

Sleep Duration and Quality in Relation to Glycemic Control in type 2 Diabetic Patients Attending Diabetic Center in Makkah Al-Mokarramah, Saudi Arabia 2021

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Abstract:

Background

Recent epidemiological studies have suggested that there is an association between glycemic control and sleep disturbances in patients with type 2 diabetes, but the extent is unclear. Diabetes remains a critical public health challenge. Its prevalence continues to increase and it now affects an estimated 180 million people worldwide, a systematic literature search was

performed in Sleep disturbances have been shown to be associated with diabetes control, but the relation between planned waking or napping with glycemic indices has not been evaluated yet. This study assessment the Sleep duration and quality in relation to glycemic control in type 2 diabetic patients Sleep disturbances may be associated with impaired glucose metabolism. Sleep loss is a common condition in modern society . Understanding the link between diabetes and sleep may represent one important part of that effort .

Aim of the study: To assessment of the Sleep duration and quality in relation to glycemic control in type 2 diabetic patients attending Diabetic Centerin Makkah Al-Mokarramah , Saudi Arabia2021

Method: Cross sectional study, was conducted among Saudi Arabia adults population in Diabetic Centerin in the primary health care center in Makkah Al-Mukarramah. All participants were requested to fill in the Pittsburgh Sleep Quality Index (PSQI) questionnaire to evaluate their sleep quality. In addition, they were inquired about their sleep schedule during day and night. Our total participants were(300)

Results:that most of the participants (62.0%) were in the age group >60 years, the majority of them were female (62.0%) while male(38.0%), regarding the marital stats most of participants married were(69.0%)while, regarding level of education the majority of participant are Illiterate education were(34.0%) . regarding Occupation the majority of participant are Retired were(64.0%) .

Conclusion:in dings from the last review suggest that sleep duration as well as sleep quality may be a novel and independent risk for poorer glycemic control in T2DM patients. However, further research is needed to establish the potential causal link between sleep and altered glucose metabolism.

Keywords: Assessment, Sleep, duration, quality, glycemic, type 2 diabetic, adult, Makkah, Saudi Arabia

INTRODUCTION

Background

Patients with diabetes require frequent contacts with the health care system for effective management and prevention of complications, and are at increased risk for premature mortality and hospitalization for cardiovascular and kidney disease.[1] Although lifestyle changes such as healthy eating, weight loss and increased physical activity are the cornerstones of diabetes prevention and treatment, efforts are needed to better understand

other determinants of this disease and to develop additional intervention strategies. Understanding the link between diabetes and sleep may represent one important part of that effort [2, 3]. Diabetes mellitus (DM) is one of the most growing diseases worldwide, it is estimated that about 382 million people suffer from diabetes with a prevalence of 8.3%. Saudi Arabia is one of the top 10 countries worldwide with highest prevalence of DM that is estimated by 23.9%. The direct national health care burden because of diabetes is likely to exceed \$0.87 billion in Saudi Arabia. Sleep loss is a common condition in modern society [3, 4]. In the KSA, nearly one-third of adult's report sleeping less than 6 h per night [5]. Factors responsible for sleep curtailment are likely to be similar in all industrialized countries and include increases in environmental light, longer working days/commuting time, an increase in shift and night work, and the advent of television, radio, and the internet [6]. Sleep is a fundamental biological process that has been associated with physiological, psychological and neurological systems' wellbeing.[7] Generally, most of healthy adults need seven to nine hours of sleep per night [8] Insufficient sleep is one of the most common problem encountered by general physician [9] . Repeated difficulty with sleep initiation , maintenance, consolidation , or quality despite adequate opportunity and time for sleep and that leads to some form of daytime impairment is defined by insomnia.[About 46% - 69% of patients in complained of at least occasional insomnia and sex in ten health care professionals do not think they have enough time during regular clinic visits to discuss with their patients about insomnia.[10] Insomnia has a bad effect on the quality of life and the efficiency of work .[11]

Many epidemiological and experimental studies mentioned that sleep disturbance, poor sleep quality and quantity are related to increasing the risk of systemic chronic diseases such as hypertension, obesity, depression, cardiovascular diseases and insulin resistance.[12]

