Original Article

Association between Gastrointestinal Symptoms and Sleep Quality: A Cross-Sectional Study

Abdulmajeed M. Algethami [1], Khulud A. Alamri [2], Amjad F. Aljoudi [3], Hutaf S. Almutairi [3], Aryam F. Alqthami [2], Ruba M. Altowairqi [2], Layan M. Alotaibi [3]

[1]Consultant of Internal Medicine, Endocrinology & Diabetes Mellitus, Taif University, KSA.
[2]Medical intern, College of Medicine, Taif University, Taif, KSA.
[3]Medical student, College of Medicine, Taif University, Taif, KSA.

ABSTRACT

Background: Gastrointestinal disorders significantly impair sleep quality through nocturnal symptoms, visceral hypersensitivity, and gut-brain axis disruptions. While this bidirectional relationship is well-documented globally, population-specific data from Saudi Arabia remains limited. This cross-sectional study examines this association using validated clinical instruments in Taif City.

Methods: We recruited 679 (472 females, 207 males) adult participants (18-50 years) in Taif City through online platforms from May 2024. Gastrointestinal symptoms were assessed using the Gastrointestinal Symptom Rating Scale (GSRS), while sleep quality was measured with the Pittsburgh Sleep Quality Index (PSQI).

Results: Participants (mean age 31.1 ± 12.5 years) reported prevalent symptoms: bloating (44%), abdominal pain (38.4%), and heartburn (28.7%). Diagnosed conditions included IBS (20.8%), GERD (9.9%), and peptic ulcers (2.9%). Poor sleep quality (PSQI >7) affected 45.2%, with highest prevalence in IBS (87.2%, $p<0.001$) and GERD (77.6%, $p<0.001$) patients. A significant dose-response relationship emerged between GSRS scores and sleep impairment (mean PSQI: 3.7±2.6 for 1 symptom vs 8.1±4.1 for 6 symptoms, $p=0.001$).

Conclusion: Gastrointestinal diseases, particularly IBS and GERD, demonstrate strong associations with sleep impairment in Saudi adults. These findings emphasize the need for dual-focused clinical management of GI and sleep disorders.

Keyword: Gastrointestinal disorders, volunteers, sleep quality, Gastrointestinal Symptom Rating Scale (GSRS), Pittsburgh Sleep Quality Index (PSQI), Saudi Arabia.

Introduction

Emerging research underscores the bidirectional communication between the gut and brain, where sleep quality modulates gastrointestinal function and vice versa. The gut-brain axis, mediated by neural, endocrine, and immune pathways, links intestinal barrier integrity and microbial homeostasis to sleep architecture [1]. Disruptions in gut permeability (e.g., "leaky gut") may elevate systemic inflammation, impairing sleep-regulatory centers in the hypothalamus [2]. Conversely, poor sleep alters the gut microbiota diversity and exacerbates visceral hypersensitivity, creating a vicious cycle [3]. This interplay is particularly relevant in functional GI disorders, where nocturnal symptoms directly fragment sleep stages [4].

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Address for correspondence: Khulud A. Alamri, Medical intern, College of Medicine, Taif University, Taif, KSA.
E-mail: kholoud31421@gmail.com

