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ORIGINAL RESEARCH

Sleep Quality and Associated Factors Among Diabetes Mellitus Patients in a Follow-Up Clinic at the University of Gondar Comprehensive Specialized Hospital in Gondar, Northwest Ethiopia: A Cross-Sectional Study

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Introduction: Diabetic mellitus has a negative impact on the quality of sleep. It is one of the leading public health conditions which can result in poor sleep quality. Poor sleep quality is an unreported and unrecognized problem which can affect the prognosis of diabetes patients.

Objective: The aim of this study is to assess the prevalence of poor sleep quality and its associated factors among patients with diabetes mellitus attending follow-up clinics at the University of Gondar Comprehensive Specialized Hospital, Northwest Ethiopia, 2019.

Methods: An institution-based cross-sectional study was conducted among 430 diabetes mellitus patients at the University of Gondar Comprehensive Specialized Hospital from February 1, 2020 to March 28, 2020. A systematic random sampling method was used to reach the study subjects. An interviewer-administered questionnaire was used for data collection. Pittsburgh sleep quality index was used for assessing sleep quality. To explain study variables, frequency tables and percentages were used. A binary logistic regression was conducted to see the relation between dependent and independent variables.

Results: A total of 430 diabetes mellitus patients participated in the study with a response rate of 100%. The overall prevalence of poor sleep quality was 47.2%. Drinking alcohol (AOR = 2.45, 95% CI: 1.28–4.69), smokers (AOR = 6.26, 95% CI: 2.04–19.21), comorbidity (AOR = 1.80, 95% CI: 1.10–2.96), BMI ≥ 30 (AOR = 4.87, 95% CI: 1.07–22.09), having type 2 diabetes mellitus (AOR = 2.16, 95% CI: 1.04–4.50), poor glycemic control (AOR = 2.61, 95% CI: 1.81–4.81) and having depression (AOR = 9.95, 95% CI: 4.85–20.38) were associated with poor sleep quality.

Conclusion: In this study, nearly half of the patients had poor sleep quality. Drinking alcohol, smoking, comorbidities, higher BMI, type 2 diabetes mellitus, poor glycemic control and having depression were factors in poor sleep quality. Creating awareness of the need for weight reduction, minimizing alcohol intake, cessation of smoking, and improving sleep hygiene for DM patients would be effective management for improving poor sleep quality.

Keywords: diabetes mellitus, sleep disturbance, sleep quality, Gondar, Ethiopia

Introduction

Diabetes mellitus (DM) is a metabolic disease that presents with the prolonged raising of blood glucose levels with the disorder of carbohydrate, fat and protein metabolism due to problems in insulin production, insulin function or both.[1]

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Globally, there is a growing burden of DM due to factors such as increasing age, urbanization, obesity, and physical inactivity.[2] Worldwide the magnitude of diabetes in 2019 was estimated as 9.3% (463 million individuals), rising to 10.2% (578 million individuals) by 2030 and 10.9% (700 million individuals) by 2045. Diabetes is a challenge for millions of people in both developed and developing countries.[3] vidence in Ethiopia showed that an estimated 3.8% of the population had DM.[4]

Sleep is essential for life and maintenance of body functions. During sleep the body secretes many important hormones to regulate metabolic and endocrine functions.[5–7] The main role of sleep is to restore a whole body's balance, including the central nervous system, and it is a daily requirement.[8]

Good sleep quality has a significant clinical importance in diabetes mellitus patients by regulating the level of insulin, the build-up of inflammatory cytokines, preserving body caloric intake, and decreasing the likelihood of unhealthy behavior.[9]

Poor sleep quality is a leading health problem in the diabetic population. It presents as symptoms characterized by difficulty in initiating and maintaining sleep, excessive somnolence, disturbed sleep-wake schedule and dysfunctions associated with sleep and sleep stages.[10] Poor sleep quality is a medical disorder of the sleep patterns with higher rates of poor sleep quality, excessive daytime sleepiness, and higher use of sleep medications.[11]