In diabetic patients, sleep disorders may lead to poor glycemic control, nocturnal hypoglycemia and diabetic neuropathy. Some studies have shown that there is association between diabetes mellitus and sleep: Diabetes can cause sleep disturbance, while sleep disturbance may make the control of diabetes more complicated.[13]

Recently, sleep disturbance become a potential risk factor for diabetic patients.[14] and about 50%-70% of diabetic patients have sleep disorders.[15]

Literature Review

By reviewing the literature ; the researcher found that the relation of sleep duration and sleep quality with glycemic control among diabetic patients have been studied in many researches

internationally but unfortunately no local study in Makkahcity has been done in the same topic.

A study done Sakamoto ,et al (2018)on patients with type 2 diabetes mellitus to describe the effect of sleep disorders on the level of hemoglobin A1C : The Pittsburgh Sleep Quality Index (PSQI) for measurement of sleep quality , the Epworth Sleepiness Scale (ESS) for assessment of daytime sleepiness and Berlin questionnaire (BQ) for obstructive sleep apnea syndrome (OSAS) were conducted among 585 patients with type 2 diabetes mellitus (392 females, 193 males, median age 57 years [50–64 years]). Diabetic parameters have been analyzed by collecting blood for measuring of HbA1C , fasting blood glucose and lipid panel.This study revealed that 64.30% of the participants had poor sleep quality , 54.40% had excessive daytime sleepiness and 50.20% were considered to have high risk for OSAS according to the results of PSQI , ESS and BQ respectively. In 50-64% of participants , sleep disorderswere detected. HbA1C and fasting blood glucose levels were significantly correlated with the results of PSQI , ESS and BQ.[16]

The results of this study was consistent with other studies by finding the bidirectional relationship between sleep disorders and diabetes : high level of HbA1C is a risk factor for developing of sleep disorders and sleep disorders are risk factors for elevating HbA1C level. Keskin *et al* suggesting addressing of sleep disturbance among diabetics patients with poor regulation of their blood glucose, both for improving control of diabetes and for decreasing the complications caused by sleep disorders.[17]

A cross sectional study done in Iran in 2015 to evaluate the relationship between sleep duration , sleep quality and sleep pattern including daytime napping of patients with diabetes mellitus and their glycemic control . 118 participants (90 males and 28 females) with T2DM on oral hypoglycemic medications were given the PSQI questionnaire to evaluate their sleep quality and given sleep schedule regarding night and daytime sleeping .[18] HbA1C , fasting blood glucose and two-hours postprandial glucose level were measured . Patients with renal impairment , ischemic heart diseases ,diabetic neuropathy , severe obesity , OSAS and psychiatric problems were excluded from this study. [19]

In contrast with other studies that mentioned a daytime napping is associated with increased risk of diabetes , this study revealed that a daytime napping is related to better glycemic control. This study also indicated that segmented sleep and longer sleep duration are associated with better glycemic control while they found no significant correlation between sleep quality and control of diabetes .[20]

After reviewing the literature of Gulf Cooperation Council (GCC) countries(Saudi Arabia, Kuwait, Bahrain, Qatar, Emirates and Oman) , the researcher found :

Locally In Saudi Arabia in Riyadh 2016, a study done on 1720 adults to evaluate the habits of sleep and sleep disturbances among Saudi adults. This study showed that 61.6% of the participants have or may have sleeping disturbances and women had the higher prevalence by (65.2%). This study indicated that participants with diabetes mellitus, asthma, chronic heart disease and hypertension showed more significantly sleep disturbance that is associated with lower performance.[21]

Rationale

While increasing the prevalence of diabetes mellitus and its complications , with its negative effect on personal and public health, the intensive glycemic control becomes more desirable by identifying the potential risks that magnify the problem . Sleep disturbance could be one of them. To the knowledge of the researcher there is no study done in Taif to measure the prevalence of sleep disturbance and its impact on glycemic control among diabetic patients , which is important for improving the health of our society .

Aim of Study

To assessment of the Sleep duration and quality in relation to glycemic control in type 2 diabetic patients attending Diabetic Center in Makkah Al-Mokarramah , Saudi Arabia 2021

Specific Objectives

- To assess the relationship between sleep disturbance and glycemic control in type 2 diabetic patients in our area .

