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INTRODUCTION

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Prevalence and determinants of insomnia among patients living with asthma in Northwest Ethiopian University specialised hospitals: Multicentre cross-sectional study

Eyayaw Ashete Belachew , Ashenafi Kibret Sendekie , Emneteab Mesfin Ayele, Adelawle Kassie Netere

ABSTRACT

Objective The study was aimed to determine the prevalence and contributing factors of insomnia among patients with bronchial asthma.

Design A multicentre cross-sectional survey was used.

Setting This study was carried out from January to March 2022 in three university comprehensive specialised hospitals in Northwest Ethiopia.

Participants 422 patients with bronchial asthma were approached of which 93.8% completed the survey.

Outcomes The degree of asthma control and the severity of insomnia were evaluated using the Asthma Control Test and Insomnia Severity Index (ISI), respectively.

Results Participants’ ages ranged from 33.6 to 65.2 years on average. Just under three-fourths (71.4%) of the participants had at least one episode of insomnia as per the ISI measurement (score ≥10). The odds of insomnia episodes were about 5.4 and 1.93 times higher in patients with uncontrolled asthma and partially controlled asthma status, with adjusted OR (AOR)=5.4 (95% CI 4.4 to 6.79, p<0.001) and AOR=1.93 (95% CI 1.21 to 4.11, p<0.001), respectively.

Conclusion Insomnia episodes were substantially higher in bronchial patients with asthma. Insomnia is accompanied by asthma severity, and uncontrolled asthma and partially controlled asthma status are the two most determining factors for experiencing sleep disturbance. Furthermore, a prospective follow-up study must determine the real association found between insomnia and asthma control.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ The source of error in this study has been minimised as a result of the usage of the probability systematic random sampling technique.

⇒ This investigation had sufficient power, and its results were comparable to those obtained by previous similar studies carried out globally.

⇒ We were unable to compare the prevalence of insomnia among persons with and without asthma because we lacked a comparison group having asthma.

⇒ Since objective measurements of insomnia were not performed, they may be biased on the subjective report either by under-reporting or exaggeration.

⇒ Since the study’s methodology was cross-sectional, it might be challenging to determine which came first, cause or effect.

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a decreased quality of life. \textsuperscript{16} Despite the fact that sleep disturbances have multifactorial causes, most of the time it is linked to poor asthma management practices. \textsuperscript{14} 15 17 18 Patients with asthma frequently experience sleeplessness, which is marked by problems such as maintaining sleep, having trouble staying asleep, waking up early in the morning and having trouble functioning during the day as a result of the disturbed sleep. About one-third of patients with asthma experience insomnia symptoms, and their prevalence has been linked to a worse quality of life, more severe asthma symptoms and increased use of medical services. \textsuperscript{19} Nonetheless, there is a dearth of information on the connection between asthma severity and sleeplessness. \textsuperscript{20} 21

Even though patients with asthma frequently experience sleep disruptions and poor sleep quality, research has shed crucial light on the rate of insomnia among patients with asthma worldwide, \textsuperscript{20} 22 23 there is a literature gap on the prevalence and its association with asthma control levels and health-related quality of life (HRQoL) among patients with asthma in resource-limited settings, particularly in Ethiopia. Therefore, the findings from this study have implications in the real-world practices and for the future investigations. It is going to make a crucial contribution to current efforts to reduce insomnia in patients with asthma and address related problems. Besides that, the findings will add to a body of evidence for future research on related subjects or for organisations working with patients with asthma. They may also contain crucial information for identifying and classifying patients at follow-up care and for maximising care based on relevant precipitants. As a result, the purpose of this investigation was to ascertain the prevalence of insomnia among a sample of adults with asthma in Ethiopia and to assess the link between insomnia and the degree of asthma control.

**METHODS AND MATERIALS**

**Study design and setting**

This institutional-based multicentre cross-sectional survey was carried out from January through March 2022 across a 3-month period. This investigation was carried out in three large multidisciplinary hospitals in northwest Ethiopia. This study included three public hospitals: Felege-Hiwot Comprehensive Specialized Hospital (FHCSH), University of Gondar Comprehensive Specialized Hospital (UoGCSH) and Bahir Dar University Tibebe-Ghion Comprehensive Specialized Hospital (TGCSH).

