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Nationwide Survey Reveals Psychological Distress Often Preceded IBS and GERD among Young Saudis after COVID-19, Suggesting Possible Gut-Brain Microbiome Dysbiosis

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Abstract **Objectives:** Psychological distress is associated with Disorders of Gut-Brain Interaction (DGBIs), including Irritable Bowel Syndrome (IBS) and Gastroesophageal Reflux Disease (GERD). This nationwide post-COVID study assessed whether mental health symptoms preceded IBS/GERD and examined associations with age, sex, work status and family history. **Methods:** A cross-sectional online survey was conducted in Saudi Arabia between August 2022 and July 2023 among adults aged ≥18 years. Participants completed a structured questionnaire covering demographics, self-reported IBS, GERD, anxiety, depression, stress, timing of symptom onset, family history, treatment and outdoor activity. Data were analyzed using SPSS v23, with associations tested using Pearson's χ^2 (α = 0.05). **Results:** Among 2,067 respondents, 72.4% were women, 66.0% were aged 18-29 years and 53.2% were students. Psychological symptoms were reported by 60.7%, IBS by 48.7% and GERD by 36.3%. Psychological symptoms were the most commonly first-noticed condition (~51%), compared with IBS (33.9%) and GERD (24.3%). Significant differences were observed across age, sex and employment status ($p<0.001$). GERD prevalence increased with age, IBS peaked in middle age, while psychological symptoms were highest among younger participants and students. Women reported more IBS and psychological symptoms, whereas men reported more GERD. **Conclusions:** In this post-pandemic Saudi cohort, psychological distress commonly preceded or accompanied IBS and GERD, particularly among younger individuals. These findings highlight the importance of early mental health screening and integrated care approaches for DGBIs. Longitudinal studies are needed to clarify temporal relationships and underlying mechanisms.

Key Words Neuro-Gastroenteritis, IBS, GERD, Mental-Health, Post-SARS-CoV2-Symdromes

INTRODUCTION

Disorders of Gut-Brain Interaction (DGBIs), notably irritable bowel syndrome (IBS) and acid-related conditions such as gastro-oesophageal reflux disease (GERD), account for substantial global symptom burden and health-care use. Rome IV formalized DGBIs as disorders arising from bidirectional disturbances across the brain-gut-microbiome axis, integrating motility, visceral hypersensitivity, mucosal/immune changes, altered microbiota and central processing [1,2]. The COVID-19 pandemic added a new layer: a growing literature links SARS-CoV-2 with persistent gastrointestinal (GI) sequelae and dysbiosis months after infection [3].

Globally, IBS prevalence varies with diagnostic criteria: Pooled estimates are ~9% using Rome III and lower with Rome IV, with pronounced regional heterogeneity [4]. In the United States under Rome IV, recent nationwide data indicate ~5% prevalence, underscoring the diagnostic shift between Rome eras [5]. GERD is similarly common; meta-analyses place global symptomatic prevalence around 14% with marked between-country variation [6]. Mechanistically, both conditions intersect with the brain-gut-microbiota axis, where microbial signals modulate emotion, stress circuitry and nociception-pathways plausibly perturbed by viral infections and psychosocial stressors [7-9].

Psychiatric comorbidity is frequent: Meta-analyses show that anxiety and depression approximately double the subsequent risk of incident IBS and IBS cases exhibit higher levels of both than controls [10,11]. Psychosocial disorders are also associated with GERD symptoms and poorer response to therapy [12]. During the pandemic, population-level anxiety/depression rose globally and across Saudi cohorts, particularly among students and young adults-groups heavily represented in GI symptom studies [13-15].

Epidemiology in Saudi Arabia is notable. A 2023 systematic review estimated IBS prevalence at ~21% nationally, higher than many western cohorts under Rome IV [16]. GERD prevalence in Saudi adults spans roughly 20-45% across contemporary cross-sectional studies, with diet, NSAID use, smoking and fast food intake repeatedly implicated [17]. Regional data also document substantial GERD-IBS overlap and quality-of-life impact, mirroring international findings [18]. Sex and age patterns are consistent with international literature: IBS disproportionately affects women-particularly IBS-C-while erosive reflux complications are often male-predominant even as symptom prevalence rises with age [12,19]. Genetics contributes modestly to IBS risk, with twin/family aggregation and GWAS revealing shared architecture with mood/anxiety traits and female-specific loci, reinforcing the gut-brain link [12-21].