METHODOLOGY

Study Area

This study will be conducted in 2021 in diabetic center in was conducted among Saudi Arabia adults population in the primary health care center in Makkah Al-Mukarramah . The diabetic center opened in 2010 and contains adult diabetic clinics , pediatric diabetic clinics, endocrine clinics and units for health education. This center provides high quality of care in diabetes and endocrinology.

A study participant has been recruited on Makkah Al-mukarramah including PHC centers under supervision of Directorate of Health Affairs of Makkah Al-Mukarramah in Saudi Arabia. The study has been carried out in the city of Makkah Al-Mokarramah, Makkah is the holiest spot on Earth. It is the birthplace of the Prophet Mohammad and the principal place of the pilgrims to perform Umrah and Hajj. The most important cities in Saudi Arabia . It is the

holy city for all Muslims, and is located in the western region. It is located in the western area in Kingdom of Saudi Arabia .Contains a population around 1.978 million

Study Design:

This is a cross sectional study.

Study Population and Selection Criteria

The target populations are those diagnosed with type 2 diabetes mellitus who are attending the diabetic center to participate in this study .

Inclusion Criteria:

- Patients with type 2 diabetes mellitus
- Both genders.
- Age above 20 years
- All nationalities
- Arabic speakers

Exclusion Criteria:

- Younger than 20 years old.
- Non-Arabic speakers.
- Type 1 or gestational diabetics.
- Patients with connective tissue disorders (e.g.rheumatoid arthritis)
- Patients with psychiatric problems.
- Patients taking hypnotic or alerting medications.

Sample Size:

Based on the statistics of the patients affairs in PHCinMakkah Al-mukarramh, the researcher found that the average number of daily attendees in male and female clinics of an adult diabetic clinic at diabetic center is (100) attendees / day. Multiplying this average by the number of working days during the period of study(one month) ; the estimated population of the study found to be 300 subjects.

Using EPI info version 24 , sample size of population is determined as follows: with expected frequency of participants awareness = 50%. Worst acceptable result = 5% with 95% confidence interval; it's believed that a sample size of about 300 participants (327 plus 10% increase in the number to compensate for drop rate) is adequate to achieve degree of precision in estimating the true prevalence across the population

Sampling Method :

Systematic random sampling technique has been adopted to select the study population from the diabetic center. An average of 100 diabetic patients attended to an adult diabetic clinics at diabetic center during working days were reported daily (25/clinic/day). One clinic has been selected randomly every shift (one morning and one afternoon). Every 2nd patient has been selected, to select 12 patients daily. Accordingly, approximately one month will be needed to collect data. In case of illegible patients, the next ones will be selected till the required number reached every working day. During the study period, the researcher will invite the selected clinics attendees to participate in the study while they are in the clinics. For those who will accept to participate in the study, a self-administered Arabic questionnaire will be distributed. Any question or clarification will be clarified by the researcher.

Data Collection Tool and Technique :

Information about socio-demographic characteristics including age, sex, marital status, education level, occupation, height, weight, BMI and smoking habits will be taken from the participants as well as the complications of diabetes mellitus with a cover letter explaining the purpose of the study without mentioning names to ensure confidentiality.

An Arabic version of the Pittsburgh sleep quality index (PSQI), a valid and reliable self-administered questionnaire will be distributed to the participants to evaluate their quality of sleep.

The PSQI is a score conducted by a self-rated questionnaire containing 9 questions that establish a wide variety of factors related to sleep quality in the last month. These included estimates of sleep latency and duration as well as severity and frequency of specific sleep-related problems. The nine questions were grouped into seven component scores, each weighted equally on a 0–3 scale. The seven components have been gathered to give a global PSQI score (range: 0–21); higher scores indicate worse sleep quality. The seven components of the PSQI are: (1) subjective sleep quality, (2) sleep latency, (3) sleep duration, (4) sleep efficiency, (5) sleep disturbances, (6) use of sleeping medications and (7) daytime dysfunction. Scores equal or less than five are categorized as good sleep quality, scores between 5–8 are categorized as average sleep quality and score of more than eight is categorized as poor sleep quality.^(4, 10)

The levels of HbA1C will be taken from the medical charts of the participants as an indicator of the glycemic control for the past two to three months. The level of HbA1c < 7% will be

considered as good glycemic control while a level of $HbA1c \geq 7\%$ will be considered as poor glycemic based on the American Diabetes Association 2017 Guidelines.⁽¹⁸⁾

Pilot Study:

A pilot study will be carried out on (35) attendees of the diabetic center in Makkah Al-mukarramh that met the inclusion criteria . The purpose is to examine the clarity of the questionnaire, to estimate the time needed to complete it as well as to give an actual situation of the main study.