Evidence shows that poor sleep quality is a common problem among people with diabetes mellitus.[11–13] Globally, 47.6% of diabetics were affected by poor sleep quality.[14] In Africa, 29.5% of the diabetic population presented sleep disturbance.[15] A study done in Ethiopia showed that about 55.6% of diabetic patients were affected by sleep disturbance.[16]

Poor sleep quality in DM patients can be due to decreases in saturation level, pain, restless leg syndrome, nocturnal polyuria, and nocturnal hypoglycemia.[17] Poor sleep quality may bring about mental impairment and decrease the working capacity of individuals with DM. Evidence shows that poor sleep quality among DM patients was associated with factors such as age, gender, body mass index, noisy environments, smoking and drinking habits.[18]

Poor sleep quality in DM patients can lead to non-adherence to their recommended medication, insulin resistance, cardiovascular disease, mental impairment and decreases in working capacity.[11–13,18] It also impairs cognitive performance, and can lead to a higher risk of stroke and depression.[19]

Reducing preventable mortality from non-communicable diseases (NCDs) including DM by 25% is a target of the World Health Organization (WHO) by the end of 2025. Tackling poor sleep quality has been identified as one key measure for achieving this target.[20] Simultaneous occurrence of poor sleep quality with DM makes clinical management more complicated. Hence, understanding the magnitude and major risk factors are a key role of health-care providers to prevent, identify and treat poor sleep quality.

So far as the researchers are aware, there was no research done in the study area. Therefore, conducting this study was able to give evidence on the prevalence as well as major factors of poor sleep quality. Determining the risk factors of poor sleep quality is important for its urgent management and further reduction of health-care costs related to the care needed.

The results of this study will provide information for health-care providers and policymakers as a baseline for further study.

Therefore, this study assessed the prevalence of poor sleep quality and its associated factors among adults with diabetes mellitus attending a follow-up clinic at the University of Gondar Comprehensive Specialized Hospital (UOCGSH), Northwest Ethiopia.

Methods

Study Design and Period

A cross-sectional institutional-based study was conducted from February 1, 2020 to March 28, 2020.

Study Area

The study was conducted at the UOGCSH diabetes follow-up clinic. The hospital is located in Gondar town, Amhara regional state, 748 km away from Addis Ababa. The UOGCSH has more than 14 outpatient medical service units and more than 250,000 people have visited the services. Chronic illness care is one of the services that the hospital provides to the population who are living in and outside of Gondar town. Provision of follow-up and treatments for DM patients is one of the services offered in the chronic illness care clinic. Besides, the hospital serves as a tertiary level referral center for over seven million people in Gondar town and Northwest Ethiopia.[21]

Source and Study Population

All adult DM patients attending DM clinics at the UOGSH were the source population, whereas all DM patients attending the follow-up clinics during the study period were the study population.

Inclusion and Exclusion Criteria

All diabetes patients having follow-up at the hospital during the study period were included in this study, whereas patients who were seriously ill, or who had a diagnosed psychiatric disorder were excluded from the study.

Sample Size Determination and Sampling Procedure

The sample size of the first objective was calculated by using single population proportion formula $n = \left(\mathbf{Z}\frac{\alpha}{2}\right)2 * \mathbf{p}(1-\mathbf{p})/(\mathbf{d})2$. From the formula "n" denotes sample size, " $\frac{\alpha}{2}$" is the reliability coefficient of standard error at the 5% level of significance with z =1.96, "p" is proportion and "d" is level of standard error. The prevalence (p) used was 55.6%, which was taken from a previous study done in Ethiopia,[16] to determine the sample size of 379 and 10% non-response rate was taken to determine the total sample size of 417. The sample size of the second objective was calculated using STATCalc Epi info version 7 by taking a proportion of factors from a similar study conducted in Ethiopia.[22] The largest sample size calculated from the second objective was 391, which was higher than the first objective and 10% of non-response rate was taken to determine the final sample size of 430 (see Table S1).

There were nearly 600 diabetic patients attending the outpatient department per month. A systematic random sampling technique was employed to select the study participants with every one interval. To avoid the recycling of data, special marks were used for the interviewed patients' charts to indicate whether they had participated or not in the previous visit.