Against this backdrop, we examined whether mental-health symptoms (anxiety, stress, depression) preceded or accompanied neuro-gastroenterological disorders (IBS, GERD) in a large, nationwide Saudi sample recruited in the post-acute COVID-19 period and how age, sex, work status and family history related to this triad. We hypothesized that psychological symptoms would be common antecedents, particularly among young women and students, consistent with regional mental-health trends and global brain-gut models [14].

METHODS

Study Design and Reporting

We performed an observational, cross-sectional, descriptive survey of adults in Saudi Arabia to estimate the frequency and co-occurrence of self-reported GI disorders (IBS, GERD) and mental-health symptoms (anxiety, depression, stress) and to examine their temporal sequence ("since childhood," "during adulthood," "recently"). The study followed STROBE recommendations for observational studies and where applicable, CHERRIES guidance for web surveys. Data were collected with a secure online questionnaire and analyzed according to a prespecified plan (sections 2.5-2.7).

Setting and Period

The survey was coordinated by the College of Medicine (Departments of Internal Medicine and Pathology), University of Ha'il, Saudi Arabia. Invitations were circulated nationally during 1 August 2022-31 July 2024, a period coinciding with widespread post-pandemic mental-health concerns. To reduce geographic clustering, reminders were sent to under-represented regions after the first circulation. To mitigate gender-access differences, comparable numbers of invitations were targeted to male- and female-dominated venues at times appropriate for each group.

Eligibility Criteria

Inclusion criteria were: (i) Age ≥18 years; (ii) Current residence in any province of Saudi Arabia and (iii) Ability to read and complete the online questionnaire. Exclusion criteria were: (i) Report of prolonged residence outside Saudi Arabia at the time the relevant disorder first developed; (ii) Age <18 years and (iii) Self-reported GI diagnoses other than IBS or GERD that could confound classification (e.g., IBD), when explicitly indicated by the respondent.

Recruitment, Consent and Questionnaire Flow

Invitations were distributed through institutional and community channels with a survey link. The landing page provided the study purpose, voluntary nature, anonymity and data-use statement. Respondents were required to confirm consent and age ≥18 years before any other items became visible. The survey used simple branching: core demographics were followed by disorder modules. Where noted in the tables, items allowed multiple selections (e.g., "Participants could select multiple disorders"). For sub-questions (e.g., "If yes, which disease was in the family?"), denominators were restricted to those who answered "Yes" to the parent item and this rule was preserved during analysis.

Measures and Variable Definitions

The web questionnaire captured fixed-choice responses mapped directly to the categories displayed in Table 1-3. Demographic/context variables included age, sex, nationality and work status. Age was entered in years and analyzed in five prespecified bands (18-29, 30-39, 40-49, 50-59, ≥60). Sex was recorded as male or female; nationality as Saudi or non-Saudi and work status as student, working or not working. Primary disorder variables comprised self-reported presence (Yes/No) of IBS, GERD and the three mental-health symptoms-anxiety, depression and stress-each collected as separate Yes/No items. For timing, respondents indicated the first occurrence ("onset") of each disorder category-GERD, depression, anxiety, stress and IBS-choosing one of three mutually exclusive options: Since childhood, during adulthood or recently (as shown in Table 3); "recently" was interpreted exactly as selected by the respondent without imposing an external time window. Family history/aggravating factors were assessed with an initial Yes/No item ("Genetic/Family history present?"); if Yes, a follow-on prompt asked which condition(s) occurred in the family, with selectable options for IBS, depression/anxiety/stress and GERD. Patient management and lifestyle items included whether the participant had received any treatment (Yes/No), whether they had ever

