

BMJ Open Sleep quality and associated factors among pregnant women attending antenatal care unit at Gondar, Ethiopia: a cross-sectional study

Girmaw Medfu Takelle , Niguse Yigzaw Muluneh, Mengesha Srahbzu Biresaw 

To cite: Takelle GM, Muluneh NY, Biresaw MS. Sleep quality and associated factors among pregnant women attending antenatal care unit at Gondar, Ethiopia: a cross-sectional study. *BMJ Open* 2022;**12**:e056564. doi:10.1136/bmjopen-2021-056564

► Prepublication history for this paper is available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2021-056564>).

Received 23 August 2021
Accepted 18 August 2022



© Author(s) (or their employer(s)) 2022. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

Department of Psychiatry, University of Gondar College of Medicine and Health Sciences, Gondar, Amhara, Ethiopia

Correspondence to

Girmaw Medfu Takelle;
girmawmedfu@gmail.com

ABSTRACT

Objective This study aimed to determine the prevalence and associated factors of poor sleep quality among pregnant women in Ethiopia.

Method Institutional based cross-sectional study.

Setting University of Gondar Comprehensive Specialized Hospital, Gondar, Ethiopia.

Participants A total of 415 pregnant women were recruited by using a systematic random sampling technique from 28 April 2020 to 12 June 2020.

Measurement The desired data were collected through face-to-face interview technique by using validated questionnaires such as the Pittsburgh Sleep Quality Index, Edinburgh Postnatal Depression Scale, Perceived Stress Scale, Oslo-3 and Abuse Assessment Screen. The data were analysed by using SPSS V.20. Logistic regression analysis was used to identify associated factors with poor sleep quality. Variables having a p value of less than 0.2 in the bivariate analysis were entered to the multivariable logistic regression. A p value of less than 0.05 was considered statistically significant, at 95% CI.

Result In this study, 175 (42.2%) pregnant women had poor sleep quality. According to multivariable logistic regression, being first and third trimesters of gestational age (adjusted OR (aOR) 2.31, 95% CI 1.16 to 4.61 and aOR 3.45, 95% CI 2.05 to 5.79, respectively), consumption of caffeinated substances (aOR 2.96, 95% CI 1.68 to 5.52), having depression (aOR 2.12, 95% CI 1.19 to 3.76), having high perceived stress (aOR 5.39, 95% CI 1.96 to 14.79) and experience of intimate partner violence (aOR 5.57, 95% CI 2.19 to 14.68) were positive significant associated factors with poor sleep quality.

Conclusion and recommendation The prevalence of poor sleep quality among pregnant women was relatively high. First and third trimesters, consumption of caffeinated substances, antenatal depression, high perceived stress and intimate partner violence were factors significantly associated with poor sleep quality. This result suggests that all pregnant women should be screened and treated for poor sleep quality during the first and third trimesters.

INTRODUCTION

Sleep is a basic requisite for human physiological and psychological functioning.^{1 2} It is a complex physiological process to restore energy, physical ability to think and the

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ The Pittsburgh Sleep Quality Index, which is validated and has high sensitivity and specificity, has been used to assess the outcome variable of sleep quality among pregnant women.
- ⇒ Due to the nature of cross-sectional study design, it could not report the temporal cause-and-effect relationship between depression and poor sleep quality.
- ⇒ Individuals who had no symptoms of sleep problem may have less motivation to recall earlier exposure than individuals with the symptoms.

ability to understand quickly.³ It is a systematic and organised behaviour that is regularly repeated on the basis of a biological rhythm. Sleep significantly contributes to the restoration or renewal of mental and physiological power and is required for doing new tasks and responsibilities.⁴

Sleep is essential for the normal growth and development of both mind and body. A good sleep pattern is important for a healthy pregnancy. During pregnancy, there is a need to get adequate sleep for the normal growth and development of the fetus.⁵ During pregnancy, getting appropriate sleep gives the mother the energy that they need for their delivery process.^{1 2}

Sleep disorders such as insomnia are common during pregnancy.⁶ Despite being a natural phenomenon, pregnancy is associated with major hormonal, psychological and physiological changes. Previous studies showed that more than two-thirds of women experience changes in sleep during pregnancy.⁷ This sleep problem in general worsens with every subsequent trimester.³ One in four women experiences sleep problems in the first trimester of pregnancy, and this increases to three in four women in the third trimester.^{8 9}

Sleep problem is a common problem for pregnant women, in which more than four

out of five pregnant women are affected by sleep disturbances. Furthermore, depressive symptoms, increased age and gestational age were found to be factors leading to poor sleep quality in pregnant women.¹⁰

Previous studies showed that pregnant women with poor quality of sleep had a 20% increased chance of undergoing caesarean section and prolonged labour.¹¹ Poor sleep quality has been shown to be a prospective risk factor for depression both during the prenatal and postpartum period.^{12–14} African-American pregnant women with poor sleep quality had 10.2 times increased risks of preterm birth compared with those with good sleep quality.¹⁵

The quantity and quality of sleep during pregnancy have been shown to be altered.¹⁶ Some previous studies have documented trimester-specific changes in sleep architecture. Different literature also indicate that sleep disturbances during pregnancy are associated with women's poor health outcomes like intrauterine growth restriction, preterm birth, stillbirth, and low Appearance, Pulse, Grimacing, Activity and Respiration (Apgar) score on the newborn.^{5 17 18} Poor sleep quality has also been indicated to have maternal complications during pregnancy period like pre-eclampsia, gestational diabetes as well as increased complications during delivery like prolonged labour and caesarean section.^{13 17}

Sleep disturbances among pregnancies reported that sleep deprivation might increase the risk of mental disorders that ranges from postpartum depression to overt psychosis and also increases the possibility of accidents.¹⁹ Although several studies have assessed sleep quality during pregnancy and its associated factor, most of these studies were conducted in the western population or developed countries.