Operational Definitions

Sleep quality: The Pittsburgh Sleep Quality Index (PSQI) classifies a global score of > 5 as indicating clients have poor sleeping quality, whereas a global score ≤ 5 is classified as good sleeping quality.[23]

Duration of diabetes mellitus: Duration of ≤ 10 years since the first diagnosis is considered short duration and > 10 years is considered to be long duration.[16]

Poor glycemic control: The average fasting blood glucose on three consecutive visits is > 130 or less than 70 mg/dl.[24]

Good glycemic control: A 3-month average fasting blood glucose was between 70 and 130.[24]

Depression: A total score of > 10 points with PHQ-9 scale, was categorized to indicate depressive symptoms.[25]

Anxiety: Study participants who scored 9 and above on the generalized anxiety disorder items of the questionnaire were categorized to have anxiety.[26]

Comorbidity: The presence of one or more distinct medical problems in an individual along with DM.[27]

BMI: A person was classified as underweight (BMI < 18.5 kg/m^2), normal body weight (BMI 18.5−24.9 kg/m^2), overweight (BMI 25–29.9 kg/m^2), or obese (BMI ≥ 30 kg/m^2).[28–30]

Smoking: Currently smoking is smoking a cigarette at least once within the last 30 days.[16,24]

Drinking alcohol: Patients were classified as drinking alcohol if they had a history of consuming an alcoholic drink since the last visit.[24,31]

Chewing khat: Current chewer is a patient who had a history of khat chewing in the past one month.[16,32]

Data Collection Tools and Procedures

A structured interviewer-administered questionnaire was adapted from other related studies to collect the data.[25,33] The questionnaire has three parts, which includes socio-demographic factors, Pittsburgh sleeping quality index (PSQI) and factors that affect sleep quality including psychosocial, behavioral, and clinical factors. Sleep quality was assessed by the PSQI scale with 19 items, which has seven subscales. The sum of scores for these seven components yields one global PSQI score. Each component of the PSQI has a score from 0 to 3. The sum of the score ranges from 0 to 21, in which the higher scores indicate poor sleep quality and the lower scores indicate good sleep quality.[33] The level of depression is assessed using a nine item Patient Health Questionnaire (PHQ-9), which was validated in Ethiopia. Each component has a score of 0 to 3 with a global score ranging from 0 to 27. A total score of more than 10 indicates the presence of depressive symptoms.[25] The Cronbach's alpha for PSQI and depression items were 0.73 and 0.80 respectively. The generalized anxiety disorder section with 7 items was used to screen participants' levels of anxiety; it has an internal reliability in Ethiopia of 0.91.[34] Before the actual data collection, four BSc nurse data collectors and one MSc

nurse acting as a supervisor had obtained a half day of training about the aim of the study and the content of the overall questionnaire.

Data Quality Assurance

To maintain data quality, a pre-test was done on 22 (5%) diabetes patients from Felege Hiwot Referral Hospital. A structured interviewer administered questionnaire was used to collect the data. The questionnaire was prepared in English and translated to local language Amharic for the sake of better understanding for the study participants. The data were checked for completeness during the data collection, entry, and analysis process.

Data Processing and Analysis

The collected data were checked for completeness and accuracy before analysis. The data were exported to Statistical Package for Social Science (SPSS) version 20 software for analysis. The data were then re-coded, and cleaned with appropriate statistical analysis using SPSS. Descriptive statistics such as the frequency and percentage were used. Tables and graphs were used to describe the sample characteristics and response to questionnaire items. Model fitness was checked using the Hosmer–Lemeshow goodness of fit test ($p = 0.26$) and interpreted as a model fitted. All variables fulfilled the chi-square assumption and the odds ratio checked. Multicollinearity was checked using variance inflation factor (VIF) and its values were between 1–10, which was interpreted as no multicollinearity. Bivariable and multivariable logistic regression analyses were used to identify associated factors. Those variables with p-value less than 0.2 in bivariable analysis were entered into multivariable analysis. The backward selection process was used to see the final associated variables. Those variables with p-value less than 0.05 with 95% confidence interval were considered as significantly associated with outcome variables.