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In recent years, there has been a rising awareness of the complex link between gastrointestinal (GI) health and sleep quality. Digestive symptoms, which range from minor discomfort to chronic illnesses, have been proven to significantly affect sleep patterns and overall sleep quality [5]. In contrast, gastrointestinal symptoms frequently intensify in response to sleep problems, showing a reciprocal link [5]. Sleep disturbances are any changes or disruptions to normal sleep patterns, such as difficulties falling asleep, staying asleep, or getting restorative sleep [6,7]. These disturbances frequently cause daytime deficits such as weariness, decreased cognitive performance, mood fluctuations, and an overall deterioration in well-being. According to research, people with gastrointestinal diseases like GERD, IBS, and IBD typically report having trouble sleeping. Individuals with sleep disorders, such as insomnia or sleep apnea, frequently report GI symptoms concurrently [6,7]. A meta-analysis found that gastro-esophageal reflux disease (GERD) is connected with an increased risk of insomnia, restless nights, and disturbed sleep. In contrast, GERD risk factors include short sleep duration, poor sleep quality, and sleep disruptions [8,9]. Zhang et al. (2022) discovered a strong link between persistent diarrheal symptoms and IBD and poor sleep quality. Notably, the connection was stronger in women [10]. Hyun, Baek, and Lee (2019) investigated the relationship between stomach symptoms and sleep disruptions in a cohort of 5,792 people from a community-based setting. Their findings revealed a robust link between sleep problems and a variety of digestive symptoms, including abdominal pain, acid reflux, bloating, and belching [11]. Several studies have found that gastrointestinal diseases, including irritable bowel syndrome (IBS), dyspepsia, and other symptoms, are linked to poor sleep quality [12,13]. Despite previous studies, the relationship between digestive disorders and sleep disturbances has not been adequately studied using large population datasets. Furthermore, few studies have investigated the link between particular digestive symptoms and sleep disturbances [11]. Therefore, the purpose of this community-based study was to assess whether there is a significant relationship between gastrointestinal symptoms and sleep disturbances among 679 adult participants (18-50 years) from Taif City in Saudi Arabia.

Methods

A cross-sectional study was undertaken in Taif City, Saudi Arabia, to explore the relationship between gastrointestinal (GI) symptoms and sleep quality. This study represents a research project done by a group of medical students and supervised by a faculty member. Data were obtained using an online questionnaire beginning in May 2024. The study sample included 679 people (472 females, 207 males) drawn at random from Taif City's general population. An online self-administered questionnaire (Appendix) designed to match the study's aims was distributed. Participants had to be at least 18 years old.

The questionnaire was distributed via Google Forms to numerous social media sites such as Telegram, Twitter, and WhatsApp. The questionnaire was separated into three sections:

1. Demographic and Social Data: This portion gathered information about the participants' gender, age, marital status, occupation, and educational level.
2. GI Symptom Rating Scale (GSRS): The GSRS is a validated instrument with demonstrated reliability in recent multinational studies (Cronbach's $\alpha > 0.85$ for all subscales) [14]. For this study, six items were selected: abdominal pain, heartburn, nausea, bloating, constipation, and diarrhea. Participants were also asked if they had been diagnosed with any gastrointestinal diseases, including GERD, IBS, or peptic ulcer disease.
3. Pittsburgh Sleep Quality Index (PSQI): The PSQI has been extensively validated, including in Arabic populations, showing strong psychometric properties ($\alpha=0.83$) [15]. The 19-item questionnaire assesses seven components: subjective sleep quality, sleep latency, sleep length, habitual sleep efficiency, sleep disruptions, use of sleeping medication, and daytime dysfunction. Each of the seven PSQI component scores was scored on a scale of 0 (no difficulty) to 3 (extreme difficulty). These component scores were added together to yield a global score (ranging from 0 to 21), with higher scores indicating poor sleep quality. The instruments' reliability was evaluated using Cronbach's alpha coefficient, which assesses the scale's internal consistency. Cronbach's alpha values of 0.7 or higher were judged acceptable [16]. The overall PSQI score was assigned a cutoff threshold of 7. Participants with a global score of 7 or less were considered "good sleepers," whereas those with a score more than 7 were classed as having "moderate to poor sleep quality." [16]. Data was analyzed using IBM SPSS Statistics version 22. All tests were two-tailed, with a p-value less than 0.05 indicating statistical significance. All variables, including participants' demographic data, were subjected to descriptive analysis using frequency and percentage distributions. GI symptoms and illnesses were illustrated via graphical depictions. Crosstabulation was used to determine the distribution of participants' sleep quality based on demographic information and gastrointestinal symptoms. The significance of correlations in cross-tabulation was assessed using Pearson's chi-square test and the exact probability test for tiny frequency distributions. A box plot was used to display the average global PSQI score based on the

number of GI symptoms experienced by the study participants.

