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Gastroesophageal Reflux Disease Among Undergraduate Medical Students in Egypt: Prevalence and Risk Factors

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Background: Gastroesophageal reflux disease (GERD) is a prevalent gastrointestinal condition that has a detrimental impact on one's quality of life because of acid reflux causing damage to the esophagus. Primary symptoms consist of heartburn and regurgitation, although patients may also encounter chest pain, nausea, and dysphagia. Medical students may be particularly susceptible due to stressful lifestyles and unhealthy habits. This study investigates the prevalence of GERD among medical students in Egypt and explores associated risk factors.

Subjects and Methods: This is a cross-sectional observational study that was conducted among undergraduate medical students at 21 medical schools across Egypt. The study included 602 participants from medical schools. The study utilized a pre-designed, self-administered questionnaire that includes questions about sociodemographic and lifestyle attributes, accompanied by the GERDQ questionnaire used to diagnose gastroesophageal reflux disease.

Results: A total of 602 undergraduate medical students completed the questionnaire. The prevalence of GERD was found to be 28.4%, with heartburn and regurgitation being the most prevalent symptoms among participants. Univariate and multivariate logistic regression revealed family history of GERD and stress after medical school enrollment as significant predictors of GERD symptoms ($p=0.043$ and $p=0.044$, respectively).

Conclusion: GERD has become increasingly common among medical students in Egypt. Contributing factors include medical students' stressful lifestyles and familial predispositions. To address this, it is essential to implement counseling programs and raise awareness as initial steps toward reducing GERD prevalence.

Keywords: GERD, medical, students, risk, factor, Egypt

Introduction

Gastroesophageal reflux disease (GERD) is a widespread gastrointestinal condition that raises the risk of complications and reduces the quality of life.[1] GERD occurs when there is an imbalance between the normal defense mechanisms of the esophagus and offensive factors such as acid and other digestive juices and enzymes in the stomach.[2]

Patients with GERD typically complain of heartburn and postprandial regurgitation. The frequency of these main symptoms, such as the occurrence of heartburn at least twice a week, is used as the basis for diagnosing the disease in most uncomplicated cases.[3,4] Patients may also present with other symptoms such as chest pain, nausea, dysphagia, burping, water brash, and vomiting.[4]

The prevalence of GERD in adults is found to be ranging from 8.7% to 33.1% in the Middle East and North African region, which is a significant increase since 1995.[5] When left untreated, acid reflux may cause esophageal mucosal damage and erosive esophagitis, which may be associated with prolonged cases of GERD. Other extra-esophageal

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disorders, including difficulties sleeping, respiratory issues, coronary artery disease, and metabolic syndrome, have all been linked to GERD.[6,7]

Reflux symptoms are more common among medical students because of the rigorous MBBS program and the unhealthy lifestyle developed throughout the years of studying medicine, such as excessive caffeine consumption and unbalanced diets.[8] Research on the prevalence of GERD among students is limited, with even fewer studies conducted in Egypt. Therefore, we conducted this study to determine the prevalence of GERD among medical students in Egypt and identify potential risk factors.

Methodology

Study Design

This research is a national cross-sectional study aimed at assessing the prevalence and associated risk factors of GERD among medical students in Egypt. This study was written in compliance with the STROBE guidelines.

Study Population

Undergraduate medical students from 21 universities across Egypt participated in the study. The universities included are Cairo University, Menoufia University, Benha University, Mansoura University, Alexandria University, Ain Shams University, Kafr Elsheikh University, New Giza University, MISR University for Science and Technology, 6 October University, Assiut University, Minia University, Sohag University, Aswan University, King Salman International University, Al-Azhar University, Delta University, Zagazig University, Port Said University, Suez Canal University, Damietta University, and Beni Suef University.

Data Collection and Duration

Data was collected over a two-month period, from February to March 2024. A Google Forms questionnaire was distributed via medical groups online. This study was approved by the Research Ethics Committee of Menoufia University IRB No. 09/2023COM1. Information about participants was kept private and secret. Informed consent was obtained from all participants before administering the questionnaire. All research has been conducted in accordance with the Declaration of Helsinki.

Questionnaire

The questionnaire was divided into three sections:

Sociodemographic Data

This section gathered basic information about the participants, including age, gender, university, and year of study.

