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SLEEP QUALITY AND ITS ASSOCIATIONS WITH OBESITY AMONG ADULT PATIENTS ATTENDING PRIMARY HEALTHCARE IN Al-Madinah, Kingdom of Saudi Arabia: A Cross-Sectional Study

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Abstract

Background: Poor sleep quality is a worldwide problem with major public health implications, especially when associated with obesity. Understanding this association is crucial in Saudi Arabia, given the high rates of obesity. However, there is no research on sleep quality and obesity among adult patients in Madinah. This cross-sectional study aimed to investigate the association between sleep quality and obesity among adult patients attending primary health care clinics at the Ministry of Health, Madinah, Saudi Arabia.

Methods:A total of 420 healthcare professionals participated in the study. The study participants were chosen usinga multistage random sampling technique. A structured questionnaire was developed based on Pittsburgh Sleep Quality Index (PSQI) and International Physical Activity Questionnaire (IPAQ). Data analysis was conducted using the Statistical Package for the Social Sciences (SPSS), employing descriptive and inferential statistics to summarize participant characteristics and explore associations between variables.

Results: A total of 420 participants completed the questionnaire. The majority of participants reported poor sleep quality (95%CI 1.2-5.0), with significant associations (95%CI 1.036-23.33) observed between sleep quality and demographic characteristics, clinical factors such as body mass index and chronic disease, and lifestyle factors including physical activity level and tobacco use.

Conclusion

The prevalence of poor sleep quality in our sample was notably high at 74.6 %, and its association with obesity and sociodemographic and lifestyle habits. Healthcare providers in Almadinah should pay particular attention while assessing patients who suffer from sleep disturbance to raise public awareness of the importance of good quality sleep and the factors that affect it.

Keywords: sleep quality, obesity, primary health care, Kingdom of Saudi Arabia,

1. Introduction

One-third of our lives are spent in an active physiological process called sleep. It is necessary to preserve optimal mental, emotional, and physical health [1]. The extent to which an individual is satisfied with their entire sleep experience is known as sleep quality.

Sleep quality refers to a range of aspects of sleep in sleep medicine. Metrics including total sleep time, sleep maintenance, sleep efficiency, sleep onset latency, total wake time, and occasionally sleep disorders like apnea or spontaneous arousal are also included [2-3]. The American Academy of Sleep Medicine (AASM) and the Sleep Research Society (SRS) recommend that healthy persons sleep for 7 or more hours every night regularly to maintain good health [4]. Disrupted or poor-quality sleep, as well as short sleep duration, have been associated with a variety of health issues, including cardiovascular disease and mental health disorders [5]. It has also been identified as a significant factor associated with obesity, an escalating global health concern [6].

The World Health Organization (WHO) has declared obesity a pandemic, affecting individuals across all ages and socioeconomic groups[7]. Obesity is linked to a variety of chronic diseases and health disorders, including diabetes, hypertension, hyperlipidemia, obstructive sleep apnea, and osteoarthritis[8].

In Saudi Arabia (2023), the National Health Survey found that the prevalence of obesity among adults (≥15 years) was 23.7%, with no significant gender differences. In contrast, 39.6% of females and 29.5% of males had normal body weight[9].Recent studies from Saudi Arabia have shown a high prevalence of sleep disturbances 44.4% among adults attending primary healthcare clinics in Jeddah, with significant associations with obesity (OR = 1.82) by Alqarni et al. (2022)[10].Mosavat, Maryam, et al. (2021) explored the potential processes underlying the sleep-obesity link, identifying hormonal imbalances (leptin, ghrelin), inflammation, and altered metabolic pathways as essential factors. Understanding these pathways is critical for developing targeted interventions[11].

Sleep quality and duration are modifiable risk factors, that are known to be associated with high body mass index and some lifestyle habits (e.g. physical activity, dietary habits, and smoking) [12-13] .Despite the known relationship between sleep and obesity, there is limited data available on this topic in the Saudi population. This study aimed to investigate the relationship between sleep quality and obesity, as well as the relationship between lifestyle behaviors (such as socio-demographic characteristics, smoking, and physical activity) and sleep quality among adults attending primary healthcare clinics in Al-Madinah.