Results

Socio-Demographic Characteristics

A total of 430 DM clients participated in the study with a response rate of 100%.

The mean age of participants was 51.23 with standard deviation (SD) of 15.19 years. More than half, 238 (55.3%) were female participants and 274 (63.7%) of them were married. The majority, 363 (83.5%) of the participants were Christian, and 102 (23.7%) of the participants had attended primary school. About 331 (77%) of the participants lived in urban areas and 130 (30.2%) were a housewife. The majority, 372 (86.5%) of them were living within the family (Table 1).

Clinical Characteristics

Less than half, 181 (42.1%) participants had confirmed DM since 1–4 years back. More than half, 231 (53.7%) of the participants had a normal body mass index (BMI). The majority, 329 (76.5%) of the participants were type 2 DM. More than half, 247 (57.4%) of the participants had

Table 1 Socio-Demographic Characteristics of Patients with DM at a Follow-Up Clinic at the UoGCSH, 2020 (n = 430)

Variables	Category	Frequency (n)	Percent (%)
Sex	Female	238	55.3
	Male	192	44.7
Age group	18–29	46	10.7
	30–39	44	10.2
	40–49	79	18.4
	≥ 50	261	60.7
	Mean/SD of age	51.23 Mean	SD ±15.19
Marital status	Single	74	17.2
	Married	274	63.7
	Divorced	35	8.1
	Widowed	47	10.9
Religion	Christianity	363	84.4
	Muslim	67	15.6
Education	Cannot read and write	55	12.8
	Read and write	94	21.9
	Primary school	102	23.7
	Secondary school	88	20.5
	College and above	91	21.2
Residence	Urban	331	77.0
	Rural	99	23.0
Occupation	Government employee	107	24.9
	Farmer	21	4.9
	Housewife	130	30.2
	Merchant	34	7.9
	Private work	82	19.1
	Others*	57	13.3
Living statues	Alone	44	10.2
	With family	372	86.5
	With non-family	14	3.3

Notes: Others*, daily labor, unemployed student.
Abbreviations: DM, diabetes mellitus; UoGCSH, University of Gondar Comprehensive Specialized Hospital; SD, standard deviation.

poor controlled fasting blood glucose. Almost half, 212 (49.3%) used an oral hypoglycemic-based regimen. Fifty-seven percent of study participants had comorbidity and almost half, 187 (47.3%) of the participants had comorbidity with hypertension (Table 2).

Psychosocial and Behavioral Characteristics

About 156 (36.3%) of the participants had depression. Of the total participants, 178 (41.4%) had anxiety. Regarding behavioral habits, about 6 (1.4%) were khat chewers, 65 (15.1%) drank alcohol and 6 (1.4%) participants were past smokers (Table 3).

Prevalence of Sleep Quality

The overall prevalence of poor sleep quality among diabetic patients was 47.2% (95% CI: 42.5–52.1), whereas the prevalence of good sleep quality was 52.8% (95% CI: 42.3–52.3). Among the total participants, 134 (31.1%) them rated their overall sleep quality as bad. Below one-third (22.6%) of the participants had faced 31–60 minute sleep latency. Almost half, 211 (49.1%) of the participants had greater than 7 hours sleep duration per night. The average bedtime of the participants was 10:04 p.m. Almost two-thirds, 272 (63.3%) of the participants had > 85% sleep efficacy. Almost all, 425 (98.8%) participants had never used sleeping medication for their sleep disturbance and almost half, 214 (49.8%) of the participants reported that their sleep quality affects their day-to-day function (Table 4).