Despite the high prevalence and multiple complications of poor sleep quality among pregnant women, it is under-recognised and largely undermined by caregivers (clinicians) as well as the government. The extent of poor sleep quality and its associated factors among pregnant women is not well known in low-and-middle-income countries including Ethiopia. To the best of the investigators' knowledge, there is no published study on the prevalence of poor sleep quality and its associated factor during pregnancy among the Ethiopian pregnant. Therefore, this study aimed to determine the magnitude of poor sleep quality and associated factors among pregnant women attending the antenatal care (ANC) units at University of Gondar Comprehensive Specialized Hospital (UoGCSH), with the aim of instituting appropriate intervention programmes.

METHODS AND MATERIALS

Study design and study period

An institutional-based cross-sectional study was conducted to assess the prevalence and associated factors of poor sleep quality among pregnant women at UoGCSH Antenatal Care Clinic from 28 April to 12 June 2020.

Study area

This study was conducted at UoGCSH, ANC clinic, Gondar, Amhara, Northwest Ethiopia. ANC service in the hospital has been given by obstetricians and gynaecologists and midwives in the outpatient departments. Approximately 11 000 pregnant women per year have been taking ANC service per year.

Inclusion criteria

We have included all pregnant women ≥ 18 years of age attending ANC clinic at UoGCSH.

Exclusion criteria

Severely ill pregnant women (bleeding, hyperemesis) were excluded from this study, as were women in labour and those who had difficulty communicating for interview during the data collection period.

Sample size determination

We applied a single proportion formula to calculate the required sample size. On sample size calculation, the following considerations were taken; margin of error (d) 5%, level of confidence (95%), proportion (p) 50% (as there was no previously published study conducted in Ethiopia) and adding 10% non-response rate. Therefore, the final sample size was taken to 423.

Sampling technique and procedure

We engaged in systematic sampling of every other woman who attended ANC during the 28 April to 12 June 2020 time frame.

Data collection tool and procedure

Data were collected from study subjects using validated and pre-tested structured questionnaires. The data were collected by four BSc psychiatry professionals after 1-day training had been given and facilitated by the principal investigator.

The interview structure consists of eight parts.

Demographic characteristics

Demographic data which gave baseline information were obtained from the participants including age, ethnicity, religion, education, occupation, marital status and residency.

Obstetrics and gynaecological characteristics

Gynaecological, obstetrical and associated clinical factors giving information such as gestational age, parity, gravidity, the experience of abortion, type of pregnancy and other comorbid illnesses like pregnancy-related hypertension, gestational diabetes mellitus and other illness were obtained from the participants and from their medical records.

Sleep characteristics

The Pittsburgh Sleep Quality Index (PSQI) is a 19-item self-reported questionnaire that evaluates sleep quality over the past month. The PSQI gives seven sleep components to assess sleep quality including subjective sleep

quality, duration of sleep, sleep disturbance, sleep latency, habitual sleep efficiency, use of sleep medication and daytime dysfunction.²⁰ Each sleep component gives a score ranging from 0 to 3, with 3 indicating the more severe problem. The sleep component scores are added to obtain a global sleep quality score that ranges from 0 to 21. Higher scores indicate poor sleep quality during the previous month. Participants with a global score of greater than 5 were classified as poor sleepers.²¹ The PSQI is validated in Ethiopia for community-dwelling Ethiopian adults with Cronbach's α of 0.73.^{22 23} Higher scores indicate poorer sleep quality. A global score of greater than 5 yielded a diagnostic sensitivity of 90% and specificity of 87% in distinguishing good and poor sleepers with a Cronbach's α of 0.73 in pregnant women²⁴ and a Cronbach's α of this study was 0.71.²⁵

Substance-related characteristics

Behavioural factors including use of alcohol, use of tobacco, khat chewing and consumption of caffeinated substance were assessed by using structured questionnaires adapted from WHO ASSIST V.3.²⁶ Participants who used substances like tobacco, khat and alcohol only for non-medical purposes during their lifetime were considered as ever substance users and pregnant women who used substances like tobacco, khat and alcohol only for non-medical purposes during the last 3 months are considered as current substance users.²⁶

Use of caffeinated substance

If positive for consumption of one or more of the substances coffee, tea and Coca-Cola during the last 1 month.

Clinical related characteristics

Antenatal depression was assessed with the Edinburgh Postnatal Depression Scale (EPDS) which consists of 10 items. EPDS has been used successfully across diverse cultural settings. The EPDS questionnaire has been validated as effective in measuring prenatal depression.²⁴ Items are rated on a 4-point scale from 0 (not at all) to 3 (yes, most of the time). Total scores range from 0 to 30. The screening tool has been validated for detecting depression in antepartum and postpartum samples in many countries. The instrument was validated in public health centres in Addis Ababa for post partum and showed a sensitivity of 84.6% and specificity of 77.0% at the cut-off score 7/8 and Cronbach's α of 0.71.²⁴ The cut-off point of EPDS among pregnant women is usually higher than postpartum women.²⁷ Like other studies conducted globally and in Ethiopia, in this study, a cut-off point of 13 was used to identify pregnant women with depressive symptoms.²⁸⁻³⁰ Those pregnant women who scored 13 and above were categorised as having depression while pregnant scored below 13 were non-depressed²⁸ and a Cronbach's α of this study was 0.74.

Social support related characteristics

A three-item questionnaire was used to determine the status of social support, which was assessed by using Oslo-3

validated tool. Oslo 3-item Social Support Scale has the sum score scale ranging from 3 to 14 with three broad categories: 'poor social support' 3–8, 'moderate social support' 9–11 and 'strong social support' 12–14 (with Cronbach's α =0.88, 86% sensitivity and 67% specificity).³⁰

Perceived stress characteristics

Perceived stress resulting from perceptions of difficulty in control or ability to cope with life events during the last 1 month was measured by the 10-item Perceived Stress Scale (PSS).³¹ Responses are rated on a 5-point scale from 0 (never) to 4 (very often). Some of the PSS scores are obtained by reversing responses (eg, 0=4, 1=3, 2=2, 3=1 and 4=0) to the four positively stated items (items 4, 5, 7 and 8) and then summed across all scale items. Scores range from 0 to 40, with higher scores indicating perceived higher stress. The Cronbach's alpha for this instrument is between 0.84 and 0.86,³¹ and the Cronbach's α of this study was 0.89.