This study will improve knowledge in this area and the results will be valuable for health providers to develop policies and programs that focus on improving the health status of people with obesity and promoting adequate sleep and eating patterns to prevent disorders.

2. Materials and Methods

2.1. Study Design:

This research adopts a cross-sectional study design to investigate the relationship between sleep

quality and obesity, as well as the relationship between lifestyle behaviors (such as socio-demographic characteristics, smoking, and physical activity) and sleep quality among adults attending primary healthcare clinics in Al-Madinah.

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2.2. **Study participants:**

The study was carried out at Al-Madinah Al-Munawaroh, the capital of Madinah Province in Saudi Arabia's west. The estimated population as of 2020 is 1,488,782 [14]. this makes it the fifth most populous city in Saudi Arabia. Al Madinah Al-Munawaroh has a total of 53 PHCCs, organized among three health sectors. In addition to curative therapy, PHCs provide free comprehensive health services, and preventative care (vaccination, screening, prenatal care, health education, and public and environmental health) to all citizens and other eligible patients.

2.3. **Inclusion criteria:**

The study targeted adult male and female patients aged between 18 to 65 years who attended primary healthcare clinics in the Ministry of Health (MOH), in Al-Madinah.

2.4. **Exclusion Criteria:**

The Exclusion Criteria included all patients diagnosed with medical conditions such as hypothyroidism, Cushing syndrome, arthritis, and psychological issuesAdditionally, patients usingspecific medications like antidepressants, anti-seizure medications, antipsychotic medications, steroids, or beta-blockers, as well as Pregnantor lactating women, were excluded.

2.5. **Sample size and sampling technique**

The sample size was calculated using OpenEpi.com with an error of 5% and 95% CI, and the prevalence of sleep quality is unknown and considered as 50%. The estimated sample size was 384 patients. In addition, we added 10% to compensate for non-responders; the final sample size was 420 patients.A multistage random sampling technique was used as follows. Stage 1: we got a list of all primary healthcare centers in Al-Madinah (urban region) which was a total of 53 PHCs, Stage 2: we selected 12 primary healthcare centers by using a simple random sampling method, Stage 3: within the selected PHCs, patients were selected by using a systematic random sampling method (Every 2nd adult patient attending to clinic was enrolled in the study).

2.6. **Questionnaire**

Data collection from participants utilized a self-administered questionnaire comprising several components: socio-demographic factors (including age, gender, marital status, education level, household income, occupation), co-morbidities, and smoking habits. Anthropometric measurements were conducted at the Nursing screening station, including height and weight using a standardized stadiometer (DETECTO SCALE). Body mass index (BMI) was calculated by dividing weight in kilograms (kg) by height in meters squared (m^2) and categorized according to World Health Organization guidelines [7]: BMI < 18.5 (underweight), BMI 18.5 - 24.9 (healthy weight), BMI 25 - 29.9 (overweight), and BMI ≥ 30.0 (obesity).

Data analysis categorized participants into three groups: Non-obese (underweight/healthy weight), Overweight, and Obese.Sleep quality was evaluated using a validated Arabic version of the Pittsburgh Sleep Quality Index (PSQI), assessing seven components: sleep quality, latency, duration, efficiency, disturbances, use of sleep medications, and daytime dysfunction. Scores ranged from zero to three for each component, with higher values indicating poorer sleep quality. A total score ranging from 0 to 21 was calculated, with a cut-off score of ≤5 indicating good sleep quality and >5 indicating poor quality. Internal consistency reliability for the PSQI was acceptable (Cronbach's alpha = .65), supported by moderate to high correlations between its components and global PSQI scores ($r = .53$ to $.82$, $p < .01$)[15].

Physical activity was assessed using a validated Arabic short version of the International Physical Activity Questionnaire (IPAQ), with participants recalling activities over the previous 7 days, including walking and moderate to vigorous activity. Frequency (days/week) and duration (hours and minutes/day) were recorded, with participants categorized as low, moderate, or high activity based on MET (Metabolic Equivalent of Task) minutes/week.

2.7. **Data Collection:**

Data will be collected through structured questionnaires distributed electronically to participants From November 2023 to January 2024.

