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Prevalence of sleep disorder in type 2 diabetes Mellitus patients and it's related factors

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Abstract

There are some evidences for the decrease of sleep quality among diabetic patients. Because of negative impact of blood glucose on sleep disorders, we aimed at investigating The prevalence of sleep disorders in patients with type 2 diabetes and its related factors. This cross-sectional study was carried out on 507 patients with type 2 diabetes. For data collection valid and reliable questionnaire and the Pittsburgh sleep quality questionnaire were used. The data were analyzed by software SPS-20 and descriptive statistics. The prevalence of sleep disorders in this study was 50.7%. 65% of participants were women, and mean (standard deviation) age of patients were 57.37 (12.15). Sleep disorder score significantly higher in women than men, and the marital status, education, occupation, daily glibenclamide, a significant relationship was observed in other diseases, and improve sleep program.In this study the prevalence of sleep disorders in patients with diabetes was high. So it seems necessary to notice more to improve sleep disorders in diabetic patients and revise their care program.

Keywords: Diabetes Mellitus, Related Factors, Sleep Disorders

Introduction

It is a long time Diabetes was discovered but no one really knows about its exact history [1]. This silent epidemiology [2] is still a health concern with an increasing prevalence [3]. According to the International Diabetes Federation in 2025, the number of patients with type 2 diabetes will be 40 million with an increase of 80 %. More than 3 million people have diabetes in Iran, which triples every 15 years. Increasing number of diabetes cases is more serious in the Middle East and is due to the economic changes, compliance with western customs and the aging population. The modernization of the society caused by the changes in people's lifestyle has been the most influential factor in the increase of diabetes incidence. Diabetes prevalence

can be decreased by changing the lifestyle of people with the same genetic predisposition to diabetes. Intervention in their lifestyle is as effective as medical prevention [4].

Diabetes complications are divided either chronic or acute. The chronic complications are either vascular or non-vascular. The vascular complications can be improved by precise treatment of diabetes and maintaining HbA1c (Hemoglobin A1c) close to the non-diabetic normal range and lifestyle changes [4,5]. One of the important aspects of human lifestyle is sleep and rest.

Sleep is one of the most important day-night cycles and its shortage causes detrimental effects on patient's health and recovery [6]. Sleep influences glucose metabolism in that the amount of glucose consumed is at its least in non-REM (Rapid Eye Movement) sleep, its most in wake time, and in between in REM sleep [4,7].

Diabetes prevalence increases during sleep of less than 6/more than 9 hours [3]. Diabetics are more prone to have insomnia and daytime sleepiness compared to non-diabetics [8]. The prevalence of sleep disorder is reported 42 % [6] and 45 % [9] in diabetics with restless leg syndrome and 71 % [10] in diabetics with chronic complications. Sleep disorders with endocrine, immunologic and metabolic effects can intensify type 2 diabetes [11] or lead to the inappropriate blood glucose control. Shorter sleep duration changes glucose metabolism more than normal/longer sleep duration [10, 12 & 13]. Also, decreased sleep duration causes an increase in hypothalamus-pituitary-adrenal axis activity which leads to an increase in nocturnal blood cortisol and insulin resistance of peripheral tissue [14]. Leptin, which causes satiety, increases during sleep, so shortage of sleep decreases leptin, increases glucose tolerance and nightly cortisol [15]. Duration and quality of sleep are the significant predictors of HbA1c which is a key marker in glucose control [10].

Quantity and quality patterns of sleep are determined by cultural, social, environmental, behavioral, physiological and pathophysiological variables. Millions of people in developed countries suffer sleep disorders due to the social changes such as time and long hours of work [13] which can potentially affect health and diabetes control in people [7]. Therefore, one of the significant factors regarding diabetics is their lifestyle.

According to various studies in Iran [6] and other countries [9, 10], the prevalence of sleep disorder has been studied in diabetics with restless leg syndrome and chronic complications but generally there is not enough information about the prevalence of sleep disorder and influential factors on sleep quality of type 2 diabetics particularly in Iran. Treatment of sleep disorders in important in controlling diabetes and inadequate attention to a better sleep quality is as important as nutrition, sport and medicine. Therefore, this study aimed to determine the prevalence of sleep disorder and its influential factors in type 2 diabetes in order to improve sleep quality of patients.