undergone colectomy or a colostomy (Yes/No) and whether they engage in outdoor activity or sport (Yes/No); the sports/activity variable used in Table 2 derives from the same underlying question. For perceived links between GI and mental-health symptoms, respondents first indicated whether they experienced depression/anxiety/stress since GERD/IBS onset (Yes/No); those answering Yes were then asked to attribute the association to IBS and/or GERD (multi-select). Additional factors used in Table 2 were recorded as surgical history (Yes/No) and sports/activity (Yes/No). Items that explicitly allowed multiple selections were coded as separate binary indicators for each option (1 = selected, 0 = not selected). Sub-questions were only displayed after an affirmative response to the parent item and in analyses the denominators for such sub-questions were restricted to those who answered Yes to the parent (as noted under Table 1). All category labels were retained verbatim in the dataset to ensure a one-to-one correspondence between the instrument and the tabulated results.

Data Management and Quality Control

Raw responses were exported to IBM SPSS Statistics v23. Prior to analysis, the dataset was screened for: (i) Missing or inconsistent age/consent (excluded listwise); (ii) Logical consistency across branched items (e.g., sub-questions only present when parent "Yes"-responses violating the skip pattern were set to missing) and (iii) Obviously incomplete submissions (records with no demographic data and no disorder responses were dropped). For multi-select items, each selection was coded as a binary variable (0/1). For sub-questions, denominators followed the note in Table 1 ("calculated based on the number of respondents who answered 'Yes' to the preceding question"). Missing data were handled by pairwise deletion for descriptive percentages and by available-case analysis for cross-tabulations; no imputation was performed. All analysis codebooks (variable names, labels and coding) can be shared upon request to support replication.

Statistical Analysis

Analyses were two-sided with $\alpha = 0.05$. We summarized sample characteristics with counts and percentages overall and within factor levels. For association testing between factors and disorder categories (Table 2), we used Pearson's χ^2 test; when any expected cell count was <5 in a 2×k table, we report the exact (Monte Carlo) p-value returned by SPSS's Exact Tests module. For the onset-by-disorder analysis (Table 3), we compared row distributions across the three onset periods using χ^2. Because this is an exploratory cross-sectional study with multiple related tests, no formal multiplicity adjustment was applied; p-values are therefore interpreted as descriptive evidence of association. We did not fit multivariable models because the instrument was designed for descriptive surveillance and because several cells were sparse (e.g., surgical history "Yes"). Age groups, sex, nationality and work status were prespecified factors. Results are presented as n (%) with exact denominators printed in the tables.

Bias Minimization and Limitations by Design

Limitations: Several limitations should be considered when interpreting these findings. Although invitations and reminders were distributed nationwide and targeted outreach was used to improve gender balance, the study relied on a voluntary web-based survey with non-probability sampling, making it susceptible to selection bias and limiting population representativeness. Data were self-reported and may be affected by recall bias, particularly regarding symptom onset and first-noticed conditions. In addition, diagnoses of IBS, GERD, anxiety, depression and stress were not confirmed using validated diagnostic instruments or objective gastrointestinal and psychiatric assessments. The cross-sectional design precludes conclusions about causality or temporal directionality between psychological distress and gastrointestinal disorders. The analysis also lacked multivariate adjustment for potential confounding factors. Furthermore, confirmed COVID-19 infection status, severity and timing were not assessed, which is important given the post-pandemic context of the study. Findings should therefore be interpreted as descriptive associations among respondents rather than population-representative or causal estimates.

Ethics and Data Availability

The study received ethical approval from the King Abdulaziz City for Science and Technology (KACST) Institutional Review Board (registration H-8-L-074; IRB log 2021-11) and the University of Ha'il Research Ethics Committee (REC approvals H-2020-187 and H-2024-491; Deanship Project RG20064; University President letter Nr. 13675/5/42). Participation was anonymous and voluntary; electronic informed consent was obtained before any data were collected. All analyses used de-identified data. Additional de-identified variables and the SPSS syntax can be shared upon reasonable request. Data availability and transparency statements were included to support research integrity, reproducibility and transparent reporting of the study findings.