Intimate partner violence characteristics

Consisted of five questions to determine the status of intimate partner violence. The questionnaire was developed from WHO Multi-Country Study on Violence Against Women, and if any questions on the screen were answered yes, the participant is considered positive for abuse.³²

Data quality control

Data were collected using face-to-face structured interviews. The study subjects were informed about the general information regarding the study objectives as well as the opportunities or benefits that this study could bring. Finally, the filled questionnaires were checked for consistency and completeness daily. To assure the data quality, high emphasis was given in designing data collection instruments. The questionnaire was prepared in English and translated to Amharic and back to English to maintain consistency. The Amharic version questionnaires were used to collect information. One-day training was given for data collectors and supervisors by the principal investigator on the methods of data collection. The questionnaire was pretested 1 week before the actual data collection on 5% of the total same size that were not included in the main survey.

Data processing and analysis

Data were coded and entered using Epidata software V.4.6.0.0, and then were exported and analysed by using SPSS V.20. Questionnaires that were incomplete were considered as non-response (n=8). The data were analysed to generate descriptive statistics—means, medians, frequency, percentages and SD—using SPSS V.20. The goodness of fit was checked by Hosmer and Lemeshow ($p=0.52$). Multicollinearity (the values of Variance Inflation Factor (VIF) were <1.08) and χ^2 assumptions were done. Logistic regression analysis was used to calculate adjusted ORs (aORs) to control for confounding variables with a 95% CI. Variables with p value less than 0.2 in bivariate logistic regression analysis were entered into

multivariable logistic regression to detect if there is a significant association. Outcome and independent variables were entered into bivariate one by one to detect association and to multivariable logistic regression to show the presence and strength of association. Statistical significance was determined at p value <0.05 .

Patient and public involvement

In this study, participants were pregnant women who were attending ANC at UoGCSH. Seriously sick patients were excluded. We did not involve participants in designing the study and the recruitment process. The result of this study has been submitted to the Department of Psychiatry, University of Gondar, and UoGCSH.

RESULTS

Sociodemographic characteristics of the participants

In total, 415 pregnant women participated in the study with a response rate of 98.1%. The mean age of the participants was 28 years ($SD\pm 5.4$); 225 (54.2%) were within the range of 26–35 years. Three hundred ninety-one (94.2%) were married and 302 (72.8%) were Orthodox by religion; 156 (37.6%) of the participants had primary education and 118 (28.4%) had a diploma and above; 406 (97.8%) of the study population were Amhara in ethnicity and 168 (40.5%) were housewives in occupation; 391 (94.2%) of the participants were living in urban areas (table 1).

Characteristics of gynaecological, obstetrical and other comorbid illnesses

In total, 196 (47.2%) of the participants were in the third trimester and nearly one-third (123, 29.6%) were experiencing their first pregnancy; 149 (35.9%) had an experience of labour two or more times before and 133 (32%) of the participants had two or more children alive; 62 (14.9%) had experienced an abortion in their lifetime and 356 (88.7%) were wanted pregnancy in current pregnancy; 58 (14%) of the participants had other comorbid illnesses, and of those, 37 (63%) and 16 (27.6%) had pregnancy-related hypertension/pre-eclampsia and gestational diabetes mellitus, respectively.

Prevalence of poor sleep quality among pregnant women

The average time to go to bed at night was 21:37 and the average time to rise was 12:22. The average sleeping duration was 7.43 hours with $SD\pm 1.59$.

The prevalence of poor sleep quality among the participants was 42.2% (95% CI 37.4% to 47.6%) with proportion of 45.9%, 26.6% and 53.6% in their first, second and third trimesters, respectively. The median PSQI score of the participants was 5.00 with a range of 0–17. Eighteen (4.3%) had very bad subjective sleep quality; 162 (39.0%) had sleep latency that took 31–60 min, and with regard to sleep duration, 221 (53.3%) had actual sleep per night of more than 7 hours; 268 (64.5%) of the participants had more than 85% sleep efficiency, while the median of sleep disturbance was 7.0 (IQR 5–9); 401 (96.6%) of the

Table 1 Sociodemographic characteristics of pregnant women attending antenatal care clinic at UoGCSH, Gondar, Northwest Ethiopia, 2020 (n=415)

Variables	Categories	Frequency	Per cent (%)
Age in years	18–25	144	34.7
	26–35	225	54.2
	≥ 36	46	11.1
Marital status	Married	391	94.2
	Single	15	3.6
	Other*	9	2.2
Educational status	No formal education	49	11.8
	Primary education	156	37.6
	Secondary education	92	22.2
	Diploma and above	118	28.4
Occupation	Unemployed	37	8.9
	Student	23	5.5
	Housewife	168	40.5
	Self-employed	83	20
	Governmental employed	104	25.1
Religion	Orthodox	302	72.8
	Muslim	65	15.7
	Protestant	31	7.4
	Catholic	14	3.4
	Others†	3	0.7
Residence	Urban	391	94.2
	Rural	24	5.8
Ethnicity	Amhara	406	97.8
	Others‡	9	2.2

*Widowed, divorced.
†Seventh-Day Adventist, Jehovah's Witness.
‡Oromo, Tigre, Wolayta, Benishagul and Afar.
UoGCSH, University of Gondar Comprehensive Specialized Hospital.

study population did not use sleep medication during the last 1 month (table 2).