Data Entry and Analysis:

Collected data has be coded, verified and analyzed with a help of a biostatistician using Statistical Package for the Social Sciences (SPSS) program version 20 developed by International Business Machines (IBM®) corporation. Descriptive statistics, e.g., number, proportions, cumulative proportions, mean and standard deviation, etc. will be displayed, as appropriate.

Analytically, parametric and non-parametric techniques will be used as required. In order to control for the effect of confounding, multivariate logistic regression will be adopted. All results of tests with p -values less than <0.05 will be considered “statistically significant.”

Ethical Considerations:

The Regional Research and Ethics committee in Armed Hospitals in Taif will approve the study protocol. Written consent will be obtained from the administration before starting the study .

Also a verbal consent will be taken from each participant to voluntary participate in the study and the data will be treated confidentially and will be used only for the purpose of research.

Budget:

It will be a self- funded research.

Result

Table 1 distribution of demographic characteristics of the research. (n=300)

	N	%
Age		
<60	114	38
>60	186	62

Gender		
Male	114	38
Female	186	62
Marital status		
Unmarried	36	12
Married	207	69
Divorced	15	5
Widowed	42	14
Education		
Illiterate	102	34
Less than secondary	54	18
Secondary	66	22
Collectors or higher	78	26
Occupation		
Government employee	69	23
Private sector employee	12	4
Soldier	6	2
Free business	21	7
Retired	192	64

Table 1 shows that most of the participants (62.0%) were in the age group >60 years, the majority of them were female (62.0%) while male(38.0%), regarding the marital stats most of participants married were(69.0%)while, regarding level of education the majority of participant are Illiterate education were(34.0%) . regarding Occupation the majority of participant are Retired were(64.0%) .

Table 2 Distribution of the characteristics of the participant habits of the study

	N	%
Smoking		
Non-smoker	240	80
Smoker	51	17
Former smoker	9	3

DM diagnosis		
Five years or less	66	22
Six to ten years	90	30
More than ten years	144	48
BMI		
Normal	18	6
Overweight	69	23
Obesity I	87	29
Obesity II	66	22
Morbid obesity	60	20
HbA1C		
Control group	87	29
Uncontrolled group	213	71

Table 2 shows that most of the participants Non- smoker were(80.0%) while smoker were (17.0%) regardingDM diagnosis the majority of participants more than ten years were (48.0%) While BMI the majority of participants Obesity I were (29.0%) regarding the HbA1C the majority of participants Uncontrolled group were (71.0%)

Table 3 Distribution of the Pittsburgh Sleep Quality Index (PSQI) questionnaire

PSQI		
	N	%
Good sleep quality	114	38
Bad sleep quality	186	62
Total	300	100
Chi-square	X²	136.855
	P-value	<0.001*

Table 3 and figure(1) Regarding Pittsburgh Sleep Quality Index (PSQI) of the participant the majority of participant Bad sleep quality were (62.0%) while Good sleep quality were (38.0%) Show that is a significant correlation in (PSQI) were p-value =0.001 and X^2 136.855.

