Original Study

# Relationship Between Gastroesophageal Reflux Disease and Sleep Disruption Among the Population in Saudi Arabia

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## Abstract

Sleep deprivation is thought to increase the risk of GERD symptoms. People who slept poorly also had more GERD symptoms. This study aimed to assess the prevalence of GERD among people with sleep disorders and the effect of GERD on sleeping quality among people in Saudi Arabia. A cross-sectional study with 733 participants took place in Saudi Arabia. A validated Arabic version of the GERD questionnaire (GERDQ) and the Athens insomnia scale (AIS) were distributed through Google fill-in forms to assess GERD and insomnia prevalence and relationship. Data about participants' demographics, weight, height, smoking, chronic diseases, physical activities, type of analgesics used, number of meals/days, types of foods, most drinks, and improvement of GERD symptoms with PPI were collected. The study's participants had an average age of 37.01 ± 13.21, and 27.1% had chronic diseases. About 36% (36.4%) had GERD, and 46.5% had insomnia. Participants with GERD had a significantly older mean age, lived in cities, drank coffee as their most common beverage, and their symptoms improved when they used (omeprazole, Esomeprazole, Lansoprazole, Pantoprazole, Rabeprazole). GERD was associated with delayed sleep induction, minor problems waking up at night, waking up slightly earlier than desired, slightly unsatisfactory overall sleep quality, and mild sleepiness during the day. Participants with insomnia had a significantly higher GERD prevalence, and the GERDQ and the AIS scale results demonstrated a significant positive association. The implementation of awareness programs for appropriate sleep hygiene behaviors among GERD patients.

**Keywords:** Relationship, GERD, AIS, Disruption, Population, Saudi

## Introduction

GERD (gastroesophageal reflux disease) is a prevalent digestive disease affecting millions worldwide [1]. Gastroesophageal reflux disease is a chronic disease that leads to acid reflux and heartburn. These symptoms are common during the day and can have a negative effect on nighttime sleep quality [2]. It is well known that sleep deprivation has a negative effect on health and quality of life [3]. However, a bidirectional connection between GERD and sleep was discovered in a previous study [4].

According to clinical research, GERD is linked to sleep difficulties such as short sleep durations, trouble falling asleep, early morning wakings, and poor sleep quality [5]. The most common symptoms, according to a large body of research involving 11,685 survey respondents, are nocturnal symptoms (88.9%), sleep disturbances (68.3%), difficulty falling asleep (49.3%), and difficulty staying asleep (58.3%) [6]. In addition, 79% of 1,000 respondents reported experiencing heartburn at night, 75% stated that the symptoms kept them up at night, 63% stated that heartburn negatively affected their ability to sleep well, and 40% believed that they experienced impairment in their ability to function the next day caused by nocturnal heartburn [7].

Sleep deprivation is also thought to be a major risk factor for GERD symptoms [8]. Furthermore, an American study discovered that people who slept poorly had more GERD symptoms [9]. Furthermore, several studies have suggested that anti-reflux treatments can help you sleep better [10-12]. A similar study in France discovered that GERD treatment

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**How to cite this article:** Sharif AT, Alshareef MA, Alqarni SA, Babaqi LS, Alshareef RM, Alzahrani MK, et al. Relationship Between Gastroesophageal Reflux Disease and Sleep Disruption Among the Population in Saudi Arabia. Arch Pharm Pract. 2023;14(S):A06231446.

significantly reduced sleep interruption and improved sleep duration and quality [13]. In addition, an Egyptian study confirmed that melatonin improved GERD symptoms when used alone or in combination with omeprazole [14]. Ramelteon was also found to significantly reduce symptoms of daytime heartburn in another study [15].

To the best of the authors' knowledge, there aren't enough studies in Saudi Arabia that look at the link between GERD and sleep disruption. As a result, this study aimed to evaluate the prevalence of GERD in individuals with sleep problems, as well as the impact of GERD on sleeping quality in Saudi Arabia.

## Materials and Methods

Study design: A cross-sectional study was done in Saudi Arabia from January 2022 to May 2022.

Study participants: A sample of residents in Saudi Arabia was contacted.