**Study population and sampling**

Patients with asthma aged 18 and older who were attending the selected hospitals at the outpatient department for follow-up were included for this survey. However, patients with established breathing disorders secondary to sleep disorder, psychiatric illnesses, lung problems, neuromuscular illnesses, heart problems and liver and kidney failure were excluded from the study. Additionally, patients who had smoked for more than 10 packs per year were also disqualified from this survey.

According to the single-population proportion formula, sample size was chosen. The percentage of 0.5 was used because there were relatively limited published publications about the prevalence of insomnia among patients with asthma in Ethiopia. With a 5% (w=0.05) margin of error at the 95% confidence level (Za1/2=1.96), about 384 participants intended to be interviewed. Ten per cent contingency was taken into account to increase sample size accuracy due to potential non-responses and missing data. The final analysis subsequently comprised 422 participants. A systematic random sampling technique was employed to select the study subjects. Depending on the number of attendances of patients with asthma at the ambulatory care clinic in the last 3-month periods in each respective hospital, about 300, 190 and 75 patients per month were served in UoGCSH, FHCSH and TGCSH, respectively. To recruit this number of patients, we used the 3 months of attendance estimated from the medical record logbook that yielded about 1695 subjects. It is advised that people with asthma see the ambulatory for no less than 1 month or no more than 3 months. Therefore, summing up all of the average patient numbers over the course of 3 months results in hospitals in Gondar (900), Felege-Hiwot (570) and Tibebe-Ghion (225). Finally, we interviewed 224, 141 and 57 patients from UoGCSH, FHCSH and TGCSH, respectively, by proportionally allocating the respondents. The data were gathered over 3 months with a sampling interval of (k-interval) 1695/422=4, roughly taking into account the sample size. The initial study participant was chosen by lottery, and then additional eligible people were contacted in accordance with the specified sampling interval. Moreover, information was gathered from each respondent’s associated medical records.

**Data collection instruments and procedures**

We first developed the data collection tool with the English language version after reviewing various related literature. To maintain uniformity, the tool was subsequently translated into the regional tongue (Amharic) and afterwards back into English. The questionnaire was divided into three sections: (1) sociodemographic and medical information of the study participants; (2) instruments for measuring asthma control status, adherence levels and the Mini-Asthma Quality of Life Questionnaire (Mini-AQLQ); and (3) tool for determining the severity of sleeplessness (Insomnia Severity Index, ISI).

Interviewing individuals and looking over their medical records allowed us to gather crucial information. The same strategy was used for data collection whenever one of our surveys was deemed ineligible, and the following one was taken into consideration. A questionnaire-guided interview was used by the data collectors to administer the questions to participants, combating issues such as language difficulties and low literacy. Based on data from the Global Initiative Asthma Network, asthma severity
was evaluated (Global Initiative for Asthma 2018). In order to assess the levels of asthma control, the Asthma Control Test (ACT) was used in this study. The instrument is consistent and used by populations everywhere. The ACT tool is a quick test that assesses the degree of asthma control in people with asthma older than 12 years and comprises five questions on a 5-point Likert scale, with a maximum of 5 points that show how frequently participants had experienced asthma symptoms and used rescue medication over the previous 4 weeks. The overall measurement score ranged from 5 (the control) to 25 (best control). Depending on the ACT measurement scores, asthma control levels were categorised as well controlled (ACT=20–25), partially controlled (ACT=16–19) and uncontrolled (ACT=5–15).

