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Evaluation of the Susceptibility of Bangladeshi University Students to Gastroesophageal Reflux Disease (GERD) and Its Associated Factors: A Cross-Sectional Study

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ABSTRACT

Background and Aims: Gastroesophageal reflux disease (GERD) is a highly prevalent clinical condition all over the world. The study was conducted to determine the GERD prevalence among Bangladeshi university students using the frequency scale for the symptoms of gastroesophageal reflux disease (FSSG) score and to find out what factors are linked to the disease.

Methods: The study was based on descriptive cross-sectional analysis. After a comprehensive literature review, a questionnaire was developed with some pre-structured options kept in the sociodemographic, dietary, and lifestyle sections along with the FSSG parameters. The tool was disseminated among students of different universities in Bangladesh. After receiving the responses, all the data was analyzed using SPSS software (version 26.0).

Results: After scrutiny, 402 responses of the study participants were subjected to statistical analysis, and among participants, 57.2% ($N = 230$) were female and 42.8% ($N = 172$) were male. The GERD prevalence was 45.5% ($N = 183$), which indicated the FSSG score was more than 8 among 45.5% of the individuals. Logistic regression analysis revealed that eating beyond fullness (OR = 2.859, CI = 1.811–4.515), consumption of painkillers (OR = 2.237, CI = 1.370–3.653), anxiety (OR = 2.349, CI = 1.529–3.611), being stressed (OR = 2.255, CI = 1.456–3.494), quick eating habit (OR = 1.845, CI = 1.240–2.745), poor sleep quality (OR = 1.760, CI = 1.183–2.620), fast food consumption (OR = 1.613, CI = 1.082–2.404), eating sour and spicy food regularly (OR = 1.610, CI = 1.073–2.415), female gender (OR = 1.595, CI = 1.068–2.381), less interval between dinner and sleep (OR = 1.561, CI = 1.020–2.389), being alone most of the time (OR = 1.514, CI = 1.016–2.257), were significantly associated with the occurrence of GERD symptoms.

Conclusion: GERD symptoms were seen among a large number of university students. Various sociodemographic, dietary, and lifestyle-related factors had an impact on the disease; these contributing factors should be positively modified to alleviate the burden of GERD symptoms.

Summary

- Among Bangladeshi university students, the prevalence of GERD was 45.5%.
- Female students are more susceptible to GERD than male students.
- Smoking and alcoholism are relatively negligible contributing factors to GERD among Bangladeshi students.
- Most of the dietary habits negatively influenced Bangladeshi university-going students to the GERD.

1 | Introduction

Gastroesophageal reflux disease (GERD), a well-known clinical condition, causes uncomfortable symptoms or complications due to the reflux of stomach's acidic load into the upper portion of the GI tract [1]. GERD patients frequently suffer from some common symptoms, such as angina-like retrosternal chest discomfort, heartburn, regurgitation, nausea, and belching. Sometimes unusual extra-esophageal symptoms are also seen among GERD affected individuals, including chest tightness, asthma, shortness of breath and so on [2]. The patient's quality of life may be negatively impacted by this prevalent clinical condition, which can also result in considerable morbidity [3]. GERD usually places a heavy financial strain on patients, their families, healthcare systems, and society as a whole because of its chronic nature and high prevalence [4].

The number of GERD patients is increasing day by day and it affects a populations of all age, including children. This disease is thought as a common health problem in western countries, but in Asian region, the disease is not considered a prevalent illness, although historically, cases have been increasing [5]. As per a report of 2019, globally 783.95 million people were suffering from GERD [6].

This complicated and multifaceted disorder is influenced by various types of factors, notably by the environmental, dietary, and lifestyle related factors. Dietary behaviors are closely linked to the GERD where time of having food, content of food, caloric content in the food, types of food, and other dietary related factors are closely associated with this disorder. In addition, smoking habit, physical activity pattern, sleeping pattern also impact the condition. GERD is influenced by the emotional, psychological conditions due to the effect on the gastric acid secretory states [7]. A number of drugs can trigger the progression of this disease by affecting the structural environment of the GI tract [7, 8].

Bangladesh is a developing country with more than 160 million population [9]. Lots of Bangladeshi people suffer from GERD. A large number of this population belong to the university-going students. From the point of establishment, Bangladesh's higher education system is separated into two sectors: the public and private sectors. The number of students in Bangladeshi higher education sector is not small [10]. Although GERD is prevalent among diversified population group, but very little is known about GERD related factors existed among Bangladeshi university students. The frequency scale for the symptoms of GERD (FSSG) questionnaire is a widely used tool to assess the GERD prevalence, where different GERD symptoms are addressed in the questions with some preset answers related to the symptom's severity [11]. The study was conducted to determine the prevalence of GERD among university-going students by utilizing the FSSG score and to evaluate the contributing factors to GERD among Bangladeshi university-going students.

