

SLEEPING PATTERN IN MEDICAL STUDENTS SUFFERING FROM GASTROESOPHAGEAL REFLUX DISEASE (GERD) IN ABBOTTABAD

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DOI: <https://doi.org/10.5281/zenodo.21974042>

Keywords

Gastroesophageal Reflux, Sleep, Medical students, Cross –sectional study, Abbottabad.

Article History

Received: 27 January 2026

Accepted: 12 March 2026

Published: 30 March 2026

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Abstract

Background

Gastroesophageal Reflux disease (GERD) is a frequently encountered gastrointestinal condition associated with reduce quality of life and disturbance in sleep schedules. Medical students are particularly vulnerable of GERD because of academic stress, irregular eating habits and disrupted sleep routines. Exploring the association between GERD and sleeping pattern is important for promoting better health outcomes and educational success amount medical student.

OBJECTIVE

To determine the prevalence of GERD among medical students (1), to access the quality of sleep using ISI scale (2), to examine the relationship between sleep quality and GERD symptoms in medical students in Abbottabad (3).

Methodology:

A cross-Sectional study was conducted among 295 undergraduate MBBS and BDS students in Abbottabad convenience sampling technique. Data were obtained through a structured online questionnaire following informed consent. Gastroesophageal Reflux Disease (GERD) was assessed using the Frequency Scale for the Symptoms of GERD (FSSG), whereas sleep quality was evaluated using the Insomnia Severity (ISI). Statistical analysis was performed using SPSS version 27. Descriptive statistics were employed to summaries the study variables, and the Chi-square test was applied to determine the association between GERD and sleep quality. A p-value <0.05 was considered statistically significant.

Result:

GERD prevalence 60.0%. Clinically significant insomnia was found in 60 % and 96.9% had at least mild insomnia. GERD was significantly associated with insomnia severity(p<0.001). Student with GERD had 2.12 times higher odds

clinically significant insomnia (OR=2.12, 95% CI: 1.32-3.42). with a positive correlation was found between FSSG and ISI score ($r=0.35$, $p < 0.001$).

CONCLUSION:

GERD is common independently associated with poor sleep quality in medical students. Managing GERD may improve sleep more than focusing on weight alone.

INTRODUCTION

Gastroesophageal reflux disease (GERD) is now a chronic gastrointestinal disorder characterized by the reflux of the contents of gastric into the esophagus with symptoms such as heartburn and regurgitation, which affect the quality of life and approximately 8% to 33% is globally prevalence of GERD, making it one of the most common digestive disorders [1]. One study also suggests that medical students living in a community with demanding academic schedules, prolonged study hours, poor sleep, academic stress, and high intake of caffeine all these factors increase the susceptibility of gastric disorders, which adversely affect their physical health and academic performance[2]

One the study in America suggests that the in the adults the prevalence of poor quality of sleep is about to 32%, in case of medical students its is reported upto 55.6%, with an average 6.5 hours sleep per night[3]. Several epidemiology studies suggests that there is a bidirectional relationship between GERD and sleep disturbance which may interrupt sleep quality by causing esophagus irritational repeated awaking in a patients[4]. Patients with a complaint of GERD frequently report daytime sleep, anxiety, reduced concentration and health-related issues, which badly affect quality of life[5]. One study in Japan also suggests that a major factor which increase the prevalence of GERD is H.pylori and gastric atrophy [6]. A similar study from Indonesian medical students also shows a significant relation between GERD and poor sleep and the factors including academic stress and stress management.[7]. One study in Karachi, Pakistan, also concluded that increasing body mass index(BMI) is also one of the risk factors contributing in GERD.[8]

The aim of our study was to evaluate the prevalence of GERD and insomnia among MBBS

and BDS students in Abbottabad and to investigate the association between GERD symptoms severity and sleep quality.

Results and Discussion

There were 295 fully answered data sets (biodata_completed.xlsx) including height, weight and BMI for all participants and thus a final analytic sample of $N = 295$. There were five records with a clear artefact of data entry due to a duplicate key-stroke on individual FSSG items (e.g. "22" rather than a single digit on a scale of 0-4); these were corrected to the correct single digit. Two out-of-range entries (coded "44") on the bedtime and screen-use items were missing and treated as missing only for the two items. BMI was calculated from the provided height and weight (checked against the provided BMI column), and classified using the same classification scheme as that of the parent study (Normal 19.5-25, Overweight 25.1-30, Obese >30 kg/m²), with an additional category "Underweight" (<19.5 kg/m²) being added as there was a meaningful number of students in this sample that were below the lower limit of the parent study.