Medication Adherence Report Scale for Asthma (MARS-A) and a self-report 10-item survey were used to evaluate the adherence levels of the patients who had been receiving asthma medication. Responses were recorded on a 5-point Likert scale (1=Never, 2=Rarely, 3=Sometimes, 4=Often, 5=Always). Self-reported level of adherence was reported after calculating the mean level of the 10-item scores (each accounts from 1 to 5), with those who had a MARS-A score of ≥4.5 considered as highly adhered, whereas those with a mean score less than this were characterised as poorly adhered. Also, the quality of life of patients with asthma was measured using Mini Asthma Quality of Life Questionnaire (Mini-AQLQ). The Mini-AQLQ is a disease-specific instrument used to gauge the impact of asthma on HRQoL. There are 15 questions in all, divided into four categories: symptomatology, activity restrictions, psychological function and factors in the environment. Before being included in the study, they were interviewed about how their conditions had been in the 2 weeks prior. On a 7-point scale on the questionnaire, researchers noted participant replies to each of the 15 questions. The mean of the 15 replies made up the overall Mini-AQLQ score, while the mean of the responses to the items in each domain made up the score for that domain.

Measurements of insomnia
The ISI was used to evaluate sleeplessness. A reliable tool for assessing the intensity of insomnia symptoms is the ISI. It consists of seven items that measure seven different aspects of sleep: difficulties falling asleep, trouble staying asleep, problems waking up early, displeasure with the quality of one’s sleep, daytime impairments brought on by the sleep disturbance, sleep issues noticed by others and distress brought on by sleep problems. Values ≥10 indicate insomnia with 86.1% sensitivities and 87.7% selectivity, whereas total ISI scores range from 0 to 28. Overall level of insomnia was divided into four categories based on the final ISI scores: no insomnia (ISI=0–7), subthreshold insomnia (ISI=8–14), moderate insomnia (ISI=15–21) and severe insomnia (ISI=22–28).

Data quality management
The questionnaire face validity was reviewed by three language experts to ensure that the questions were clear. The data collection instrument was pretested for contents, readability and comprehension from 5% of the total sample size and a modification was created by taking into account local clinical settings. Data collectors were trained for 1.5 days regarding the aims of the study, data collection instrument usage, producers and ethical issues. Using WHO principles, sociocultural modification was carried out, and adjustments were made in response to inputs. As a result, the tool provided reliable statistics while being simple to understand and use. At each stage of the data collection process, the supervisors and data collectors checked the accuracy of the data. The internal validity and consistency of the tools were tested and resulted in a Cronbach’s alpha test of MARS-A (α=0.90), ISI (α=0.85), Mini-AQoL (α=0.87) and ACT (α=0.83).

Data entry and analysis
The data collected were coded and cleaned using EpiData V.3.1 software, then entered and analysed by Statistical Package for Social Sciences (SPSS) V.26 software after cleaning incomplete data. All statistical tests were performed using SPSS for analysis. Descriptive statistics were applied for the analysis of patient characteristics, including frequency, means, SD and percentiles. Inferential statistics were employed to show the association between predictor variables and insomnia. The Q-Q plot, histogram and Shapiro-Wilk tests indicated the nature of data distribution. Mean (±SD) and median (IQR) summarised the normally and skewed distribution of the data, respectively. Logistic regression analysis was performed to examine the association between independent variables and insomnia. The OR with 95% CI was calculated to measure the strength of association between predictor and outcome variables. Bivariate analysis between each variable and the dependent variable was done first then variables with p value <0.20 were selected to be included in multivariable regression. Probability values less than 0.05 are accepted as statistically significant.

Ethical consideration
The hospital directors and heads of the Department of Chest Clinic were informed about the purpose of the study to get agreement and cooperation. Patients were requested for written informed consent. Confidentiality of the patients was kept by omitting patient identifiers and giving code numbers. Study participants had the right not to take part in the study. All rules and regulations were followed according to the Helsinki ethical declarations.