Behavioural characteristics of the participants

In total, 411 (99%) of the participants had not ever smoked tobacco in their lifetime and there were no participants who smoked tobacco in the last 3 months. Forty-eight (11.6%) of the study participants had used alcohol in their lifetime and 26 (6.3%) used alcohol within the last 3 months. Among those pregnant women who had used alcohol during the last 3 months, 14 (53.8%) used tella (local alcoholic beverage). Five (1.2%) of the participants had ever chewed khat, but there was no one reporting using khat in the last 3 months. Also, 310 (74.7%) of the participants used a caffeinated substance for the last 1 month, and from those, 209 (67.7%) and 45 (14.5%)

Table 2 Sleep quality and its component score among pregnant women attending antenatal care clinic at UoGCSH, Gondar, Northwest Ethiopia, 2020 (n=415)

Sample number	Variables	Score	Frequency (n=415)	Per cent (%)
1	Subjective sleep quality	Very good	153	36.9
		Fairly good	164	39.5
		Fairly bad	80	19.3
		Very bad	18	4.3
2	Sleep latency	0	30	7.2
		2-Jan	82	19.8
		4-Mar	161	38.8
		6-May	142	34.2
3	Sleep duration	Greater than 7 hours	221	53.3
		6–7 hours	95	22.9
		5–6 hours	64	15.4
		Less than 5 hours	35	8.4
4	Habitual sleep efficiency	Greater than 85%	268	64.5
		75%–85%	70	16.9
		65%–74.9%	43	10.4
		Less than 65%	34	8.2
5	Sleep disturbance	0	21	5.1
		9-Jan	299	72
		18-Oct	92	22.2
		19–27	3	0.7
6	Use of sleep medication	Not during the past month	401	96.6
		Less than once a week	14	3.4
7	Daytime dysfunction	0	244	58.8
		2-Jan	132	31.8
		4-Mar	34	8.2
		6-May	5	1.2
	Global sleep quality	Good sleep quality	240	57.8
		Poor sleep quality	175	42.2

Sleep latency=sum of Q2 and Q5a subscores from PSQI and interpreted as 0=0, 1–2=1, 3–4=2 and 5–6=3.

Sleep efficiency=(# hours slept/# hours in bed) × 100%.

Sleep disturbance=sum of questions 5b to 5j from PSQI and scored as follows: not during past month=0, less than once a week=1, once or twice a week=2, three or more times a week=3.

Daytime dysfunction=sum of Q7 and Q8 subscores from PSQI and interpreted as 0=0, 1–2=1, 3–4=2 and 5–6=3.

PSQI, Pittsburgh Sleep Quality Index; UoGCSH, University of Gondar Comprehensive Specialized Hospital .

used coffee and both coffee and tea on a daily basis; 206 (80.2%) consumed two or more cups of coffee per day.

Mental illness and psychosocial factors

Of the study participants, 86 (20.7%) had antenatal depression and 29 (7.0%) had high and 83 (20.0%) moderate perceived stress. Also, 103 (24.8%) had poor and 125 (30.1%) had strong social support.

The overall prevalence of intimate partner violence (IPV) among the participants was 29 (7.0%). Twenty participants (4.8%) had been abused physically or emotionally during their lifetime; 13 (3.1%) had been slapped, kicked or otherwise physically hurt by someone

during the past 1 year, and of those, 8 (61.5%) were abused by their husbands. Eleven (2.7%) of the participants had been hit, slapped, kicked or otherwise physically hurt by someone during the current pregnancy, and of those, 8 (72.7%) were abused by their husband. Ten (2.4%) of the study participants had forced sexual activities within the past year.

Prevalence and associated factors of poor sleep quality

Prevalence of poor sleep quality

The overall prevalence of poor sleep quality among the participants attending the ANC clinic at UoGCSH was 42.2% (95% CI 37.4% to 47.6%).

Associated factors of poor sleep quality

Maternal age, educational level, gestational age, experience of abortion, consumption of caffeinated substances, antenatal depression, social support, perceived stress and IPV were variables which had a p value less than 0.2 at bivariate logistic regression. First and third trimesters of pregnancy, use of caffeinated substances, depression, high perceived stress and experience of IPV were found to be significantly associated with poor sleep quality among pregnant in multivariable logistic regression analysis at a p value of less than 0.05.

The odds of having poor sleep quality among pregnant women were 2.3 times higher in the first trimester (aOR 2.316, 95% CI 1.162 to 4.617) and 3.4 times higher in the third trimester (aOR 3.451, 95% CI 2.055 to 5.794) when compared with those in the second trimester. We took second trimester as a reference by considering the lower occurrence of poor sleep quality among those who were

in their second trimester, which is supported by previous literatures.^{5 33} Pregnant women who consumed caffeinated substances were nearly three times likely to report poor sleep quality than non-consumers (aOR 2.964, 95% CI 1.684 to 5.215). The likelihood ratio for developing poor sleep quality among pregnant women with depression was 2.1 times that of pregnant women without depression (aOR 2.124, 95% CI 1.197 to 3.769).

The odds of having poor quality of sleep among pregnant women with high perceived stress was 5.4 times more likely compared with those with low perceived stress (aOR 5.392, 95% CI 1.965 to 14.797). The odds of having poor sleep quality among pregnant women who had experienced IPV was 5.6 times as likely when compared with pregnant women who had not experienced IPV (aOR 5.570, 95% CI 2.190 to 14.683) (table 3).