Arabic Version of GerdQ

The GerdQ is a validated questionnaire used to diagnose and assess the severity of GERD symptoms and was adopted by previous studies.[9–11] In a previous study, the GerdQ reliability was 0.81 for patients and 0.90 for healthy controls; the validity was 88%,[12] the sensitivity was 67%, and the specificity was 70%. It consists of six questions, each scored on a scale from 0 to 3, with higher scores indicating more severe symptoms. The total score ranges from 0 to 18, with a score of ≥8 suggesting a likely diagnosis of GERD.[13]

Association Risk Factors and Lifestyle

This section included questions about potential risk factors and lifestyle factors associated with GERD, such as dietary habits, smoking, family history, daily habits and sleep, medical habits, physical activity, and stress levels after joining medical school.

Sample Size

Based on the review of past literature,[8] it found that of the 600 medical students, 150 (25%) had GERD symptoms; the least sample size calculated using statistics and Sample Size Pro is 289 participants, which increases up to 347 participants to avoid a 20% dropout rate. The study's power is 80%, and the confidence interval is 95%.

Statistical Analysis

Data was analyzed using The Statistical Package for Social Science Program (SPSS 25). Descriptive statistics were used to summarize the sociodemographic characteristics and prevalence of GERD among the participants. Inferential statistics, including chi-square tests for categorical variables and independent *t* tests for normally distributed continuous variables, were used for group comparison. Logistic regression was used to identify significant associations between GERD and potential risk factors. Statistical significance was set at $p < 0.05$.

Results

A total of 602 medical students participated in solving the questionnaire distributed amongst 21 medical schools in Egypt. Heartburn (55.0%) and regurgitation (54.2%) were the most prevalent symptoms, regardless of whether they were occurring once per week, 2–3/week, and 4–7/week, followed by chest pain and nausea. Sleep disruption due to GERD symptoms and the use of over the counter (OTC) medications [antiacids, H2 blockers, or proton pump inhibitors (PPI)] were less frequent among participants, as demonstrated in Table 1.

The study included a total of 171 individuals with GERD and 431 individuals without GERD, demonstrating a prevalence of 28.4%. Among the GERD group, 76 (44.4%) were males and 95 (55.6%) were females. In comparison, the non-GERD group comprised 162 (37.6%) males and 269 (62.4%) females. Participants were categorized based on their BMI into two groups: those with a BMI less than 25 kg/m² and those with a BMI of 25 kg/m² or higher. In the GERD group, 113 (66.1%) had a BMI less than 25 kg/m², while 58 (33.9%) had a BMI of 25 kg/m² or higher. In the non-

Table 1 Frequency of GERD Symptoms per Week

Symptoms	Frequency (N= 602)
Heartburn	
0 Days	271 (45.0%)
1 Day	170 (28.2%)
2 to 3 Days	113 (18.8%)
4 to 7 Days	48 (8.0%)
Regurgitation	
0 Days	276 (45.8%)
1 Day	177 (29.4%)
2 to 3 Days	116 (19.3%)
4 to 7 Days	33 (5.5%)
Chest Pain	
0 Days	288 (47.8%)
1 Day	144 (23.9%)
2 to 3 Days	127 (21.1%)
4 to 7 Days	43 (7.1%)
Nausea	
0 Days	287 (47.7%)
1 Day	171 (28.4%)
2 to 3 Days	102 (16.9%)
4 to 7 Days	42 (7.0%)

(*Continued*)

Table 1 (Continued).

Symptoms	Frequency (N= 602)
Sleep Disruption	
0 Days	414 (68.8%)
1 Day	106 (17.6%)
2 to 3 Days	69 (11.5%)
4 to 7 Days	13 (2.2%)
OTC Medication for heartburn or regurgitation	
0 Days	523 (86.9%)
1 Day	46 (7.6%)
2 to 3 Days	21 (3.5%)
4 to 7 Days	12 (2.0%)

Abbreviation: OTC, over the counter.

GERD group, 265 (61.5%) had a BMI less than 25 kg/m², and 166 (38.5%) had a BMI of 25 kg/m² or higher. Regarding residence, 81 (47.4%) of the GERD group lived in urban areas and 91 (52.6%) in rural areas. Conversely, 236 (54.8%) of the non-GERD group resided in urban areas, while 195 (45.2%) lived in rural areas. We also categorized the participants based on the type of university program they enrolled in. 74 (43.3%) of the GERD group enrolled in a public university with a conventional program, 88 (51.5%) in a public university with a credit hours program, 7 (4.1%) in a national university, and 2 (1.2%) in a private university. In the non-GERD group, 215 (49.9%) were in a public university with a conventional program, 186 (43.2%) in a public university with a credit hours program, 21 (4.9%) in a national university, and 9 (2.1%) in a private university. Participants' distribution by university year showed a peak prevalence of GERD in year 4, with 75 (43.9%). The sociodemographic factors such as age, sex, BMI, university program, residence, and university year came out to be insignificant when comparing GERD to non-GERD groups. This data is statistically detailed in Table 2.