RESULTS

Participant Characteristics

A total of 2,067 respondents completed the questionnaire. Most were women (72.4%, n = 1,496), Saudi nationals (94.7%, n = 1,957) and aged 18-29 years (66%, n = 1,364); 53.2% were students, 26.1% employed and 20.7% not working. Across the triad of conditions, any mental-health symptom (anxiety, stress or depression) was reported by 60.7% (n = 1,255), IBS by 48.7% (n = 1,006) and GERD by 36.3% (n = 750); only 3.7% (n = 76) reported none, with very few reporting other gastric disorders (Table 1).

With respect to which condition appeared first (multi-select), psychological symptoms predominated: Depression and anxiety were each chosen by 51.6% (n = 1,027) and stress by 50.3% (n = 1,001), whereas IBS and GERD were first in 33.9% (n = 674) and 24.3% (n = 483), respectively. Considering timing overall, most

Table 1: Frequency, Onset and Characteristics of Neuro-gastroenteritis Triad Disorders (N = 2067)

Characteristic	Category/Response	Number (Percentage)
Prevalence of Triad Disorders	**Participants could select multiple disorders**	
	Anxiety, stress, depression	1255 (60.7%)
	Irritable Bowel Syndrome (IBS)†	1006 (48.7%)
	Gastroesophageal Reflux (GERD)*	750 (36.3%)
	None	76 (3.7%)
	Gastric disorder	6 (0.3%)
	Others	2 (0.1%)
Initial Onset of Disorders (Which occurred first)	**Participants could select multiple disorders**	
	Depression	1027 (51.6%)
	Anxiety	1027 (51.6%)
	Stress	1001 (50.3%)
	Irritable Bowel Syndrome (IBS)	674 (33.9%)
	Gastroesophageal Reflux (GERD)	483 (24.3%)
Timing of Symptom Start	Recently	1178 (59.2%)
	During adulthood	669 (33.6%)
	Since childhood	144 (7.2%)
Aggravating Factors (Family History)	**Genetic/Family History Present?**	
	No	1386 (67.1%)
	Yes	681 (32.9%)
	If yes, which disease was in the family?	
	Irritable Bowel Syndrome (IBS) †	476 (69.9%)
	Depression, Anxiety or Stress	215 (31.6%)
	Gastroesophageal Reflux (GERD)	175 (25.7%)
Patient Management and Lifestyle	**Received any treatment?**	
	No	1689 (81.7%)
	Yes	378 (18.3%)
	Ever had a procedure(colectomy/colostomy)?	
	No	2001 (96.8%)
	Yes	66 (3.2%)
	Engage in outdoor activity and sport?	
	Yes	1201 (58.1%)
	No	866 (41.9%)
Association with Mental Health	**Experienced depression/anxiety/stress since GERD/IBS onset?**	
	No	1180 (57.1%)
	Yes	887 (42.9%)
	If yes, the association was with:	
	Irritable Bowel Syndrome (IBS)	615 (69.3%)
	Gastroesophageal Reflux (GERD)	272 (30.7%)

Note: GERD: Gastroesophageal reflux, †IBS: Irritable bowel syndrome, Percentages for sub-questions (e.g., "If yes, which disease...") are calculated based on the number of respondents who answered "Yes" to the preceding question

respondents indicated recent onset (59.2%, n = 1,178), followed by onset during adulthood (33.6%, n = 669) and since childhood (7.2%, n = 144) (Table 1).

Family history or genetic/aggravating factors were reported by 32.9% (n = 681). Among those, a family history of IBS was most frequent (69.9%, n = 476), followed by depression/anxiety/stress (31.6%, n = 215) and GERD (25.7%, n = 175). Only 18.3% (n = 378) had ever received any treatment; 3.2% (n = 66) reported prior colectomy/colostomy. A little over half (58.1%, n = 1,201) engaged in outdoor activity/sport. Regarding perceived links between GI and mental-health symptoms, 42.9% (n = 887) reported experiencing depression/anxiety/stress since GI symptom onset; of these, 69.3% (n = 615) attributed the association to IBS and 30.7% (n = 272) to GERD (Table 1).