Ethical consideration: The study received an ethical approval from Scientific Research Ethics Committee at Taif University, Ministry of Education, Saudi Arabia. (HAO-02-T-105).

Results

Our findings demonstrate significant relationships between demographic characteristics, gastrointestinal symptoms, and sleep quality indicators. A total of 679 eligible participants completed the study questionnaire (Appendix). The cohort comprised adults aged 18-50 years (mean 31.1±12.5), with predominance of females (69.5%) and single individuals (54.6%). Most participants were unemployed (60.5%) and had university-level education (73%). The most prevalent gastrointestinal symptoms included bloating (44%), abdominal pain (38.4%), and heartburn (28.7%), while diagnosed conditions were IBS (20.8%), GERD (9.9%), and peptic ulcers (2.9%). Sleep quality analysis revealed 45.2% of participants had poor sleep (PSQI>7), with particularly high rates among IBS (87.2%) and GERD (77.6%) patients (both $p<0.001$). We observed a strong dose-response relationship, where increasing GI symptoms correlated with worse sleep scores (mean PSQI 3.7±2.6 for 1 symptom vs 8.1±4.1 for 6 symptoms, $p=0.001$). Gastrointestinal Symptoms: The most frequently reported gastrointestinal symptoms among research participants were bloating (44%), stomach pain (38.4%), heartburn (28.7%), constipation (27.2%), nausea (21.8%), and diarrhea (11.3%). In terms of gastrointestinal disease prevalence, the most common diagnoses were IBS (20.8%), GERD (9.9%), peptic ulcer disease (2.9%), and IBD (1.3%). A total of 442 (65.1%) participants reported no gastrointestinal disease. Sleep Quality: A total of 28.6% of individuals reported poor subjective sleep quality, 39.1% reported poor sleep latency, and 24.6% reported significant sleep disruptions. Additionally, 6.9% of participants slept for less than 7 hours each day, and 3.7% had a sleep efficiency of less than 65%. In terms of sleep medicine use, 16.2% of participants had taken it in the previous six months, and 14.2% reported significant daytime dysfunction. The global Pittsburgh Sleep Quality Index (PSQI) score ranged from 0 to 16, with a mean of 5.7 ± 3.6. Overall Sleep Quality: Of the 679 individuals, 307 (45.2%) were classed as poor sleepers, and 372 (54.8%) as good sleepers. Sleep Quality and Sociodemographic Characteristics: 52.5% of people over 50 were classified as bad sleepers, compared to 41.1% of participants under 30 years old, indicating a statistically significant difference ($P = 0.047$). Furthermore, 47.4% of unemployed participants slept poorly, compared to 41.8% of working participants, indicating a significant difference ($P = 0.048$). Gastrointestinal Symptoms and Sleep Quality: 62.2% of people with nausea slept poorly, compared to 57.1% with diarrhea, 55.9% with bloating, and 52.4% with constipation. 41.8% of subjects who experienced stomach pain reported poor sleep quality ($P = 0.001$). In terms of gastrointestinal diseases, those with IBS had the highest rate of poor sleep quality (87.2%), followed by GERD (77.6%) and peptic ulcer disease (70%). The lowest rate of poor sleep quality was seen among participants with IBD (44.4%), compared to 25.8% of participants with no gastrointestinal disorder ($P = 0.001$). Number of Gastrointestinal Symptoms and Sleep Quality: The global PSQI score increased considerably (indicating lower sleep quality) as the number of gastrointestinal symptoms increased. Participants with one symptom had a mean PSQI score of 3.7 ± 2.6, whereas those with six symptoms had a mean score of 8.1 ± 4.1 ($P = 0.001$).