Table 3 Bivariant and multiple logistic regression analysis of factors significantly associated with poor sleep quality among pregnant women attending ANC clinic at UoGCSH, Gondar, Northwest Ethiopia, 2020 (n=415)

Variables	Categories	Sleep quality		COR (95% CI)	aOR (95% CI)
		Poor n (%)	Good n (%)		
Maternal age in years	18–25	57 (13.7)	87 (21)	1	1
	26–35	91 (21.9)	134 (32.3)	1.037 (0.676 to 1.589)	0.894 (0.548 to 1.457)
	≥36	27 (6.5)	19 (4.6)	2.169 (1.104 to 4.261)*	1.643 (0.753 to 3.582)
Educational level	No formal education	28 (6.7)	21 (5.1)	2.242 (1.139 to 4.416)*	0.953 (0.415 to 2.188)
	Primary education	76 (18.3)	80 (19.3)	1.598 (0.981 to 2.602)	1.274 (0.718 to 2.263)
	Secondary education	27 (6.5)	65 (15.7)	0.699 (0.390 to 1.252)	0.552 (0.282 to 1.082)
	Diploma and above	44 (10.6)	74 (17.8)	1	1
Pregnancy term	1st trimester	28 (6.7)	33 (8)	2.343 (1.267 to 4.334)*	2.316 (1.162 to 4.617)*
	3rd trimester	105 (25.3)	91 (22)	3.187 (2.030 to 5.003)†	3.451 (2.055 to 5.794)†
	2nd trimester	42 (10)	116 (28)	1	1
Abortion	Yes	21 (5.1)	41 (9.9)	0.662 (0.376 to 1.166)	0.675 (0.347 to 1.314)
	No	154 (37)	199 (48)	1	1
Use of caffeinated substances	Yes	150 (36)	158 (38)	3.114 (1.888 to 5.136)†	2.964 (1.684 to 5.215)†
	No	25 (6)	83 (20)	1	1
Depression	No	126 (30.4)	203 (48.9)	1	1
	Yes	49 (11.8)	37 (8.9)	2.134 (1.319 to 3.453)*	2.124 (1.197 to 3.769)*
Social support	Strong	44 (10.6)	81 (19.5)	1	1
	Moderate	85 (20.5)	102 (24.6)	1.486 (0.871 to 2.535)	1.305 (0.683 to 2.490)
	Poor	46 (11.1)	57 (13.7)	1.534 (0.96 to 2.446)	1.401 (0.821 to 2.391)
Perceived stress	Low	110 (26.6)	193 (46.5)	1	1
	Moderate	42 (10)	41 (9.9)	1.797 (1.101 to 2.933)*	1.663 (0.961 to 2.878)
	High	23 (5.5)	6 (1.5)	6.726 (2.258 to 17.021)†	5.392 (1.965 to 14.797)*
Intimate partner violence	Yes	22 (5.3)	7 (1.7)	4.786 (1.996 to 11.477)†	5.570 (2.190 to 14.683)*
	No	153 (36.9)	233 (56.1)	1	1

*p<0.05.
†p<0.001.
aOR, adjusted OR, 1 for reference; COR, crude OR.

DISCUSSION

This study has found a significant number of poor sleep quality among pregnant women. Overall, this study has shown that almost one in two pregnant women experiences poor sleep quality. Different variables like pregnancy trimester, consumption of caffeinated substances, antenatal depression, high perceived stress and IPV were variables found to have a significant association with poor sleep quality.

The prevalence of poor sleep quality among pregnant women attending ANC clinics at UoGCSH was in line with studies conducted in Northwestern University (40%), Vietnam (41.2%), Iran (43.8%) and a meta-analysis study conducted globally (45.7%).^{11 34–36}

However, this study showed higher prevalence rates of poor sleep than studies conducted in Taiwan (24.4%),³⁷ Finland (16%)³⁸ and Turkey (31.5%).¹⁸ Possible reasons for this discrepancy might be the characteristics of the participants, sampling techniques and the use of different measurement tools other than PSQI. Some of these studies exclude pregnant women prescribed psychiatric medication and sleeping pills or those who had chronic health problems, and night shift workers. These factors might have negative effects on sleep quality as supported by studies conducted in Rotterdam.³⁹

The prevalence of poor sleep in this study was lower than that of studies conducted in the USA (76%),³⁵ China (87%)¹⁰ and Taiwan (60%–65.5%).^{24 36 40} The possible reasons for this variation might be characteristics of the participants such as low prevalence of high perceived stress and prenatal depression among the participants of this study as compared with others,^{24 40} convenient sampling technique⁴⁰ and internet-based data collection methods³³ that might contribute to this discrepancy.

Factors like the first and third trimesters of pregnancy, consumption of caffeinated substances, antenatal depression, high perceived stress and IPV were found to be significantly associated with poor sleep quality.

First and third trimester pregnancy terms were seen as contributing factors for poor sleep quality. Respondents who were in first trimester and third trimester had the odds of having poor sleep quality more than two and three times, respectively, as compared with pregnant women in the second trimester. This study was supported by studies done in Iran³³ and south India⁵ for both first and third trimesters, and studies conducted in China,¹⁰ Taiwan,⁴⁰ USA³⁵ and a meta-analysis study done globally³⁶ for third trimester. The possible reasons might be increased rate of nocturnal urinary frequency, heartburn or pyrosis, daytime sleepiness, feeling of fatigue, and frequent nausea and vomiting which occurs commonly during the first trimester of pregnancy and can interfere with the quality of sleep.⁴¹ The common reasons for poor sleep quality for pregnant women during the first trimester might be a mix of excitement and surprises. The rise of progesterone levels may be one of the reasons for poor sleep quality during the first trimester due to its soporific (sleep-inducing) and thermogenic (heat-producing)

effect which is secreted from placenta and causes fatigue and earlier sleep onset and also discomfort with body change (breast tenderness).^{41 42} The possible reasons of poor sleep quality during the third trimester might be urinary frequency, fetal movement, lower back pain, leg cramps, heartburn, fatigue and abdominal discomfort, as reported by the American sleep foundation studies conducted in Taiwan and China.^{18 41–44}