Sample size: It was required to have a minimum sample size of 385 participants, representing the 20 million people in Saudi Arabia, with a confidence level (CL) of 95% and a confidence interval (CI) of 5%. For sample determination, the Raosoft online sample calculator was used [16]. The total sample size was 733 people.

Data collection: Google fill-in Forms were used to collect data. An Arabic version of the GERD questionnaire (GERDQ) was validated and adopted for usage among Arabic speakers [17]. In addition, The Athens insomnia scale's Arabic-validated version was employed [18]. The questionnaire included items to collect participants' demographics: Age, Gender, Place of residence, Weight and Height, Smoking, Education, Occupation, and Any chronic diseases .In addition to questions related to GERD: physical activities, type of analgesics used, number of meals/days, types of foods, most types of drinks, and improvement GERD symptoms with PPI. Yes and no questions were present that included the following :Family History of Gastroesophageal Disease, Consuming pickles or salt with meals, consuming fast food, Regular use of analgesics, Having fibers (fruits, vegetables, etc.).

The GERDQ is a scale that includes symptoms including nausea, regurgitation, epigastric discomfort, heartburn, disturbed sleep, and medication usage. Patients were requested to rate the frequency of different symptoms during the previous week using a scale of 0 to 3, with an overall GERDQ score ranging from 0 to 18. In addition, the recommended cut-off score of 8 is used to diagnose GERD [19]. The GERDQ score has an advantage over other GERD scores and scales in that it has a valid and predetermined cut-off point for determining the likelihood of GERD. It is also a simple, convenient, noninvasive examination that is inexpensive, has high patient compliance, and can be conducted in the clinic. Many studies in various countries have confirmed the diagnostic reliability and validity of the GERDQ. Hence, they conducted the study to better understand the occurrence rates of reflux-related symptoms to investigate the relationship between endoscopic manifestations and GERDQ score [20, 21].

Data analysis: SPSS version 26 was used to statistically analyze the data. The Chi-squared test. ($\chi^2$) was used to determine the association between the variables. Qualitative data was represented as numbers and percentages. The Mann-Whitney test was used to examine non-parametric variables, while the mean and standard deviation (Mean ± SD) were used to express quantitative data. Correlation analysis was performed using Spearman's test, and statistical significance was defined as a p-value of less than 0.05.

## Results and Discussion

Participants' mean age was 37.01 ± 13.21 years; 73% were females, 56.9% were married, and 92.5% lived in cities. Of them, 87.2% had an education equivalent to or higher than a university level, 43.8% were employed, and 40.5% had an O+ blood group type **(Table 1)**.

**Table 1.** Distribution of studied participants according to their demographics and blood group (No.: 733)

| Variable | No. (%) |
|---|---|
| Age (years) | 37.01 ± 13.21 |
| Gender | |
| Female | 535 (73) |
| Male | 198 (27) |
| Marital status | |
| Divorced | 22 (3) |
| Married | 417 (56.9) |
| Single | 275 (37.5) |
| Widow | 19 (2.6) |
| Residence | |
| Rural | 55 (7.5) |
| Urban | 678 (92.5) |
| Education | |
| Illiteracy | 6 (0.8) |
| Primary/intermediate school | 11 (1.5) |
| Highschool | 77 (10.5) |
| University and above | 639 (87.2) |
| Employment | |
| Employed | 321 (43.8) |
| Unemployed | 132 (18) |
| Retired | 87 (11.9) |
| Student | 193 (26.3) |
| Blood group | |
| A- | 21 (2.9) |
| A+ | 188 (25.6) |
| AB- | 2 (0.3) |

| | |
|---|---|
| AB+ | 32 (4.4) |
| B- | 6 (0.8) |
| B+ | 93 (12.7) |
| I don't know | 65 (8.9) |
| O- | 29 (4) |
| O+ | 297 (40.5) |

**Table 2** demonstrates that 27.1% of the respondents had chronic diseases, 40.9% never practiced physical activities for 30 mins per week, and the most commonly used analgesic was Paracetamol (Panadol, Fevadol, etc.) for 69.3%. Of them, 51.3% were eating less than 3 meals daily, 53% were eating Greasy food most of the time, and 40.5% were drinking water as the most common drink. About 28% (28.4%) were improved on using these medications (Omeprazole, Esomeprazole, Lansoprazole, Pantoprazole, Rabeprazole). Only 16.9% were smokers, and 38.9% had a family history of Gastroesophageal Disease. Most of them (65.8%) consume salt or pickles with meals, 40% eat fast food, 22.8% were using analgesics on a regular basis, and 77.5% eat fiber (fruits, vegetables, etc.).