Discussion

The current study sought to determine the association between gastrointestinal (GI) symptoms and sleep quality among Saudi participants, as well as to evaluate other sleep-related parameters. Insomnia is the most common sleep problem worldwide [18]. According to the American Psychiatric Association, 10-20% of people report serious sleep problems to their primary care physicians [19]. Furthermore, the National Sleep Foundation discovered that 16.6% of people aged 50 and up have trouble sleeping [20,21]. These sleep abnormalities have been associated with a variety of health issues, including psoriasis, mental health disorders, alcohol usage, nocturnal acid reflux, and suicidal ideation [22,23]. In the current study, the participants were mostly young, educated females who were unemployed. In terms of gastrointestinal disorders, around one-third of participants reported having IBS or GERD. Bloating, abdominal pain, heartburn, and constipation were the four most commonly reported GI symptoms. In a global survey, 49% of women and 36.6% of men reported having at least one GI illness, with the most common conditions being IBS, functional diarrhea, proctalgia, functional constipation, and functional dyspepsia [24]. Other studies have found that the prevalence of functional GI illnesses in the general population surpasses 10%, which is consistent with our results [25,26]. However, Almasary et al. reported a prevalence of IBS in the Saudi population of 20.7%, which is almost identical to our study's findings [27]. In terms of sleep disorders, fewer than half of the study's participants reported poor sleep quality. This was more common among older and unemployed participants, many of whom had retired. Nasim et al. showed that 46% of Saudis reported sleep difficulties on weekdays and 33% on weekends, which is remarkably comparable to our

Table 1: Socio-demographic characteristics of study participants, Taif, Saudi Arabia (n=679).

Socio-demographic data	**No**	**%**
Age in years		
18-30	358	52.7%
30-50	222	32.7%
> 50	99	14.6%
Gender		
Male	207	30.5%
Female	472	69.5%
Marital status		
Single	371	54.6%
Married	308	45.4%
Employment		
Unemployed	411	60.5%
Employed	268	39.5%
Educational level		
Secondary education	132	19.4%
University education	496	73.0%
Post-graduate	51	7.5%

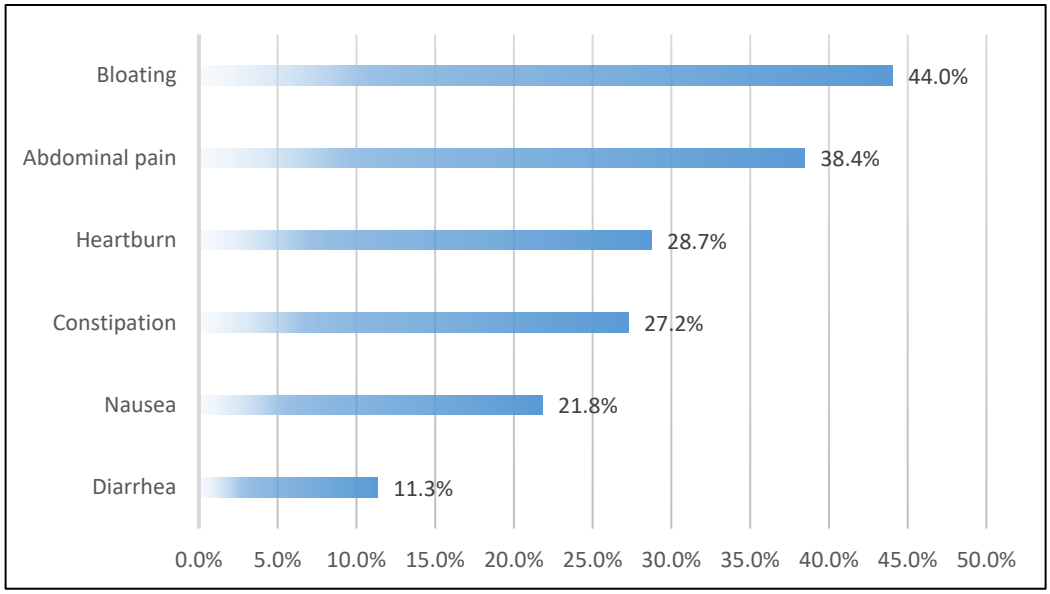

Figure 1: Gastrointestinal symptoms among study participants, in Taif, Saudi Arabia (n=679).