Table 2 Sociodemographic Data in Relation to GERD

Parameters	GERD (N = 171)	NO GERD (N = 431)	P Value
Age (mean ± SD)	20.6±1.31	20.5±1.32	0.561
Sex			0.12
Males	76 (44.4%)	162 (37.6%)	
Females	95 (55.6%)	269 (62.4%)	
BMI			0.31
< 25 kg/m^2	114 (66.7%)	264 (61.2%)	
> 25 kg/m^2	57 (33.3%)	167 (38.8%)	
Residence			0.10
Urban	81 (47.4%)	236 (54.8%)	
Rural	90 (52.6%)	195 (45.2%)	
University program			0.29
Public University-Conventional program	74 (43.3%)	215 (49.9%)	
Public University-Credit hours	88 (51.5%)	186 (43.2%)	
National University	7 (4.1%)	21 (4.9%)	
Private University	2 (1.2%)	9 (2.1%)	

(*Continued*)

Table 2 (Continued).

Parameters	GERD (N = 171)	NO GERD (N = 431)	P Value
University year			0.07
Year 1	18 (10.5%)	48 (11.1%)	
Year 2	28 (16.4%)	75 (17.4%)	
Year 3	46 (26.9%)	152 (35.3%)	
Year 4	75 (43.9%)	138 (32.0%)	
Year 5	2 (1.2%)	15 (3.5%)	
Year 6	2 (1.2%)	3 (0.7%)	

Abbreviations: SD, standard deviation; BMI, body mass index.

A higher percentage of GERD patients (48.5%) reported a family history of GERD compared to non-GERD participants (38.7%). In comparison to individuals who did not have a family history of GERD, this discovery indicated a statistically significant difference (p=0.02). A significantly higher percentage of GERD patients (94.2%) reported experiencing stress or anxiety after enrolling in medical school compared to non-GERD participants (88.2%). Significant risk factors associated with GERD included family history (p=0.02) and stress or anxiety after medical school enrollment (p=0.02). Other factors such as smoking, eating before sleep, tobacco chewing, chocolate consumption, caffeinated and aerated beverage consumption, eating from restaurants, sleeping patterns, physical exercise, and the OTC medications use showed no significant differences between GERD and non-GERD groups as shown in Table 3.

We used univariate regression analysis to assess the associations between the different variables and GERD symptoms. We then ran multivariate regression models to find the adjusted odds ratios (AORs) and rule out any confounding variables, as shown in Table 4. In the univariate analysis, we found that positive family history (OR = 1.5, 95% CI: 1.04–2.13, p = 0.028) and stress after medical school enrollment (OR = 2.16, 95% CI: 1.07–4.36, p = 0.032)

Table 3 Risk Factors in Relation to GERD

Parameters	GERD (N= 171)	NO GERD (N= 431)	P Value
Family History			0.02*
Yes	83 (48.5%)	167 (38.7%)	
No	88 (51.5%)	264 (61.3%)	
Smoking			0.31
Yes	1 (0.6%)	7 (1.6%)	
No	170 (99.4%)	424 (98.4%)	
Tobacco Chewing			0.55
Yes	3 (1.8%)	11 (2.6%)	
No	168 (98.2%)	420 (97.4%)	
Chocolate Consumption			0.41
Never	49 (28.7%)	96 (22.3%)	
1–3 days/week	100 (58.5%)	270 (62.6%)	
5 days/week	13 (7.6%)	38 (8.8%)	
Everyday	9 (5.3%)	27 (6.3%)	
Caffeinated Beverages Consumption			0.81
Never	39 (22.8%)	108 (25.1%)	
1–3 cups/day	117 (68.4%)	289 (67.1%)	
More than 3 cups/day	15 (8.8%)	34 (7.9%)	

(*Continued*)

Table 3 (Continued).