RESULTS

295 medical and dental students gave complete responses and were analyzed. The mean age of the participants was 21.6 ± 1.5 years (range, 18-28 years). Males comprised 53.9% ($n = 159$) and females 46.1% ($n = 136$) of the sample. Mean BMI was 25.4 ± 6.2 kg/m² (range 13.3-41.3), with 20.0% of students classified as underweight, 28.5% normal weight, 29.5% overweight, and 22.0% obese (Figure 10). As for how students perceived the level of stress in their academic studies, 39.3% said their studies were "high" stress, 24.7% said their studies were "very high" stress, 27.5% said their studies were "moderate"

stress, and 8.5% said their studies were "low" stress.

Sixty percent (177/295) of the students screened positive and 40% (118/295) screened negative for GERD using the validated cut-off from the validated parent study and the Frequency Scale for the Symptoms of GERD (FSSG total score > 10) (Figure 2). Only 3.1% of students reported

that their insomnia was not clinically meaningful (ISI) (Figure 1), with 37.0% reporting mild, 41.7% reporting moderate, and 18.3% reporting severe insomnia. In other words, 96.9% of these participants experienced at least moderate sleep problems, and 60.0% had clinically significant (moderate-to-severe) insomnia.

Table 1. Baseline Characteristics of Participants (N = 295)

Characteristic	n	%
Sex – Male	159	53.9
Sex – Female	136	46.1
Age, years (mean ± SD)	21.6 ± 1.5	–
BMI, kg/m ² (mean ± SD)	25.4 ± 6.2	–
BMI – Underweight (<19.5)	59	20.0
BMI – Normal (19.5–25)	84	28.5
BMI – Overweight (25.1–30)	87	29.5
BMI – Obese (>30)	65	22.0
Academic stress – Low	25	8.5
Academic stress – Moderate	81	27.5
Academic stress – High	116	39.3
Academic stress – Very high	73	24.7
GERD status – Positive (FSSG > 10)	177	60.0
GERD status – Negative	118	40.0
Insomnia severity – No insomnia (ISI 0–7)	9	3.1
Insomnia severity – Mild (ISI 8–14)	109	37.0
Insomnia severity – Moderate (ISI 15–21)	123	41.7
Insomnia severity – Severe (ISI 22–28)	54	18.3

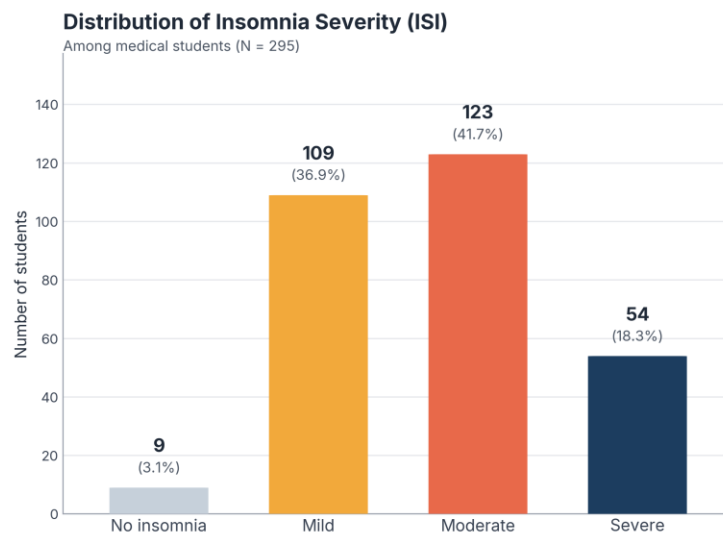


Figure 1. Distribution of insomnia severity (ISI) among medical students (N = 295).