**Table 2.** Distribution of studied participants according to chronic diseases, physical activity, analgesics use, eating pattern, smoking status, family history of gastroesophageal disease (No.: 733)

| Variable | No. (%) |
|---|---|
| Having chronic diseases | |
| No | 534 (72.9) |
| Yes | 199 (27.1) |
| How many times do you do physical activities for 30 minutes per week? | |
| Neve | 300 (40.9) |
| Once per week | 170 (23.2) |
| 2-3 times per week | 163 (22.2) |
| More than three times per week | 100 (13.6) |
| What's the common type of analgesics you use? | |
| Buscopan (antispasmodic drug ) | 1 (0.1) |
| Chemotherapy and hormonal therapy | 1 (0.1) |
| It depends on the condition | 1 (0.1) |
| Non-steroidal anti-inflammatory (Diclofenac, Brufen, Aspirin, etc.) | 75 (10.2) |
| Paracetamol (Panadol, Fevadol… etc.) | 508 (69.3) |
| Paracetamol (Panadol, Fevadol, etc.), Non-steroidal anti-inflammatory (Diclofenac, Brufen, Aspirin, etc.) | 2 (0.3) |
| Other | 3 (0.4) |
| I don't use it | 142 (19.4) |
| How many meals do you eat per day? | |
| less than 3 per day | 376 (51.3) |
| Three meals | 286 (39) |
| More than 3 per day | 71 (9.7) |
| What's the common type of food you eat? | |
| Chocolate | 113 (15.4) |
| Greasy food | 395 (53.9) |
| Spicy food | 177 (24.1) |
| Tomato | 48 (6.5) |
| What do you drink the most? | |
| Citrus juice | 8 (1.1) |
| Coffee | 232 (31.7) |
| Peppermint | 3 (0.4) |
| Soft drink | 72 (9.8) |
| Tea | 121 (16.5) |
| Water | 297 (40.5) |
| Do your symptoms improve when you use any type of these medications? (omeprazole, Esomeprazole, Lansoprazole, Pantoprazole, Rabeprazole) | |
| I don't use it | 487 (66.4) |
| No | 38 (5.2) |
| Yes | 208 (28.4) |
| Are you a smoker? | |
| No | 609 (83.1) |
| Yes | 124 (16.9) |
| Do you have a family history of Gastroesophageal Disease? | |
| No | 448 (61.1) |
| Yes | 285 (38.9) |
| Do you consume salt or pickles with meals? | |
| No | 251 (34.2) |
| Yes | 482 (65.8) |
| Do you eat fast food? | |
| No | 440 (60) |
| Yes | 293 (40) |
| Do you use analgesics regularly? | |
| No | 566 (77.2) |
| Yes | 167 (22.8) |
| Do you eat fiber? (fruits, vegetables, etc. )? | |
| No | 165 (22.5) |
| Yes | 568 (77.5) |

The participants' response to the Athens Insomnia Scale (AIS) items is illustrated in **(Table 3)**. It was found that 40.9% had a slightly delayed sleep induction, 36.7% had a minor problem in awakening during the night, and 38.7% were awakening a little earlier than desired. 43.9% of them reported that their sleep duration is slightly insufficient, 39% reported that their overall sleep quality is slightly unsatisfactory, and 33.3% reported that their sensation of well-being is slightly diminished during the day. About 33% (33.8%) reported that their functioning during the day is slightly decreased, and 57% had mild sleepiness during the day.