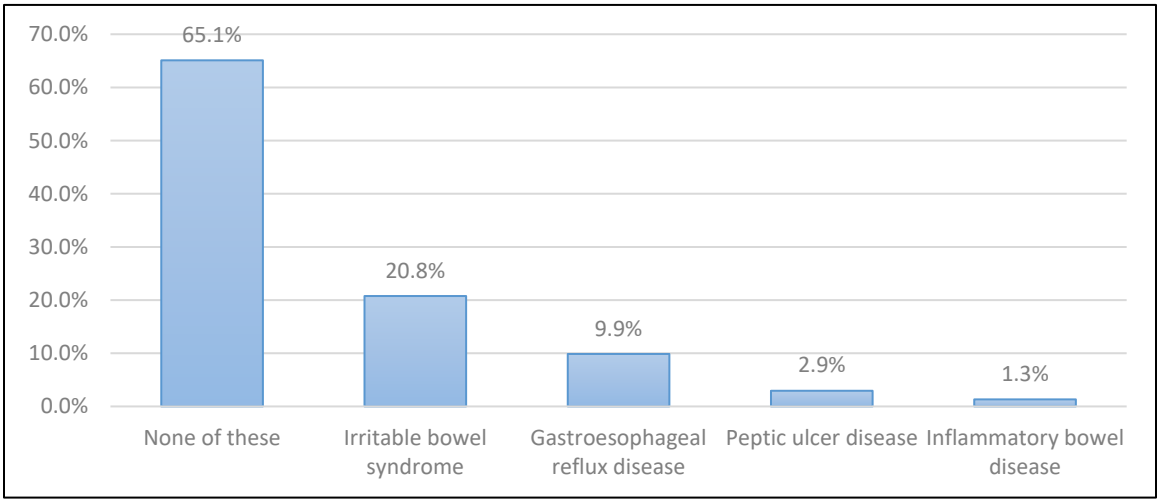

Figure 2: Prevalence of gastrointestinal symptoms among study participants, in Taif, Saudi Arabia (n=679).

Table 2: Sleep quality components among study participants, in Taif, Saudi Arabia (n=679).

Domain	No	%
Subjective sleep quality		
Very good	329	48.5%
Fairly good	156	23.0%

Fairly bad	180	26.5%
Very bad	14	2.1%
Sleep latency		
Very good	147	21.6%
Fairly good	266	39.2%
Fairly bad	208	30.6%
Very bad	58	8.5%
Sleep duration		
> 7 hours	166	24.4%
6-7 hours	466	68.6%
5-6 hours	28	4.1%
< 5 hours	19	2.8%
Habitual sleep efficiency		
> 85%	177	26.1%
75-84%	455	67.0%
65-74%	22	3.2%
< 65%	25	3.7%
Sleep disturbances		
Very low	192	28.3%
Fairly low	320	47.1%
Fairly high	163	24.0%
Very high	4	.6%
Use of sleeping medication		
Not during the last period	569	83.8%
Less than once	53	7.8%
once or twice	33	4.9%
Three or more times	24	3.5%
Daytime dysfunction		
Very low	333	49.0%
Fairly low	250	36.8%
Fairly high	90	13.3%
Very high	6	.9%
Global PSIQ score		
Range	0-16	
Mean ± SD	5.7 ± 3.6	