**Prevalence of GERD
(FSSG score > 10) Among Medical Students**

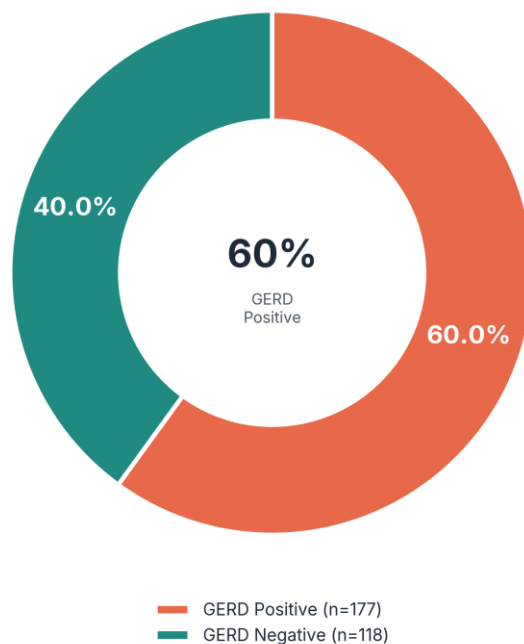


Figure 2. Prevalence of GERD (FSSG score > 10) among medical students.

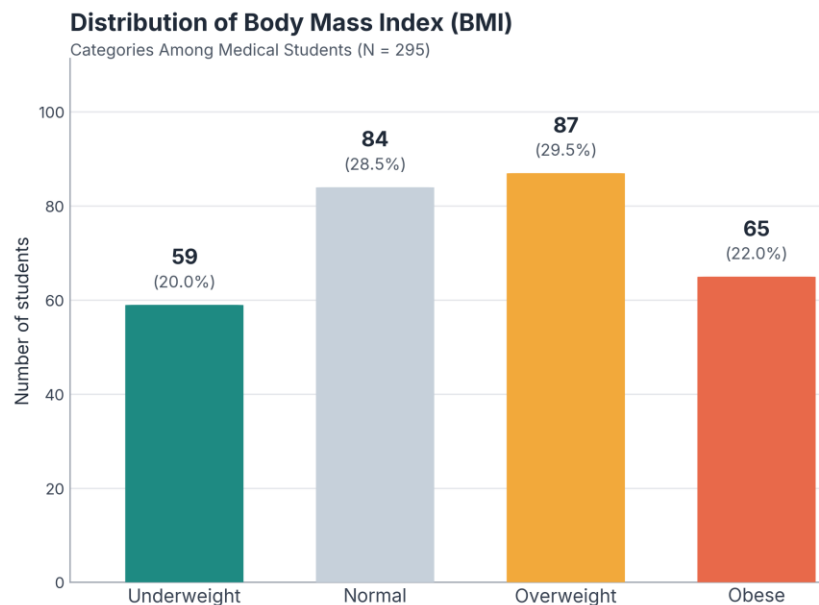


Figure 10. Distribution of BMI categories among medical students.

Sleep Quality in Relation to Demographic, Behavioral, and BMI Factors

Chi-square analysis showed that the intensity of insomnia severity was not significantly associated with sex ($p = 0.243$), perceived academic stress level ($p = 0.573$), pre-sleep screen use ($p = 0.186$), eating meals/snacks close to bedtime ($p = 0.209$), average sleep duration ($p = 0.293$), or BMI category ($p = 0.592$). GERD status was, however, strongly and significantly related with insomnia severity ($p < 0.001$) (Table 2, Figure 9). This is in contrast with the parent study (Teimouri &

Amra, 2021), which found BMI to be the strongest independent correlate of poor sleep (in addition to dormitory living) in Isfahan medical students, and in the present sample, there was no meaningful gradient in the severity of insomnia across underweight, normal, overweight, and obese groups (Figure 9), although the GERD-sleep association was the strongest and consistent result across both studies. This comparison and possible explanations for the disparate BMI finding is explored in the Discussion.

Table 2. Association of Insomnia Severity with Demographic, Behavioral, and BMI Factors

Variable	No insomnia	Mild	Moderate	Severe	p value
Sex – Male	2 (1.3%)	59 (37.1%)	70 (44.0%)	28 (17.6%)	0.243
Sex – Female	7 (5.1%)	50 (36.8%)	53 (39.0%)	26 (19.1%)	
BMI – Underweight	1 (1.7%)	19 (32.2%)	27 (45.8%)	12 (20.3%)	0.592
BMI – Normal	3 (3.6%)	29 (34.5%)	40 (47.6%)	12 (14.3%)	
BMI – Overweight	3 (3.4%)	36 (41.4%)	35 (40.2%)	13 (14.9%)	
BMI – Obese	2 (3.1%)	25 (38.5%)	21 (32.3%)	17 (26.2%)	
Stress – Low	0 (0.0%)	8 (32.0%)	13 (52.0%)	4 (16.0%)	