2 | Methods

2.1 | Study Design and Setting

The study was conducted between January 2024 and June 2024. The study was based on descriptive cross-sectional analysis. Different public and private universities of Dhaka city, the capital of Bangladesh was the study site. The participants were from all the disciplines (e.g., engineering, health sciences, commerce, arts, etc.) of those universities. The study aimed at evaluating GERD occurrence as well as factors which may be responsible for the diseases. The association of GERD with different subgroups (age, gender, economic status, educational level etc.) as well as the groups risk estimate were also planned to be studied.

2.2 | Sampling and Ethical Permission

The total number of universities going students is nearly 5,000,000 in Bangladesh [12]. For a more precise calculation, this total calculation and this figure were considered as the population in the study. RaoSoft says the sample should be 385, ensuring a 95% confidence level ($Z = 1.96$). The population portion was deemed at 50% while the margin error was considered at 5% [13].

$$\begin{aligned} n &= Z^2P(1-P)/d^2 \\ &= \{(1.96)^2 \times 0.5 \times 0.5\}/(0.05)^2 \\ &= 384.16 \approx 385 \end{aligned}$$

where n = sample size, Z = Z statistic for a level of confidence (1.96 for 95% confidence level), P = prevalence or proportion, and d = precision. Taking the precision value of 5%, the calculated sample number was 385. To make the data more reliable, the data was collected from 410 individuals.

The study design and detailed protocol were submitted to the ethical review committee of the Faculty of Pharmacy, University of Dhaka. The study was started after obtaining permission from the concerned review committee (Ref.No.Fa.Ph. E/027/023).

2.3 | Development of the Data Collection Tool

To collect the information from the study participants, a questionnaire was constructed. Comprehensive literature review helped in developing the data collection tool. In the questionnaire, the first section focused on sociodemographic

information, FSSG questions was kept in the second section, and the last section contained dietary, lifestyle, health related parameters. Sociodemographic section carried information related to age, gender, height, weight, educational level, marital status. A total of 12 GERD symptoms related questions were in the FSSG questionnaire, and five options with preset were kept in each question. All the operational terms used in the study by following the published articles [14]. Before disseminating the tool, it was thoroughly reviewed by expert personnel from diversified fields, including doctors, pharmacists, statistician, and public health specialists, and it went through proper validation process.

2.4 | Data Collection Procedure

A data collection team was formed consisting university students from health science related departments after developing the questionnaire. They were briefed thoroughly about the procedure and purpose of the study. Data collectors went to the students of the selected universities. Before the interview, a consent form was provided to the participant, and it was explained in the native language. After obtaining consent, the data collection procedure was begun. The confidentiality of the study participants was ensured throughout the work. While collecting data, participants height and weight were measured using standard measuring tape and calibrated digital weighing machine. Body mass index (BMI) was calculated by using the formula BMI = (kg/m^2) = body weight (kg)/body height (m^2). The World Health Organization's criteria were followed to categorize the study individuals based on their BMI [15]. In the first section of the questionnaire, three options of surplus, balanced, and deficit were kept in the economic status item. Participants were asked to give the answer based on their previous 1-year financial activities; emergency expenses, total financial investments, owned assets, and tax-related issues were also considered for this item. The 12 GERD-related questions were presented, and data collectors told them to fill up the preset answers based on the frequency of GERD symptoms experienced. Then all the operational definition were briefed to the study participants for their ease of understanding and they were asked to answer about their dietary, lifestyle, health related questions accordingly. After collecting the responses, all of them were checked by the investigators of the study.

2.5 | Data Analysis

The collected responses against 12 different symptoms of GERD for each participant were calculated. An FSSG score > 8 indicated the presence of GERD. The demographic characteristics (age group, gender, BMI, education level, living area, marital status, and economic status were examined) were summarized based on descriptive measures (percentage, frequency, and confidence interval). Pearson χ^2 test was employed to study the association between different variables with occurrence of GERD. The comparison was based on one way analysis of variance (ANOVA). Effect size was evaluated using Cramer's V and phi (φ) value. Odds ratio was calculated to identify the subgroups which were at greater risk of developing GERD than others. The p-value of less than 0.05 was considered statistically significant. Version 26.0 of IBM Statistical Product and Service Solutions (SPSS) was used for all types of statistical data analyses [16–18].