Figure (1) Distribution of the Pittsburgh Sleep Quality Index (PSQI) questionnaire

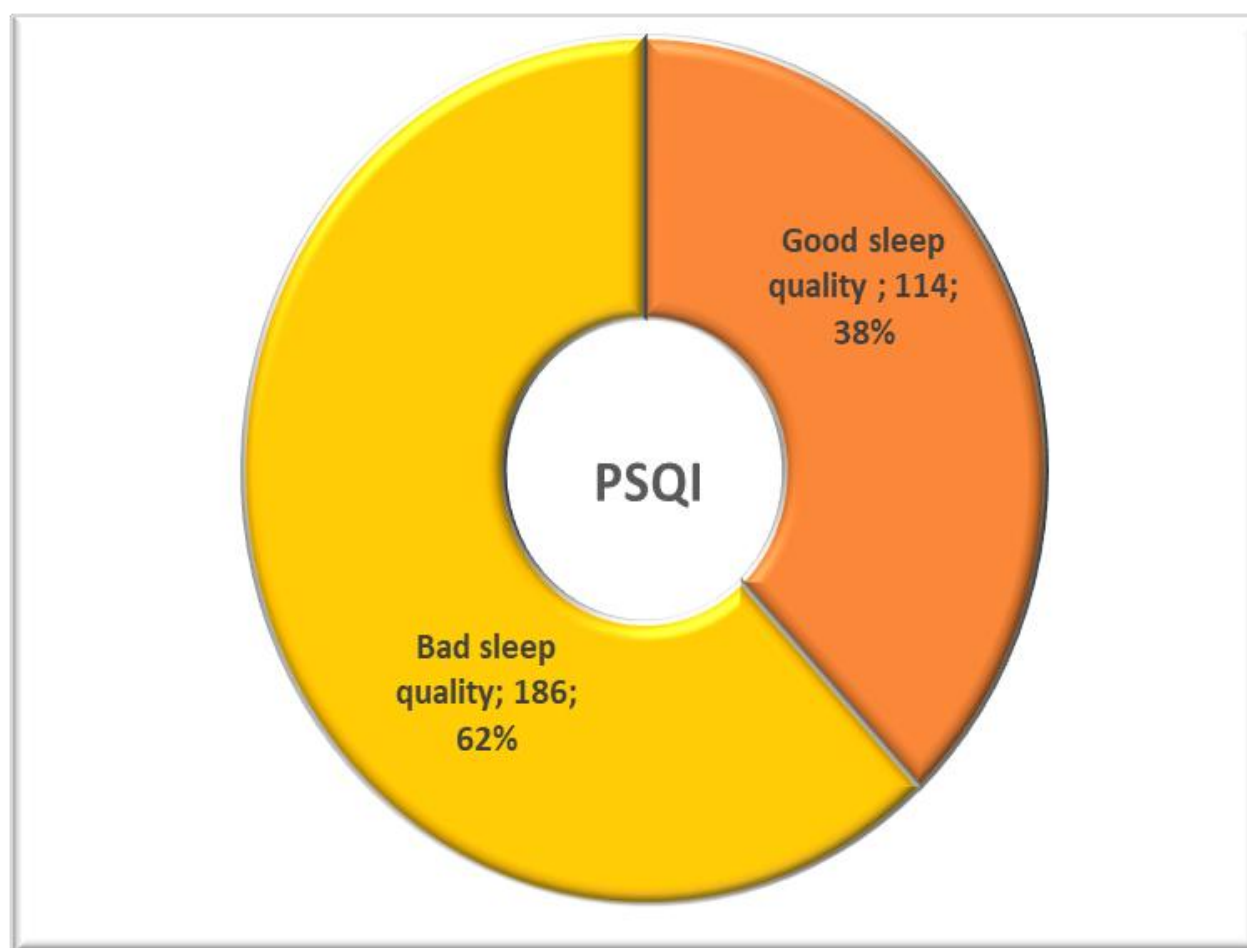


Table 4 Distribution the relation of socio-demographic data (Age, gender, marital status, level of education and region) and Pittsburgh Sleep Quality Index (PSQI)

		Total		Bad sleep quality		Good sleep quality		Chi-square	
		N	%	N	%	N	%	X ²	P-value
Age	<60	114	38	25	13.44	89	78.07	125.308	<0.001*
	>60	186	62	161	86.56	25	21.93		
Gender	Male	114	38	56	30.11	58	50.88	12.941	<0.001*
	Female	186	62	130	69.89	56	49.12		
Marital status	Unmarried	36	12	28	15.05	8	7.02	9.213	0.027*
	Married	207	69	120	64.52	87	76.32		
	Divorced	15	5	13	6.99	2	1.75		
	Widowed	42	14	25	13.44	17	14.91		

