RESEARCH NOTE

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The association between GERD symptoms severity and psychosocial health in palestine: a cross-sectional study

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Abstract

Objective This study aimed to investigate the relationship between GERD and mental health status, alongside lifestyle factors and eating patterns among Palestinian adults.

Results In this study, 144 participants with GERD were analyzed. GERD symptom severity was categorized into three groups: mild (35.4%), moderate (32.0%), and severe (32.6%), according to the GERD-HRQOL. Multiple linear regression analysis revealed that sleeping problems are the only predictor of GERD symptoms severity (B = 3.785, 95% confidence interval = 0.712–6.857, p = 0.016).

Keywords GERD, Sleep problems, Psychological distress, Eating patterns

Introduction

GERD is a condition that develops when the reflux of stomach contents causes troublesome symptoms and/or complications [1]. The pathophysiology of GERD is complex and involves changes in reflux exposure, epithelial resistance, and visceral sensitivity. The exposure to the gastric refluxate, which is a noxious material that injures the esophagus and elicits symptoms, is the primary determinant of the disease severity [2]. However, recent literature suggests that the cornerstone for GERD treatment includes lifestyle modifications [3], pharmacologic treatment using antacids, mucosal protectants, histamine$_2$-receptor antagonists, and proton pump inhibitors (PPI). In addition, endoscopic techniques are an alternative approach in GERD treatment, while surgical treatments can mechanically augment the anti-reflux barrier and include anti-reflux surgery, magnetic sphincter augmentation systems, and gastric bypass [4].

GERD affects 13.98% of the global population, with the highest global prevalence in the Middle East, where it exceeds 20% of the population [5]. However, an increased incidence was noticed among adults aged at least 50 years, smokers, and those with obesity [6]. In addition, prevalence varied according to sex, yielding an increased rate of GERD among males compared to females [7]. Although there is a universal agreement on the definition of GERD and its risk factors are largely consistent, its prevalence rates vary due to numerous factors, such as the accessibility of over-the-counter antacid medications. Patients with GERD commonly report heartburn or retrosternal burning and regurgitation symptoms.

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However, it also manifests with atypical symptoms, including water brash, chest pain, chest discomfort, dysphagia, belching, epigastric pain, nausea, and bloating [3]. In addition, GERD has been associated with numerous illnesses, including cancer, cardiovascular disorders, and psychological concerns [8]. Clinical studies have confirmed that GERD can induce anxiety and depression; conversely, psychological disorders can also precipitate reflux symptoms [9].

Research on gastrointestinal disorders and biopsychosocial aspects of GERD patients suggests a direct bidirectional relationship between various symptoms of GI distress and their impact on cerebral function and responses, including brain-gut processing and visceral hypersensitivity. This underscores a continuous bidirectional hormonal interaction between the central nervous system and the GI tract, manifesting as a direct relationship between GI stressors and heightened emotional and behavioral responses [10]. Furthermore, patients with GERD exhibit an increased risk of developing depression and anxiety [11, 12], with a fold of 1.7 [12].

Despite the extensive research on GERD, existing literature failed to establish or explain the relationship between GERD and psychological well-being or eating pattern abnormalities. Therefore, this work aims to investigate this relationship among a representative sample, with special focus on GERD determinants.

Methods and participants

Study design and population

A cross-sectional study was conducted among GERD patients at two private gastroenterology clinics in Nablus, West Bank, Palestine. Participants who were included in this study were GERD patients who were at least 18 years old and diagnosed by a gastroenterologist. Exclusion criteria included participants with other GI disorders (ulcers, celiac, IBD, etc.), participants with confirmed psychiatric disorders, and those who have incomplete responses or invalid data.

Sample size

Sample size was calculated using the G*Power (Version 3.1) software to determine the relationship between GERD severity and psychological distress and lifestyle factors. To estimate sample size, we used a moderate effect size of Cohen's d of 0.5, a level of significance or type I error of 0.05 (5%), and a power or type II error (1-β) of 0.8 (80%). The formula underlying this calculation in G*Power is based on the following standard formula for detecting differences between two independent group means: $n = (2*(Z_{1-\alpha/2}+Z_{1-\beta})^2) / d^2$, where n is the sample size per group, $Z_{1-\alpha/2}$ is the Z-score for the desired significance level (e.g., 1.96 for $\alpha = 0.05$, two-tailed), $Z_{1-\beta}$ is the Z-score for the desired power (e.g., 0.84 for 80%

power), and d is the Cohen's d, the expected effect size (e.g., 0.5 for moderate) [13]. Accordingly, a total of 129 participants is the minimum required sample size. Given the dropout owing to missing data, the sample size was increased to include at least 140 participants.