Variable	No insomnia	Mild	Moderate	Severe	p value
Stress — Moderate	2 (2.5%)	36 (44.4%)	30 (37.0%)	13 (16.0%)	0.573
Stress — High	4 (3.4%)	36 (31.0%)	49 (42.2%)	27 (23.3%)	
Stress — Very high	3 (4.1%)	29 (39.7%)	31 (42.5%)	10 (13.7%)	
Screen use — Never	1 (4.5%)	6 (27.3%)	14 (63.6%)	1 (4.5%)	
Screen use — Sometimes	3 (6.0%)	14 (28.0%)	21 (42.0%)	12 (24.0%)	0.186
Screen use — Frequently	3 (3.5%)	36 (41.9%)	35 (40.7%)	12 (14.0%)	
Screen use — Always	2 (1.5%)	52 (38.2%)	53 (39.0%)	29 (21.3%)	
Late meals — Never	0 (0.0%)	11 (52.4%)	5 (23.8%)	5 (23.8%)	
Late meals — Occasionally	4 (6.7%)	19 (31.7%)	26 (43.3%)	11 (18.3%)	0.209
Late meals — Frequently	3 (2.7%)	38 (34.5%)	54 (49.1%)	15 (13.6%)	
Late meals — Always	2 (1.9%)	41 (39.4%)	38 (36.5%)	23 (22.1%)	
Sleep duration — <5 h	0 (0.0%)	34 (41.0%)	33 (39.8%)	16 (19.3%)	
Sleep duration — 5–6 h	3 (3.5%)	36 (42.4%)	36 (42.4%)	10 (11.8%)	0.293
Sleep duration — 6–7 h	4 (7.5%)	12 (22.6%)	24 (45.3%)	13 (24.5%)	
Sleep duration — 7–8 h	1 (2.6%)	14 (35.9%)	17 (43.6%)	7 (17.9%)	
Sleep duration — >8 h	1 (2.9%)	13 (37.1%)	13 (37.1%)	8 (22.9%)	
GERD — Positive	3 (1.7%)	55 (31.1%)	73 (41.2%)	46 (26.0%)	<0.001
GERD — Negative	6 (5.1%)	54 (45.8%)	50 (42.4%)	8 (6.8%)	

p values from Pearson chi-square test comparing the full distribution across insomnia categories for each variable.

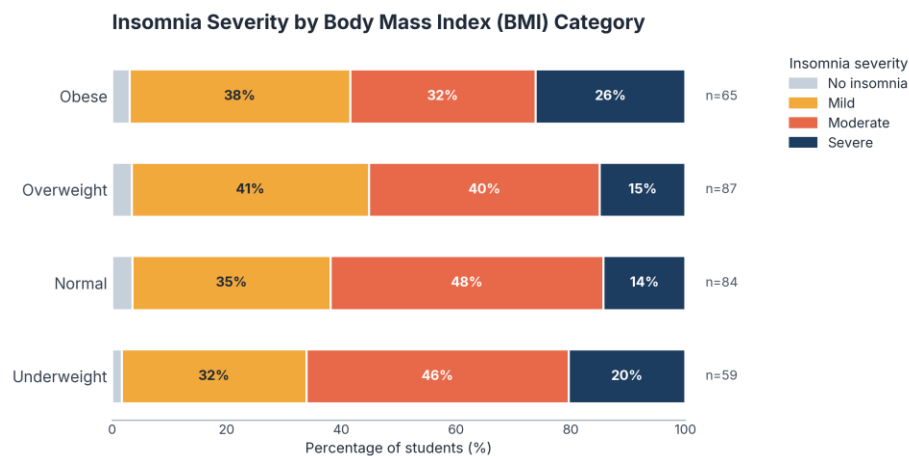


Figure 9. Insomnia severity by BMI category: no significant gradient was observed ($p = 0.592$).

