). Because of the differences in people cultures, the association between mental health conditions and common FGIDs in Madina especially among university students needs more focus. Therefore, our study aimed to identify the association between perceived stress and FGIDs in University students in Madina.

In this study, FGIDs were detected in 146 (63.8%) participating students. Most students 83(36.24%) suffered one or two symptoms. Among the FGIDs, upper dysmotility symptoms, postprandial fullness, early satiety, and bloating recorded a higher prevalence rate. Similar findings were demonstrated in other studies. In a cross-sectional study on 715 Korean college students, the prevalence rate of FGIDs was 65%. 31.1% of FGID-experienced students reported more than three GI symptoms. A high prevalence of upper dysmotility and bowel symptoms was observed (Lee et al., 2011). A Canadian study investigated the prevalence of FGIDs in 1149 participants using Rome II and I criteria. 61.7% of the study population reported one or more functional gastrointestinal disorders. Functional bowel disorders and oesophageal symptoms had higher percentages (Thompson et al., 2002).

Another Tunisian study reported a 54.2% prevalence rate of FGIDS using Rome III criteria among 143 medical students, mainly functional bowel disorder was observed (Gallas et al., 2022). The prevalence of Rome IV FGIDs was 26.9% of 1309 undergraduate students. Functional dyspepsia, bowel disorders and oesophageal reflux were the most detected symptoms (Goyal et al., 2021). In another study included 400 medical students, 10.3% experienced FGIDS mainly functional dyspepsia, in a cross-sectional study that was conducted in Vietnam (Tran et al., 2023). We did not observe a significant difference in the analysis of the presence of FGIDs concerning the general characteristics of the study. Although females recorded a higher percentage of FGIDs than male students no significant difference was detected.

Lee et al., (2011) reported similar results except for subjective health status, where students who described their health as poor had a significantly higher percentage of FGIDs. This may be explained by cultural differences in variable localities, where a person may define his health as good despite having health issues. Other studies postulated significantly higher FGIDs among female participants (Thompson et al., 2002; Goyal et al., 2021). This may be explained by the difference in sample size in both studies. All participating students reported perceived stress to varying degrees; the highest percentages were reported for moderate stress. There was a significant gender difference, females recorded higher levels of perceived stress.

The same results were detected in another study (Ragab et al., 2021). This work proved a positive correlation between perceived stress and FGIDs. Prior research has established a clear link between mental health issues and gastrointestinal ailments. (Lee et al., 2011; Zhang et al., 2018; Lee et al., 2017; Zamani et al., 2019). The logistic regression analysis was done to detect the possible predictors of FGIDs among the students. BMI, smoking, and female gender are good predictors of FGIDs. Similarly, among multiple variables, female gender and BMI were found to be good predictors for FGIDs among students in previous research (Gallas et al., 2022; Goyal et al., 2021).

Highlighting the factors related to FGIDs helps in early detection and prevention of further deterioration of the student's physical and mental health. The results of this research, indicate that certain demographic and lifestyle characteristics, such as gender and

smoking are important risk factors. Organizing programs for weight loss and smoking cessation should be considered by universities. This study had some limitations. The small sample size of participants may have hampered the potential to identify meaningful relationships. A bigger sample size is required in future research for a more thorough examination.

5. CONCLUSION

FGIDs occur frequently among undergraduate university students in Madina. Upper dysmotility symptoms were the most presented symptoms. A significant association between FGIDs and perceived stress was detected. Female gender, smoking, and BMI are good predictors of FGIDs. This research emphasizes the university's responsibility to recognize students' perceived stress and FGIDS and provide them with physical and psychological support.

Author Contributions

SE designed and supervised the study. SA, data collection. ZA analysed the results and statistical data. All authors contributed to the writing and approved the final draft.

Ethical approval

REC (Research Ethics Committee-Al Rayan Colleges (HA-03-M-122) approved the study. The ethical guidelines for Human Subjects are followed in the study.

Informed consent

Written consent was obtained from individual participants included in the study.

Acknowledgement

We extend our gratitude to AL Rayan Colleges staff and students for their support and to Shada Mohammad Alrawi medical student for her help in this research.

Funding

This study has not received any external funding.

Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

REFERENCES

1. Ali AM, Hendawy AO, Ahmad O, Al Sabbah H, Smail L, Kunugi H. The Arabic Version of the Cohen Perceived Stress Scale: Factorial Validity and Measurement Invariance. Brain Sci 2021; 11(4):419. doi: 10.3390/brainsci11040419
2. Appleton J. The Gut-Brain Axis: Influence of Microbiota on Mood and Mental Health. Integr Med (Encinitas) 2018; 17(4):28-32
3. Black CJ, Drossman DA, Talley NJ, Ruddy J, Ford AC. Functional gastrointestinal disorders: advances in understanding and management. Lancet 2020; 396(10263):16644-1674. doi: 10.1016/S0140-6736(20)32115-2
4. Bytzer P, Howell S, Leemon M, Young LJ, Jones MP, Talley NJ. Low socioeconomic class is a risk factor for upper and lower gastrointestinal symptoms: a population based study in 15000 Australian adults. Gut 2001; 49(1):66-72. doi: 10.1136/gut.49.1.66
5. Cohen S, Williamson G. Perceived stress in a probability sample of the United States. In S. Spacapan & S Oskamp (Eds.), The social psychology of health: Claremont Symposium on applied social psychology. Newbury Park, CA: Sage, 1988.