Data collection and research tools

Data was collected from February to July 2023, skipping the fasting month of Ramadan. Participants were recruited through convenient sampling and a face-to-face based survey. Data was collected using printed, structured questionnaires from two private gastroenterology clinics in Nablus City, Palestine. Each participant voluntarily participated, provided informed written consent, and received study objectives. All information was confidential and used only for research purposes.

The collected data included sociodemographic, lifestyle, medical, and nutritional history; GERD symptom severity; meal patterns; psychological disorders; and adherence to the Mediterranean diet.

Demographic data included age, gender, educational level, marital status, number of family members, place of living (city, village, or camp), living status (with spouse, family, or alone), working condition, and economic status. Medical history included data related to chronic diseases, medications used, any previous surgical procedures, the age at which GERD was diagnosed, and the duration of the disease. In addition, lifestyle characteristics included data about smoking history, such as smoking status (yes or no), type of smoking (cigarettes, bubbly), changes in smoking habits after GERD diagnosis (yes or no), and pattern of change (decrease in the amount, change the type, stop, then return). It also contains sleeping habits-related data, including bedtime, wake-up time, duration of sleep, sleep problems, and type of sleep problem (insomnia, sleep apnea, others).

Nutritional-related information included height, weight, source of nutritional information (dietitian, physician, healthcare worker, or others), and methods of searching for nutritional information (ask a nutritionist, physician, or health worker; search in books, scientific publications, or the internet).

Gastrointestinal reflux Disease-Health related quality of life (GERD-HRQOL) questionnaire

The validated Gastrointestinal Reflux Disease-Health Related Quality of Life (GERD-HRQOL) questionnaire was used to measure the severity of GERD symptoms, including heartburn, regurgitation, and their impact on life quality. It is an 11-item instrument; 10 items are scale-related and contribute to the overall GERD-HRQL assessment. Item 11 is a global item related to patient satisfaction [14].

The meal pattern questionnaire (MPQ)

The meal pattern questionnaire (MPQ) is an instrument that is used to assess eating patterns. It is a questionnaire with seven items, one for each day's meal or snack plus nightly eating. Each item is scored on a seven-point Likert scale from 0 to 6 [15].

The general health questionnaire (GHQ)

The General Health Questionnaire (GHQ) is a self-report screening measure used to detect possible psychological disorders using a 4-point Likert-type scale (from 0 to 3). A score ranging from 0 to 36 was used to generate a total score, with a score exceeding the threshold value of 16 was classified as having mental distress [16].

The mediterranean diet adherence scale (MEDAS)

The Mediterranean Diet Adherence Scale (MEDAS) is a validated tool to measure the level of adherence to the Mediterranean diet. It contains 14 items about dietary behavior; the answer is yes or no. The total score is 14, ranging from 1 to 14, and a MEDAS score greater than 9 indicates high adherence to the Mediterranean diet [17].

Statistical analysis

We used the Statistical Package of Social Sciences program (SPSS) version 25 to analyze the data. Descriptive summary measures, including mean and standard deviation, were used for expressing continuous variables, and percentages were used for categorical variables. Median and interquartile range (IQR) scores are reported to reflect central tendency and dispersion, given the non-normal distribution of HRQOL scores. For the univariate analysis, the Mann-Whitney U test, the Kruskal-Wallis test, and the correlation test were used where appropriate, whereas multiple linear regression analysis was used for multivariable analysis. The level of significance was set at a p-value < 0.05, and the confidence intervals (CI) was 95%.

Results

Sociodemographic, medical history, and lifestyle characteristics

A total of 144 participants were included in the final analysis. The mean age of participants was 34.8 ± 12.9. The majority of participants were females (61.8%), and the mean family member was 5 ± 2, as shown in Table 1.