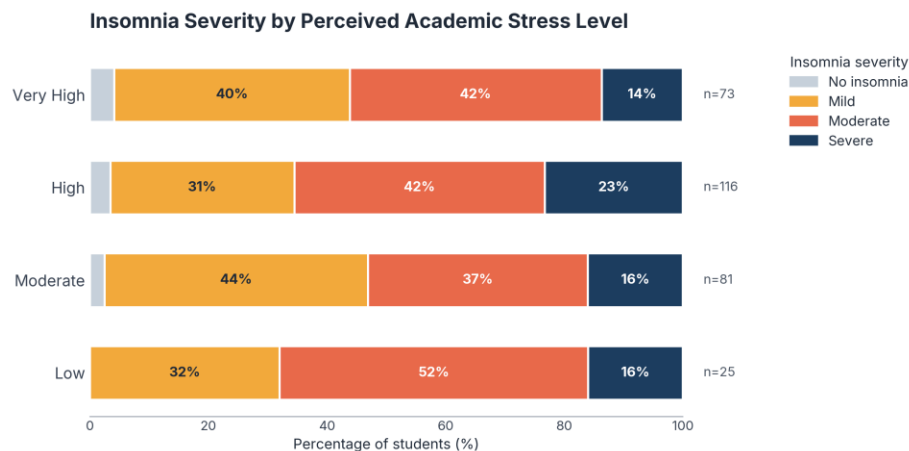


Figure 6. Insomnia severity by perceived academic stress level (not statistically significant, $p = 0.573$).

Predictors of Clinically Significant Insomnia: Univariate Logistic Regression

Since only nine participants (3.1%) reported no insomnia at all, for regression purposes insomnia was dichotomised as “clinically significant” (moderate or severe, $ISI \geq 15$; $n = 177$, 60.0%) versus “none/mild” ($ISI \leq 14$; $n = 118$, 40.0%). The odds of clinically significant insomnia were more than twice as high in GERD-positive students as in GERD-negative students ($OR = 2.12$, 95% CI: 1.32–3.42, $p = 0.002$) in univariate logistic regression (Table 3, Figure 7). For every 1-point increase in the FSSG score there was an

11% higher chance of clinically significant insomnia ($OR = 1.11$, 95% CI: 1.07–1.16, $p < 0.001$). Neither BMI category nor continuous BMI was a significant predictor (Overweight vs Normal: $OR = 0.76$, 95% CI: 0.41–1.39, $p = 0.372$; Obese vs Normal: $OR = 0.87$, 95% CI: 0.45–1.68, $p = 0.670$; Underweight vs Normal: $OR = 1.20$, 95% CI: 0.60–2.41, $p = 0.608$; continuous BMI per kg/m^2 : $OR = 0.98$, $p = 0.320$). None of the other variables (sex, age, perceived academic stress, pre-sleep screen use, late night eating, or sleep duration) proved to be significant.

Table 3. Univariate Logistic Regression: Factors Associated with Clinically Significant Insomnia ($ISI \geq 15$)

Variable	Category (ref.)	OR	95% CI	p value
Sex	Female vs Male	0.86	0.54–1.38	0.535
Academic stress	Moderate vs Low	0.53	0.21–1.37	0.192
Academic stress	High vs Low	0.89	0.36–2.25	0.812
Academic stress	Very high vs Low	0.60	0.23–1.57	0.301
Screen use	Always vs Never	0.71	0.27–1.85	0.482
Screen use	Frequently vs Never	0.56	0.21–1.52	0.256
Screen use	Sometimes vs Never	0.91	0.31–2.64	0.856
Late meals/snacks	Always vs Never	1.56	0.61–4.00	0.354
Late meals/snacks	Occasionally vs Never	1.77	0.65–4.82	0.264

Variable	Category (ref.)	OR	95% CI	p value
Late meals/snacks	Frequently vs Never	1.85	0.72–4.74	0.199
GERD status	Positive vs Negative	2.12	1.32–3.42	0.002
Sleep duration	<5 h vs 7–8 h	0.90	0.41–1.96	0.793
Sleep duration	5–6 h vs 7–8 h	0.74	0.34–1.60	0.440
Sleep duration	6–7 h vs 7–8 h	1.45	0.60–3.46	0.408
Sleep duration	>8 h vs 7–8 h	0.94	0.37–2.39	0.892
BMI category	Overweight vs Normal	0.76	0.41–1.39	0.372
BMI category	Underweight vs Normal	1.20	0.60–2.41	0.608
BMI category	Obese vs Normal	0.87	0.45–1.68	0.670
Age (continuous)	per year	1.02	0.87–1.19	0.848
BMI (continuous)	per kg/m ²	0.98	0.94–1.02	0.320
FSSG score (continuous)	per 1-point increase	1.11	1.07–1.16	<0.001



Figure 7. Forest plot of univariate odds ratios for clinically significant insomnia. Only GERD status (highlighted) reached statistical significance; BMI category showed no significant association.