Method

This descriptive analytical study was conducted on all the patients with type 2 diabetes presenting to diabetes clinics and health centers of Gonabad city (in north-east of Iran) using census method (2012). Data collection in this study was through the checklist of demographic data and Pittsburgh Sleep Quality Index (PSQI). The primary researcher-made checklist consisted of two parts. The first was related to the demographic information such as age, sex, marital status, education level, job and income and the second was related to the information regarding patient's disease such as type and dose of medicine intake, sleep disorders, using medical or non-medical treatments to improve sleep (breathing practices, watching television…) and exercise. The second section was related to the sleep quality of patients which was assessed by Pittsburgh Sleep Quality Index. This questionnaire analyzes 7 components

of sleep: sleep duration, sleep latency, sleep efficacy, self-assessment of sleep quality, sleep disturbances, sleep medication, day time dysfunction during the last one month. The Pittsburgh Sleep Quality Index includes 9 main items. Likert scale is used for the scoring of the all items ranging from zero to 3. The total score of each person's sleep quality questionnaire ranges from zero to 21. According to this questionnaire, the score <4 is indicative of a good sleep and score of >5 is indicative of a poor sleep. Higher scores indicate worse sleep quality. The designers of this scale reported its reliability as 0.83, sensitivity as 89.6%, and specificity as 86.5% [16]. Farahi et al. studied 85 patients with stress disorders after an earthquake and 133 healthy people to analyze the psychometric properties of this questionnaire which resulted in 100 % sensitivity, 93% specificity, and 0.89 Cronbach's alpha for its Persian version [15]. The questionnaires is completed in a self-reported manner. After data collection and entry to the SPSS-20, descriptive statistics of frequency distribution, mean, standard deviation, number and percentage were used for describing data, and chi-square and Fisher's exact tests were used for their analysis. In this study, the level of significance was set 0.05.

Results

In this study, 507 completed and fully analyzed questionnaires were returned from 524 questionnaires distributed among patients with type 2 diabetes in Gonabad. According to PSQI, the prevalence of sleep disorder in this group was 50.7 %. Patient's age ranged between 25 and 91 years old and the mean age (standard deviation) in the patients were 57.37 (12.15). Most subjects (65%) were female and (92.7%) married. Most subjects (84.5 %) were high school dropouts. Most subjects (64.2 %) were housewives and most of them had the income-level under 130 USD. Most subjects (29.5 %) used multidrug treatments for controlling their diabetes. 36.4 % took 1-3 tablets of Glibenclamide, 52.7% took more than 3 tablets of metformin and 36.7%, 20 units of insulin and less per day. 58.6% mentioned they have other diseases while most of them (72.7 %) had cardiovascular diseases. 46.6 % mentioned they have sleep disorders and 38% used programs to improve sleep quality and most of them (84.7%) used non-medical techniques to improve sleep quality. 56.3% did exercises while 91.8 % of them took walking and other kinds of physical activities.

Demographic data, disease and treatment status of the subjects and their relationship with presence/absence of sleep disorders are shown in Table 1. According to the results of chi-square test, there was a significant relationship between sleep disorder and sex, marital status, education level, job, the dose of Glibenclamide per day, presence of the other diseases and the techniques to improve sleep quality ($P<0.05$), but there was no significant relationships between age, income, drug use, dose of metformin/day, dose of insulin/day and the physical activity with sleep disorder score ($P>0.05$). The relationship shown in Table 2 is between demographic and treatment factors of the subjects with type 2 diabetes with 7 components of night sleep status of the PSQI. According to this table, there was no significant relationship between age and any of the sleep components ($P>0.05$), but there was a significant relationship between sex and three components of sleep efficacy, sleep disorders and the use of sleep medications, also between the job and sleep duration and sleep disorders. Taking doses of Glibenclamide per day had a significant relationship with sleep duration, sleep efficacy and sleep disorders. Presence of other diseases had a significant relationship with all the sleep components except with subjective sleep quality and daily activity of the patients. Also, physical activity had a significant relationship with components of sleep disorders and using sleep medication ($P<0.05$) (Table 2).