The mean duration since starting smoking was 11.2 ± 9.5 years. Among participants, 38.9% were smokers and 45.1% were having sleep problems, with insomnia representing the most common sleeping issue (57.4%), as shown in Table 2.

GERD-related data

The mean age at which GERD was diagnosed was 29.9 ± 11 years, with a mean duration of 4.6 ± 6.5 years. According to the GERD-HQROL score results, GERD severity was categorized into three groups: mild, moderate, and severe, with a cut score of 0–9 for mild, 9–16 for moderate, and ≥ 17 for severe (Fig. 1a). In addition,

Table 1 Demographic information and general characteristics of the participants

Variable		*n* (%)
Gender	Male	55 (38.2%)
	Female	89 (61.8%)
Marital status	Unmarried	24 (16.7%)
	Married	120 (83.3%)
Mean income	Less than 1500 NIS	12 (8.3%)
	1500–3000 NIS	28 (19.4%)
	3000–5000 NIS	80 (55.6%)
	Above 5000 NIS	24 (16.7%)
Place of living	City	70 (48.6%)
	Town\village	74 (51.4%)
Living status	With spouse	58 (40.3%)
	With family	85 (59.0%)
	Alone	1 (0.7%)
Educational level	School level	41 (28.5%)
	Undergraduate level	91 (63.2%)
	Postgraduate level	12 (8.3%)
Work status	Full-time	69 (47.9%)
	Part-time	14 (9.7%)
	Not working	59 (41.0%)
	Retired	2 (1.4%)

Abbreviations; NIS: New Israeli shekel

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Table 2 Medical history and lifestyle characteristics

Variable		*n* (%)
Smoker	Yes	56 (38.9%)
	No	88 (61.1%)
Smoke type	Cigarettes	47 (32.6%)
	Bubbly	9 (6.3%)
Changing smoking habits after diagnosis	Yes	17 (11.8%)
	No	46 (31.9%)
Changing pattern	Decreased the amount	12 (8.3%)
	Changed the type	3 (2.1%)
	Stop then return	2 (1.4%)
Bed time	Before 7 pm	6 (4.2%)
	7–9 pm	16 (11.1%)
	After 9 pm	122 (84.7%)
Wake up time	6 am or before	56 (38.9%)
	7–9 am	54 (37.5%)
	After 9 am	34 (23.6%)
Duration of sleep during the day	<6 h	27 (18.8%)
	6–8 h	99 (68.8%)
	>8 h	18 (12.5%)
Chronic disease	Yes	19 (13.2%)
	No	125 (86.8%)
Surgery	Yes	53 (36.8%)
	No	91 (63.2%)
Sleep problem	Yes	65 (45.1%)
	No	79 (54.9%)
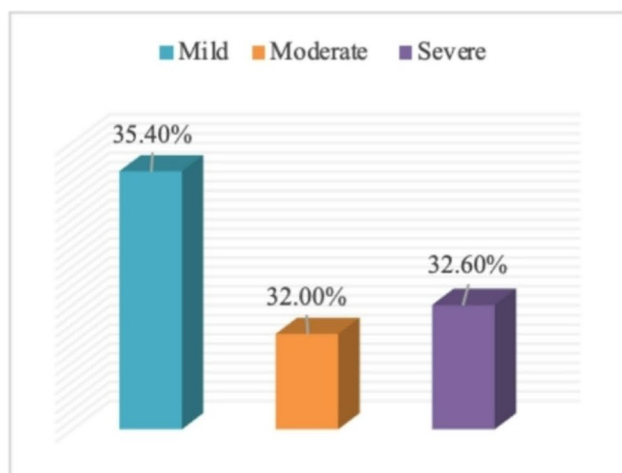
(a)
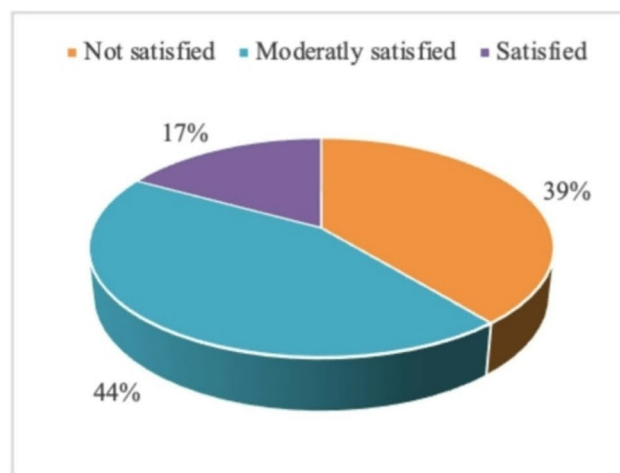
(b)

Fig. 1 **(a)** GERD severity, **(b)** Participants' life satisfaction

participants' global satisfaction is categorized into not satisfied, moderately satisfied, and satisfied (Fig. 1b).