GERD Symptoms and Sleep Quality

Mirroring the approach of the parent study, heartburn and regurgitation (acid coming up into the throat) were each examined individually against insomnia severity. Both symptoms were significantly associated with worse insomnia severity: heartburn ($p = 0.0006$) and regurgitation

($p = 0.0002$) (Table 4, Figures 3–4). Students reporting either symptom showed a clear shift toward the moderate and severe insomnia categories and a corresponding drop in the “no insomnia” and “mild” categories, matching the direction of the parent study's Table 3 findings for heartburn and regurgitation.

Table 4. Association Between Insomnia Severity and Individual GERD Symptoms

Symptom	No insomnia	Mild	Moderate	Severe	p value
Heartburn – Absent	0 (0.0%)	55 (50.0%)	41 (37.3%)	14 (12.7%)	
Heartburn – Present	9 (4.9%)	54 (29.2%)	82 (44.3%)	40 (21.6%)	0.0006
Regurgitation – Absent	4 (3.5%)	58 (51.3%)	40 (35.4%)	11 (9.7%)	
Regurgitation – Present	5 (2.7%)	51 (28.0%)	83 (45.6%)	43 (23.6%)	0.0002

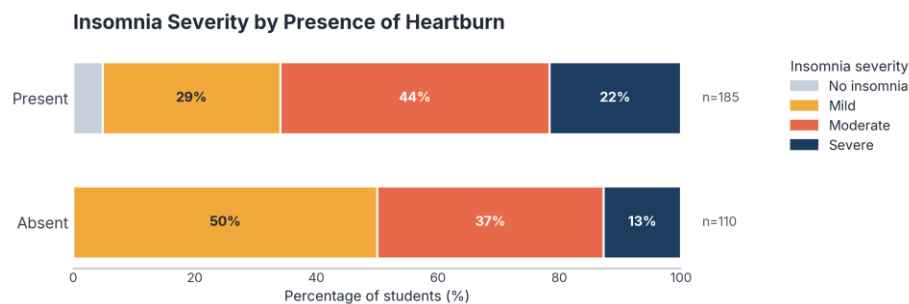


Figure 3. Insomnia severity by presence of heartburn

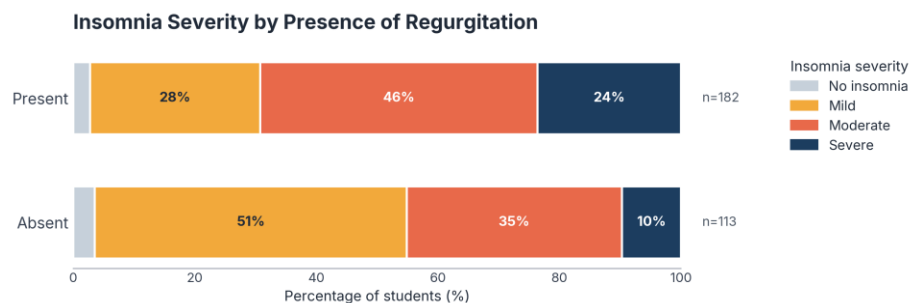


Figure 4. Insomnia severity by presence of regurgitation

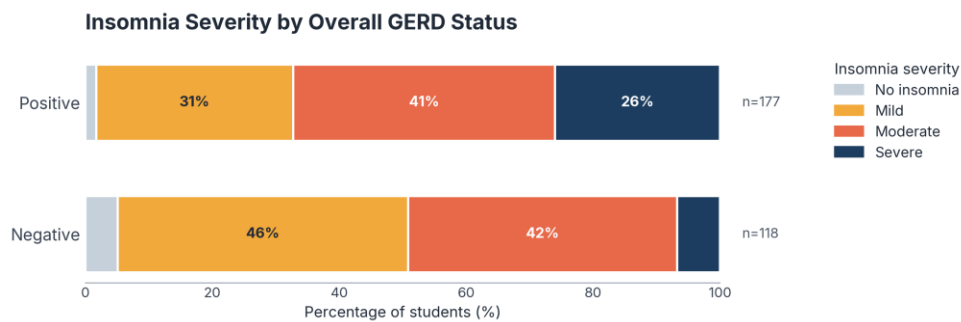


Figure 5. Insomnia severity by overall GERD status

To assess the relationship between total FSSG score and total ISI score beyond the simple positive/negative GERD classification, a Spearman correlation was conducted, which found a significant positive correlation ($r_s = 0.35$,

$p < 0.001$; Figure 8). However, in this sample, there was essentially no correlation between BMI and either GERD symptom severity ($r_s = -0.10$, $p = 0.101$) or insomnia severity ($r_s = -0.02$, $p = 0.681$).