Table 1 *The relation between demographic and disease variables with sleep disturbance*

Variable	Good sleep		Bad sleep		Chi square test P-Value	Total number*
	No	%	No	%		
Age						
Under 45 years	43	62.3	26	37.7	0.082	489
45-54years	65	44.1	71	55.9		
55-64 years	61	45.9	72	54.1		
Up 65 years	81	50	81	50		
Gender						
Female	147	44.5	183	55.5	0.017	506
Male	98	55.7	78	44.3		
Marital Status						
Single	23	69.7	10	30.3	0.012	503
Married	225	47.9	245	52.1		
Educational status						
Under diploma	207	48.8	217	51.2	0.111	504
Diploma	24	43.6	31	56.4		
License and over	17	68.0	8	32.0		
Occupation						
Government employee	9	32.1	19	67.9	0.004	506
Self- employed	64	63.4	37	36.6		
Housekeeper(women)	148	45.5	177	54,5		
Retired	28	53.8	24	46.4		
The level of income/Toman						
Under 400.000	110	52.1	101	47.9	0.900	365
400.000-800.000	77	54.6	64	45.4		
Over 800.000	7	53.8	6	46.2		
use of diabetes medication					0.351	464
Glibenclamide	64	50	64	50		
Metformin	69	53.9	59	46.1		
insulin	26	50	26	50		
Herbal `therapy	58	42.3	79	57.7		
Combination therapy with two types drugs	8	66.7	4	33.3		
Combination therapy with three types drugs	4	57.1	3	42.9		
Daily dose of glibenclamide						
Less than 1 pill	52	5.60	34	39.5	0.002	247
1-3 pills	31	34.8	58	65.2		
More than 3 pills	30	47.1	42	58.3		
Daily dose of metformine						
Less than 1 pill	31	59.6	21	40.4	0.21	242
1-3 pills	29	46	34	54		
Over 3 pills	58	45.7	69	54.3		
Daily dose of insulin						
20 and low unites	13	59.1	9	40.9	0.147	58
21- 40 unites	10	58.8	7	41.2		
41 and over	6	31.6	13	68.4		
Other disease						
Yes	125	42.5	169	57.5	0.001	497
No	117	6.57	86	4.42		
Sleep improving program						
Yes	58	33	118	67	001/0	458
No	163	8/57	119	2/42		
Physical activity						
Yes	145	2/51%	138	8/48%	0.298	500
No	101	5/46%	116	5/53%		

*Difference in total number is related to missed or non-relevant data

Table 2 *The relation between demographic and disease variables with 7 domains of Pittsburgh sleep quality index (PSQI)*

Domains of PSQI Demographics- therapeutic variable	Subjective sleep quality	Sleep latency	Sleep duration	Habitual sleep efficiency	Sleep disturbances	Use of sleep medication	Daytime dysfunction
Group age	2720.	140.0	303.0	115.0	708.0	163.0	902.0*
Gender	052.0	179.0	248.0	042.0#	001.0 #	009.0 #	936.0*
Marital status	787.0	085.0	074.0	922.0	066.0	228.0	249.0**
Educational status	147.0	198.0	170.0	240.0	123.0	817.0	831.0*
employment status	486.0	511.0	047.0 #	070.0	001.0 #	120.0	724.0*
Income	298.0	629.0	576.0	241.0	205.0	996.0	478.0*
Number of daily using glybenclamide pill	063.0	103.0	014.0 #	011.0 #	002.0 #	514.0	201.0*
Number of daily using metformine pill	730.0	709.0	778.0	466.0	457.0	204.0	072.0*
Other disease	070.0	001.0 #	015.0 #	001.0 #	001.0 #	029.0 #	769.0*
Sleep improving program	298.0	005.0 #	017.0 #	041.0 #	018.0 #	001.0 #	012.0 * #
Physical Activity	141.0	312.	5120.	175.0	043.0 #	039.0 #	322.0*

* Chi square test ** Fisher's Exact Test #P<0.05 was consider significant

Discussion

The prevalence of sleep disorder in this study was 50.7%. Loops et al. [9] and Konatson et al. [10] reported 45% and 71% of diabetics, respectively had low sleep quality. In Iran also, 42.6 % of diabetics [6] had low sleep quality in the study of Ghane'ee et al. and 40.7% of diabetics with complications in the study of Monjamed et al. [17] which conforms to the results of the present study and shows high prevalence of sleep disorder in these patients. The findings of this study showed a significant relationship between the sleep disorder and female gender in that sleep disorder was more prevalent in women which is in agreement with the results of Mer'asi et al. study and Ghane'ee et al. study [4,6].