6. Drossman DA. Functional Gastrointestinal Disorders: History, Pathophysiology, Clinical Features and Rome IV. Gastroenterology 2016; S0016-5085(16)00223-7. doi: 10.1053/j.gastro.2016.02.032
7. Gallas S, Knaz H, Methnani J, Maatallah-Kanzali M, Koukane A, Bedoui MH, Latiri I. Prevalence and risk factors of functional gastrointestinal disorders in early period medical students: a pilot study in Tunisia. Libyan J Med 2022; 17(1):2082029. doi: 10.1080/19932820.2022.2082029
8. Goyal O, Nohria S, Dhaliwal AS, Goyal P, Soni RK, Chhina RS, Sood A. Prevalence, overlap, and risk factors for Rome IV functional gastrointestinal disorders among college students in northern India. Indian J Gastroenterol 2021; 40(2):144-153. doi: 10.1007/s12664-020-01106-y
9. Jamshidi F, Mogehi S, Cheraghi M, Jafari SF, Kabi I, Rashidi L. A Cross-Sectional study of Psychiatric disorders in Medical Sciences Students. Mater Sociomed 2017; 29(3):188-191. doi: 10.5455/msm.2017.29.188-191
10. Krejcie RV, Morgan DW. Determining Sample Size for Research Activities. Educational and Psychological Measurement 1970; 30:607-610. doi: 10.1177/001316447003000308
11. Lee C, Doo E, Choi JM, Jang SH, Ryu HS, Lee JY, Oh JH, Park JH, Kim YS; Brain-Gut Axis Research Group of Korean Society of Neurogastroenterology and Motility. The Increased Level of Depression and Anxiety in Irritable Bowel Syndrome Patients Compared with Healthy Controls: Systematic Review and Meta-analysis. J Neurogastroenterol Motil 2017; 23(3):349-362. doi: 10.5056/jnm16220
12. Lee EY, Mun MS, Lee SH, Cho HS. Perceived stress and gastrointestinal symptoms in nursing students in Korea: A cross-sectional survey. BMC Nurs 2011; 10:22. doi: 10.1186/1472-6955-10-22
13. Levecque K, Anseel F, De-Beuckelaer A, Van-der-Heyden J, Gisle L. Work organization and mental health problems in PhD students. Res Policy 2017; 46(4):868-879. doi: 10.1016/j.respol.2017.02.008
14. Morgan V, Pickens D, Gautam S, Kessler R, Mertz H. Amitriptyline reduces rectal pain related activation of the anterior cingulate cortex in patients with irritable bowel syndrome. Gut 2005; 54(5):601-7. doi: 10.1136/gut.2004.047423
15. Pavlin S, Matjaž U, Marjan H. Changing the context of researchers'work in academia. Annales, Series historia et sociologia 2013; 23:365-376.
16. Phillips AC. Perceived stress. Encyclopedia of behavioral medicine. Springer 2016; 1-1.
17. Ragab EA, Dafallah MA, Salih MH, Osman WN, Osman M, Miskeen E, Taha MH, Ramadan A, Ahmed M, Abdalla ME, Ahmed MH. Stress and its correlates among medical students in six medical colleges: an attempt to understand the current situation. Middle East Curr Psychiatry 2021; 28:75. 10.1186/s43045-021-00158-w
18. Talley NJ. Functional gastrointestinal disorders as a public health problem. Neurogastroenterol Motil 2008; 20 Suppl 1:121-129. doi: 10.1111/j.1365-2982.2008.01097.x
19. Talley NJ, Weaver AL, Zinsmeister AR, Melton LJ 3rd. Onset and disappearance of gastrointestinal symptoms and functional gastrointestinal disorders. Am J Epidemiol 1992; 136(2):165-77. doi: 10.1093/oxfordjournals.aje.a116483
20. Thompson WG, Irvine EJ, Pare P, Ferrazzi S, Rance L. Functional gastrointestinal disorders in Canada: first population-based survey using Rome II criteria with suggestions for improving the questionnaire. Dig Dis Sci 2002; 47(1):225-35. doi: 10.1023/a:1013208713670
21. Tran TTT, Luu MN, Tran LL, Nguyen D, Quach DT, Hiyama T. Association of mental health conditions and functional gastrointestinal disorders among Vietnamese new-entry medical students. PLoS One 2023; 18(7):e0289123. doi: 10.1371/journal.pone.0289123
22. 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):132-143. doi: 10.1111/apt.15325
23. Zhang QE, Wang F, Qin G, Zheng W, Ng CH, Ungvari GS, Yuan Z, Mei S, Wang G, Xiang YT. Depressive symptoms in patients with irritable bowel syndrome: a meta-analysis of comparative studies. Int J Biol Sci 2018; 14(11):1504-1512. doi: 10.7150/ijbs.25001