Nutritional characteristics
Table 3 shows that 63.2% of participants did receive nutritional information, with 41.0% coming from a physician. In addition, 54.2% of participants showed moderate adherence to the Mediterranean diet.

Relationship between HRQOL score and study variables
No significant association was found between the HRQOL score and demographic or medical history. A significant association was found between HRQOL

Table 3 Nutritional characteristics

Variable		n (%)
Receive nutritional information	Yes	91 (63.2%)
	No	53 (36.8%)
Source of nutritional information	Nutritionist	29 (20.1%)
	Physician	59 (41.0%)
	Health worker	7 (4.9%)
	Books or scientific publication	4 (2.8%)
	Internet	45 (31.3%)
BMI	Underweight	8 (5.6%)
	Normal weight	55 (38.2%)
	Overweight	51 (35.4%)
	Obese	30 (20.8%)
Adherence to Mediterranean diet (MEDAS)	Low adherence	25 (17.4%)
	Moderate adherence	78 (54.2%)
	High adherence	41 (28.5%)

Abbreviations; BMI: Body mass index, MEDAS: Mediterranean Diet Adherence Screener

and sleep problems ($P = 0.004$). However, no significant association was found between HRQOL and other lifestyle- or nutrition-related data. A significant association was found between HRQOL and psychological disorder ($P = 0.027$), as shown in Table 4. Nevertheless, a Mann–Whitney U test revealed a statistically significant difference in GERD-HQRL scores between participants with and without sleep problems (U = 1844, z=-2.91, $p = 0.004$). A significant difference was also found based on psychological well-being status (U = 582, z=-2.21, $p = 0.027$).

However, when adjusting for multiple comparisons using the Bonferroni correction (adjusted alpha = 0.025), only the association with sleep problems remained statistically significant. The association with psychological well-being may not remain significant under this stricter threshold.

Correlation between GERD severity and continuous variables

No significant correlation was found between HRQOL and continuous variables, including age, age at diagnosis, duration of diagnosis, or first mealtime (Table 5).

A multiple linear regression analysis was conducted to assess the relationship between several predictors and GERD severity. The model was statistically significant ($p = 0.036$, with R-squared = 0.103. Among the predictors, only sleeping problems showed a statistically significant association with GERD symptom severity (B = 3.785, 95%CI = 0.712–6.857, $p = 0.016$). Other factors, including age, BMI, gender, and psychological well-being, were not significant predictors, as shown in Table 6.

Discussion

This study aimed to evaluate the gastrointestinal reflux disease (GERD) and psychosocial health among adult participants. The findings of this study contribute to the

growing evidence indicating that GERD is not only a gastrointestinal-related issue but is also associated with behavioral and physiological factors.

In this study, the majority of participants were young adults, with a mean age of disease onset of 29 years old. This aligns with previous findings that revealed that cases with GERD were more likely to have the onset of GERD symptoms before 30 years old [18], reflecting the recent epidemiological changes regarding disease onset over the last decade, whereas a significant increase was found in the proportion of younger adults with GERD, especially those within the age range of 30–39 years, suggesting that younger subjects are more exposed today to risk factors for GERD development [19], which might be attributed to recent lifestyle and eating pattern changes.

