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Association of Sleep Health Metrics (Sleep Duration and Quality) and Mental Health Status: A Population-Based Cross-Sectional Survey

Amirhossein **Shahsavand**[1,2], Keyvan **Karimi**[1,3],Reza **Samiee**[1,2], Mehran **Saberian**[3,4], Yosra **Azizpour**[1,3], Samaneh **Akbarpour**[1,3], Khosro **Sadeghniiat**[4,5*],Arezu **Najafi**[4,5*]

[1]Non-Communicable Diseases Research Center, Endocrinology and Metabolism Population Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran.
[2]School of Medicine, Tehran University of Medical Sciences, Tehran, Iran.
[3]Department of Epidemiology and Biostatistics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran.
[4]Occupational Sleep Research Center, Baharloo Hospital, Tehran University of Medical Sciences, Tehran, Iran.
[5]Sleep Breathing Disorders Research Center (SBDRC), Tehran University of Medical Sciences, Tehran, Iran.

ABSTRACT

Introduction: Sleep pattern is a vital part of healthy lifestyle, with deviations from the recommended 7 to < 9 hours associated to negative outcomes. Limited studies have investigated the relationship between sleep patterns and mental health in underserved urban communities. This study explores the association between sleep health metrics, such as sleep duration and mental health among the population residing in Southern Tehran.

Methods: This population-based cross-sectional study utilized data from 1,311 participants in the "Study Protocol and Lessons from Iran for the Integrated and Repeated Public Health Surveillance System (IRPHS)" telephone survey participants to evaluate amount of sleep duration (< 7 h and ≥ 9 h) and sleep quality, along with their associations with anxiety, depression, suicidal ideation, and related sociodemographic factors.

Results: The mean ± standard deviation (SD) age of participants was 40.4±13.4 years, and 60.4% of the sample was female. Among our participants 15.0% had insufficient sleep (< 7 h) and 18.5% had long sleep duration (≥ 9 h). Sex, socioeconomic status (SES), and tobacco use were associated with sleep duration ($p < 0.05$). Moderate and high anxiety, moderate depression, and high suicidal ideation were associated with long sleep duration ($p < 0.05$).

Conclusion: In southern Tehran population, prevalence of both insufficient and long sleep duration is high. Poor sleep quality and oversleeping can happen due to underlying depression and anxiety, and targeting improvement of mental health can increase sleep health. The findings provide insights for prevention strategies tailored to the study.

Key words: Sleep; Anxiety; Depression; Suicide; Epidemiology; Sleep health; Sleep duration; Sleep quality

*Corresponding Authors:
najafeeaz@gmail.com &
sadeghniiat@yahoo.com

INTRODUCTION

Sleep is increasingly acknowledged as a crucial element of healthy growth and overall well-being.[1-3] It is a multifaceted process encompassing several aspects, including sufficient duration, good quality, proper timing and regularity, and the absence of sleep disorders.[4, 5] Adults are recommended to get between 7 to 9 hours of sleep each night to support optimal physical and mental health.[6, 7] Sleep is a fundamental physiological process that plays a vital role in maintaining cognitive functions and supporting overall mental health and well-being.[8, 9]

Deviations from the recommended sleep duration, whether insufficient (< 7 hours) or excessive (≥ 9 hours), have been associated with negative outcomes such as poor self-rated health, and decreased functional capacity.[10-14] Previous studies on physical diseases have shown that both short and long sleep durations correlate with a higher risk of obesity,[15, 16] hypertension (HTN),[17] cardiovascular diseases (CVDs),[18] diabetes mellitus (DM),[19] and dyslipidemia.[20]