3 | Result

3.1 | Demographic Features of the Study Participants

Among the 410 responses obtained from study participants, 402 were chosen for final analysis after close scrutiny to remove erroneous data (Table 1). The majority (57.2%, $N = 230$, CI: 52.36–62.04) of the participants were female, and 75.9% ($N = 305$, CI: 71.72–80.08) of the participants were aged between 22 and 24. 56.0% ($N = 217$, CI: 51.15–60.85) of the participants represented a healthy BMI (body mass index) ranging between 18.5 and 24.9. 212 (52.7%, CI: 47.82–57.58) of the respondents were fourth-year university students, and 75.4% ($N = 303$, CI: 71.19–79.61) of the respondents were living with their family. 363 (90.3%, CI: 87.41–93.19) of the participants were unmarried. 11.9% ($N = 48$, CI: 8.73–15.06) participants were suffering from income less than required for meeting their needs.

3.2 | Participants Distribution Based on Lifestyle, Behavioral, and Dietary Factors

Participants distributions based on lifestyle, behavioral, dietary, and health related factors are presented in Table 2. Most of the individuals were reported to be nonalcoholic and nonsmokers ($N = 376$, 93.5%, and $N = 308$, 79.7%, respectively). 281 (69.9%) participants had a family history of GI disorder. 262 (65.2%) and 272 (67.7%) of the participants were suffering from anxiety and stress, respectively. 214 (53.2%), 241 (60%), 294 (74.1%), and 170 (42.3%) consumed fried snacks, sour and spicy food, tea and coffee, and fast food frequently. 109 (27.1%) were habituated to eating beyond fullness, and 131 (32.6%) had a habit of lying down soon after dinner. 191 (47.5%) of the participants were suffering from poor sleep quality.

3.3 | GERD Symptoms Evaluation Utilizing the FSSG Questionnaire

GERD prevalence was determined by the FSSG scale. Among the responses of the 12 FSSG questionnaire, the majority of the individuals answered “occasionally” and “sometimes” rather than the other three options (Table 3). For 183 (45.5%, CI: 40.63–50.37) participants, the evaluation score was > 8, which indicated the GERD prevalence (Figure 1). On the contrary, 54.5% (219, CI = 49.63–59.37) belonged to the non–GERD group.

TABLE 1 | Characteristics of the study participants.

Variables	Group	Number of participants	Percentage	95% CI
Gender	Female	230	57.2	52.36–62.04
	Male	172	42.8	37.96–47.64
Age	19–21	31	7.7	5.10–10.31
	22–24	305	75.9	71.72–80.08
	≥ 25	66	16.4	12.78–20.02
BMI	< 18.5	31	7.7	5.1–10.31
	18.5–24.9	217	56.0	51.15–60.85
	25.0–29.9	122	30.3	25.81–34.79
	> 30.0	32	8	5.34–10.65
Educational status	1First year	49	12.2	9.00–15.39
	Second year	25	6.2	3.84–8.56
	Third year	77	19.2	15.34–23.05
	Fourth year	212	52.7	47.82–57.58
	Masters	39	9.7	6.81–12.59
Living area	Family residence	303	75.4	71.19–79.61
	In the mess, university hostel	99	24.6	20.39–28.81
Marital status	Unmarried	363	90.3	87.41–93.19
	Married	39	9.7	6.81–12.59
Economic status	Surplus	34	8.5	5.77–11.23
	Balanced	320	79.6	75.66–83.54
	Deficit	48	11.9	8.73–15.06

3.4 | Evaluation of Association Between GERD and Demographic Parameters

The study responses were evaluated to study the association of demographic factors with the occurrence of GERD, which is reflected in Table 4. Female participants were more susceptible to GERD than male participants (50.4% vs. 39.0%). 143 (46.9%) of participants who fell under the age group 22–24 were found to have GERD. The majority ($N = 122$, 56.2%) of participants who exhibited a healthy BMI value (18.5–24.5) were not found to be suffering from GERD. Among the individuals with a BMI greater than 25, GERD and non-GERD prevalence was similar. Individuals with economically deficient status were more vulnerable to GERD. It was found that gender ($\chi^2 = 5.231$, $p = 0.022$), educational status ($\chi^2 = 11.829$, $p = 0.019$), living area ($\chi^2 = 4.443$, $p = 0.035$), and economic status ($\chi^2 = 8.872$, $p = 0.012$) were associated with the occurrence of GERD. No association between BMI, marital status, and GERD was observed.

3.5 | Evaluation of Association Between GERD and Dietary Habits

Several dietary habits have been found to be associated with GERD in this study (Table 5). Regular consumption of fried snacks ($\chi^2 = 5.405$, $p = 0.020$), consumption of sour and spicy food ($\chi^2 = 5.326$, $p = 0.021$), regular fast food consumption ($\chi^2 = 5.542$, $p = 0.019$), eating warm foods ($\chi^2 = 3.769$, $p = 0.052$), quick eating habit ($\chi^2 = 9.214$, $p = 0.002$), taking foods beyond fulfillment of hunger ($\chi^2 = 21.083$, $p < 0.001$), lying down soon after dinner ($\chi^2 = 4.238$, $p = 0.040$) were found to be associated with GERD development.