Patient and public involvement
No participants or members of the general public were involved in the study conception, methodology or interpretations, and neither group will be involved in the results dissemination.
### Table 1  
Sociodemographic and clinical characteristics of patients with asthma at the selected hospitals in northwest Ethiopia, 2022 (n=396)

| Variables                          | Total sample (n=396) | Insomnia (n=283) | No insomnia (n=113) | P value |
|------------------------------------|----------------------|-------------------|---------------------|---------|
| **Age (±SD)**                      | 49.4 (15.8)          | 50 (15.6)         | 47.9 (16.3)         | 0.41    |
| 18–34                              | 81 (20.5)            | 56 (69.1)         | 25 (30.9)           | 0.65    |
| 35–65                              | 234 (59.1)           | 166 (70.9)        | 68 (29.1)           |         |
| ≥65                                | 81 (20.5)            | 61 (75.3)         | 20 (24.7)           |         |
| **Sex**                            |                      |                   |                     |         |
| Male                               | 158 (39.9)           | 101 (63.9)        | 57 (36.1)           | 0.007   |
| Female                             | 138 (60.1)           | 182 (76.5)        | 56 (23.5)           |         |
| **Residency**                      |                      |                   |                     |         |
| Rural                              | 106 (26.8)           | 84 (79.2)         | 22 (20.8)           | 0.038   |
| Urban                              | 290 (73.2)           | 199 (68.6)        | 91 (31.4)           |         |
| **Marital status**                 |                      |                   |                     |         |
| Single                             | 39 (9.8)             | 26 (67.2)         | 13 (33.3)           | 0.109   |
| Married                            | 286 (72.2)           | 198 (69.2)        | 88 (30.8)           |         |
| Divorced                           | 16 (4)               | 14 (87.5)         | 2 (12.5)            |         |
| Widowed                            | 55 (13.9)            |                   |                     |         |
| **Level of education**             |                      |                   |                     |         |
| Unable to read or write            | 166 (41.9)           | 127 (76.5)        | 39 (23.5)           | 0.302   |
| Grades 1–8                         | 70 (17.7)            | 47 (67.1)         | 23 (32.9)           |         |
| Grades 9–12                        | 87 (22)              | 60 (69)           | 27 (31)             |         |
| Above grade 12                     | 73 (18.4)            | 49 (67.1)         | 24 (32.9)           |         |
| **Occupation**                     |                      |                   |                     |         |
| Employed                           | 185 (46.7)           | 117 (63.2)        | 68 (36.8)           | 0.004   |
| Student                            | 41 (10.4)            | 29 (70.7)         | 12 (29.3)           |         |
| Home maker                         | 107 (27)             | 88 (82.2)         | 19 (17.8)           |         |
| Farmer                             | 63 (15.9)            | 49 (77.8)         | 14 (22.2)           |         |
| **Fuel use**                       |                      |                   |                     |         |
| Yes                                | 351 (88.6)           | 249 (70.9)        | 102 (29.1)          | 0.51    |
| No                                 | 45 (11.4)            | 34 (75.6)         | 11 (24.4)           |         |
| **Smoking**                        |                      |                   |                     |         |
| Yes                                | 15 (3.8)             | 3 (20)            | 12 (80)             | 0.445   |
| No                                 | 381 (96.2)           | 271 (71.1)        | 110 (28.9)          |         |
| **Tea/coffee intake**              | 1.54 (1.13)/1.05 (0.58) | 1.66 (1.21)/1.1 (0.64) | 1.26 (0.83)/0.91 (0.39) | <0.001 |
| **Sleep duration (hour)**          | 5 (2)                | 4.5 (1.46)        | 6.1 (1.69)          | 0.112   |
| **Clinical characteristics**       |                      |                   |                     |         |
| Duration of asthma medication (year)| 5.3 (5.8)           | 5.54 (6)          | 5 (5.2)             | 0.216   |
| Adherence to asthma medication     |                      |                   |                     | <0.001  |
| Non-adherent                       | 342 (84.4)           | 254 (75.4)        | 84 (24.6)           |         |
| Adherent                           | 54 (13.6)            | 25 (46.3)         | 29 (53.7)           |         |
| **Comorbidities**                  |                      |                   |                     |         |
| GERD                               | 30 (19.1)            | 28 (93.3)         | 2 (6.7)             | <0.001  |
| Hypertension                       | 30 (19.1)            | 26 (86.7)         | 4 (13.3)            |         |
| Allergies                          | 59 (36.3)            | 39 (68.4)         | 18 (31.6)           |         |
| DM                                 | 40 (25.5)            | 35 (88.6)         | 5 (11.8)            |         |
| ACT score, mean (±SD)              | 16.3 (4.1)           | 14.8 (3.58)       | 20.3 (2.5)          | <0.001  |