Consumption of caffeinated substances had a significant negative ($p < 0.001$) effect on sleep quality. The likelihood ratio of having poor sleep quality among participants who consumed caffeinated substance was nearly three times higher than non-consumers. Other studies have shown that consumption of caffeinated substances can affect sleep quality negatively, particularly when taken later in the daytime or having multiple doses/day.⁴⁵ Caffeinated substances are rapidly and almost completely (99%) absorbed.⁴⁶ The effect of caffeine is primarily related to its blocking effect of A_1 and A_{2A} subtypes of adenosine receptors which is an inhibitory neuromodulator in sleep–wake regulation. Caffeine-induced wakefulness depends specifically on its antagonistic effect at A_{2A} receptor subtype.^{46–48}

Antenatal depression was the clinical diagnosis that showed a significant association with sleep quality during pregnancy. The likelihood of having poor sleep quality among depressed pregnant women was two times higher than non-depressed participants. This finding was similar to findings in studies conducted in China,^{10 49} Taiwan²⁴ and Nepal.¹⁸ A possible reason might be the fact that persistent feelings of sadness, hopelessness and disinterest in things previously enjoyed are symptoms of depression and might result in sleep disturbances.⁵⁰ Depression may also be associated with physical symptoms such as headache, back pain, gastrointestinal symptoms, fatigue, sleep problems (commonly insomnia) and daytime sleepiness.^{41 51 52} Symptoms of poor sleep quality at night in people with depression have been described extensively in both clinical and epidemiological studies of depressed people.⁵³ Depression influences the stress hormone, cortisol, and adrenocorticotrophic hormone, which results in the alteration of sleep patterns.⁵⁴

Pregnant women with high perceived stress were found to be 5.6 times more likely to have poor sleep quality compared with pregnant women with low perceived stress during the previous month. This finding is similar to studies conducted in China⁴⁹ and Taiwan.²⁴ Stress is thought to act on sleep primarily through increased cognitive and somatic arousal during the short time before the sleep period.⁵⁵

The sleep quality of the pregnant women that participated in the study was strongly affected by IPV. The women who had experienced IPV were more than 5.5 as likely to have poor sleep quality as compared with those who had no experience of IPV. This finding is supported by the study conducted in Peru.⁵⁶ A possible reason might be the fact that IPV, which includes physical, emotional, or psychological and sexual abuse, is a serious community challenge that affects women around the globe. Pregnant

women experiencing IPV are reported to have elevated levels of mood and anxiety disorders,⁵⁷ hyperarousal and chronic stress⁵⁸ which in turn might lead to poor sleep quality. Victims of IPV experience an elevated risk of sleep disturbances stemming from heightened vigilance and anticipation of violence while sleeping.⁵⁹ Those women who experienced IPV had a high incidence of post-traumatic stress disorders and major depression with associated poor sleep quality.^{59 60}

LIMITATION OF STUDY

Even though this study revealed important findings in the under-investigated area of sleep quality of pregnant women in Ethiopia, there were some limitations that need to be considered when generalising the results. The first limitation is the possibility of under-reporting of the events, which could be related to the data collection method we employed. There might be some recall bias as a face-to-face interview method was used.

Second, due to the nature of cross-sectional study design, it is not possible to report the temporal cause-and-effect relationship between depression and poor sleep quality. Individuals who had no symptoms of sleep problem may have less motivation to recall earlier exposure than individuals with the symptoms.

CONCLUSION AND RECOMMENDATION

The prevalence of poor sleep quality among pregnant women was relatively high. The first and third trimesters, consumption of caffeinated substances, antenatal depression, high perceived stress and IPV were factors significantly associated with poor sleep quality.

This study recommends that all pregnant women should be screened and treated for poor sleep quality during the first and third trimesters. Emphasis should be given to early detection and treatment of antenatal depression. Those with high perceived stress and those who have experienced IPV are particularly likely to report poor sleep quality during pregnancy.

Acknowledgements The authors would like to acknowledge the University of Gondar and Adigrat University for ethical clearance and financial support. The authors would also like to thank University of Gondar Comprehensive Specialized Hospital ANC staff and study participants. Finally, we would like to thank Dr Heather Dipple from England who helped us to review the manuscript for language and grammar.

Contributors The study was conceived by GMT, with additional technical guidance provided by NYM and MSB. All authors contributed to the design and data collection process, analysis and documentation of the results. GMT is acting as a guarantor for this article. All authors commented on the manuscript and approved the final draft.

Funding The authors had no a specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Competing interests None declared.

Patient and public involvement 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. Ethical clearance and official letter for permission were obtained from the institutional review board (IRB) of University of Gondar with reference number 1868/02/2020, and letter of support was given by University of Gondar College of Medicine and Health Science. Then, the letters were summated to UoGCSH Department of Gynecology and Obstetrics outpatient unit. Participants gave informed consent to participate in the study before taking part. Detailed information about the study was explained to all participants before starting data collection. Written consent was obtained from each participant before starting data collection. Study participants were told that they had the right not to participate in the study. The privacy of study participants and the confidentiality of the information were kept at every stage of data processing. Pregnant participants who complained of very bad subjective sleep quality during the time of data collection were advised to visit psychiatry OPD.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement The dataset is available on request by emailing the corresponding author (girmawmedfu@gmail.com).

Open access This is an open access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited, appropriate credit is given, any changes made indicated, and the use is non-commercial. See: <http://creativecommons.org/licenses/by-nc/4.0/>.