3.6 | GERD and Its Association With Lifestyle, and Behavioral Parameters

No association between smoking, alcoholism, and GERD was observed in this study (Table 6). 52 out of 85 respondents who took NSAID developed GERD. Among the 262 participants who suffered from anxiety, 138 of them (52.7%) developed GERD. Passing most of the time alone ($\chi^2 = 4.173$, $p = 0.041$) was associated with the occurrence of GERD. 52.6% ($N = 72$) individuals with late-night sleeping habits and 52.1% ($N = 110$) poor sleep quality sufferers developed GERD. Painkillers consumption ($\chi^2 = 10.651$, $p = 0.001$), suffering from anxiety ($\chi^2 = 15.506$, $p < 0.001$), stressful mental condition ($\chi^2 = 13.529$, $p < 0.001$), late night sleeping habit ($\chi^2 = 4.144$, $p = 0.042$), and poor sleep quality ($\chi^2 = 7.852$. $p = 0.005$) were likely to be associated with GERD occurrence.

3.7 | Impact of the Sociodemographic, Dietary, and Behavioral Variables on the GERD Occurrence

The factors that were considered for the present study were assessed for their perceived risk with the development of GERD (Table 7). Individuals with a BMI value falling under the category of obese-overweight were 1.340-times more likely to

TABLE 2 | Lifestyle, behavioral, and dietary related factors of the study participants.

Variable	Group	Number of participants	Percentage	95% CI
Smoking history	Ex-smoker	15	3.6	1.78–5.4
	Nonsmoker	308	79.7	75.77–83.63
	Smoker	79	19.7	15.81–23.59
Alcohol consumption	Yes	26	6.5	4.09–8.91
	No	376	93.5	91.09–95.91
Painkillers (NSAIDs) consumption	Yes	85	21.1	17.11–25.09
	No	317	78.9	74.91–82.89
Inhaler user	Yes	31	7.7	5.09–10.31
	No	371	92.3	89.69–94.91
Family history of GI disorder	Yes	281	69.9	65.42–74.38
	No	121	30.1	25.62–34.58
Suffering from anxiety	Yes	262	65.2	60.54–69.86
	No	140	34.8	30.14–39.46
Subjective perception of stress	Yes	272	67.7	63.13–72.27
	No	130	32.3	27.73–36.87
Being most of the times alone	Yes	226	56.2	51.35–61.05
	No	176	43.8	38.95–48.65
Consumption of fried snacks regularly	Yes	214	53.2	48.32–58.08
	No	188	46.8	41.92–51.68
Consumption of sour or spicy food	Yes	241	60	55.21–64.79
	No	161	40	35.21–44.79
Fast food consumption regularly	Yes	170	42.3	37.47–47.13
	No	232	57.7	52.87–62.53
Consuming sweets regularly	Yes	196	48.8	43.91–53.69
	No	206	51.2	46.31–56.09
Consuming tea/coffee frequently	Yes	294	74.1	69.82–78.38
	No	104	25.9	21.62–30.18
Habit of heavy dinner	Yes	228	56.7	51.86–61.54
	No	174	43.3	38.46–48.14
Habit of chewing pan-masala	Yes	25	6.2	3.84–8.56
	No	377	93.8	91.44–96.16
Consuming soft drinks frequently	Yes	170	42.3	37.47–47.13
	No	232	57.7	52.87–62.53
Consuming citrous fruits regularly	Yes	145	36.1	31.40–40.80
	No	257	63.9	59.20–68.60
Eating warm foods frequently	Yes	194	48.3	43.42–53.18
	No	208	51.7	46.82–56.58
Quick eating habit	Yes	193	48	43.12–52.88
	No	209	52	47.12–56.88
Eating beyond fullness	Yes	109	27.1	22.75–31.45
	No	293	72.9	68.55–77.25
Habit of lying down soon after dinner	Yes	131	32.6	28.0–37.18
	No	272	67.4	62.82–71.98

(Continues)

TABLE 2 | (Continued)

Variable	Group	Number of participants	Percentage	95% CI
Late night sleeping habit	Yes	265	65.9	61.27–70.53
	No	137	34.1	29.47–38.73
Suffering from poor sleep quality	Yes	191	47.5	42.62–52.38
	No	211	52.5	47.62–57.38

TABLE 3 | FSSG questionnaire and GERD symptoms evaluation.