The association between sleep duration and health outcomes appears complex and bidirectional. Some studies indicate a U-shaped relationship between sleep duration and mortality, implying that both short and long sleep durations can lead to poor health outcomes. Clarifying these associations and identifying the clinical factors involved is critical for understanding the mechanisms underlying these correlations.[21, 22] Recent studies suggest that sleep disturbances are common in mental health disorders and are associated with impaired cognitive, emotional, and interpersonal functioning.[23-25] While traditional models have associated specific sleep changes with distinct mental disorders,[26] recent research highlights the transdiagnostic nature of sleep disturbances, implying that they may act as a common dimension influencing the overall brain and mental health.[8, 27] There is limited data in Iran regarding the association between sleep health metrics and mental health in underserved urban communities. The research aimed to explore the association between self-reported sleep duration classified as short or insufficient (< 7 hours) or long (≥ 9 hours) as a primary risk factor and the odds of mental health disorders, such as anxiety, depression, and suicidal thoughts. This investigation, counducted on a subgroup of the general population in South Tehran, represents a unique effort to examine these relationships within a regional context.

METHODS

Study population and sampling

The data for this study were collected using a telephone survey as part of the "Integrated and Repeated Public Health Surveillance System (IRPHS)" project. Further information about the IRPHS can be found elsewhere.[28] The primary objective of the IRPHS was to assess and estimate critical health-related indicators in order to improve Iran's public health surveillance systems. In brief, the IRPHS is a population-based cross-sectional telephone survey that was undertaken in South Tehran in 2023. The target population included of all individuals aged 18 and older in three areas: South Tehran, Eslamshahr, and Shahr-e Rey. In the IRPHS, stratified random sampling was employed using probability proportional to size (PPS), to select individuals from each area. Ultimately, a total of

1,311 individuals participated in the survey and the subsequent analysis.

Variables measurement and definitions

The sleep duration of the participants was subjectively asked by asking them "On average, how many hours do you sleep during the night?". Participants were categorized into three groups based on their sleep duration: insufficient or short sleep (< 7 h), normal sleep (7 < 9 h), and long sleep (≥ 9 h).[29, 30] Participants' sleep quality was subjectively determined by asking them" How satisfied are you with your sleep?" with a score from 0 to 10. A higher score indicates better sleep quality.

We used three mental health parameters including anxiety, depression and suicidal ideation parts to assess participants' mental health. We employed the Generalized Anxiety Disorder 2-Item (GAD-2) tool to evaluate anxiety levels in our study population. This questionnaire is validated for use in Iranian culture and demonstrates outstanding psychometric characteristic.[31] To assess depressive moods among participants, we utilized the Patient Health Questionnaire-2 (PHQ-2). This concise questionnaire consists of two items that ask respondents to rate their feelings over the past two weeks. This questionnaire was translated into Persian and adapted, demonstrating satisfactory internal consistency and validity.[32] Each item can be scored using a likert scale (0 = not at all, 1 = on some days, 2 = more than half the days, 3 = nearly every day). Higher total scores indicate more pronounced depressive or anxious symptoms. To assess suicidal ideations among participants, we utilized 2 questions contained in the 28-item GHQ.[33] These 2 questions were "In the last month, have you felt that life is completely hopeless?" and "In the past month, have you considered whether you want to end your life?" Each item can be scored using a likert scale (1 = none or minimal, 2 = mild, 3 = moderate, 4 = severe). Higher total scores indicate more tendency to commit suicide. In this study, the scores of each of these three parameters were ranked and divided into tertiles, from the lowest to the highest scores. These tertiles were then categorized into three groups: "low", "moderate", and "high". Due to low prevalence of suicidal ideation in sample, the sample was automatically divided into two groups: "low", and "high".

Participants were asked about their age, sex, height, weight, education level, marital, and employment status, and family size (categorized as less than or equal to 4, and more than 4). We assessed the history of tobacco use by asking participants about their current smoking and hookah habits. Socioeconomic status (SES) was determined with the question, 'If the entire Iranian population were divided into 5 categories based on their socioeconomic status, to which level could your family be assigned?' There were five options: '1. Low', '2. Average Downward', '3. Middle', '4. Middle Upward', and '5. High'. levels one and two as well as levels four and five combined. Participants'. Comorbidities such as HTN, DM, dyslipidemia, CVDs, and history of cancer were asked and having at least two comorbidities considered positive comorbidity.