ORCID iDs

Girmaw Medfu Takelle <http://orcid.org/0000-0001-7444-864X>

Mengesha Srahbzu Biresaw <http://orcid.org/0000-0002-6486-3732>

REFERENCES

- 1 Chang JJ, Pien GW, Duntley SP, *et al*. Sleep deprivation during pregnancy and maternal and fetal outcomes: is there a relationship? *Sleep Med Rev* 2010;14:107–14.
- 2 Montgomery-Downs HE, Insana SP, Clegg-Kraynok MM, *et al*. Normative longitudinal maternal sleep: the first 4 postpartum months. *Am J Obstet Gynecol* 2010;203:465.e1–465.e7.
- 3 Bernert RA, Kim JS, Iwata NG, *et al*. Sleep disturbances as an evidence-based suicide risk factor. *Curr Psychiatry Rep* 2015;17:1–9.
- 4 Rahmasita SA, Mahardika A, Jumsa MR. Pengaruh Tingkat Kecemasan Terhadap Kualitas Tidur Ibu Hamil trimester III di Puskesmas Tanjung Karang Mataram. *Smart Society Empowerment Journal* 2021;1:81–90.
- 5 Venugopal L, Rajendran P, V. P. A study on rate pressure product in South Indian pregnant women with anaemia. , 2018: 5, 1158.
- 6 Dijk D-J, von Schantz M. Timing and consolidation of human sleep, wakefulness, and performance by a symphony of oscillators. *J Biol Rhythms* 2005;20:279–90.
- 7 Tsai S-Y, Lin J-W, Wu W-W, *et al*. Sleep disturbances and symptoms of depression and daytime sleepiness in pregnant women. *Birth* 2016;43:176–83.
- 8 Ahmed Net *al*. Prevalence of sleep disturbances during pregnancy—a pilot study. *BAOJ Gynaec* 2019;2:1–8.
- 9 Okun ML, Roberts JM, Marsland AL, *et al*. How disturbed sleep may be a risk factor for adverse pregnancy outcomes. *Obstet Gynecol Surv* 2009;64:273–80.
- 10 Yang Y, Mao J, Ye Z, *et al*. Determinants of sleep quality among pregnant women in China: a cross-sectional survey. *J Matern Fetal Neonatal Med* 2018;31:2980–5.
- 11 Naghi I, Keypour F, Ahari SB, *et al*. Sleep disturbance in late pregnancy and type and duration of labour. *J Obstet Gynaecol* 2011;31:489–91.
- 12 Mellor R, Chua SC, Boyce P. Antenatal depression: an artefact of sleep disturbance? *Arch Womens Ment Health* 2014;17:291–302.
- 13 O'Brien LM. Sleep disruption and adverse pregnancy outcomes. *BMC Pregnancy and Childbirth* 2012;12:1–2.
- 14 Skouteris H, Wertheim EH, Germano C, *et al*. Assessing sleep during pregnancy: a study across two time points examining the Pittsburgh Sleep Quality Index and associations with depressive symptoms. *Womens Health Issues* 2009;19:45–51.
- 15 Blair LM, Porter K, Leblebicioglu B, *et al*. Poor sleep quality and associated inflammation predict preterm birth: heightened risk among African Americans. *Sleep* 2015;38:1259–67.
- 16 Laura Pet *al*. *Chronic sleep loss during pregnancy as a determinant of stress: impact on pregnancy outcome*. 2014.
- 17 Lee KA, Gay CL. Sleep in late pregnancy predicts length of labor and type of delivery. *Am J Obstet Gynecol* 2004;191:2041–6.