Parameters	GERD (N= 171)	NO GERD (N= 431)	P Value
Aerated Beverages Consumption			0.33
Never	118 (69.0%)	320 (74.2%)	
1–3 cups/day	51 (29.8%)	104 (24.1%)	
More than 3 cups/day	2 (1.2%)	7 (1.6%)	
Eating from Restaurants			0.87
Never	21 (12.3%)	44 (10.2%)	
Multiple times/month	112 (65.5%)	295 (68.4%)	
Multiple times/week	31 (18.1%)	76 (17.6%)	
Everyday	7 (4.1%)	16 (3.7%)	
Sleeping at night			0.34
1–3 hours	3 (1.8%)	18 (4.2%)	
3–6 hours	59 (34.5%)	146 (33.9%)	
More than 6 hours	109 (63.7%)	267 (61.9%)	
Eating <1 hour before sleep			0.32
Yes	126 (73.7%)	300 (69.6%)	
No	45 (26.3%)	131 (30.4%)	
Physical Exercise			0.66
Never	55 (32.2%)	118 (27.2%)	
<5 times/week	97 (56.7%)	264 (61.4%)	
>5 times/week	11 (6.4%)	30 (7.0%)	
Everyday	8 (4.7%)	19 (4.4%)	
OTC Analgesics Consumption			0.15
Yes	101 (59.1%)	281 (65.2%)	
No	70 (40.9%)	150 (34.8%)	
Stress or Anxiety after Medical school enrolment			0.02*
Yes	161 (94.2%)	380 (88.2%)	
No	10 (5.8%)	51 (11.8%)	

Note: *; significant at p≤0.05.
Abbreviation: OTC, over the counter.

Table 4 Logistic Regression Analysis for Predicting GERD in Participants

Variable	Univariate Analysis		Multivariate Analysis	
	OR (95% C.I)	P-Value	AOR (95% C.I)	P-Value
BMI (>25 kg/m^2)	1.2 (0.8–1.8)	0.318		
Smoking (Yes)	0.36 (0.04–2.9)	0.336		
Family History (Yes)	1.5 (1.04–2.13)	0.028*	1.4 (1.01–2.07)	0.043*
Eating dinner one or two hours before sleeping (Yes)	0.82 (0.55–1.2)	0.32		
Stress or Anxiety after Medical School Enrolment (Yes)	2.16 (1.07–4.36)	0.032*	2.06 (1.02–4.2)	0.044*

Note: *; significant at p≤0.05.
Abbreviations: BMI, Body Mass Index; OR, Odds Ratio; C.I, Confidence Interval; AOR, Adjusted Odds Ratio.

were statistically significant. Patients who were positive for both or either risk factors had an increased likelihood of experiencing GERD symptoms, while BMI (p = 0.318), smoking (p = 0.336), and eating dinner one or two hours before sleeping (p = 0.32) showed no statistical significance. After adjusting for other variables, positive family history (AOR =

1.4, 95% CI: 1.01–2.07, p = 0.043) and stress after medical school enrollment (AOR = 2.06, 95% CI: 1.02–4.2, p = 0.044) remained statistically significant.

Discussion

GERD is a widespread gastrointestinal disorder that is accompanied by an array of complications. The aim of this study was to evaluate the prevalence of gastroesophageal reflux disease (GERD) within the medical student community in Egypt and to establish a correlation between GERD and specific critical variables, including lifestyle and a variety of risk factors.

Our study showed that 28.4% of medical students in Egypt suffer from GERD, which is deemed a relatively high percentage. These results are significantly lower than a similar study carried out in Taif and Riyadh that revealed a prevalence of 53.2% and 34.6%, respectively.[14,15] Adding to that, another study in Abha found the prevalence of GERD to be up to 67.8%.[16] However, another similar study carried out in Oman found the prevalence of GERD among their students to be 10.3%,[17] which is notably lower than our findings. Both similar studies used the GERDQ to evaluate the likelihood of GERD and frequency of its symptoms, which concurs with our study.

The prevalence of GERD among medical students has not been a popular topic of research in Egypt, where only one research published in 2024 addressed this phenomenon. This research revealed 17.1% of the Egyptian medical student population experienced GERD and its symptoms.[18] The difference in prevalence of GERD between our study and this study could be due to the difference in the number of covered universities, as they only covered 6 universities across Egypt compared to our 21. Nevertheless, both results fall into the calculated prevalence of GERD in the Middle East of 8.7%–33.1% as found by a systematic review in 2013.[5]

The results of the current study indicated no significant correlation between age or sex and the frequency of GERD amongst participants. This coincides with the results of a population-based study in Arar City, Northern Saudi Arabia.[19] Nonetheless, a study carried out in India demonstrated a significant correlation between males and GERD.[20] University year was another sociodemographic variable that showed no association with the prevalence of GERD symptoms among medical students in the current study, which is supported by a recent study in Pakistan.[21]

In relation to participants having a BMI higher than 25 kg/m^2, our study showed no correlation with the increased prevalence of GERD. This is contrary to the findings of a study in India that discovered a positive correlation between a high BMI and the frequency of GERD symptoms.[22] The absence of a substantial correlation between GERD and a BMI higher than 25 kg/m^2 in our study may be ascribed to various causes. These factors encompass the dependence on weight measurements given by individuals themselves or the likelihood that weight fluctuations among university students may not accurately mirror those of the wider community.