One of the key findings in this study is the significant association between HRQOL and participants' psychological well-being, suggesting poorer mental health among GERD patients with more severe symptoms. This agrees with recent findings indicating that GERD patients with depression and anxiety had significantly poorer HRQOL than their counterparts [8], while GERD severity was significantly associated with decreased quality of life among GERD patients [20]. Psychological distress can heighten esophageal sensitivity, which affects the brain-axis and alters neuroendocrine functioning, contributing to the development of GERD [21]. On the other hand, psychological factors, such as anxiety and depression, can affect the severity of GERD symptoms by both lowering the sensory threshold in the human body and increasing esophageal stimulation [22]. The bidirectional relationship between GERD and psychological well-being necessitates the need for targeted interventions for mental health screening and the implementation of strategies to improve their psychological well-being. However, although psychological distress was associated with lower

Table 4 Relationship between HRQOL score and study variables

Variable		Median (IQR)	*P*-value
Demographic			
Gender	Male (*n* = 55)	12.0 (11.0)	0.244[a]
	Female (*n* = 89)	14.0 (13.5)	
Marital status	Unmarried (*n* = 24)	10.0 (13.8)	0.220[a]
	Married (*n* = 120)	13.0 (12.8)	
Medical history			
Chronic diseases	Yes (*n* = 19)	15.0 (10.0)	0.271[a]
	No (*n* = 125)	12.0 (42.0)	
Lifestyle data			
Smoking status	Yes (*n* = 56)	13.0 (10.8)	0.972[a]
	No (*n* = 88)	12.5 (13.0)	
Sleep problems	Yes (*n* = 65)	15.0 (12.0)	0.004[a]*
	No (*n* = 79)	11.0 (12.0)	
Duration of sleep	< 6 h (*n* = 13)	17.0 (14.5)	0.933[b]
	6–8 h (*n* = 28)	16.5 (12.3)	
	> 8 h (*n* = 6)	13.5 (7.3)	
Wake up time	6 am or before (*n* = 56)	12.0 (12.8)	0.938[b]
	7–9 am (*n* = 54)	12.5 (13.0)	
	After 9 am (*n* = 34)	14.0 (12.5)	
Bed time	before 7 pm (*n* = 6)	6.5 (16.3)	0.412[b]
	7–9 pm (*n* = 16)	12.0 (9.3)	
	After 9 pm (*n* = 122)	13.0 (13.0)	
Nutritional history			
BMI	Normal (*n* = 19)	14.5 (15.0)	0.151[b]
	Overweight (*n* = 20)	11.2 (11.08)	
	Obese (*n* = 8)	11.0 (8.5)	
Adherence to Mediterranean diet (MEDAS)	Low (*n* = 8)	18.5 (23.8)	0.969[b]
	Medium (*n* = 25)	15.0 (14.5)	
	High (*n* = 14)	17.5 (11.5)	
Psychological well-being			
Psychological distress (GHQ)	Yes (*n* = 14)	16.5 (11.0)	0.027[a]*
	No (*n* = 130)	12.0 (12.8)	

[a] using Mann Whitney u test, [b] Kruskal-Wallis test, * Significant at $P \leq 0.05$, ≤ 0.01, or ≤ 0.001. Abbreviations; BMI: Body mass index, MEDAS: Mediterranean Diet Adherence Screener, GHQ: General Health Questionnaire

Table 5 Correlation coefficients of HRQOL

		Age	Age at diagnosis	Duration of diagnosis	First mealtime	MPQ
HRQOL	Spearman Correlation	-0.082	-0.036	-0.133	0.023	-0.114
	P-value	0.331	0.670	0.111	0.780	0.173

Abbreviations; HRQOL: health-related quality of life, MPQ: Meal Pattern Questionnaire

Table 6 Multiple linear regression model for determinants of GERD severity

Factors	Beta (95% CI)	B	*P*-value [a]	*R* square	*P*-value [b]
Age	-0.098 (-0.205–0.068)	-0.068	0.323	0.103	**0.036***
Gender (Male vs. Female)	0.004 (-3.194–3.340)	0.073	0.965		
Smoking status	-0.056 (-4.165–2.118)	-1.024	0.520		
Sleeping problems	0.210 (0.712–6.857)	3.785	**0.016***		
BMI category	-0.144 (-3.363–0.359)	-1.502	0.113		
Chronic diseases	0.122 (-1.627–8.090)	3.232	0.191		
Psychological well-being	0.073 (-2.881–7.302)	2.211	0.392		

[a]Significance for each variable. [b]Significance of the overall model. *Significant at $p < 0.05$. B: Unstandardized regression coefficient. Beta (95% CI): Standardized coefficient (95% confidence interval)

GERD severity in univariate analysis, this association did not remain significant in the multivariable model. This suggests that its effect may be mediated by other factors, warranting further investigation.