**Table 3.** Distribution of studied participants according to their response to the Athens Insomnia Scale (AIS) items (No.: 733)

| Variable | No. (%) |
|---|---|
| Sleep induction (time it takes you to fall asleep after turning off the lights) | |
| No problem | 193 (26.3) |
| Slightly delayed | 300 (40.9) |
| Markedly delayed | 152 (20.7) |
| Very delayed or did not sleep at all | 88 (12) |
| Awakening during the night | |

| | |
|---|---|
| No problem | 320 (43.7) |
| Minor problem | 269 (36.7) |
| Considerable problem | 104 (14.2) |
| Serious problem or did not sleep at all | 40 (5.5) |
| Final awakening earlier than desired | |
| Not earlier | 311 (42.4) |
| A little earlier | 284 (38.7) |
| Markedly earlier | 103 (14.1) |
| Much earlier or did not sleep at all | 35 (4.8) |
| Total sleep duration | |
| Sufficient | 285 (38.9) |
| Slightly insufficient | 322 (43.9) |
| Markedly insufficient | 108 (14.7) |
| Very insufficient or did not sleep at all | 18 (2.5) |
| Overall quality of sleep (no matter how long you slept) | |
| Satisfactory | 326 (44.5) |
| Slightly unsatisfactory | 286 (39) |
| Markedly unsatisfactory | 108 (14.7) |
| Very unsatisfactory or did not sleep at all | 13 (1.8) |
| Sense of well-being during the day | |
| Normal | 378 (51.6) |
| Slightly decreased | 244 (33.3) |
| Markedly decreased | 39 (5.3) |
| Very decreased | 72 (9.8) |
| Functioning (physical and mental) during the day | |
| Normal | 402 (54.8) |
| Slightly decreased | 233 (31.8) |
| Markedly decreased | 77 (10.5) |
| Very decreased | 21 (2.9) |
| Sleepiness during the day | |
| None | 116 (15.8) |
| Mild | 418 (57) |
| Considerable | 155 (21.1) |
| Intense | 44 (6) |
| Male | 66 (24.7) | 132 (28.3) | | |
| Marital status | | | | |
| Divorced | 9 (3.4) | 13 (2.8) | 1.89 | 0.596 |
| Married | 158 (59.2) | 259 (55.6) | | |
| Single | 92 (34.5) | 183 (39.3) | | |
| Widow | 8 (3) | 11 (2.4) | | |
| Residence | | | | |
| Rural | 28 (10.5) | 27 (5.8) | 5.38 | **0.02** |
| Urban | 239 (89.5) | 439 (94.2) | | |
| Education | | | | |
| Illiteracy | 4 (1.5) | 2 (0.4) | 3.94 | 0.268 |
| Primary/intermediate school | 5 (1.9) | 6 (1.3) | | |
| Highschool | 32 (12) | 45 (9.7) | | |
| University and above | 226 (84.6) | 413 (88.6) | | |
| Employment | | | | |
| Employed | 128 (47.9) | 193 (41.4) | 4.55 | 0.207 |
| Unemployed | 49 (18.4) | 83 (17.8) | | |
| Retired | 31 (11.6) | 56 (12) | | |
| Student | 59 (22.1) | 134 (28.8) | | |
| Blood group | | | | |
| A- | 11 (4.1) | 10 (2.1) | 3.66 | 0.886 |
| A+ | 69 (25.8) | 119 (25.5) | | |
| AB- | 0 (0.0) | 2 (0.4) | | |
| AB+ | 12 (4.5) | 20 (4.3) | | |
| B- | 2 (0.7) | 4 (0.9) | | |
| B+ | 33 (12.4) | 60 (12.9) | | |
| O- | 10 (3.7) | 19 (4.1) | | |
| O+ | 106 (39.7) | 191 (41) | | |
| I don't know | 24 (9) | 41 (8.8) | | |

N.B.: * = Mann-Whitney test

Based on the GERDQ and the AIS cut-off points, our research found that 36.4% of the participants had GERD and 46.5% had insomnia.

**Table 4** demonstrates that respondents with GERD had a significantly older mean age and lived in cities (p= <0.05). GERD prevalence, on the other hand, was found to have a non-significant relationship with other participants' demographics or blood groups (p=>0.05).

**Table 4.** Relationship between GERD prevalence and participants' demographics and blood group (No.: 733)

| Variable | GERD | | $\chi^2$ | p-value |
|---|---|---|---|---|
| | Yes No. (%) | No No. (%) | | |
| Age | 38.82 ± 13.49 | 35.98 ± 12.95 | 2.72* | **0.006** |
| Gender | | | | |
| Female | 201 (75.3) | 334 (71.7) | 1.12 | 0.29 |

**Table 5** shows that those who drink coffee as their preferred beverage had considerably higher rates of GERD, whose symptoms were improved when using (Omeprazole, Esomeprazole, Lansoprazole, Pantoprazole, Rabeprazole), had no family history of Gastroesophageal Disease, who don't use analgesics regularly and who eat fibers (p=<0.05).