2.8. **Data Analysis:**

Statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL, USA), version 26. Frequencies and percentages were obtained for the categorical variables, while mean and standard deviation (SD) were calculated for the scale variables. The chi-square test was used to assess the association between the categorical variables and the outcome (poor sleep, and good sleep quality). Multiple logistic regression was employed to find the predictors of sleep quality and to control for confounders. Odds ratios (OR) and 95% confidence intervals (95% CI) were estimated to assess the strength of association between the outcome and variables in the model. $P< 0.05$ was considered statistically significant.

2.9. **Ethical Considerations:**

Ethical approval obtained from the Institutional Review Board General Directorate of Health Affairs in Madinah National Registration Number with NCBE-KACST, KSA: (H-03-M-84) was issued approval - IRB Log No 23-094. All participants provided informed consent, which ensured the privacy and confidentiality of their data.

3. **Results**

A total of 420 questionnaires were completed. The demographic and baseline characteristics of the participants are presented in Table 1.

Table 1. Demographic characteristics of the participants(n=420)

Characteristics	Frequency	Percent (%)
Gender		
Male	190	45.2
Female	230	54.8
Age		
18 - 33	167	39.8
34 - 49	201	47.9
50 - 65	52	12.4
Marital status		
Married	284	67.6
Not married	136	32.4
Educational level		
Primary school	23	5.5
Intermediate school	27	6.4
High school	145	34.5
Bachelor	216	51.4
Postgraduate	9	2.1
Occupation		
Student	33	7.9
Housewife	112	26.7
Unemployed	7	1.7
Governmental employee	126	30.0
Private sector employee	115	27.4
Freelancer	21	5.0
Retired	6	1.4
Family income		
≤15,000	368	87.6
>15,000	52	12.4
BMI		
Non-obese	157	37.4
Overweight	191	45.5
Obese	72	17.1
Physical activity		
High physical activity	6	1.4
Moderate physical activity	251	59.8
Low Physical activity	165	39.3

The mean age (SD) was 36.69 (10.13%) years, ranging from 19 to 63 years. The majority were females (54.8%), married (67.6%), had bachelor's degree (51.4%), and had an income of less than 15000SAR. About (45.5%) were overweight, (17.1%) were obese, and (37.4%) were non-obese. Moderate physical activity was reported by (59.8%) while low physical activity was reported by (39.3%) of the participants.

Table 2. Association between Demographic characteristics and sleep quality of the participants (n=420)

Characteristics	Pittsburgh Sleep Quality Index (PSQI) global score		P value
	Good sleep Quality ≤ 5 n=106(25.4%)	Poor sleepquality > 5 n=312 (74.6 %)	
Gender			
Male	52(27.4)	138(72.6)	.389
Female	54(23.7)	174(76.3)	
Age			
18 - 33	67 (40.4)	99(59.6)	<0.001
34 - 49	38(19.0)	162(81.0)	
50 - 65	1(1.9)	51(98.1)	
Marital status			
Married	54(19.1)	228(80.9)	<0.001
Not married	52(38.2)	84(61.8)	
Educational level			
Primary school	0(0.0)	23(100)	<0.001
Intermediate school	1(3.7)	26(96.3)	
High school	18(12.6)	125(87.4)	
Bachelor	81(37.5)	135(62.5)	
Postgraduate	6(66.7)	3(33.3)	
Occupation			
Student	9 (27.3)	24 (72.7)	0.001
Housewife	12 (10.9)	98 (89.1)	
Unemployed	3 (42.9)	4 (57.1)	
Governmental employee	46 (36.5)	80 (63.5)	
Private sector employee	31 (27.0)	84 (73.0)	
Freelancer	5 (23.8)	16 (76.2)	
Retired	0 (0.0)	6 (100.0)	

Family income			
≤15,000	81 (22.1)	286 (77.9)	<0.001
>15,000	25 (49.0)	26 (51.0)	

Table 3. Association between Clinical and lifestyle characteristics of the participants and the quality of sleeping (n=420)