Questions	Never (0)	Occasionally (1)	Sometimes (2)	Often (3)	Always (4)
1. Do you get heartburn?	75 (18.7)	156 (39.8)	123 (30.6)	43 (10.7)	5 (1.2)
95% CI	14.89–22.51	35.01–44.59	26.09–35.11	7.68–13.72	0.14–2.26
2. Does your stomach get bloated?	86 (21.4)	126 (31.3)	122 (30.3)	53 (13.2)	15 (3.7)
95% CI	17.39–25.41	26.77–35.83	25.81–34.79	9.89–16.51	1.85–5.45
3. Does your stomach ever feel heavy after meals?	39 (9.7)	129 (32.1)	103 (25.6)	90 (22.4)	41 (10.2)
95% CI	6.81– 12.59	27.54–36.66	21.33–29.87	18.32–26.48	7.24–13.16
4. Do you subconsciously rub your chest with your hand?	202 (50.2)	103 (25.6)	71 (17.7)	25 (6.2)	1 (0.2)
95% CI	45.31–55.09	21.33–29.87	13.97–21.43	3.84–8.56	0–0.64
5. Do you ever feel sick after meals?	112 (27.9)	158 (39.3)	100 (24.9)	30 (7.5)	2 (0.5)
95% CI	23.52–32.28	34.53–44.07	20.67–29.13	4.93–10.07	0.0–1.19
6. Do you get heartburn after meals?	145 (36.1)	136 (33.8)	98 (24.4)	21 (5.2)	2 (0.5)
95% CI	31.40–40.80	29.18–38.42	20.20–28.60	3.03–7.37	0.00–1.19
7. Do you have an unusual (e.g., burning) sensation in your throat?	184 (45.8)	124 (30.8)	70 (17.4)	21 (5.2)	3 (0.7)
95% CI	40.93–50.67	26.29–35.31	13.69–21.11	3.03–7.37	0.0–1.52
8. Do you feel full while eating meals?	81 (20.1)	133 (33.1)	98 (24.4)	71 (17.7)	(19 4.7)
95% CI	16.18–24.02	28.50–37.70	20.20–28.60	13.97–21.43	2.63–6.77
9. Do some things get stuck when you swallow?	217 (54.0)	111 (27.6)	58 (14.4)	16 (4.0)	0 (0.0)
95% CI	49.13– 58.87	23.23–31.97	10.97–17.83	2.08–5.92	0.00–0.00
10. Do you get bitter liquid (acid) coming up into your throat?	129 (32.1)	161 (40.0)	89 (22.1)	18 (4.5)	5 (1.2)
95% CI	27.54–36.66	35.21–44.79	18.04–26.16	2.47–6.53	0.14–2.26
11. Do you burp a lot?	94 (23.4)	164 (40.8)	84 (20.9)	46 (11.4)	14 (3.5)
95% CI	19.26–27.54	36.00–45.60	16.93–24.87	8.29–14.51	1.70–5.30
12. Do you get heartburn if you lean over?	235 (58.5)	107 (26.6)	48 (11.9)	10 (2.5)	2 (0.5)
95% CI	53.68–63.32	22.28–30.92	8.73–15.07	0.97–4.03	0.0–1.19

develop GERD. Females are at higher risk of developing GERD compared to males (OR = 1.595). Married participants were found to be at 1.448-times higher risk of developing GERD than their unmarried counterparts. Consumption of painkillers and inhaler use were all found to pose a greater risk of developing GERD. Among the behavioral parameters, the highest odds were found from eating beyond fullness (OR = 2.859). Living with anxiety, mental stress, family history of GERD, fried snacks, sour and spicy food, soft drink consumption, quick eating habits, and eating beyond fullness also imposed a higher risk of GERD.

4 | Discussion

Studies in different regions worldwide show a notable variation regarding GERD prevalence. A study in Saudi Arabia showed that 34.6% of the students were GERD affected [19]; another

study of Ethiopia expressed 32.1% GERD prevalence among university students. More than 50% GERD prevalence was also found in the Middle East region in a study [20]. This study found 44.5% GERD prevalence among university-going students, clearly indicating a high number of GERD-affected university students in Bangladesh. Besides, the impact of various associated sociodemographic, behavioral, dietary, and lifestyle-related factors was evaluated in this study.

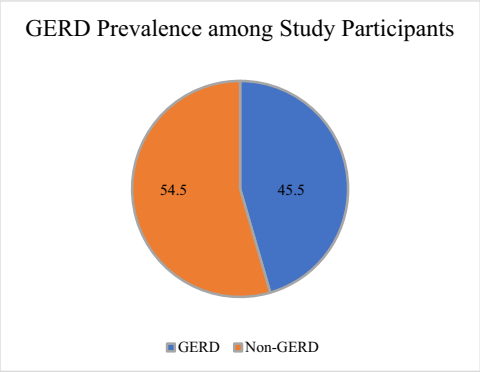

FIGURE 1 | Prevalence of GERD among Bangladeshi university going students. 45.5% ($N = 183$, CI: 40.63–50.37) participants were suffering from GERD, while 54.5% ($N = 219$, CI: 49.63–59.37) were not GERD affected.