Regarding the elevated risk of GERD in participants with a positive family history of the disease revealed by our study, these results are in line with earlier studies conducted in Saudi Arabia amongst the student population.[23] Another study in Saudi Arabia investigating the prevalence of GERD among a more diverse population group and not only restricted to students also revealed a correlation between a positive family history and risk of GERD.[24] These findings indicate genetic variables could be attributed to cause GERD in some patients, which is also supported by a meta-analysis study on a Northern European population.[25]

A notable risk factor for GERD is mental stress, which has been shown to exacerbate GERD symptoms in several ways in a Korean study.[26] This is also proven through the findings of the current study showing that 94.2% of participants that had GERD reported experiencing higher levels of stress after enrollment in medical school. Medical students are highly affected by psychological stress due to the demanding lifestyle that requires constant studying and frequent exams.[27] In addition, a study in Pakistan found that patients with GERD, especially those who also experienced chest pain, exhibited notably elevated levels of depression and anxiety.[28] These factors put the medical student population at a higher risk of developing GERD due to stress and consequently suffering from anxiety and depression.

Previous research has shown a strong correlation between GERD and current tobacco smokers, adding to the growing body of evidence linking smoking to the condition.[29–31] However, our study found no correlation between tobacco smoking and GERD, and this can be attributed to the low number of participants who smoke, which is not a common practice among the student population in Egypt. This finding aligns with the findings of a previous study on university

students in Sri Lanka, which found no significant correlation between tobacco smoking and the prevalence of GERD.[32] Additionally, e-cigarette smoking has gained popularity among students and is associated with a higher incidence of GERD compared to traditional smoking.[33]

Consistent with our findings, caffeinated and aerated beverages did not show any correlation with symptoms of GERD in previous research.[34,35] Yet, a separate investigation revealed that coffee exacerbated symptoms of GERD.[36] Furthermore, a 2021 meta-analysis and systematic review on college freshmen found that students who regularly drank green tea or coffee had a higher risk of developing GERD compared to those who did not.[37] However, due to insufficient data investigating the relationship between overall caffeine use and GERD risk, further research is required.

Our research demonstrated that GERD is not substantially correlated with dietary habits, including the timing of dinner and the lateness of meals. This opposes a study conducted in Japan, where it was observed that GERD symptoms were correlated with a shorter dinner-to-bed time.[38] Other studies found that disregarding the timing of meals, the difference in diet contents could be a notable risk factor. A meta-analysis comparing predominantly vegetarian and non-vegetarian diets portrays this as one of the risk factors for GERD.[39] Overeating more than 5 times weekly and eating at very irregular timings were noted to be predicators of GERD in past research.[40] Fast food consumption was also found not significantly in the current study, which conflicts with findings of an Iranian study[41] and multiple Saudi studies that revealed fast food intake and the decrease in fiber intake as significant risk factors for GERD.[16,42]

The current study failed to find a significant relationship between GERD and physical exercise. Nevertheless, certain studies have indicated that the risk of reflux symptoms is reduced when individuals engage in regular physical exercise.[43] Previous studies also revealed that physical activity less than once weekly was a significant risk factor for functional gastrointestinal disorders, of which GERD is part of.[40] Other studies indicate that a sedentary lifestyle could contribute to the development of GERD and that reflux symptoms are less prominent in individuals who participate in frequent, mild to moderate physical exercise.[44,45]

Limitations

Some of the few limitations that this study faced were a relatively small sample size and missing data regarding alcohol consumption. The findings of this study indicate a significant occurrence of GERD symptoms. However, it is important to note that these results are specific to the medical student population at the universities where the study was conducted and may not be representative of the overall Egyptian or Middle Eastern community. Adding to that, the nature of the study, depending on the GerdQ tool, which revolves around participants self-reporting the symptoms, can be subjective and influenced by recall bias.

Conclusion

GERD is one of many common medical problems that have been rampant amongst the medical student population in Egypt in recent times. This condition can impose a substantial health and financial burden given the high frequency of GERD, its impact on daily life, and the possibility of future complications. The rise in its prevalence can be attributable to many factors, including the stressful lifestyle adopted by many medical students and previous family history. This makes it necessary to introduce counseling programs for students that help them manage stress and spread awareness on this important topic through public health campaigns as our first step towards a GERD-free world.

Data Sharing Statement

The data of this study are available from the corresponding author upon reasonable request.

Ethical Considerations

This study was approved by the Research Ethics Committee of Menoufia University. Information about participants was kept private and secret. Informed consent was obtained from all participants before administering the questionnaire.

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Disclosure

The authors have no relevant financial or non-financial interests to disclose.

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