Tomilito et al. also showed that decrease or increase of sleep duration raises the risk of type 2 diabetes in middle aged women, but not in men [18]. Although some other studies suggested the gender differences, Yagi et al. expressed that more long-term studies should be done to reach this conclusion [3].

In the present study, there was no significant relationships between age and sleep disorder in diabetics which it does not agree with Mer'asi's et al. [4], Loops et al. [9] and also Yagi et al. [3]. They claimed that the low quality and quantity of sleep is related to patient's age. The difference can be attributed to the difference between the study population regarding their health and sickness.

We did not observe a significant relationship between education level and any of the sleep components, but Mer'asi et al. [4] and also Yagi et al. [3] reported a relationship between education and sleep duration, sleep efficacy and the dose of sleep medicine, that is, those who have a higher education level have a longer and better sleep duration. Also, there was a significant relationship between sleep disorder and marital status implying that the risk of sleep disorder in married patients with diabetes was more than singles. Also, it has a significant relationship with job, the dose of glibenclamide per day, presence of other diseases and the technique to improve sleep and physical activity but no significant relationship was seen with age, education, income, the dose of metformin per day. Yagi et al. study [3] showed that factors such as marital status, employment status, age and sex, physical activity in diabetics with sleep

disorder have a significant relationship that even with controlling them as the confounding factors, this relationship still existed. Konatson et al. [10] and Yagi considered some of these factors such as duration of physical activity, insulin use, affliction period, age and sex as predictors of sleep disorder incidence.

The results of this study showed that sleep disorder has a significant relationship with the dose of Glibenclamide per day in that those who took one tablet and less per day and had a less severe disease, had a better sleep compared to others. This case can be related to their blood glucose implying that people with lower blood glucose have a better sleep and the interaction between good sleep and more blood glucose control leads to the use of less doses of tablet [4,10,13].

A significant relationship was seen between the presence of other diseases with diabetes and sleep disorder in diabetics implying that diabetics with chronic diseases such as cardiovascular diseases, kidney diseases and blood pressure reported more cases of sleep disorder. Presence of other diseases had a significant effect on all the components of sleep except subjective sleep quality and patients' daily activity (Table 2] while diabetics with other diseases had a longer initial insomnia and stayed in bed more than others. They had a worse sleep efficacy and reported more complaints of sleep disorder which agrees with Mezinger et al. study. In their study on type 2 diabetics, they reported that hypertension in women has a significant relationship with sleep latency implying that women with hypertension sleep with more delay compared to men. Also, a history of angina pectoris causes sleep latency in men and women. Hypertension and a history of angina pectoris has a significant impact on their sleep duration in that diabetics with hypertension and people with angina pectoris have a shorter sleep duration compared to others [11]. Kapusio also asserts that sleep disorders cause more calorie absorption and obesity particularly with the change of leptin and consequently causes cardiovascular diseases [13].

There was a significant relationship between the sleep improvement programs (use of sleep medicine) and sleep disorder implying that those who have more sleep disorders use sleep improvement programs more often. Such programs had a significant effect on all sleep components except subjective sleep quality of the patients which implies those who reported more sleep latency use programs to improve sleep more often. Therefore, they use sleep medicine more and have latency more than others. Also, those with worse sleep efficacy and more complaints of sleep disturbing factors and have daily dysfunction are more likely to use sleep improvement programs more which is caused by the sleep medicine side-effects and requires interventions (non-medical techniques) [7].

The limitations of this study could be its cross-sectional method, uncertainty about the duration of diabetes, not measuring the blood glucose in both groups with/without sleep disorder.

Conclusion

Due to the preventative effect of a good sleep pattern in diabetes and optimal blood glucose control, also regarding the high prevalence of sleep disorders in type 2 diabetics, it seems this aspect of public health has to be attended by the policymakers and managers and other health services-related researchers within the health care setting. Therefore, the efficacy of sleep improvement programs should be analyzed and regarded in the program of patients' health care.

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Contributions

Study design: Sh Kh,A A, S G R
Data collection: S G R
Data analysis : Sh Kh ,A A, S G R
Manuscript preparation: Sh Kh, A A, S G R

Conflict of interest

"The authors declare that they have no competing interests."

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