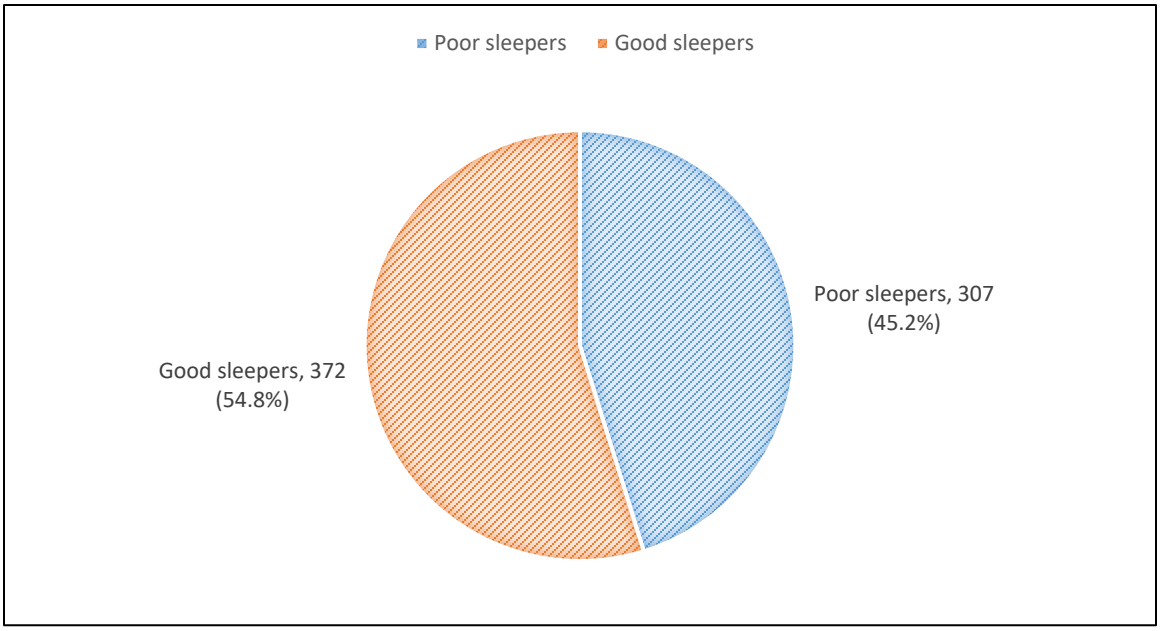

Figure 3: The overall sleep quality among study participants, in Saudi Arabia (n=679).

Table 3: Distribution of sleep quality by socio-demographic characteristics of the study participants.

Socio-demographics	**Sleep Quality**				**p-value**
	Poor sleepers		**Good sleepers**		
	No	**%**	**No**	**%**	
Age in years					.047*^
18-30	147	41.1%	211	58.9%	
30-50	108	48.6%	114	51.4%	
> 50	52	52.5%	47	47.5%	
Gender					.075
Male	85	41.1%	122	58.9%	
Female	222	47.0%	250	53.0%	
Marital status					.463
Single	163	43.9%	208	56.1%	

Married	144	46.8%	164	53.2%	
Employment					.048*
Unemployed	195	47.4%	216	52.6%	
Employed	112	41.8%	156	58.2%	
Educational level					.636^
Secondary education	57	43.2%	75	56.8%	
University education	224	45.2%	272	54.8%	
Post-graduate	26	51.0%	25	49.0%	

*N.B.: P: Pearson X2 test, ^: Exact probability test, * P < 0.05 (significant)*

Table 4: Association between gastrointestinal symptoms and sleep quality in Taif, Saudi Arabian population.

GIT symptoms/disorders	**Sleep hygiene**				**p-value**
	Poor sleepers		**Good sleepers**		
	No	**%**	**No**	**%**	
Do you have any of the following symptoms?					.001*
Abdominal pain	109	41.8%	152	58.2%	
Heartburn	101	51.8%	94	48.2%	
Nausea	92	62.2%	56	37.8%	
Bloating	167	55.9%	132	44.1%	
Constipation	97	52.4%	88	47.6%	
Diarrhea	44	57.1%	33	42.9%	
Do you have any of the following diseases?					.001*^
Gastroesophageal reflux disease	52	77.6%	15	22.4%	
Inflammatory bowel disease	4	44.4%	5	55.6%	

Irritable bowel syndrome	123	87.2%	18	12.8%	
Peptic ulcer disease	14	70.0%	6	30.0%	
None of these	114	25.8%	328	74.2%	