**Table 5.** Relationship between GERD prevalence and participants' chronic diseases, physical activity, analgesics use, eating pattern, smoking status, family history of gastroesophageal disease (No.: 733)

| Variable | GERD | | $\chi^2$ | p-value |
|---|---|---|---|---|
| | Yes No. (%) | No No. (%) | | |
| Having chronic disease | | | | |
| No | 185 (69.3) | 349 (74.9) | 2.69 | 0.101 |
| Yes | 82 (30.7) | 117 (25.1) | | |

| | | | | |
|---|---|---|---|---|
| How many times do you do physical activities for 30 minutes per week? | | | | |
| Neve | 106 (39.7) | 194 (41.6) | 0.83 | 0.842 |
| Once per week | 60 (22.5) | 110 (23.6) | | |
| 2-3 times per week | 64 (24) | 99 (21.2) | | |
| More than three times per week | 37 (13.9) | 63 (13.5) | | |
| What's the common type of analgesics you use? | | | | |
| Buscopan (antispasmodic drug) | 0 (0.0) | 1 (0.2) | 4.18 | 0.758 |
| Chemotherapy and hormonal therapy | 1 (0.4) | 0 (0.0) | | |
| It depends on the condition | 0 (0.0) | 1 (0.2) | | |
| Non-steroidal anti-inflammatory (Diclofenac, Brufen, Aspirin, etc.) | 30 (11.2) | 45 (9.7) | | |
| Paracetamol (Panadol, Fevadol etc.) | 187 (70) | 321 (68.9) | | |
| Paracetamol (Panadol, Fevadol, etc.), Non-steroidal anti-inflammatory (Diclofenac, Brufen, Aspirin, etc.) | 1 (0.4) | 1 (0.2) | | |
| Other | 1 (0.4) | 2 (0.4) | | |
| I don't use it | 47 (17.6) | 95 (20.4) | | |
| How many meals do you eat per day? | | | | |
| less than 3 per day | 134 (50.2) | 242 (51.9) | 0.38 | 0.823 |
| Three meals | 105 (39.3) | 181 (38.8) | | |
| More than 3 per day | 28 (10.5) | 43 (9.2) | | |
| What's the common type of food you eat? | | | | |
| Chocolate | 37 (13.9) | 76 (16.3) | 3.52 | 0.318 |
| Greasy food | 141 (52.8) | 254 (54.5) | | |
| Spicy food | 74 (27.7) | 103 (22.1) | | |
| Tomato | 15 (5.6) | 33 (7.1) | | |
| What do you drink the most? | | | | |
| Citrus juice | 2 (0.7) | 6 (1.3) | 16.04 | **0.007** |
| Coffee | 92 (34.5) | 140 (30) | | |
| Peppermint | 0 (0.0) | 3 (0.6) | | |
| Soft drink | 22 (8.2) | 50 (10.7) | | |
| Tea | 59 (22.1) | 62 (13.3) | | |
| Water | 92 (34.5) | 205 (44) | | |
| Do your symptoms improve when you use any type of these medications? (omeprazole, Esomeprazole, Lansoprazole, Pantoprazole, Rabeprazole) | | | | |
| I don't use it | 121 (45.3) | 366 (78.5) | 86.8 | **<0.001** |
| No | 18 (6.7) | 20 (4.3) | | |
| Yes | 128 (47.9) | 80 (17.2) | | |
| Are you a smoker? | | | | |
| No | 225 (84.3) | 384 (82.4) | 0.42 | 0.517 |
| Yes | 42 (15.7) | 82 (17.7) | | |
| Do you have a family history of Gastroesophageal Disease? | | | | |
| No | 137 (51.3) | 311 (66.7) | 17 | **<0.001** |
| Yes | 130 (48.7) | 155 (33.3) | | |
| Do you consume salt or pickles with meals? | | | | |
| No | 91 (34.1) | 160 (34.3) | 0.005 | 0.945 |
| Yes | 176 (65.9) | 306 (65.7) | | |
| Do you eat fast food? | | | | |
| No | 167 (62.5) | 273 (58.6) | 1.11 | 0.292 |
| Yes | 100 (37.5) | 193 (41.4) | | |
| Do you use analgesics regularly? | | | | |
| No | 183 (68.5) | 383 (82.2) | 17.97 | **<0.001** |
| Yes | 84 (31.5) | 83 (17.8) | | |
| Do you eat fiber? (fruits, vegetables, etc. )? | | | | |
| No | 72 (27) | 93 (20) | 4.78 | **0.029** |
| Yes | 195 (73) | 373 (80) | | |