Table 2 The Clinical Characteristics of Patients with DM at a Follow-Up Clinic at the UoGCSH, 2020 (n = 430)

Variables	Category	Number (n)	Percent (%)
Duration of DM in year	1–4 year	181	42.1
	5–10 year	163	37.9
	>10	86	20.0
History of comorbidity	Yes	249	57.9
	No	181	42.1
Type of comorbidity	HTN	187	47.3
	CHF	11	2.6
	Both	35	8.1
	Others*	16	3.7
Type of DM	Type 1	101	23.5
	Type 2	329	76.5
Glycemic control	Good	183	42.6
	Poor	247	57.4
Treatment modalities	Oral	212	49.3
	Insulin	159	37.0
	Both	59	13.7
BMI	Underweight	19	4.4
	Normal	137	31.9
	Overweight	231	53.7
	Obese	43	10.0

Notes: Others*, kidney failure, epilepsy, stroke.
Abbreviations: DM, diabetes mellitus; UoGCSH, University of Gondar Comprehensive Specialized Hospital; BMI, body mass index; CHF, congestive heart failure; DM, diabetics mellitus; HTN, hypertension.

Table 3 The Psychosocial and Behavioral Characteristics of Patients with DM at a Follow-Up Clinic at the UoGCSH, 2020 (n = 430)

Variables	Category	Number (n)	Percent (%)
Depression	Yes	156	36.3
	No	274	63.7
Anxiety	Yes	178	41.4
	No	252	58.6
Khat chewing	Current chewer	6	1.4
	Past chewer	18	4.2
	Never chewer	406	94.4
Smoking	Never smoke	390	90.7
	Currently smoking	6	1.4
	Past smoker	34	7.9
Drinking alcohol	Yes	65	15.1
	No	365	84.9
Use of hashish and Shisha	Yes	0	0
	No	430	100

Abbreviations: DM, diabetes mellitus; UoGCSH, University of Gondar Comprehensive Specialized Hospital.

Factors Associated with Sleep Disturbance

In multivariable regression analysis, seven variables, drinking alcohol, smoking, high BMI, comorbidities, type 2 DM, poor glycemic control and depression were significantly associated with poor sleep quality. In this study the odds of poor sleeping quality was 2.45 times (AOR = 2.45, 95% CI: 1.28–4.69) more likely in patients who drank alcohol than those who did not. Cigarette smoking was 6.26 times (AOR = 6.26, 95% CI: 2.04–19.21) the odds of poor sleeping quality than non-cigarette smoking. The

Table 4 Characteristics of Sleep Disturbance Among Patients with DM at a Follow-Up Clinic at the UoGCSH, 2020 (n = 430)

Variables	Category	Frequency (n)	Percent (%)
Subjective sleep quality	Very good (0)	187	43.5
	Fairly good (1)	109	25.3
	Fairly bad (2)	78	18.1
	Very bad (3)	56	13.0
Sleep latency	0–15 minutes (0)	86	20.0
	16–30 minutes (1)	236	54.9
	31–60 minutes (2)	97	22.6
	>60 minutes (3)	11	2.6
Sleep duration	>7 hours	211	49.1
	6–7 hours	90	20.9
	5–6 hours	81	18.8
	<5 hours	48	11.2
Sleep efficacy	≥85%	272	63.3
	75–84%	46	10.7
	65–74%	82	49.1
	<65%	30	7.0
Sleep disturbance	Never (0)	39	9.1
	1 times a week (1)	328	76.3
	1–2 times a week (2)	58	13.5
	≥3 times a week (3)	5	1.2
Used sleep medication	Never (0)	425	98.8
	1–2 once a week (1)	5	1.2
Daytime dysfunction	No problem (0)	216	50.2
	1–2 times a week (1)	69	16.0
	3 times a week (2)	89	20.7
	>3 times a week (3)	56	13.0
Overall sleep quality	Good	227	52.8
	Poor	203	47.2

Abbreviations: DM, diabetes mellitus; UoGCSH, University of Gondar Comprehensive Specialized Hospital.

odds of poor sleeping quality was 1.8 (AOR =1.80, 95% CI: 1.09–2.96) times more likely in patients with comorbidities as compared with no comorbidities. Patients with type 2 DM were 2.16 times (AOR = 2.16, 95% CI: 1.04–-4.48) more likely to have poor sleep quality as compared with type 1 DM patients. Having poor glycemic control was 2.61 times (AOR = 2.61, 95% CI: 1.81–4.81) the odds of poor sleep quality than good glycemic control. Patients with depression were 9.93 times (AOR = 9.93, 95% CI: 4.84–20.38) more likely to have poor sleeping quality as compared with their counterparts. The odds of poor sleep quality was 5 times (AOR = 5.01, 95% CI: 1.10–22.86) more likely in patients with a BMI ≥30 kg/m^2 as compared with patients with lower BMIs (Table 5).