*N.B.: P: Pearson X2 test, ^: Exact probability test, * P < 0.05 (significant)*

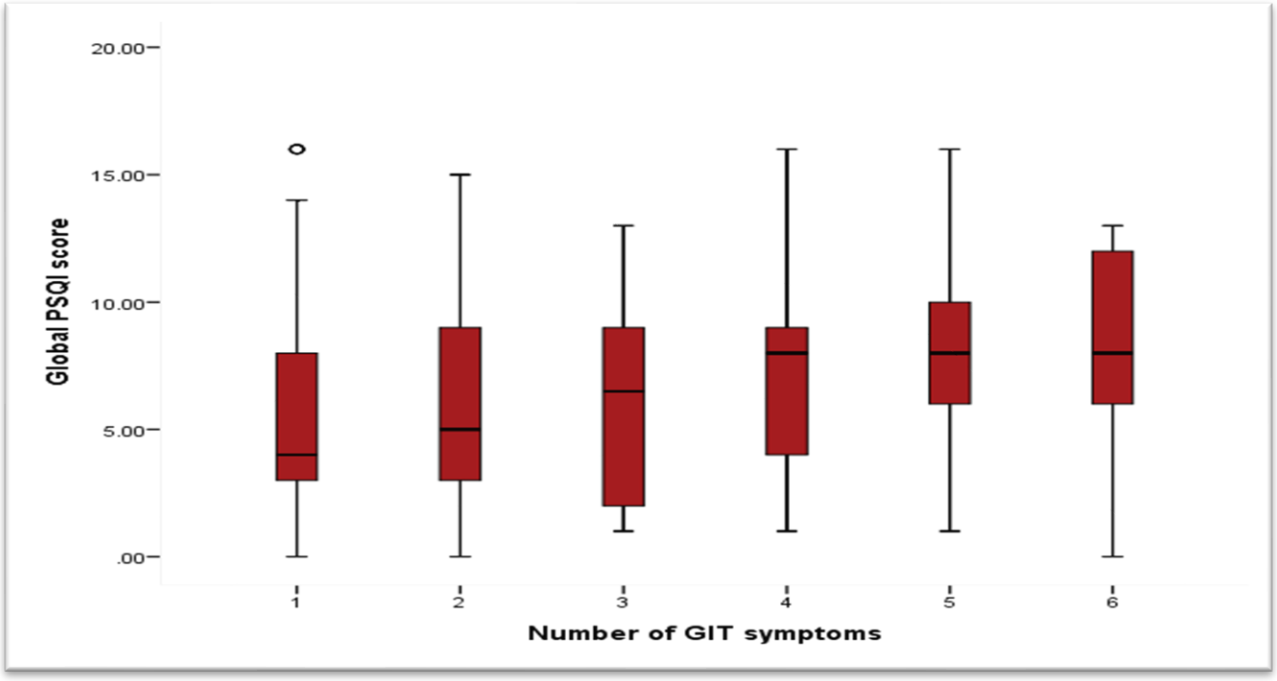

Figure 4: The average global PSQI score by the number of experienced GIT symptoms among study participants.

findings [28]. Similarly, Hazzaa et al. observed a 31% prevalence of sleep disorders among teenagers [29], while another study among Saudi adults indicated that 33.8% had sleep disruptions [30]. Our study also looked at the relationship between gastrointestinal diseases and sleep quality. We discovered that around two-thirds of people with nausea slept poorly, compared to less than half of those with abdominal discomfort. Overall, around three-quarters of people with gastrointestinal disease reported poor sleep quality. Participants with IBS reported the worst sleep quality (87.2%), followed by those with GERD (77.6%) and peptic ulcers (70%). In contrast, people with inflammatory bowel disease (IBD) had the lowest rate of poor sleep quality (44.4%), compared to 25.8% of those without a GI problem. Additionally, experiencing multiple GI symptoms was associated with poorer sleep quality. These findings align with studies that found a strong correlation between sleep disturbances and digestive symptoms, such as abdominal pain, acid reflux, bloating, and belching, in a community-based cohort of 5,792 individuals [11]. Similarly, Zhang et al. discovered a substantial link between persistent diarrheal symptoms, IBD, and poor sleep quality in a sample of 14,696 persons in the United States, particularly women [10]. Other research have found similar links between GI problems and poor sleep quality, which supports the current findings [8,9]. In Saudi Arabia, Awadalla et al. investigated the relationship between sleeplessness and GERD and discovered a strong link [31]. A systematic review found that 37.6% of people with IBS had sleep disturbances, which is lower than the prevalence found in our study [32]. Furthermore, Teimouri and Amra found that GERD was substantially associated with poor sleep quality, particularly among obese people [33]. These findings support the link between numerous gastrointestinal illnesses and sleep hygiene, whether shown as poor sleep quality, short sleep duration, or insomnia.