Continued
RESULTS
Sociodemographic and clinical characteristics of the study participants

Of a total of 422 patients with asthma approached for this study, 396 were included in the final analysis. The mean (±SD) age of the study respondents was 49.4 (±15.8) years. The majority of the participants (60.1%) were females. Around three-fourths of the respondents were married (72.2%) and city dwellers (73.2%). Insomnia (ISI ≥ 10) was reported in more than two-thirds of the participants with a rate of 71.4%. The duration of asthma medication, degree of airflow obstruction and most demographic characteristics except sex, residency and occupation were not different between patients with and without insomnia. The ACT scores were lower (p<0.001) in the insomnia group than in the no-insomnia groups. However, there was also an increment of insomnia in non-adherent groups who have comorbid conditions and tea/coffee user participants (p<0.001) in all comparison groups (table 1).

Respondents with insomnia had lower asthma-specific quality of life mean scores in all domains of Mini-AQLQ and had a significant association (p<0.001) in all comparisons of independent t-tests (figure 1).

The severity of sleeplessness varied with the degree of asthma control. For all comparisons, individuals with uncontrolled asthma had a greater prevalence of severe insomnia (86.3%) compared with those with partially controlled asthma (10.5%) or well-controlled asthma (3.2%) (p<0.001) (table 2).

Predictors of insomnia

In multivariable regression analysis, the presence of insomnia (ISI≥10) was significantly associated with lower level of education (unable to read and write, and grades 1–8, AOR=0.25 and 0.18, respectively), partially controlled asthma (AOR=1.95) and uncontrolled asthma (AOR=5.4) (p<0.05 for all factors). One important observation identified in multivariable regression was that there was an

| Variables                        | Total sample (n=396) | Insomnia (n=283) | No insomnia (n=113) | P value |
|----------------------------------|----------------------|-------------------|---------------------|---------|
| Mini-AQLQ, mean (±SD)            | 4.1 (0.85)           | 3.94 (0.84)       | 4.54 (0.71)         | <0.001  |
| FEV1, percentage predicted, mean (±SD) | 74.3 (5.2)          | 73.54 (5.51)      | 76.27 (3.66)        | 0.48    |
| FVC, percentage predicted, mean (±SD) | 78 (5.78)           | 77.15 (5.82)      | 80.2 (4.84)         | 0.47    |
| FEV1/FVC, percentage predicted, mean (±SD) | 82 (9.46)           | 81.9 (9.6)        | 82.3 (9.1)          | 0.706   |
| ISI score, mean (±SD)            | 14.89 (7.6)          | 18.77 (5.1)       | 5.11 (2.11)         | <0.001  |

Except when otherwise noted, data were presented as mean (SD) or number (%).

ACT, Asthma Control Test; DM, diabetes mellitus; FEV1, forced expiratory volume in 1 s; FVC, forced vital capacity; GERD, gastroesophageal reflux disease; ISI, Insomnia Severity Index; Mini-AQLQ, Mini-Asthma Quality of Life Questionnaire.

Table 1 Continued

Figure 1 The relationship between mean asthma-specific quality of life score and insomnia. Mini-AQLQ, Mini-Asthma Quality of Life Questionnaire.
indirect relationship between insomnia and quality of life in patients with asthma (AOR=0.049) (table 3).