Among lifestyle factors, approximately half of GERD patients who participated in this study have reported having sleeping problems, with insomnia representing the highest percentage. Accordingly, sleeping problems showed a significant association with a lower HRQOL score, indicating that sleeping problems worsen GERD symptoms. Moreover, a significant connection was also discovered between sleeping problems and GERD severity symptoms, using linear regression analysis, which indicates that as sleeping problems increase, the GERD severity score increases. Evidence suggests that poor sleep quality can exacerbate reflux incidents and increase acid contact time [23]. While the underlying mechanism pointing out the reciprocal influence between GERD and sleeping disturbances remains poorly understood, numerous explanations are suggested. Acid reflux abnormalities can induce esophageal pain and disrupt sleep, while simultaneous sleep deprivation can intensify esophageal sensitivity and aggravate this effect. In addition, hormonal change could influence both GERD and sleep issues, at which melatonin hormone can suppress the biosynthesis of nitric oxide, reducing transient lower esophageal sphincter relaxations and mitigating GERD morbidity. Furthermore, psychological aspects are influential since mucosal damage results from a combination of inflammatory and immune responses, which are linked to depression, acting as a mediator between GERD and sleep issues [24]. Therefore, improving sleeping hygiene is an important aspect to consider and include in GERD treatment protocol to present a better quality of life for individuals with GERD.

However, no statistical significance was found between GERD symptom severity and other lifestyle factors, medical-related data, or nutritional characteristics, including adherence to the Mediterranean diet or meal pattern. Nevertheless, it is worth noting that 54.2% of participants moderately adhered to the Mediterranean diet, which is known for its anti-inflammatory effect on gastrointestinal health [25], but their adherence did not translate into a statistically significant relationship in our study. This variation could be attributed to dietary interpretation differences and confounding variables.

Limitations

This study has few limitations, including the cross-sectional design, which limits the ability to establish a causal effect between study variables. In addition, the self-reported data make this study prone to reporting bias. Selection bias is a potential limitation of this study since participants were recruited from private clinics, as individuals attending these clinics are more likely to have higher socioeconomic status and better access to healthcare services. Moreover, the GERD-HRQL cannot measure atypical symptoms, like respiratory or laryngeal symptoms or chest pain, independently of heartburn. Furthermore, the sample size is relatively small; thus, more prospective future studies at larger sample sizes are recommended, as well as including participants from diverse clinical settings, including public hospitals, to improve the generalizability and representativeness of the findings. However, this study provided valuable information about the psychological dimensions of GERD in the Middle East, where such data is limited.

Conclusion

In conclusion, GERD patients are more likely to develop abnormalities in their psychological well-being and sleeping patterns, with sleep problems emerging as the only significant predictor of GERD severity. The findings of this study underscore that GERD management should be beyond symptom control only to include psychological evaluation, psychological support, and lifestyle modification to yield better quality of life and health outcomes.

Declarations

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participating individuals. The data was kept with the research team; only anonymized data were seen by the researchers.

Ethical considerations
The study was approved by the ethics committee of Hospital Universitario La Paz. All participants signed the informed consent form.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