Discussion

Poor sleep quality is a serious problem for DM patients since it increases risk of insulin resistance and complications related to DM. Better sleep management can increase the likelihood of better diabetes management and good management of DM can improve sleep quality.[35]

In this study, the overall prevalence of poor sleep quality among DM was found to be 47.2% with 95% CI (42.5–52.1). The finding of this study was lower than studies conducted in Ethiopia (55.6%),[33] Kenya (53.4%),[15] USA (80%),[36] another similar study in the USA (84%),[37] Sudan (97.1%),[38] India (64%),[11] Saudi Arabia (72%),[39] another similar study in Saudi Arabia (61.6%),[40] and Turkey 64.3%.[41] The discrepancy between the current study and studies conducted in Jimma, southwest Ethiopia might be due to the majority of the participants in the studies conducted in Jimma being khat users. This could be the result of khat's effect on sleep latency and duration.[33,42] The discrepancies with Nigeria were due to a different assessment tool.

Other discrepancies might be due to the sleep quality cut-off point of PSQI, a different measurement tool, and sociocultural differences, and that the setting in which the study was done in Turkey was in admitted DM patients.

This finding was in line with studies conducted in Malaysia (47.2%),[43] Japan (43.9%),[10] Korea (49%),[44] and Iran 50.7%.[45] However, the finding of this study was higher than the studies conducted in Ethiopia (36.5%),[33] USA (29.7%),[46] Iraq (35.3%),[47] Spain (40%),[14] Iran (38%),[48] Korea (38.4%),[49] China (33.6%),[50] and Nigeria (27%).[51] The discrepancy with studies done in the USA, Spain, Iraq, Korea, Iran, China and Nigeria might be due to socio-economic, psychosocial and behavioral factors.[52–54] Another discrepancy might be due to study of composite sleep quality among three chronic diseases in Debre Markos, northwest Ethiopia.

In a multivariable logistic regression analysis, patients who drank alcohol were 2.45 times more likely to have poor sleep quality as compared with their counterparts. This was in line with the study conducted in Ethiopia.[16] This might be because drinking more alcohol can negatively affect the quality of sleep.[55,56]

Cigarette smoking had 6.26 times the odds of poor sleep quality than for those who had not smoked. This study was consistent with the studies conducted in

Table 5 Factors Associated with Poor Sleep Quality Among Patients with DM at a Follow-Up Clinic at the UOGCSH, 2020 (n = 430)

Variables	Poor Sleep Quality		OR 95% CI	
	Yes	No	COR	AOR
Alcohol Drinking				
Yes	40	25	1.98(1.55–3.40)	2.45(1.28–4.69)*
No	163	202	1	
Smoking status				
Not smoked	221	172	1	
Smoked	6	31	6.64(2.71,18.27)	6.27(2.04–19.21)**
BMI				
<18.5 kg/m^2	7	12	1	
18.5–24.9 kg/m^2	92	139	1.13(0.43–2.98)	0.86(0.24–2.99)
25–29.9 kg/m^2	69	68	1.73(0.64–4.68)	1.14(0.30–4.20)
≥30 kg/m^2	35	8	7.50(2.24–25.03)	5.01(1.10–22.86)**
Comorbidity				
Yes	143	106	2.72(1.82–4.05)	1.80(1.10–2.96)*
No	60	121	1	
Type DM				
Type 2	177	152	3.36(2.05–5.51)	2.16(1.04–4.48)*
Type 1	26	75	1	
Glycemic control				
Good	40	139	1	1
Poor	126	125	3.56(2.16–5.71)	2.61(1.81–4.81)*
Depression				
No	32	231	1	
Yes	119	37	23(13.8–39)	9.93(4.84–20.38)*

Notes: *Indicates statistically significant (p<0.05), **Highly statistically significant (p< 0.01).
Abbreviations: DM, diabetes mellitus; UoGCSH, University of Gondar Comprehensive Specialized Hospital.