**DISCUSSION**

To the best of the authors’ literature search, no other author has disclosed the prevalence of insomnia in patients with asthma and its correlation with level of asthma control and quality of life in Ethiopia. Therefore, this multicentre institutional-based survey highlighted the prevalence of insomnia and its association with asthma treatment outcome (asthma control and quality of life). Consequently, we examined the association between insomnia and level of asthma control. The study revealed that more than two-thirds of participants had at least one symptom of insomnia (ISE≥10). The prevalence of insomnia in our sample of patients with asthma was very high (71.1%). This finding conflicts with earlier research from many nations that looked at the prevalence of insomnia in patients with asthma reported at 20%–47%. A possible discrepancy in this outcome might be due to the asthma control levels that were low in the current study compared with other studies which leads to patients experiencing the symptoms of asthma, and in turn asthma symptoms may increase episodes of insomnia.

In addition, insomnia was more prevalent in patients with poorly managed or uncontrolled asthma than in those with well-controlled asthma, and it was inversely correlated with the degree of asthma control and HRQoL. This result is consistent with other research from several nations that demonstrated that individuals with better asthma control experience fewer sleep disturbances. Consistent with the previous study, this research also revealed that 10% of patients with well-controlled asthma experienced sleep problems.

Additionally, the prevalence and severity of sleeplessness varied among various asthma control levels, according to the findings obtained. Only 8.1% of participants with well-managed asthma, 43.1% of those with poorly controlled asthma and 48.8% of those with uncontrolled asthma reported having insomnia. Furthermore, patients with uncontrolled or just partially controlled asthma experienced moderate to severe sleeplessness more frequently than those with well-controlled asthma. Our results are consistent with a study by Luyster et al. Similar research found that patients with uncontrolled asthma had a greater prevalence of sleeplessness (32%) than those with partially controlled or controlled asthma (20%). Chronic insomnia and asthma have been found to be correlated in both directions. A total of 17,927 people in a prospective research by Brumpton et al. were asthma free at baseline, but 686 of them developed the condition throughout the course of the 11-year follow-up. According to the study, people with persistent sleeplessness had a threefold increased risk of developing asthma incidentally.

The results of this study showed that there was a negative association between insomnia and HRQoL among patients with asthma, which is consistent with different studies. However, contrary to the previous study, this study reported that an educational status was identified as an independent predictor of insomnia.

This study has its own strengths and some limitations that warrant consideration. The investigation will be a crucial contribution to an ongoing attempt to reduce insomnia in patients with asthma and tackle the associated causes. The results will also be useful for the study setting to prepare interventional methods, as well as a knowledge base for future research on relevant disciplines or for organisations working with patients with asthma. They may also hold key information for identifying and classifying patients at follow-up care, as well as for maximising care based on pertinent precipitants. Nevertheless, because it is a cross-sectional study, we were unable to draw any conclusions on the exact cause of the link between insomnia and asthma control. Moreover,
we were unable to compare the prevalence of sleeplessness in people with and without asthma due to the lack of a comparable control group without asthma. Furthermore, the study was cross-sectional and completed quickly. Seasonal variations in both asthma and insomnia’s complexity have an impact on both conditions. Additionally, it should be taken into account because it may have an impact on asthma severity and insomnia prevalence. Lastly, there were no objective evaluations of sleep disturbance, such as sleep tests for obstructive sleep apnoea and sleep diaries.