Female gender was significantly associated with the occurrence of the GERD symptoms in the study ($p = 0.022$). Lin et al.'s study showed that female gender was independently associated with GERD. It was also revealed that other contributing factors, like specific drug (NSAID) consumption patterns and other behavioral factors, negatively affected the female gender's susceptibility to the disease [21]. In our study, NSAID utilization and anxiety existence were more prevalent among female students. These parameters made female individuals in this study more vulnerable to the GERD occurrence. In the study, individuals who had the habit of NSAID consumption were 2.237-times more prone to GERD occurrence, and the association was statistically significant ($p = 0.001$). NSAIDs are well-known to exert their effects by inhibiting COX-1 enzyme-mediated prostaglandin activity. Thus, also inhibiting the protective function of the enzymes [22]. These lead to injury of different portions of the GI tract, mainly by lowering lower esophageal sphincter pressure (LESP), damaging mucosa, and altering esophagogastric motility [23]. A prior history of peptic ulcers can aggravate the GERD symptoms expression by consumption of NSAIDs [22].

Psychological conditions are well characterized to be linked to GERD. Being alone most of the time was significantly associated with GERD symptoms occurrence ($p = 0.041$) in the study, and its prevalence was higher among individuals who pass most of their time alone (OR = 1.514, CI = 1.106–2.257). According to research by Sharma et al., acid-induced esophageal hyperalgesia can

TABLE 4 | Association between GERD and sociodemographic variables.

Variable	Group	GERD *N* (%)	Non-GERD *N* (%)	χ^2	*p* value (Cramer's *V*/Phi)
Gender	Female	116 (50.4)	114 (49.6)	5.231	< 0.05 (0.114)
	Male	67 (39.0)	105 (61.0)		
Age	19–21	11 (35.5)	20 (64.5)	2.079	> 0.1
	22–24	143 (46.9)	162 (53.1)		
	> 25	29 (43.9)	37 (56.1)		
BMI	< 18.5	11 (35.5)	20 (64.5)	2.771	> 0.1
	18.5–24.9	95 (43.8)	122 (56.2)		
	25.0–29.9	61 (50.0)	61 (50.0)		
	> 30.0	16 (50.0)	16 (50.0)		
Educational status	First year	19 (38.8)	30 (61.2)	11.829	< 0.05
	Second year	10 (40.0)	15 (60.0)		(0.172*)
	Third year	48 (62.3)	29 (37.7)		
	Fourth year	92 (43.4)	120 (56.6)		
	Masters	14 (35.9)	25 (64.1)		
Living area	Family residence	147 (48.5)	156 (51.5)	4.443	< 0.05
	In the mess, university hostel	36 (36.4)	63 (63.6)		(−0.105)
Marital status	Unmarried	162 (44.6)	201 (55.4)	1.207	> 0.1
	Married	21 (53.8)	18 (46.2)		
Economic status	Surplus	12 (35.3)	22 (64.7)	8.872	< 0.05
	Balanced	140 (43.8)	180 (56.3)		(0.149*)
	Deficit	31 (64.6)	17 (35.4)		

*Indicates Creamer's *V* (effect size)

TABLE 5 | Association between GERD and dietary habits.

Variable	Group	GERD *N* (%)	Non-GERD *N* (%)	χ^2	*p* value (phi)
Consumption of fried snacks regularly	Yes	109 (50.9)	105 (49.1)	5.405	< 0.05 (0.116)
	No	74 (39.4)	114 (60.6)		
Consumption of sour or spicy food	Yes	121 (50.2)	120 (49.8)	5.326	< 0.05 (0.115)
	No	62 (38.5)	99 (61.5)		
Fast food consumption regularly	Yes	89 (52.4)	81 (47.6)	5.542	< 0.05 (0.117)
	No	94 (40.5)	138 (59.5)		
Consuming sweets regularly	Yes	83 (42.3)	113 (57.7)	1.555	> 0.1
	No	100 (48.5)	106 (51.5)		
Consuming tea/coffee frequently	Yes	128 (43.0)	170 (57.0)	3.066	> 0.05
	No	55 (52.9)	49 (47.1)		
Habit of heavy dinner	Yes	108 (47.4)	120 (52.6)	0.724	> 0.1
	No	75 (43.1)	99 (56.9)		
Habit of chewing pan masala	Yes	12 (48.0)	13 (52.0)	0.066	> 0.1
	No	171 (45.1)	208 (54.9)		
Consuming soft drinks frequently	Yes	80 (47.1)	90 (52.9)	0.280	> 0.1
	No	103 (44.4)	129 (55.6)		
Consuming citrus fruits regularly	Yes	65 (44.8)	80 (55.2)	0.044	> 0.1
	No	118 (45.9)	139 (54.1)		
Eating warm foods frequently	Yes	98 (50.5)	96 (49.5)	3.769	> 0.05
	No	85 (40.9)	123 (59.1)		
Quick eating habit	Yes	103 (53.4)	90 (46.6)	9.214	< 0.01 (0.151)
	No	80 (38.3)	129 (61.7)		
Eating beyond fullness	Yes	70 (64.2)	39 (35.8)	21.083	< 0.001 (0.229)
	No	113 (38.6)	180 (61.4)		
Habit of lying down soon after dinner	Yes	133 (49.1)	138 (50.9)	4.238	< 0.05 (0.103)
	No	50 (38.2)	81 (61.8)		