**Table 6** illustrates that GERD was significantly higher among participants whose sleep induction was slightly delayed, who had a minor problem in awakening during the night, who were awakening a little earlier than desired, whose overall quality of sleep was slightly unsatisfactory, the sensation of well-being during the day was normal, whose functioning during the day was normal and who had mild sleepiness during the day (p=<0.05).

**Table 6.** Relationship between GERD prevalence and participants' response to the AIS scale items (No.: 733)

| Variable | GERD | | χ2 | p-value |
|---|---|---|---|---|
| | Yes No. (%) | No No. (%) | | |
| Sleep induction (time it takes you to fall asleep after turning off the lights) | | | | |
| No problem | 49 (18.4) | 144 (30.9) | 19.89 | **<0.001** |
| Slightly delayed | 108 (40.4) | 192 (41.2) | | |
| Markedly delayed | 67 (25.1) | 85 (18.2) | | |
| Very delayed or did not sleep at all | 43 (16.1) | 45 (9.7) | | |
| Awakening during the night | | | | |
| No problem | 81 (30.3) | 239 (51.3) | 32.04 | **<0.001** |
| Minor problem | 115 (43.1) | 154 (33) | | |
| Considerable problem | 51 (19.1) | 53 (11.4) | | |
| Serious problem or did not sleep at all | 20 (7.5) | 20 (4.3) | | |
| Final awakening earlier than desired | | | | |
| Not earlier | 93 (34.8) | 218 (46.8) | 15.75 | **0.001** |
| A little earlier | 106 (39.7) | 178 (38.2) | | |
| Markedly earlier | 50 (18.7) | 53 (11.4) | | |
| Much earlier or did not sleep at all | 18 (6.7) | 17 (3.6) | | |
| Total sleep duration | | | | |
| Sufficient | 88 (33) | 197 (42.3) | 7.02 | 0.071 |
| Slightly insufficient | 127 (47.6) | 195 (41.8) | | |
| Markedly insufficient | 43 (16.1) | 65 (13.9) | | |

| | | | | |
|---|---|---|---|---|
| Very insufficient or did not sleep at all | 9 (3.4) | 9 (1.9) | | |
| Overall quality of sleep (no matter how long you slept) | | | | |
| Satisfactory | 106 (39.7) | 220 (47.2) | 10.0 | **0.018** |
| Slightly unsatisfactory | 106 (39.7) | 180 (38.6) | | |
| Markedly unsatisfactory | 46 (17.2) | 62 (13.3) | | |
| Very unsatisfactory or did not sleep at all | 9 (3.4) | 4 (0.9) | | |
| Sense of well-being during the day | | | | |
| Normal | 109 (40.8) | 269 (57.7) | 20.44 | **<0.001** |
| Slightly decreased | 108 (40.4) | 136 (29.2) | | |
| Markedly decreased | 20 (7.5) | 19 (4.1) | | |
| Very decreased | 30 (11.2) | 42 (9) | | |
| Functioning (physical and mental) during the day | | | | |
| Normal | 121 (45.3) | 281 (60.3) | 19.1 | **<0.001** |
| Slightly decreased | 97 (36.3) | 136 (29.2) | | |
| Markedly decreased | 36 (13.5) | 41 (8.8) | | |
| Very decreased | 13 (4.9) | 8 (1.7) | | |
| Sleepiness during the day | | | | |
| None | 44 (16.5) | 72 (15.5) | 11.81 | **0.008** |
| Mild | 133 (49.8) | 285 (61.2) | | |
| Considerable | 67 (25.1) | 88 (18.9) | | |
| Intense | 23 (8.6) | 21 (4.5) | | |

**Figure 1** demonstrates that respondents who had insomnia had a significantly higher prevalence of GERD (60.3%) than those who did not have insomnia (39.7%). (p=<0.05).