Prevalence, Co-Occurrence and Temporal Onset of Disorders

Stratified analyses demonstrated significant heterogeneity by age, sex and work status (overall $p<0.001$ for each factor; Table 2). GERD increased with age, affecting 62.4% of those 50-59 years and 65.3% of those ≥60, whereas psychological symptoms were most common in the youngest group (18-29 years: depression 70.6%, anxiety 70.7%, stress 70.7%). IBS peaked in midlife (40-49 years: 58.7%). By sex, women reported higher IBS (50.7% vs. 43.3% in men) and higher depression/anxiety/stress (e.g., depression 63.4% vs. 53.1%), while men reported GERD more often (47.3% vs. 32.1%). Students exhibited the greatest psychological symptom burden (depression 72.4%; anxiety 72.6%) compared with employed or not-working groups; GERD was most frequent among employed respondents (46.7%). In contrast, nationality ($p = 0.417$), surgical history ($p = 0.394$) and sports/activity ($p = 0.133$) were not significantly associated with the disorder profiles (Table 2).

Factors Associated with Disorder Profiles (Age, Sex and Work Status)

Onset distributions also differed significantly by diagnosis ($p = 0.002$; Table 3). For GERD, 59.9% reported recent onset, 31.6% during adulthood and 8.5% since childhood. Depression (57.7%), anxiety (57.8%) and stress (57.8%)

Table 2: Factors Associated with Neuro-Gastroenteritis Triad Disorders Among Study Participants

Factor	Category	n (%)						
		None	GERD*	Depression	Anxiety	Stress	IBS†	p-value
Age in years	18-29	58 (4.3%)	426 (31.2%)	963 (70.6%)	964 (70.7%)	965 (70.7%)	617 (45.2%)	0.001*
	30-39	13 (4.8%)	99 (36.7%)	132 (48.9%)	132 (48.9%)	132 (48.9%)	145 (53.7%)	
	40-49	4 (1.5%)	115 (44.4%)	104 (40.2%)	104 (40.2%)	104 (40.2%)	152 (58.7%)	
	50-59	1 (0.8%)	78 (62.4%)	43 (34.4%)	45 (36.0%)	44 (35.2%)	65 (52.0%)	
	> 60	0 (0.0%)	32 (65.3%)	10 (20.4%)	10 (20.4%)	10 (20.4%)	27 (55.1%)	
Gender	Male	31 (5.4%)	270 (47.3%)	303 (53.1%)	305 (53.4%)	304 (53.2%)	247 (43.3%)	0.001*
	Female	45 (3.0%)	480 (32.1%)	949 (63.4%)	950 (63.5%)	951 (63.6%)	759 (50.7%)	
Work	Not working	14 (3.3%)	164 (38.3%)	206 (48.1%)	207 (48.4%)	207 (48.4%)	231 (54.0%)	0.001*
	Student	49 (4.5%)	334 (30.4%)	796 (72.4%)	797 (72.5%)	798 (72.6%)	485 (44.1%)	
	Working	13 (2.4%)	252 (46.7%)	250 (46.3%)	251 (46.5%)	250 (46.3%)	290 (53.7%)	
Nationality	Saudi	71 (3.6%)	713 (36.4%)	1179 (60.2%)	1182 (60.4%)	1182 (60.4%)	958 (49.0%)	0.417
	Non-Saudi	5 (4.5%)	37 (33.6%)	73 (66.4%)	73 (66.4%)	73 (66.4%)	48 (43.6%)	
Surgical History	Yes	1 (1.5%)	25 (37.9%)	34 (51.5%)	34 (51.5%)	34 (51.5%)	32 (48.5%)	0.394
	No	75 (3.7%)	725 (36.2%)	1218 (60.9%)	1221 (61.0%)	1221 (61.0%)	974 (48.7%)	
Sports/Activity	Yes	47 (3.9%)	418 (34.8%)	722 (60.1%)	724 (60.3%)	724 (60.3%)	558 (46.5%)	0.133
	No	29 (3.3%)	332 (38.3%)	530 (61.2%)	531 (61.3%)	531 (61.3%)	448 (51.7%)	