Characteristics	**Pittsburgh Sleep Quality Index (PSQI) global score**		**P value**
	Good sleep Quality ≤ 5 n=106(25.4%)	**Poor sleepquality > 5** n=312 (74.6 %)	
BMI			
Non-obese	71(45.5)	85 (54.5)	<0.001*
Overweight	33 (17.4)	157 (82.6)	
obese	2 (2.8)	70 (97.2)	
Do you have chronic diseases?			
yes	19 (10.9)	156 (89.1)	<0.001*
no	87 (35.8)	156 (64.2)	
Are you currently smoking any form of tobacco (cigarettes, hookah, shisha)?			
yes	13 (14.8)	75 (85.2)	0.010*
no	93 (28.2)	237 (71.8)	
IPAQ			
Low	30 (18.3)	134 (81.7)	0.008*
Moderate	75 (30.4)	174 (69.6)	
High	1 (16.7)	5 (83.3)	

Table 2&3 summarizes the Association between demographic characteristics & Clinical and lifestyle characteristics of the participants and the quality of sleeping. According to the Pittsburgh Sleep Quality Index, the majority had poor sleep quality(74.3%), while 25.4% had good sleep quality.Factors associated with poor sleep quality in univariate analysis were older age ($p<0.001$), low education level ($p<0.001$), being retired ($p=0.001$) lower family income ($p<0.001$), being married($p<0.001$), low physical activity level($p=0.008$), having chronic diseases ($p<0.001$), and body mass index; Poor sleep quality was higher among obese (97.2%) and overweight participants (82.6%) compared to normal weight participants (54.5%), ($p<0.001$).

Table 4. Association between components of Pittsburgh Sleep Quality Index and obesity status (n=420)

Characteristics	Weight Status			P value
	Non-obese	Overweight	Obese	
Subjective sleep quality				
Very good	61 (69.3)	26 (29.5)	1 (1.1)	<0.001*
Fairly good	21 (52.5)	14 (35.0)	5 (12.5)	
Fairly bad	62 (26.7)	121 (52.2)	49 (21.1)	
Very bad	13 (21.7)	30 (50.0)	28.3)	
Sleep latency				
No difficulty	23 (74.2)	8 (25.8)	0 (0.0)	<0.001*
Minimal difficulty	50 (58.1)	29 (33.7)	7 (8.1)	
Fair difficulty	40 (31.5)	56 (44.1)	31 (24.4)	
Severe difficulty	44 (25.0)	98 (55.7)	34 (19.3)	
Sleep duration				
> 7 hours	49 (62.8)	24 (30.8)	5 (6.4)	<0.001*
6-7 hours	68 (34.3)	91 (46.0)	39 (19.7)	
5-6 hours	35 (26.7)	70 (53.4)	26 (19.8)	
< 5 hours	4 (36.4)	5 (45.5)	2 (18.2)	
Sleep efficiency				
>85%	142 (39.6)	159 (44.3)	58 (16.2)	
75-84%	14 (25.5)	30 (54.5)	11 (20.0)	
65-74%	0 (0.0)	1 (25.0)	3 (75.0)	
<65%	0 (0.0)	1 (100.0)	0 (0.0)	
Sleep disturbance				
No sleeping disturbances	1 (33.3)	2 (66.7)	0 (0.0)	<0.001*
Minimal sleeping disturbances	96 (53.0)	66 (36.5)	19 (10.5)	
Significant sleeping disturbances	58 (27.1)	115 (53.7)	41 (19.2)	
High sleeping disturbances	2 (9.1)	8 (36.4)	12 (54.5)	
Use of sleep medication				
Not during past month	104 (45.6)	93 (40.8)	31 (13.6)	<0.001*
Less than once a week	35 (25.0)	68 (48.6)	37 (26.4)	
Once or twice a week	17 (33.3)	30 (58.8)	4 (7.8)	

Three or more times a week	1 (100.0)	0 (0.0)	0 (0.0)	
Daytime dysfunction				
No problem at all	69 (71.1)	27 (27.8)	1 (1.0)	<0.001*
Only a very slight problem	42 (34.7)	56 (46.3)	23 (19.0)	
Somewhat of a problem	46 (23.8)	103 (53.4)	44 (22.8)	
A very big problem	0 (0.0)	5 (55.6)	4 (44.4)	

All the Pittsburgh Sleep Quality Index subdomains were also associated with body mass index of the participants; subjective sleep quality (p<0.001), sleep latency (p<0.001), (p<0.001),sleep duration (p<0.001), sleep efficiency (p<0.001), sleep disturbance (p<0.001), use of sleep medication (p<0.001), and daytime dysfunction as shown in table 4.