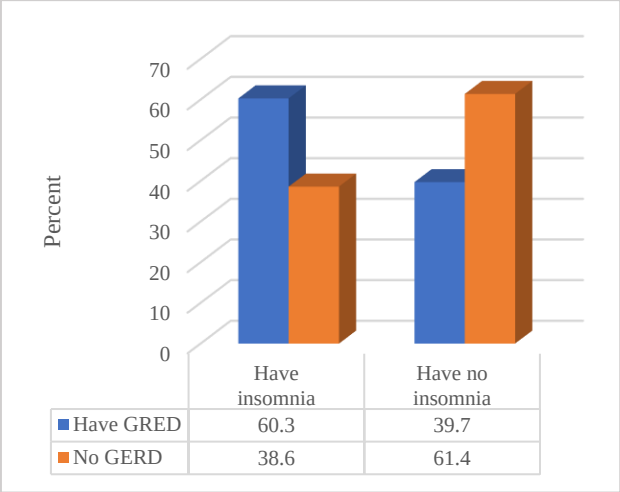


**Figure 1.** Relationship between GERD prevalence and insomnia
N.B.: ($\chi^2$= 32.04, p-value = <0.001)

Simultaneously, a significant positive association was discovered between the GERDQ scores and the AIS scale scores (r = 0.217, p-value = <0.001).

The current study sought to ascertain the impact of GERD on sleeping quality as well as the prevalence of GERD among Saudis suffering from sleep disorders. GERD is a common digestive disorder linked to several sleep-related symptoms, including insomnia, disturbed sleep, and daytime fatigue. Several studies similar to ours have been conducted [5].

According to our findings, 46.5% of the participants had insomnia. The prevalence among Saudi university students is equivalent to this; the prevalence rate was 41% during the COVID-19 Lockdown [22]. This percentage is significantly higher than the 11.7% prevalence rate of insomnia among adults in the Norwegian population [23]. This figure is lower than that revealed in previous Saudi studies, where the prevalence was 60.1% and 76.4%, respectively [24, 25].

The current study discovered that 73.6% of our participants experienced delayed sleep induction. This prevalence is higher than the prevalence among France's adult population, of which 57% have difficulties initiating sleep [26], and the Canadian population, of which 27.9% have initial insomnia [27].

Sleep onset latency of more than 30 minutes is defined as initial insomnia. In our study, we discovered that 56.4% of the population has a problem with waking up during the night; however, the prevalence of waking up during the night in the French adult population was 35%, which is lower [26]. The study found that 42.4% of participants had no problem with waking up earlier than desired, 43.9% had slightly insufficient total sleep duration, 44.5% had satisfactory overall quality of sleep, 51.6% reported feeling well during the day, 54.8% had normal daytime physical and mental functioning, and 57% did not suffer from sleepiness during the day.

The current study included 36.4% of participants who had GERD. This is higher than the 20.6% prevalence of GERD in Saudi Arabia's Eastern Region [28]. According to a systematic review study conducted in the Middle East, the prevalence of GERD ranged from 8.7% to 33.1%; in North America, it ranged from 18.7% to 27.8%; in East Asia it ranged from 2.5% to 7.8%, and in Europe it ranged from 8.8% to 25.9%, 23% in South America, and 11.6% in Australia [29].

According to our results, GERD is associated more with older individuals, with a mean age of 38.82 ± 13.49. Similarly, other studies conducted in the UK, China, and Saudi Arabia (Riyadh) showed a strong correlation between GERD and age [30-32]. The primary causes are that elderly individuals had poor esophageal acid clearance and diminished defensive mechanisms against acid gastric contents refluxing onto the esophageal mucosa [33]. In contrast, a study conducted in Iran has not found a significant association [34].