potentially be exacerbated by abruptly elevated anxiety levels [24]. Persistently high anxiety can lower the threshold for perceiving visceral signals, which raises the possibility of having a functional gastrointestinal illness. In this study, individuals with anxiety were 2.349-times more vulnerable to GERD. Besides, acute stress can make the esophagus more permeable, which makes it easier for stomach acid to get to the esophageal nociceptors [25]. Thus, stress has a notable role in aggravating GERD symptoms expression. Study participants of this survey with subjective perception of stress were 2.255-times more prone to GERD. Individuals who had prior family history of GERD were 1.406-times more GERD sufferers in the work; but in some studies, the genetic component was a more intense contributing factor [18, 26].

The majority of reflux symptoms in GERD patients do arise during the postprandial phase, indicating a connection between the nature and quantity of the stomach contents and the likelihood of reflux. Although the exact process is unknown, spicy foods were shown to cause heartburn in many individuals. Fast food consumption is an important risk factor for acid reflux [27]. An experiment utilizing rodent model showed that intestinal barrier permeability is accelerated by prolonged use of processed foods. Thus, innate immune complement activation results from a processed diet, leading to worsening of the damaged area [28]. Logistic regression analysis in this study revealed that the odds for fast food consumption, eating sour and spicy food regularly, were OR = 1.613 (CI = 1.082–2.404) and OR = 1.610 (CI = 1.073–2.415), respectively.

Among dietary behaviors, slow eating habit was a significant lifestyle modification that has been shown to alleviate GERD symptoms [29]. In this study, the individuals with a quicker meal-taking habit were 1.845-times more susceptible to the disease. Gastric distention from a full stomach causes the lower esophageal sphincters to temporarily relax more, which leads to an increase in gastroesophageal reflux [30]. Eating beyond fullness put the study individuals 2.859-times more prone to GERD in this study. Eating warm meals was also a notable contributing dietary habit (OR = 1.477, CI = 0.996–2.192) to GERD symptoms occurrence, and the result was similar to the work of Yuan et al. [31]

Sleep quality plays a strong role in revealing GERD symptoms. Due to the influence of sleep stages on the esophago-upper

TABLE 6 | GERD with lifestyle, and behavioral considerations.

Variable	Group	GERD *N* (%)	Non-GERD *N* (%)	χ^2	*p* value (phi value)
Alcohol consumption	Yes	13 (50.0)	13 (50.0)	0.225	> 0.1
	No	170 (45.2)	206 (54.8)		
Smoking history	Nonsmoker	139 (45.1)	169 (54.9)	0.415	> 0.1
	Current smoker	38 (48.1)	41 (51.9)		
	Ex-smoker	6 (40.0)	9 (60.0)		
Taking painkillers (NSAIDs)	Yes	52 (61.2)	33 (38.8)	10.651	< 0.01 (0.163)
	No	131 (41.3)	186 (58.7)		
Inhaler user	Yes	19 (61.3)	12 (38.7)	3.368	> 0.05
	No	164 (44.2)	207 (55.8)		
Family history of GI disorder	Yes	135 (48.0)	146 (52.0)	2.391	> 0.1
	No	48 (39.7)	73 (60.3)		
Suffering from anxiety	Yes	138 (52.7)	124 (47.3)	15.506	< 0.001
	No	45 (32.1)	95 (67.9)		
Subjective perception of stress	Yes	141 (51.8)	131 (48.2)	13.529	< 0.001
	No	42 (32.3)	88 (67.7)		
Being most of your time alone	Yes	113 (50.0)	113 (50.0)	4.173	< 0.05 (0.102)
	No	70 (39.8)	106 (60.2)		
Late night sleeping habit	Yes	72 (52.6)	65 (47.4)	4.144	< 0.05 (0.112)
	No	111 (41.9)	154 (58.1)		
Suffering from poor sleep quality	Yes	110 (52.1)	101 (47.9)	7.852	< 0.01 (0.140)
	No	73 (38.2)	118 (61.8)		

esophageal sphincter contractile reflex or the reinforcement of intraesophageal acid sensing [32], a potential connection between GERD and sleep disturbances exists. A healthy sleep environment is crucial to preventing GERD symptoms. Besides, salivary production, conscious-dependent behavior while sleeping, and esophageal motility are some crucial sleep-related factors to influence the nocturnal GERD [33]. Hyperalgesia of the esophagus mucosa to stomach acid can be brought on by sleep deprivation [34]. In this study, poor sleep quality was significantly associated with GERD ($p = 0.005$), and individuals who were suffering from poor sleep patterns were 1.760-times more susceptible to GERD. It could be necessary to enhance sleep quality to reduce GERD symptoms.