Table 5. Multiple logistic regression model for predictors of poor sleeping quality among the participants

Predictors	Categories	Reference group	P value	Odds Ratio**	Lower limit (95% C.I)	Upper limit (95% C.I)
BMI	Overweight	(Non-obese) Normal or underweight	0.014*	2.5	1.2	5.0
	Obese	(Non-obese) Normal or underweight	0.022*	6.66	1.31	23.33
Family income	Lower income category	Upper income category	0.003*	2.17	1.30	3.70
Educational level	Primary school	Postgraduate	0.010*	2.33	1.22	4.35
Physical activity (in Total METs)	Per one MET decrease due to physical activity		<0.001*	1.086	1.036	1.099

**Odds ratio adjusted for confounders including gender, marital status, and family income.

Table 5 show the result of Logistic regression analysis was employed to assess the relationship between sleep quality body mass index and physical quality while controlling for other confounders in the study. All significant variables in the univariate analysis were entered into the analysis. The final model showed that after controlling for variables in the model, BMI remains

a significant predictor of sleep quality among study participants. Overweight participants were 2.5 times more likely to have poor sleep quality compared to participants who were normal or underweight (OR= 2.5, 95%CI 1.2-5.0). Obese participants were 6.66 times more likely to have poor sleep quality compared to participants who were normal or underweight (OR= 6.66, 95%CI 1.31-23.33).

4. Discussion

A good sleep pattern is extremely important for a person's health and well-being. According to studies, a person usually needs 7-9 hours per night. However, global data indicate that a large proportion of the population lacks adequate sleep[2,4].

The main results of this study indicate that 74.3% of the study participants had poor sleep quality, and sleep duration decreases with age from 34 to 49 years. In addition, bachelor's teens are more likely to have poor sleep quality. In addition, short sleep duration has been associated with an increased risk of overweight and obesity[11]. These findings are consistent with previous studies on the widespread nature of sleep quality and its associations with obesity among Saudi adults[16,17]. Factors such as marital status, old age, level of education, low family income, the presence of chronic diseases and smoking emerged as factors significantly related to poor sleep quality, which confirms the multifactorial nature of sleep quality.

moreover, the study elucidated a robust association between obesity and poor sleep quality, with overweight and obese individuals exhibiting significantly higher rates of sleep disturbances compared to normal-weight counterparts (OR = 6.66%95 ، CI 1.31-23.33). This finding highlights that insufficient sleep duration is an important factor in increasing the risk of obesity and is consistent with the results of several previous studies[10,15,16].

The results also show a correlation between lifestyle, such as body mass index (BMI) and physical activity, with sleep quality. The study found that participants with low levels of physical activity and high body mass index are more likely to have poor sleep quality. BMI effect was not significant (P =0.022) in the logistic regression model Table 5, this did not materially change the observed associations between sleep duration and obesity. Such findings agree with results of previous studies from different countries[4,5,10,11,17]. a study by (Öztürk, and Nurcan) conductedsimilarly found that individuals with obesity were more likely to experience sleep disturbances, suggesting a robust association across diverse populations[18].

Furthermore, our findings support the beneficial effects of physical activity on sleep quality, in line with existing literature demonstrating the positive effect of exercise on sleep patterns. Conversely, smoking appears to be a risk factor for poor sleep quality, consistent with previous research linking tobacco use to sleep disorders [4,10,18].

There are some limitations in this study. Despite examining many factors and variables that may influence sleep quality, other variables weren't assessed such as the sleep environment, working nights, and napping during the day. In addition, the study's cross-sectional design limits its ability to determine causation. Nevertheless, this study clearly shows the magnitude of poor-quality sleep and its association with several important factors.

Conclusion

The prevalence of poor sleep quality in our sample was notably high at 74.6 %. Many factors are strongly associated with poor sleep quality, including overweight/obesity, sociodemographic, and low physical activity levels. Healthcare providers in Almadinah should pay particular attention while assessing patients who suffer from sleep disturbance to raise public awareness of the importance of good quality sleep and the factors that affect it. Future studies should seek to examine the associations between diet, internet usage, academic achievement, and sleep quality.

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