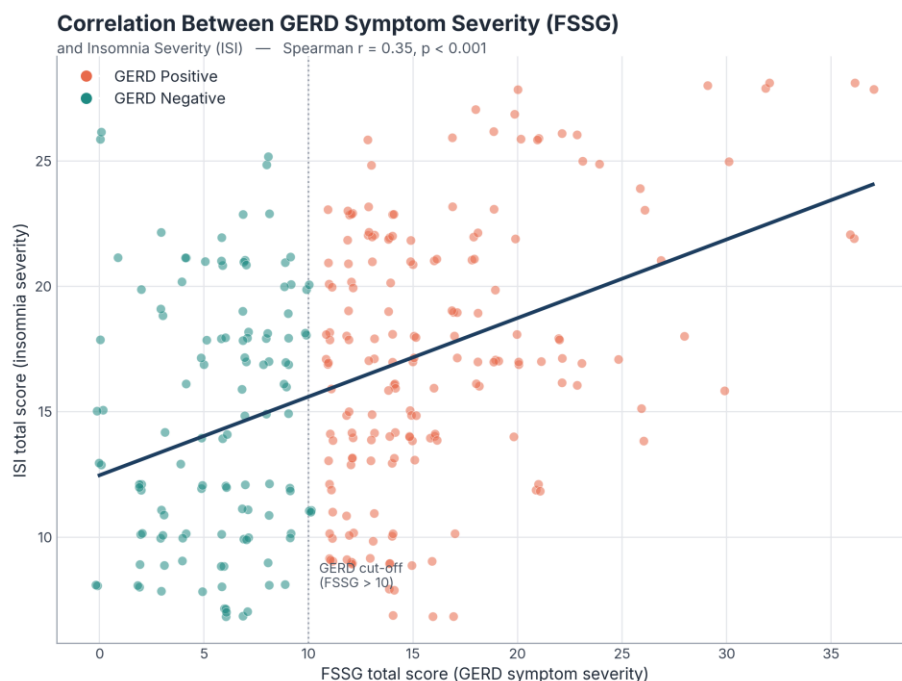


Figure 8. Correlation between GERD symptom severity (FSSG total) and insomnia severity (ISI total).

DISCUSSION

This cross-sectional study on 295 medical and dental students from Abbottabad studied the association between GERD symptoms, BMI and sleep quality in medical and dental students, similar to Teimouri and Amra's (2021) study of medical students of Isfahan. As the main outcome, the status of GERD was strongly

associated with insomnia, and this association was independent of any other factor, both when analysed categorically (OR = 2.12, 95% CI: 1.32–3.42, $p = 0.002$) and when analysed more granularly – as a continuum of FSSG scores (OR = 1.11, $p < 0.001$). This discovery is in line with the main message of the parent study, which revealed that GERD (both expressed as heartburn

and regurgitation) was associated with worse sleep quality among medical students, in a different population, country, and sleep measure.

When analyzed individually, both heartburn ($p = 0.0006$) and regurgitation ($p = 0.0002$), were significantly associated with worse insomnia severity as in the parent study, Table 3, where both were independently associated with lower sleep-related quality of life ($p < 0.001$ for both) (Teimouri & Amra, 2021). This is consistent with the broader literature associating reflux symptoms with impaired sleep (Fujiwara, Arakawa, & Fass, 2012)[9]. The Spearman correlation between the total FSSG and ISI scores ($r_s = 0.35$, $p < 0.001$) was added to the parent study to demonstrate a dose-response type of relationship and not a threshold response: the higher the reflux symptom burden, the higher the insomnia severity.