Besides sleep quality, the interval between dinner and night sleep is also a remarkable consideration. The proportion of reflux time is much higher when there is less than 2 h between dinner and sleep than when there is more than 2 h between dinner and sleep (22.6% vs. 14.2%; $p = 0.012$) [35]. In the present work, the odds of lying down soon after having a meal were 1.561 (CI = 1.020–2.389).

4.1 | Limitations

Our study, like many others, has some drawbacks. The effect size indicates that although the association of GERD with different factors have been identified but the association is very poor. To produce a more precise result the sample size should be increased. Although the association has been poor, the clinical significance of the finding should not be overlooked. The study was mainly symptom-oriented, and the prevalence information would be more accurate if diagnostic tools could be used to determine GERD; but due to a lack of funding, it was not possible for the authors. Nevertheless, this study will provide an insight into the GERD causes and consequences of the condition.

5 | Conclusion

Gastroesophageal reflux disease (GERD) prevalence among Bangladeshi university-going students was determined, and the contributing factors to the disease were evaluated in this study. The work indicates that a large number of university-going students are GERD sufferers. Sociodemographic, lifestyle, dietary, and behavioral factors were significantly associated with the occurrence of GERD. Many of these contributing factors are modifiable, and positive modification of these factors can reduce the burden of the disease. The study also gives an insight about the disease. The respective authority can utilize the study findings to take necessary steps to reduce the morbidity and health-related costs caused by this disease as well as to develop an overall healthcare system.

TABLE 7 | Impact of the variables on the GERD occurrence.

Factors (yes/no)	Odds ratio (OR)	95% CI	
		Low	High
BMI (obese-overweight vs. normal or underweight)	1.340	0.895	2.00
Gender (female vs. male)	1.595	1.068	2.381
Marital status (married vs. unmarried)	1.448	0.746	2.808
Economic condition (surplus vs. balance or deficit)	0.628	0.305	1.307
Living area (Mess, hostel vs. family residence)	0.606	0.380	0.968
Academic year (masters vs. undergrad)	0.643	0.324	1.277
Age (above 25 vs. below 25)	0.897	0.529	1.52
Smoking habit	1.070	0.673	1.700
Alcoholism	1.212	0.547	2.684
Painkiller (NSAIDs) consumption	2.237	1.370	3.653
Inhaler use	1.998	0.943	4.236
Family history	1.406	0.912	2.168
Anxiety	2.349	1.529	3.611
Subjective perception of stress	2.255	1.456	3.494
Regular fried snacks consumption.	1.599	1.075	2.378
Sour and spicy food consumption	1.610	1.073	2.415
Fast food consumption	1.613	1.082	2.404
Sweet food consumption	0.779	0.525	1.154
Frequent tea/coffee consumption	0.571	0.429	1.050
Habit of heavy dinner	1.188	0.799	1.767
Pan masala chewing	1.112	0.494	2.501
Soft drink consumption	1.113	0.748	1.656
Citrous food consumption	0.957	0.636	1.441
Being most of the time alone	1.514	1.016	2.257
Quick eating habit	1.845	1.240	2.745
Eating beyond fullness	2.859	1.811	4.515
Eating warm food frequently	1.477	0.996	2.192
Lying down soon after having dinner	1.561	1.020	2.389
Late night sleeping habit	1.537	1.015	2.327
Poor sleep quality	1.760	1.183	2.620

Author Contributions

Tashfia Hossain: writing – original draft, investigation, methodology. **Ipshita Fariha Mahmood:** writing – original draft, investigation. **Md Sabbir Hossain:** conceptualization, investigation, writing – original draft, writing – review and editing, supervision, methodology. **Nazifa Tabassum:** investigation, software, data curation, formal analysis, writing – review and editing, writing – original draft. **Sowkat Jahan Shipa:** investigation, writing – review and editing, writing – original draft. **Md Raihan Sarkar:** writing – review and editing, supervision, conceptualization.

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Ethics Statement

The work was approved ethically by the University of Dhaka's Faculty of Pharmacy's ethical review committee.

Consent

After being informed of the goal and methodology of the study, each participant granted their permission to take part in the study.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

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

Transparency Statement

The lead author Md. Sabbir Hossain affirms that this manuscript is an honest, accurate, and transparent account of the study being reported; that no important aspects of the study have been omitted; and that any discrepancies from the study as planned (and, if relevant, registered) have been explained.

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