Note: GERD: Gastroesophageal reflux, †IBS: Irritable bowel syndrome, Percentages represent the proportion of participants within each factor category (row) who reported the specific disorder, *p<0.05 indicates a statistically significant association

Table 3: Onset of Neuro-gastroenteritis Triad Disorders by Diagnosis Period

Disorder	n (%)			
	Since Childhood	During Adulthood	Recently	p-value
GERD*	64 (8.5%)	237 (31.6%)	449 (59.9%)	0.002*
Depression	91 (7.3%)	438 (35.0%)	723 (57.7%)	
Anxiety	91 (7.3%)	438 (34.9%)	726 (57.8%)	
Stress	91 (7.3%)	438 (34.9%)	726 (57.8%)	
IBS†	84 (8.3%)	375 (37.3%)	547 (54.4%)	

Note: GERD: Gastroesophageal reflux, †IBS: Irritable bowel syndrome, Percentages represent the proportion of participants with a specific disorder who reported its onset during that time period, *p<0.05 indicates a statistically significant association

likewise clustered in the recent category. IBS showed a similar, though less pronounced, pattern: recent in 54.4%, during adulthood in 37.3% and since childhood in 8.3% (Table 3).

Together, these data indicate that in this nationwide, predominantly young female sample, psychological symptoms are both common and frequently precede or accompany IBS and GERD, with clear age-, sex- and work-status gradients and a dominant recent onset across diagnoses.

DISCUSSION

In this nationwide, post-pandemic Saudi survey (N = 2,067), neuro-gastroenterology phenotypes clustered with mental-health symptoms and showed clear age-sex gradients: psychological distress (depression, anxiety, stress) was most common and often preceded GI diagnoses; IBS peaked in mid-life and GERD rose with older age, with a strong female preponderance overall. These patterns fit the Rome IV DGBI framework, which posits interacting psychosocial, sensory-motor, immune and microbiome pathways; current guidelines emphasize a positive diagnosis and integrated care [22].

The frequent precedence of psychological symptoms over IBS/GERD aligns with prospective data showing ~2× higher incident IBS risk with baseline anxiety/depression, particularly after enteric infections-paralleling post-infectious mechanisms proposed for some long-COVID trajectories [10]. Consistent with our demographics, the WHO reported ~25% global increases in anxiety/depression during the first pandemic year, disproportionately affecting youth and women [23,24]. Biologically, SARS-CoV-2 and pandemic stressors plausibly perturb the gut-brain-microbiome axis: cohorts show persistent dysbiosis/immune alterations after COVID-19 and a large VA study found elevated 1-year risks of several GI disorders, including dyspepsia and GERD [25,26].

Prevalence comparisons contextualize our signals. Under Rome IV, IBS prevalence in North America/U.K. is ~4.4-4.8%, lower than many pre-Rome estimates and several Middle-Eastern surveys [22]. A Saudi systematic review reported double-digit IBS prevalence with strong links to stress, echoing our high co-occurrence of distress [27]. A Makkah Rome IV study (~20% IBS; n = 921) showed an independent association with stress (OR≈2.5) [28]. For GERD, a 2020 meta-analysis estimated ~14% global point prevalence, with higher regional figures in North America (~19-21%) and heterogeneity across countries (e.g., Turkey ~22%, Iran ~18%) [6,29]. Our age-linked GERD rise and female-skewed symptom burden are congruent with known demographic gradients for reflux and DGBIs [22].

Genetics reinforces epidemiologic links between IBS and affective traits: A 2021 GWAS (>250 k cases) identified six IBS loci and strong genome-wide correlations with anxiety, depression and neuroticism, supporting shared pathways rather than "psychological overlay" [21]. This helps explain our observation that psychological symptoms frequently predated abdominal diagnoses in young women, without implying that symptoms are "all in the head."

We also observed substantial IBS-GERD co-occurrence with temporal overlap of distress. Prior work documents clinically meaningful overlap, likely reflecting shared sensorimotor dysregulation along the esophagogastric-intestinal axis. Psychosocial comorbidity amplifies symptom severity, care-seeking and disability-consistently shown in meta-analyses and guidelines [10]. Our age/sex patterns (youth → more distress; mid-life → more IBS; older age → more GERD) map onto life-course risk factors (sleep/stress, gynecologic influences, weight gain, medications) and established GERD contributors (central adiposity, hiatal hernia), though we did not phenotype BMI or hernia [6,30].