Turkey,[41] Japan,[10] and Saudi Arabia.[40,57] A possible reason might be due to the fact that smoking cigarettes has an effect on sleep latency and efficiency.[58]

Comorbidity was 1.80 times more likely to result in poor sleep quality as compared with no history of comorbidity. This study is consistent with studies conducted in Ethiopia[16] and Turkey.[41] This might be due to comorbidities resulting in poor glycemic control, more chronic complications and increased emotional disorder which can result in disturbed hemostasis and poor sleep quality.[59]

Having depression was 9.93 times more likely to result in poor sleep quality as compared with not reporting depressive symptoms. This finding was similar to studies conducted in Norway,[60] China,[61] and India.[11] This might be due to common psychiatric disorders such as depression and anxiety being major factors in sleep disturbance among DM patients.[62]

Participants who had type 2 DM were 2.16 times more likely to have poor sleep quality as compared with those who had type 1 DM. This finding was similar to a study conducted in Spain.[14] This might be because complications such as pain due to peripheral neuropathy commonly occur in type 2 DM, which can lead to sleep disturbance. Evidence also supports that, nocturia, sleep apnea, and restless leg syndrome can exacerbate sleep disruption.[63]

The odds of poor sleep quality was 2.61 times in patients with poor glycemic control than for those with good glycemic control. This finding was in line with studies done in China[64] and Saudi Arabia[39] This might be because patients with poor glycemic control may develop nocturia which leads to frequent sleep disturbance at night.[65] Participants who had BMI ≥ 30 kg/m^2 were 5 times more likely to have poor sleep quality as compared with their counterparts. This study was consistent with the study conducted in Japan.[10] This might be due to higher

BMI leading to less physical activity, more diabetes complications and sleep disturbance.[11]

Conclusion

The finding of this study showed that nearly half of participants had poor sleep quality. Variables such as drinking alcohol, havin a history of smoking, comorbidities, type 2 DM, poor glycemic control, depression and BMI ≥30 kg/m^2 were factors in poor sleep quality. Policymakers ought to incorporate a sleep quality assessment checklist in routine DM follow-up clinics. Health-care professionals ought to be give attention to comorbidities with DM. Early management services including health education as a part of the routine management of diabetes mellitus can improve poor sleep quality. Special education is also needed in patients who drink alcohol, are cigarette smokers, have comorbidities or report symptoms of depression.

Limitation of the Study

Recall bias was a limitation in this study due to self-reporting in the questionnaire by participants. The participants also might respond with only socially acceptable answers. The cross-sectional nature of the study cannot rule out the cause–effect relationship.

Abbreviations

AOR, adjusted odds ratio; BMI, body mass index; CHF, congestive heart failure; Cl, confidence interval; COR, crude odds ratio; DM, diabetes mellitus; FBG, fasting blood glucose; HTN, hypertension; OPD, outpatient department; PHQ, Patient Health Questionnaire; SD, standard deviation; PSQI, Pittsburgh Sleep Quality Index; SPSS, Statistical Package Social Science; UOGSH, University of Gondar Specialized Hospital; USA, United States; WHO, World Health Organization.

Data and Material Availability

The raw data are available from one of the corresponding authors on rational request.

Ethical Approval and Consent

The study was performed based on the ethical standards of the declaration of Helsinki. Ethical clearance was obtained from the institutional ethical review committee of the School of Nursing and College of Health Science of University Gondar with ethical clearance letter reference number Rf.No:S/N2012/06/2012. An official permission letter was obtained from the University of Gondar hospital administration. After understanding the purpose of the study, written informed consent was obtained from study participants. Confidentiality of participants' information was kept.

Consent to Publication

Not applicable.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

The authors report no conflicts of interest for this work.

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