- 18 Sut HK, Asci O, Topac N. Sleep quality and health-related quality of life in pregnancy. *J Perinat Neonatal Nurs* 2016;34:302–9.
- 19 Kaneita Y, Ohida T, Takemura S, *et al.* Relation of smoking and drinking to sleep disturbance among Japanese pregnant women. *Prev Med* 2005;41:877–82.
- 20 Buysse DJ, Reynolds CF, Monk TH, *et al.* The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res* 1989;28:193–213.
- 21 Berhanu H, Mossie A, Tadesse S, *et al.* Prevalence and associated factors of sleep quality among adults in Jimma town, Southwest Ethiopia: a community-based cross-sectional study. *Sleep Disord* 2018;2018:1–10.
- 22 Gelaye B, Lohsoonthorn V, Lertmeharit S, *et al.* Construct validity and factor structure of the Pittsburgh Sleep Quality Index and Epworth Sleepiness Scale in a multi-national study of African, South East Asian and South American college students. *PLoS One* 2014;9:e116383.
- 23 Qiu P-L, Liu S-Y, Bradshaw M, *et al.* Multi-Locus phylogeny and taxonomy of an unresolved, heterogeneous species complex within the genus *Golovinomyces* (Ascomycota, Erysiphales), including *G. ambrosiae*, *G. circumfusum* and *G. spadiceus*. *BMC Microbiol* 2020;20:1–16.
- 24 Ko S-H, Chang S-C, Chen C-H. A comparative study of sleep quality between pregnant and nonpregnant Taiwanese women. *J Nurs Scholarsh* 2010;42:23–30.
- 25 Taber KS. The use of Cronbach's alpha when developing and reporting research instruments in science education. *Res Sci Educ* 2018;48:1273–96.
- 26 Heslop K, Ross C, Osmond B, *et al.* The Alcohol Smoking and Substance Involvement Screening Test (ASSIST) in an acute mental health setting. *Int J Ment Health Addict* 2013;11:583–600.
- 27 Ayano G, Tesfaw G, Shumet S. Prevalence and determinants of antenatal depression in Ethiopia: a systematic review and meta-analysis. *PLoS One* 2019;14:e0211764.
- 28 Biratu A, Haile D. Prevalence of antenatal depression and associated factors among pregnant women in Addis Ababa, Ethiopia: a cross-sectional study. *Reprod Health* 2015;12:1–8.
- 29 Dibaba Y, Fantahun M, Hindin MJ. The association of unwanted pregnancy and social support with depressive symptoms in pregnancy: evidence from rural southwestern Ethiopia. *BMC Pregnancy Childbirth* 2013;13:1–8.
- 30 Senturk V, Abas M, Berksun O, *et al.* Social support and antenatal depression in extended and nuclear family environments in Turkey: a cross-sectional survey. *BMC Psychiatry* 2011;11:1–10.
- 31 Cohen S, Kamarck T, Mermelstein R. A global measure of perceived stress. *J Health Soc Behav* 1983;24:385.
- 32 Basile KC, Hertz MF, Black SE. *Intimate partner violence and sexual violence victimization assessment instruments for use in healthcare settings*. 2007.
- 33 Saadati F, Sehhatie Shafaei F, Mirghafourvand M. Sleep quality and its relationship with quality of life among high-risk pregnant women (gestational diabetes and hypertension). *J Matern Fetal Neonatal Med* 2018;31:150–7.
- 34 Huong NTT, Thuy NTH, Yen LTH. Quality of sleep among pregnant women. *Int J Clin Med* 2019;10:16–25.
- 35 Mindell JA, Cook RA, Nikolovski J. Sleep patterns and sleep disturbances across pregnancy. *Sleep Med* 2015;16:483–8.
- 36 Sedov ID, Cameron EE, Madigan S, *et al.* Sleep quality during pregnancy: a meta-analysis. *Sleep Med Rev* 2018;38:168–76.
- 37 Tsai S-Y, Lee P-L, Lin J-W, *et al.* Cross-Sectional and longitudinal associations between sleep and health-related quality of life in pregnant women: a prospective observational study. *Int J Nurs Stud* 2016;56:45–53.
- 38 Polo-Kantola P, Aukia L, Karlsson H, *et al.* Sleep quality during pregnancy: associations with depressive and anxiety symptoms. *Acta Obstet Gynecol Scand* 2017;96:198–206.
- 39 Van Ravesteyn LM, Tulen JHM, Kamperman AM, *et al.* Perceived sleep quality is worse than objective parameters of sleep in pregnant women with a mental disorder. *J Clin Sleep Med* 2014;10:1137–41.
- 40 Hung H-M, Tsai P-S, Ko S-H, *et al.* Patterns and predictors of sleep quality in Taiwanese pregnant women. *MCN Am J Matern Child Nurs* 2013;38:95–101.
- 41 Baker FC, Wolfson AR, Lee KA. Association of sociodemographic, lifestyle, and health factors with sleep quality and daytime sleepiness in women: findings from the 2007 National Sleep Foundation "Sleep in America Poll". *J Womens Health* 2009;18:841–9.
- 42 Won CHJ. Sleeping for two: the great paradox of sleep in pregnancy. *J Clin Sleep Med* 2015;11:593–4.
- 43 Al Lawati NM, Patel SR, Ayas NT. Epidemiology, risk factors, and consequences of obstructive sleep apnea and short sleep duration. *Prog Cardiovasc Dis* 2009;51:285–93.
- 44 Haseli-Mashhadi N, Dadd T, Pan A, *et al.* Sleep quality in middle-aged and elderly Chinese: distribution, associated factors and associations with cardio-metabolic risk factors. *BMC Public Health* 2009;9:1–11.
- 45 Drake C, Roehrs T, Shambroom J, *et al.* Caffeine effects on sleep taken 0, 3, or 6 hours before going to bed. *J Clin Sleep Med* 2013;9:1195–200.
- 46 Porkka-Heiskanen T, Strecker RE, Thakkar M, *et al.* Adenosine: a mediator of the sleep-inducing effects of prolonged wakefulness. *Science* 1997;276:1265–8.
- 47 Huang Z-L, Qu W-M, Eguchi N, *et al.* Adenosine A2A, but not A1, receptors mediate the arousal effect of caffeine. *Nat Neurosci* 2005;8:858–9.
- 48 Kalinchuk AV, Urrila A-S, Alanko L, *et al.* Local energy depletion in the basal forebrain increases sleep. *Eur J Neurosci* 2003;17:863–9.
- 49 Gao M, Hu J, Yang L, *et al.* Association of sleep quality during pregnancy with stress and depression: a prospective birth cohort study in China. *BMC Pregnancy Childbirth* 2019;19:1–8.
- 50 Palagini L, Gemignani A, Banti S, *et al.* Chronic sleep loss during pregnancy as a determinant of stress: impact on pregnancy outcome. *Sleep Med* 2014;15:853–9.
- 51 Gelaye B, Barrios YV, Zhong Q-Y, *et al.* Association of poor subjective sleep quality with suicidal ideation among pregnant Peruvian women. *Gen Hosp Psychiatry* 2015;37:441–7.
- 52 Skouteris H, Germano C, Wertheim EH, *et al.* Sleep quality and depression during pregnancy: a prospective study. *J Sleep Res* 2008;17:217–20.
- 53 Ford DE, Kamerow DB. Epidemiologic study of sleep disturbances and psychiatric disorders. An opportunity for prevention? *JAMA* 1989;262:1479–84.
- 54 Steiger A. Neurochemical regulation of sleep. *J Psychiatr Res* 2007;41:537–52.
- 55 Taylor ND, Fireman GD, Levin R. Trait hostility, perceived stress, and sleep quality in a sample of normal sleepers. *Sleep Disord* 2013;2013:1–8.
- 56 Sanchez SE, Islam S, Zhong Q-Y, *et al.* Intimate partner violence is associated with stress-related sleep disturbance and poor sleep quality during early pregnancy. *PLoS One* 2016;11:e0152199.
- 57 Rallis S, Skouteris H, McCabe M, *et al.* A prospective examination of depression, anxiety and stress throughout pregnancy. *Women and Birth* 2014;27:e36–42.
- 58 Walker R, Shannon L, Logan TK. Sleep loss and partner violence victimization. *J Interpers Violence* 2011;26:2004–24.
- 59 Neria Y, Gross R, Litz B, *et al.* Prevalence and psychological correlates of complicated grief among bereaved adults 2.5–3.5 years after September 11th attacks. *J Trauma Stress* 2007;20:251–62.
- 60 Pigeon WR, Cerulli C, Richards H, *et al.* Sleep disturbances and their association with mental health among women exposed to intimate partner violence. *J Womens Health* 2011;20:1923–9.