Smoking	Non-smoker	240	80	120	64.52	120	105.26	22.502	<0.001*
	Smoker	51	17	44	23.66	7	6.14		
	Former smoker	9	3	5	2.69	4	3.51		
DM diagnosis	Five years or less	66	22	24	12.90	42	36.84	61.741	<0.001*
	Six to ten years	90	30	40	21.51	50	43.86		
	More than ten years	144	48	122	65.59	22	19.30		
BMI	Normal	18	6	10	5.38	8	7.02	45.981	<0.001*
	Overweight	69	23	33	17.74	36	31.58		
	Obesity I	87	29	72	38.71	15	13.16		
	Obesity II	66	22	50	26.88	16	14.04		
	Morbid obesity	60	20	21	11.29	39	34.21		
HbA1C	Control group	87	29	38	20.43	49	42.98	17.459	<0.001*
	Uncontrolled group	213	71	148	79.57	65	57.02		

Table 4 and figure(2) Regarding age, results show a significant relation between the (PSQI) and age were $X^2=125.308$ and $P\text{-value}=0.001$, increase(Good sleep quality and age<60)

Regarding gender, results show a significant relation between the (PSQI) and gender were $X^2=12.941$ and $P\text{-value}=0.001$, increase(Good sleep quality and in male)

Regarding Marital status, results show a significant relation between the (PSQI) and Marital status were $X^2=9.213$ and $P\text{-value}=0.027$, increase(Good sleep quality and Married)

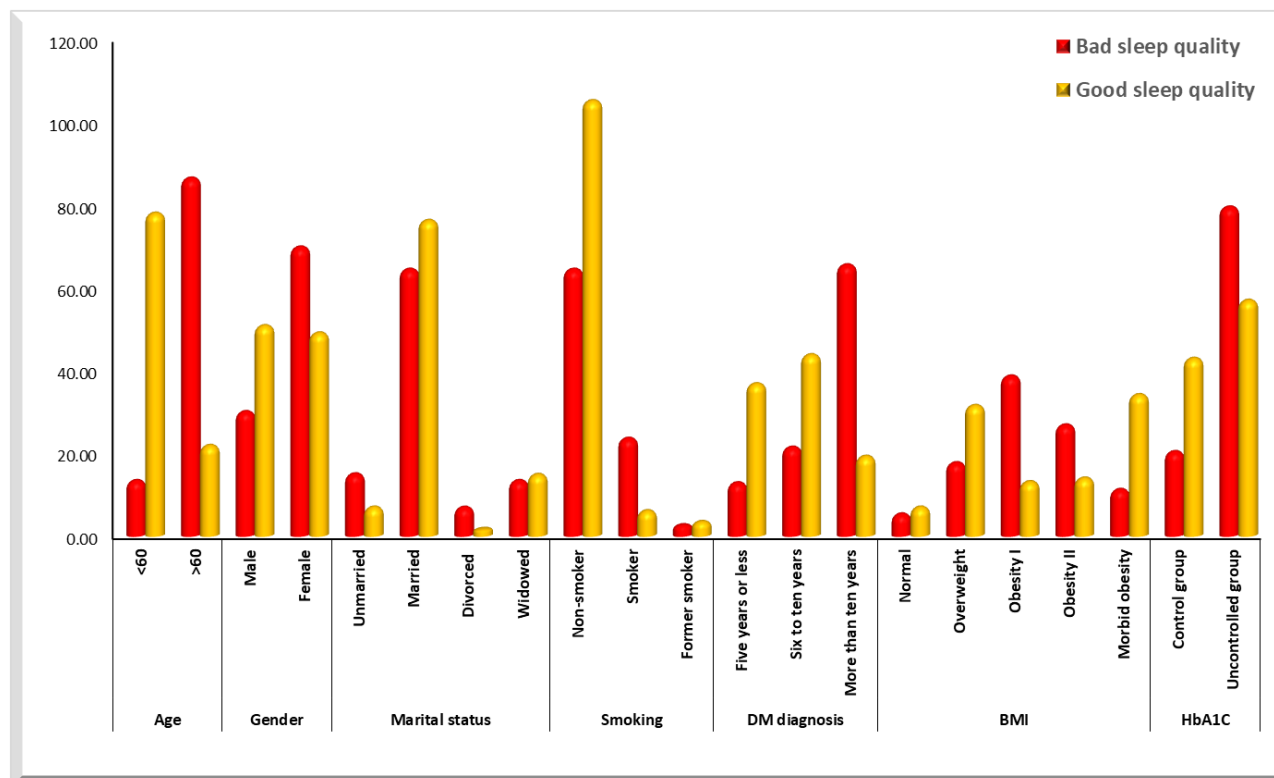
Regarding Smoking, results show a significant relation between the (PSQI) and Smoking were $X^2=22.502$ and $P\text{-value}=0.001$, increase(Good sleep quality and Non-smoking)