**Table 3** Predictors of insomnia among adult patients with asthma in northwest Ethiopia

| Variables                  | COR (95% CI)       | P value | AOR (95% CI)       | P value |
|----------------------------|--------------------|---------|--------------------|---------|
| Age (±SD)                  | 1.00 (0.99 to 1.02) | 0.23    | 1.0 (0.96 to 1.03) | 0.93    |
| Sex                        |                    |         |                    |         |
| Male                       | 1.8 (1.12 to 2.8)  | 0.007   | 0.855 (0.35 to 2.0) | 0.73    |
| Female                     | 1                  |         | 1                  |         |
| Residency                  |                    |         |                    |         |
| Rural                      | 0.57 (0.33 to 0.97) | 0.04    | 1.49 (0.42 to 5.2) | 0.53    |
| Urban                      | 1                  |         | 1                  |         |
| Marital status             |                    |         |                    |         |
| Single                     | 0.44 (0.17 to 1.15) | 0.096   | 1.1 (0.14 to 8.6)  | 0.92    |
| Married                    | 0.50 (0.24 to 1.03) | 0.063   | 0.53 (0.13 to 2.04) | 0.53    |
| Divorced                   | 1.55 (0.3 to 7.9)  | 0.59    | 2.1 (0.20 to 22)   |         |
| Widowed                    | 1                  |         | 1                  |         |
| Education                  |                    |         |                    |         |
| Unable to read or write    | 1.59 (0.87 to 2.9) | 0.13    | 0.25 (0.065 to 0.96) | 0.043* |
| Grades 1–8                 | 1.0 (0.49 to 2.0)  | 0.99    | 0.189 (0.052 to 0.69) | 0.012* |
| Grades 9–12                | 1.0 (0.55 to 2.1)  | 0.80    | 0.43 (0.13 to 1.41) | 0.16    |
| Above grade 12             | 1                  |         | 1                  |         |
| Occupation                 |                    |         |                    |         |
| Employed                   | 0.49 (0.25 to 0.95) | 0.036   | 0.307 (0.067 to 1.41) | 0.12    |
| Student                    | 0.69 (0.28 to 1.61) | 0.41    | 0.45 (0.078 to 6.64) | 0.37    |
| Home maker                 | 1.32 (0.61 to 2.86) | 0.47    | 0.84 (0.16 to 4.21) | 0.86    |
| Farmer                     | 1                  |         | 1                  |         |
| Tea/coffee intake          | 1.44 (1.14 to 1.83) | 0.002   | 1.47 (0.93 to 2.32) | 0.097   |
| Sleep duration (hours)*    | 0.53 (0.45 to 0.62) | <0.001  | 0.45 (0.34 to 0.60) |         |
| Adherence to asthma medication |                |         |                    |         |
| Non-adherent               | 3.5 (1.9 to 6.4)   | <0.001  | 1.83 (0.62 to 5.3)  | 0.26    |
| Adherent                   | 1                  |         | 1                  |         |
| Comorbidities              |                    |         |                    |         |
| CCI score                  | 1.13 (0.95 to 1.33) | 0.149   | 1.01 (0.72 to 1.41) | 0.94    |
| ACT score, mean (±SD)      | 0.52 (0.45 to 0.59) | <0.001  | 0.76 (0.54 to 1.06) | 0.76    |
| Asthma control status      |                    |         |                    |         |
| Uncontrolled               | 6.9 (2.95 to 16)   | <0.001  | 5.4 (4.4 to 6.79)  | <0.001* |
| Partially controlled       | 3.7 (1.8 to 7.8)   | <0.001  | 1.93 (1.21 to 4.11) | <0.001* |
| Well controlled            | 1                  |         | 1                  |         |
| Mini-AQLQ, mean (±SD)      | 0.35 (0.25 to 0.49) | <0.001  | 0.49 (0.27 to 0.90) | 0.023* |

*Significant at p<0.05.
ACT, Asthma Control Test; AOR, adjusted OR; CCI, Charlson comorbidity index; COR, crude OR; Mini-AQLQ, Mini-Asthma Quality of Life Questionnaire.
CONCLUSIONS
Patients with asthma, especially those with inadequate asthma management, frequently experience insomnia. More research is required to fully comprehend the various interconnections between asthma control and insomnia.

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EAB, AKS, EMA and AKN participated in the conception and design of the study. EAB supervised the data collection. EAB, AKS, EMA and AKN participated in data analysis and interpretation. EAB drafted the initial manuscript. All authors read and approved the final manuscript, and contributed to the critical review and content. Eyayaw Ashete Belachew is the guarantor accepts full responsibility for the work and/or the conduct of the study, had access to the data, and controlled the decision to publish.

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None declared.

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Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication
Obtained.

Ethics approval
This study involves human participants and ethical approval was obtained from the Institutional Review Board (IRB) of the University of Gondar (approval number: SOP /131/2021). Then, the official letter from the clinical director of the hospitals was also received to precede the study in the facilities. Participants gave informed consent to participate in the study before taking part.

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Data availability statement
Data are available upon reasonable request.

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