References
1. Vakil N, Van Zanten SV, Kahrilas P, Dent J, Jones R, Bianchi LK, et al. The Montreal definition and classification of gastroesophageal reflux disease: A global evidence-based consensus. Am J Gastroenterol. 2006;101:1900–20.
2. Tack J, Pandolfino JE. Pathophysiology of gastroesophageal reflux disease. Gastroenterology. 2018;154:277–88.
3. Sandhu DS, Fass R. Current trends in the management of gastroesophageal reflux disease. Gut Liver. 2018;12:7–16.
4. Ronnie F. Gastroesophageal reflux disease. N Engl J Med. 2022;387:1207–16.
5. Nirwan JS, Hasan SS, Babar Z-U-D, Conway BR, Ghori MU. Global prevalence and risk factors of Gastro-oesophageal reflux disease (GORD): systematic review with Meta-analysis. Sci Rep. 2020;10:5814.
6. Eusebi LH, Ratnakumaran R, Yuan Y, Solaymani-Dodaran M, Bazzoli F, Ford AC. Global prevalence of, and risk factors for, gastro-oesophageal reflux symptoms: a meta-analysis. Gut. 2018;67:430–40.
7. Nilsson M, Johnsen R, Ye W, Hveem K, Lagergren J. Prevalence of gastro-oesophageal reflux symptoms and the influence of age and sex. Scand J Gastroenterol. 2004;39:1040–5.
8. Alwhaibi M. Anxiety and depression and Health-Related quality of life in adults with gastroesophageal reflux disease: A Population-Based study. Healthc. 2023;11.
9. He M, Wang Q, Yao D, Li J, Bai G. Association between psychosocial disorders and gastroesophageal reflux disease: A systematic review and Meta-analysis. J Neurogastroenterol Motil. 2022;28:212–21.
10. Van Oudenhove L, Crowell MD, Drossman DA, Halpert AD, Keefer L, Lackner JM, et al. Biopsychosocial aspects of functional Gastrointestinal disorders. Gastroenterology. 2016. https://doi.org/10.1053/j.gastro.2016.02.027.
11. Zeng Y, Cao S, Yang H. The causal role of gastroesophageal reflux disease in anxiety disorders and depression: A bidirectional Mendelian randomization study. Front Psychiatry. 2023;14:1135923.
12. Abo Alabbas, Metwaly M, ELSheref, Saad Eldeen M, Berengy MS. Depression and anxiety in patients with persisting gastroesophageal reflux disease. Glob J Curr Res. 2019;6:144–8.
13. Cohen J. Statistical power analysis for the behavioral sciences. Rev. ed. New York: Lawrence Erlbaum Associates; 1988.
14. Velanovich V. The development of the GERD-HRQL symptom severity instrument. Dis Esophagus Off J Int Soc Dis Esophagus. 2007;20:130–4.
15. Alfonsson S, Sewall A, Lidholm H, Hursti T. The meal pattern questionnaire: A psychometric evaluation using the eating disorder examination. Eat Behav. 2016;21:7–10.
16. Petkovska MS, Bojadziev MI, Stefanovska VV, Reliability. Validity and factor structure of the 12-Item general health questionnaire among general population. Open Access Maced J Med Sci. 2015;3:478–83.
17. Gregório MJ, Rodrigues AM, Salvador C, Dias SS, de Sousa RD, Mendes JM et al. Validation of the Telephone-Administered version of the mediterranean diet adherence screener (MEDAS) questionnaire. Nutrients. 2020;12.
18. Bakr O, Zhao W, Corley D. Gastroesophageal reflux frequency, severity, age of onset, family history and acid suppressive therapy predict Barrett esophagus in a large population. J Clin Gastroenterol. 2018;52:873–9.
19. Yamasaki T, Hemond C, Eisa M, Ganocy S, Fass R. The changing epidemiology of gastroesophageal reflux disease: are patients getting younger?? J Neurogastroenterol Motil. 2018;24:559–69.
20. Bulqaini AA, Darmadi. Relationship between degrees of severity gastroesophageal reflux disease (Gerd) with quality of life. J Endocrinol Trop Med Infect Dis. 2023;4:96–103.
21. Ahmed HAA, Yousef A, El-Kurdy R, Murad MA, Abdelwahab SM, Shiba HAA. Psychological factors, lifestyle habits, and their association with gastroesophageal reflux disease among Egyptian university students: A cross-sectional study. Med (United States). 2024;103:e40477.
22. Özenoğlu A, Anul N, Özçelikçi B. The relationship of gastroesophageal reflux with nutritional habits and mental disorders. Hum Nutr Metab. 2023;33 May.
23. Hung J-S, Lei W-Y, Yi C-H, Liu T-T, Chen C-L. Association between nocturnal acid reflux and sleep disturbance in patients with gastroesophageal reflux disease. Am J Med Sci. 2016;352:141–5.
24. Tan X, Wang S, Wu F, Zhu J. Bidirectional correlation between gastroesophageal reflux disease and sleep problems: a systematic review and meta-analysis. PeerJ. 2024;12:1–19.
25. Komolafe K, Komolafe TR, Crown OO, Ajiboye B, Noubissi F, Ogungbe IV et al. Natural products in the management of gastroesophageal reflux disease: mechanisms, efficacy, and future directions. Nutrients. 2025;17.

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