Regarding DM diagnosis, results show a significant relation between the (PSQI) and gender were $X^2=61.741$ and $P\text{-value}=0.001$, increase(bad sleep quality and More than ten year).

Regarding BMI, results show a significant relation between the (PSQI) and BMI were $X^2=145.981$ and $P\text{-value}=0.001$, increase(Good sleep quality and morbid obesity)

Regarding HbA1C, results show a significant relation between the (PSQI) and HbA1C were $X^2=17.459$ and $P\text{-value}=0.001$, increase(bad sleep quality and Uncontrolled group)

Figure (2) Distribution the relation of socio-demographic data (Age, gender, marital status, level of education and region) and Pittsburgh Sleep Quality Index (PSQI)



Discussion

The purpose of this study was To assessment of the Sleep duration and quality in relation to glycemic control in type 2 diabetic patients attending Diabetic Center in Makkah Al-Mokarramah , Saudi Arabia2021 . Socioeconomic characteristics of the population to obtain information that could be used awareness campaign and to determine whether people's knowledge differed based on particular characteristics of the target population. shows that most of the participants (62.0%) were in the age group >60 years, the majority of them were female (62.0%) while male(38.0%), regarding the marital stats most of participants married were(69.0%)while, regarding level of education the majority of participant are Illiterate education were(34.0%) . regarding Occupation the majority of participant are Retired were(64.0%)(See Table 1)

To our knowledge, our study is the first systematic review and meta-analysis to examine the evidence for an association between sleep quantity and/or quality with glycemic control in T2DM patients. Overall, we identified 20 studies and found that sleep disturbance as well as altered sleep duration is associated with higher HbA1c levels. There was increase in HbA1c

levels in patients who reported insufficient sleep durations increase in those with long sleep duration of 8 h or more. The accumulated evidence suggests that short and long sleep duration is significantly associated with higher HbA1c levels, indicating poorer glycemic control compared to normal sleep duration, with the relationship being U-shaped.[22] The associations are consistent, as shown in our sensitivity analysis, particularly for short and long sleep duration. Insufficient evidence exists to draw a firm conclusion regarding the association between sleep quality and HbA1c levels. We found that sleep disturbance resulted in higher HbA1c levels. However, disturbed sleep did not seem to affect HbA1c levels. Results of this study are in part consistent with many other similar epidemiological studies which show that perceived insufficient and poor sleep were detrimental to various health aspects such as glycemic control [23,24], increased risk of coronary artery calcification [25] and hypertension [26]. Several meta-analyses conducted on published epidemiological studies examining the effects of sleep duration on the risk of T2DM confirm the results of our study. Indeed, two recent studies by [27] and consistently found that sleep duration was significantly associated with a risk for T2DM, with a relative risk between 1.28 for short sleep duration or a 1.09 risk for every hour of short sleep duration compared to those who sleep between 7 and 8 h (normal sleep). comprehensive multi-centre study that will improve our understanding of the factors associated with poor control of blood glucose level, the factors that increase risk of diabetes complications and the factors associated with poor quality of life among people with T2DM in Saudi Arabia. [28]

Conclusion

These studies ideally should stem from large prospective cohorts, with objective measurements of sleep and glycemic control, repeated over a period of time. If proven true, these findings may open up new strategies for targeted intervention to improve quality and quantity of sleep. On the basis of current evidence, health care professionals should encourage and motivate their patients to enjoy sufficient sleep.

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