We also discovered that people who live in cities have significantly higher rates of GERD. This result is equivalent to two other studies carried out in southern India and China and is believed to be the result of a combination of psychosocial factors [33, 35]. Furthermore, our study found no statistically significant relationship between gender and GERD, which concurs with the results of multiple studies [31-33, 35]. GERD is more common in women, according to a previous study conducted in Bangladesh [36]. In addition, previous research found no correlation between GERD and blood group, which is consistent with our findings in this study [37].

NSAID use and GERD have been shown in numerous studies to be strongly correlated [38]. However, no correlation between these variables could be established in our study, and a similar study conducted in Saudi Arabia and Iran found no correlation [39, 40]. In this study, PPI improved symptoms in GERD patients; similar findings were seen in other studies [38].

Although family history had no statistical significance in relation to GERD, the findings of several studies revealed a positive correlation [38, 39]. The symptoms of GERD have been linked to coffee drinking, and another research has found a similar association [40].

Our study found no significant association between GERD and smoking, and another study found no correlation [35]. At the same time, other studies included in a systematic review discovered a link [41]. Furthermore, the current study found no link between physical activity and GERD, which agrees with the findings of another study [39]. A lack of physical activity was also identified as a risk factor for GERD in another study [42]. In contrast to other studies, ours found no link between fiber consumption and the presence of GERD symptoms [38]. This study found no link between eating fat and reflux symptoms. These findings are consistent with those of another study [43].

Furthermore, similar to Alkhathami *et al*., 2017, our study found no link between salt or pickle consumption and GERD symptoms [38]. Moreover, we discovered that more than half (60.3%) of GERD patients reported problems falling asleep, awakening during the night, waking up early, getting a good night's sleep, sleep quality, and functioning during the day. The result was consistent with another research done in Japan, which showed that almost one-third of GERD patients have a high prevalence of sleep disturbance and much shorter sleep duration [44]. In addition, less than half (39.7%) of GERD patients had no sleep disturbance or insomnia.

The current study found that GERD is significantly associated with sleep disturbance, daytime fatigue, and insomnia. In parallel, a previous study in Saudi Arabia found that GERD is correlated substantially to poor sleep quality, with GERD patients experiencing more awakenings and lower sleep efficiency than non-GERD patients [45].

In the current study, participants with GERD had significantly higher rates of insomnia (60.3%). Similarly, a previous study in the Aseer region revealed an even higher prevalence rate of GERD and insomnia (70.3%) [24]. Simultaneously, there was a significant correlation between the GERDQ scores and AIS scale scores, demonstrating that GERD and insomnia correlate. Taketani *et al*., 2014 discovered this correlation in a previous study conducted in Japan [46]. An Awadalla and Al-Musa study conducted in the Aseer region in 2021 revealed the same [24].

### *Limitations*

Because this is a questionnaire-based study based on self-reported sleep symptoms, it may be prone to recall bias. Furthermore, a cross-sectional study design can reveal associations between variables without estimating casual relationships.

## Conclusion

Of the studied participants, 36.4% had GERD, and 46.5% had insomnia. Participants with GERD had a significantly older mean age, lived in cities, drank coffee as their most common beverage, and their symptoms improved after using an anti-GERD medication (omeprazole, Esomeprazole, Lansoprazole, Pantoprazole, Rabeprazole). GERD was associated with delayed sleep induction, minor problems waking up at night, waking up slightly earlier than desired, slightly unsatisfactory overall sleep quality, and mild sleepiness during the day. Participants with insomnia had a significantly higher prevalence of GERD, and there was a significant positive relationship between GERDQ scores and AIS scale scores. It is critical to establish a strategy for the early detection and management of insomnia, as well as screening for GERD in people who have insomnia. Furthermore, awareness programs for sufficient sleep hygiene practices should be implemented in order to prevent sleep-disrupting factors among people with GERD.

ACKNOWLEDGMENTS: The authors gratefully acknowledge the cooperation of all study participants.
CONFLICT OF INTEREST: None
FINANCIAL SUPPORT: None
ETHICS STATEMENT: The King Abdulaziz University Faculty of Medicine research ethics committee in Jeddah, Saudi Arabia, approved the study. At the beginning of the questionnaire, all participants consented to the following statement: "This is a confidential research questionnaire; your information will be anonymous. We need your permission to complete this questionnaire."

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