Two additional lines of evidence support a post-COVID biological lens: longitudinal studies show lasting loss of commensals/enrichment of pathobionts correlating with inflammation [25] and VA data link COVID-19 to incident functional/structural GI diagnoses at one year, independent of hospitalization-implicating both infection and syndemic contributor [26]. These mechanisms cohere with DGBI models and the bidirectional effects of anxiety/depression on gut symptoms [10].

Compared with Western Rome IV estimates, our youth-dense, female-skewed symptom burden appears higher, mirroring Saudi/regional surveys and WHO's observation that young women bore disproportionate mental-health harms during the pandemic [27]. At the same time, North American GERD prevalence (~20%) can exceed many Asian settings, while parts of the Middle East approach or surpass Western levels-reflecting diet, adiposity and care-seeking heterogeneity beyond the scope of our cross-sectional design [29].

Clinically, the frequent precedence of psychological symptoms supports early, integrated screening (e.g., GAD-7/PHQ-9/DASS-21) and stepped, mechanism-based care: positive diagnosis and education; dietary strategies (including structured low-FODMAP where appropriate); gut-directed psychotherapies (CBT, hypnotherapy) and neuromodulators (e.g., low-dose TCAs for pain and IBS-D) [31]. For GERD, guideline-concordant care (lifestyle, optimized PPI when indicated; alarm evaluation; impedance-pH testing for refractory cases) plus weight management remains central [4]. Given low treatment uptake despite high symptom load, scalable psycho-educational access is needed; WHO highlights both increased need and service disruptions, reinforcing integrated models [23].

Post-pandemic evidence continues to highlight the significant role of psychological distress in gastrointestinal disorders. Population-based studies show sustained increases in anxiety, depression and stress following COVID-19, with clear associations to gastrointestinal symptom burden and altered health behaviors. This supports our finding that psychological symptoms frequently preceded or accompanied IBS and GERD, reinforcing the importance of the gut-brain axis in post-pandemic disease patterns [32,33].

Additionally, Helicobacter pylori infection may act as an age-dependent modifier of gastrointestinal disease. Evidence suggests its role in influencing symptom severity and disease progression across different age groups, particularly in older populations. This highlights the value of incorporating H. pylori status into future research on gut-brain interactions and gastrointestinal disorders [34,35].

Strengths include a large national sample, targeted outreach to balance gender access and stratified analyses by age, employment and onset timing. Limitations include cross-sectional self-report (no causal inference), potential selection bias inherent to online surveys and lack of standardized clinical phenotyping (BMI, endoscopy, pH testing) and biomarkers (fecal calprotectin) recommended for positive DGBI diagnoses. We captured onset categories ("recent/adulthood/childhood") but not detailed COVID-19 infection/vaccination/severity, limiting separation of infection versus pandemic-related stress effects. Regional comparisons are further constrained by mixed diagnostic criteria (Rome III vs. IV) and heterogeneous sampling frames.

CONCLUSIONS

Post-COVID, neuro-gastroenterology burden in Saudi Arabia appears shifted toward young women, with psychological distress frequently preceding IBS/GERD and notable IBS-GERD overlap-findings biologically plausible under DGBI models, consistent with global mental-health surges and directionally in line with regional prevalence studies. Early mental-health screening, gut-directed psychotherapies and guideline-based GI care are warranted; population strategies should expand mental-health access and reflux/IBS literacy. Priorities include longitudinal Saudi cohorts with Rome IV phenotyping; incorporation of COVID-19 exposure/severity; objective reflux/motility testing and multi-omics to probe links suggested by post-COVID dysbiosis and shared IBS-mood genetic architecture.

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Ethical Approval

The study was conducted in accordance with the Declaration of Helsinki declarations. The ethical application for this study was reviewed and (Approved) by the Research Ethics Committee (REC at the University of Ha'il (KSA), number H-2021-187212.

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