Limitations: This study has various limitations that must be addressed when evaluating the results. First, the use of an online questionnaire and convenience sampling may limit the sample's representativeness by focusing on people with internet access and those who are more engaged on social media sites. This may alter the results' applicability to the larger Saudi population. Second, the study was conducted in a single city, Taif, which may have underestimated regional variations in the prevalence of gastrointestinal diseases and sleep disruptions in Saudi Arabia. A more geographically diverse sample could provide a more complete picture of the link between GIT symptoms and national sleep quality. Another disadvantage is that GIT diseases and symptoms are assessed subjectively. Personal biases, individual views, and recollection bias may all influence self-reported data, affecting the findings' accuracy. Despite these limitations, the study sheds light on the relationship between GIT symptoms and sleep quality in the Saudi population, which may impact future research and treatment approaches.

Conclusion

This study discovered that sleep quality was poor among less than half of the study participants (45.2%), with individuals reporting poor subjective sleep quality, trouble with sleep latency, and a significant amount of sleep disruption. The study found a link between GI symptoms and sleep disturbances, with IBS patients having the highest proportion of poor sleep quality. These findings show the bidirectional association between gastrointestinal diseases and sleep difficulties, emphasizing the need for a more comprehensive strategy to managing these conditions. In clinical practice, healthcare clinicians, particularly gastroenterologists and sleep specialists, must address both gastrointestinal and sleep-related complaints.

Conflict of Interest

None

Funding

None

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APPENDIX

QUESTIONNAIRE

Do you agree to participate in this research?

☐ Yes

☐ No

Section 1: Demographic and social data

1- Sex
☐ Male
☐ Female

2- Age
☐ less than 18 years
☐ 18-30 years
☐ 30-50 years
☐ More than 50 years

3- Marital status
☐ Married
☐ Not married

4- Occupation
☐ Employed
☐ Unemployed

5- Education level
☐ Not educated
☐ High school
☐ Bachelor's degree
☐ Postgraduate

Section 2: Gastrointestinal Symptom Rating Scale (GSRS)

1- Do you have any of the following symptoms?
☐ Abdominal pain
☐ Heartburn
☐ Nausea
☐ Bloating
☐ Constipation
☐ Diarrhea

2- Do you have any of the following diseases?
☐ Gastroesophageal reflux disease
☐ Inflammatory bowel disease
☐ Irritable bowel syndrome
☐ Peptic ulcer disease

Section 3: Pittsburgh Sleep Quality Index (PSQI)

1. When have you usually gone to bed?.....
2. How long (in minutes) has it taken you to fall asleep each night? ……
3. When have you usually gotten up in the morning?.....
4. How many hours of actual sleep do you get at night?.....

5- During the past month, how often have you had trouble sleeping because you	Not during the past months (0)	Less than once a week (1)	Once or twice a week (2)	Three or more times week (3)
A-Cannot get to sleep within 30 minutes				
B-wake up in the middle of the night or early morning				
C- Have to get up to use the bathroom				
D-cannot breathe comfortably				
E-cough or snore loudly				
F- feel too cold				
G- feel too hot				
H- have bad dreams				
I-have pain				
J- other reason, please describe, including how often you have had trouble sleeping because of this reason				
6-during the past month, have you taken medicine to help you sleep?				
7- during the past month How often have you had trouble staying awake while driving, eating meals, or engaging in social activity?				
	No problem at all	Only a very slight problem	Somewhat of problem	A very big problem
8-during the past month, how much of problems has it been for you to keep up enthusiasm to get things done?				
	Very good (0)	Fairly good (1)	Fairly bad (2)	Very bad (3)
9- during the past month, How would you rate your sleep quality overall?				