Statistical analysis

The collected data were examined for missing and atypical values to ensure its integrity. We

summarized continuous variables using a mean and standard deviation (SD) and median and interquartile range (IQR) while appropriate , while categorical variables were described as frequency and percentages. To assess relationships between the study variables and our dependent variable sleep duration and quality, we employed the chi-square test and ANOVA test. We then utilized multinominal logistic regression analysis to further explore crude and adjusted association between mental health and sleep duration and sleep quality within the study population. All statistical analyses were conducted with a significance level set at a p value of less than 0.05.

Ethical consideration

Ethical approval for the primary study was obtained from the Research Ethics Committees of the SchoolsofMedicine—TehranUniversityofMedicalSciences(IR.TUMS.MEDICINE.REC.1400.599). Participants in the telephone survey provided their verbal informed consent. The present study is a secondary analysis based on data collected during the original research, which was approved by the Research Ethics Committees of the Schools of Nursing and Midwifery & Rehabilitation—Tehran University of Medical Sciences under the code IR.TUMS.FNM.REC.1403.113.

RESULTS

Overall characteristics

A total of 1,311 individuals aged 18 years and older participated in this survey. The mean ± SD age was 40.4 ± 13.4 years, and 60.4% of the sample's participants were female. As shown in Table 1, 197 (15.0%) participants experienced insufficient sleep, 871 participants (66.5%) had normal sleep and 243 participants (18.5%) reported long sleep. The mean ± SD age for the insufficient sleep group was 41.0 ± 14.6 years, and for the long sleep group was 40.4 ± 15.3 years (p = 0.803). The mean ± SD body mass index (BMI) for the insufficient group was 26.7 ± 4.4 kg/m2, and for the long sleep group was 26.3 ± 4.6 kg/m^2 (p = 0.485). The median ± IQR of family size for both groups was 4 ±1. Males had a higher prevalence of long sleep 128 (24.7%), and females had higher insufficient sleep 128 (16.2%). Divorced/widow participants had higher insufficient sleep 18 (22.0%) and single participants had higher long sleep 45 (23.2%), but the difference was not significant (p = 0.134). Retired participants had higher long sleep but the difference was also not significant (p = 0.150). There was a trend for higher insufficient sleep, and lower long sleep for higher educated participants, but the difference was statistically non-significant (p = 0.059). SES was also inversely associated with sleep duration (p < 0.001): the middle-class had the highest long sleep, and, higher-class had the highest prevalence of insufficient sleep. Participants with comorbidities had higher insufficient sleep and long sleep, but the difference was not significant (p = 0.183). Tobacco use was associated with sleep duration (p = 0.001).

Association of sleep duration and mental health status

Table 2 indicates the association between mental health factors and sleep duration. Sleep duration

was significantly associated with anxiety (p <0.001). Participants with moderate or high anxiety had higher long sleep (23.0% and 21.3%, respectively) compared to participants with low anxiety (9.8%). Participants with low anxiety also had higher insufficient sleep (20.1%) compared to participants with moderate or high anxiety (12.2% and 13.6%, respectively). In summary, lower anxiety was associated with insufficient sleep, while moderate or high anxiety was associated with long sleep.

Sleep duration was significantly associated with depression (p =0.003). Participants with moderate or high depression had higher long sleep (24.2% and 20.8%, respectively) compared to participants with low depression (14.4%). Participants with high depression had higher insufficient sleep (29.4%) compared to moderate or low depression (14.9% and 17.1%, respectively). In summary, moderate and high anxiety were associated with long, and insufficient sleep, respectively.