BMI is a significant difference from the parent study. Among Irani medical students, being overweight was the most significant independent risk factor for poor sleep quality ($OR = 3.09$) and the worse the participant's BMI, the worse the sleep quality (Teimouri & Amra, 2021). Although there was a good distribution across the BMI categories in this present sample (20.0% underweight, 28.5% normal, 29.5% overweight, and 22.0% obese), there was no such gradient in this sample: insomnia severity did not differ significantly across BMI categories ($p = 0.592$), nor were BMI related to insomnia severity ($r_s = -0.02$) or GERD symptom severity ($r_s = -0.10$) as continuous measures. The following explanation(s) appear to be feasible. The parent study was the PSQI (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989) that assesses wider domains of sleep quality that could be more responsive to metabolic and weight-related changes than the ISI's focus on insomnia symptoms specifically (Bastien, Vallières, & Morin, 2001)[10]. The role of obstructive sleep apnoea and nocturnal reflux mechanics in the effect of obesity on sleep is also believed to play a part (Sabaté et al., 2008), and this pathway may not be captured on a subjective insomnia scale without polysomnographic or apnoea screening data[11]. Differences in demographic

characteristics (dietary pattern, climate, activity level and other medical/dental student groups sampled) could also affect the BMI-sleep association between Isfahan and Abbottabad. This difference represents a difference in the modifiable correlates of poor sleep, not a failure to replicate, as in this population reflux symptoms, and not body weight, are more important.

None of the other demographic or behavioral factors measured here (sex, age, perceived academic stress, pre-sleep screen time, eating close to sleep, or self-reported sleep duration) were statistically significant individual factors for insomnia, compared to the parent study. This stands opposed to the parent study results which observed that along with BMI, dormitory residence was also an independent predictor of impaired sleep (Teimouri & Amra, 2021); residence type was not measured in this survey and is a potential variable for future data collection. Alternatively, it may have been that in this sample, the amount of stress and screen use was so consistent (about 64% of students reported "high" or "very high" stress, and 83% reported "frequent" or "always" pre-sleep screen use) that there was not enough variation of the sample to demonstrate a statistical association, which is called a "ceiling effect".

The overall prevalence of sleep disturbance was remarkable: 96.9% of the students had at least mild insomnia on the ISI and 60.0% had clinically significant insomnia on the ISI. But this is significantly higher than the percentage of any impairment reported with the PSQI in the parent study, although the two measures can't be compared directly because the ISI was designed specifically to measure insomnia, while the PSQI measures sleep quality in seven sub-domains including latency, duration, efficiency, and more (Buysse et al., 1989; Bastien, Vallières, & Morin, 2001)[12]. The continuous high levels of stress and screen usage reported here align with the parent study, which highlighted medical-student burnout, stressful rotations, and nighttime waking as factors in poor sleep and reflux symptoms (Teimouri & Amra, 2021), and have also been reported among medical students

elsewhere (Corrêa et al., 2017; Alsaggaf et al., 2016)[13].

Limitations

There are a few restrictions to be considered: This survey did not include any items related to residence, as one of the two important predictors in the parent study (Teimouri & Amra, 2021), which was examined, and was not collected. Sleep quality was measured with the Insomnia Severity Index, not the Pittsburgh Sleep Quality Index (PSQI) which was used in the parent study (Bastien, vallièrès, & Morin, 2001; Buysse et al., 1989), and thus provides only limited numerical comparison between the two studies, but both are validated and widely used [14]. The cross-sectional design does not allow for causal inference: while the parent study does acknowledge that GERD and poor sleep could be a bidirectional relationship (Teimouri & Amra, 2021) [15], there is also a bidirectional relationship between any pathway and BMI. Lastly, there are risks of selection bias and self-report questionnaires, and five of the records identified apparent data entry error, which is a common and appropriate data clean-up procedure that is reported for completeness.

Conclusion

As in the parent study (Teimouri & Amra, 2021), GERD was significantly and independently correlated with poor sleep quality among medical students in Abbottabad and there was a clear dose-response relationship between the severity of GERD symptoms and the insomnia severity. In the present sample, BMI was not related to insomnia severity, nor was the other demographic and lifestyle factors measured (sex, stress, screen use, late-night eating, sleep duration). Due to the high prevalence of GERD symptoms (60.0%) and clinically significant insomnia (60.0%) in this sample, targeted counseling towards GERD symptoms (and not weight management alone) may be a more viable approach to improving sleep quality in this population. The type of residence should be added to future data collection so that the model can be replicated in the future.

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