Table 1. Distribution of sociodemographic of Study Participants Based on Sleep Duration

Parameter	Total population n=1,311	Insufficient sleep (<7h) n=197	Normal sleep (7 <9h) n=871	Long sleep (≥9h) n=243	p-value
Continuous variables					
Age; Mean (SD)	40.4 (13.4)	41.0 (14.6)	40.3 (12.6)	40.4 (15.3)	0.803[a]
BMI; Mean (SD)	26.6 (4.5)	26.7 (4.4)	26.7 (4.5)	26.3 (4.6)	0.485[a]
Family size; median (IQR)	4 (1)	4 (1)	4 (1)	4 (1)	0.130[ab]
Categorical variables n (%)					
Sex					<0.001[c]
Male	519 (39.6%)	69 (13.3%)	322 (62.0%)	128 (24.7%)	
Female	792 (60.4%)	128 (16.2%)	549 (69.3%)	115 (14.5%)	
Marriage					0.134[c]
Single	194 (14.8%)	30 (15.5%)	119 (61.3%)	45 (23.2%)	
Married	1,035 (78.9%)	149 (14.4%)	702 (67.8%)	184 (17.8%)	
Divorced/widow	82 (6.3%)	18 (22.0%)	50 (61.0%)	14 (17.1%)	
Employment					0.150b[c]
Unemployed	738 (56.3%)	110 (14.9%)	505 (68.4%)	123 (16.7%)	
Employed	505 (38.5%)	77 (15.2%)	327 (64.8%)	101 (20.0%)	
Retired	68 (5.2%)	10 (14.7%)	39 (57.4%)	19 (27.9%)	
Education level					0.059
Illiterate/Primary	254 (19.4%)	34 (13.4%)	160 (63.0%)	60 (23.6%)	
Under diploma	233 (17.8%)	30 (12.9%)	154 (66.1%)	49 (21.0%)	
Diploma or higher educated	824 (62.9%)	133 (16.1%)	557 (67.6%)	134 (16.3%)	
Socio-economic status					<0.001
Low	747 (57.0%)	80 (10.7%)	474 (63.5%)	193 (25.8%)	
Middle	500 (38.1%)	97 (19.4%)	360 (72.0%)	43 (8.6%)	
high	64 (4.9%)	20 (31.3%)	37 (57.8%)	7 (10.9%)	
Comorbidities [d]					0.183
No	1,232 (94.0%)	182 (14.8%)	826 (67.0%)	224 (18.2%)	
Yes	79 (6.0%)	15 (19.0%)	45 (57.0%)	19 (24.1%)	
Tobacco use					0.001
No	1,069 (81.5%)	159 (14.9%)	734 (68.7%)	176 (16.5%)	

Yes	242 (18.5%)	38 (15.7%)	137 (56.6%)	67 (27.7%)

[a]ANOVA test; [b]Kruskal–Wallis test; [c]Chi-square test; [d]Hypertension, diabetes mellitus, dyslipidemia, cardiovascular disease, and cancer. SD, Standard deviation; BMI, Body mass index; IQR, Interquartiles range

Table 2. Association Between Mental Health Factors and Sleep Duration

Variables	Insufficient sleep (<7h) n (%)	Normal sleep (7 <9h) n (%)	Long sleep (≥9h) n (%)	P-value*	Total population N (%)
Anxiety				<0.001	
Low	74 (20.1)	258 (70.1)	36 (9.8)		368 (28.1)
Moderate	45 (12.2)	240 (64.9)	85 (23.0)		370 (28.2)
High	78 (13.6)	373 (65.1)	122 (21.3)		573 (43.7)
Depression				0.003	
Low	102 (17.1)	409 (68.5)	86 (14.4)		597 (45.5)
Moderate	37 (14.9)	151 (60.9)	60 (24.2)		248 (18.9)
High	58 (29.4)	311 (66.7)	97 (20.8)		466 (35.6)
Suicidal ideation				0.161	
Low	164 (14.6)	743 (66.1)	217 (19.3)		1124 (85.7)
High	33 (17.6)	128 (68.4)	26 (13.9)		187 (14.3)

*Chi-square test

Participants with higher suicidal ideation had higher insufficient sleep (17.6%) compared to participants with lower suicidal ideation (14.6%), and, lower long sleep (13.9%) compared to participants with lower suicidal ideation (19.3%)., however, this association was not significant (p = 0.161).

Regarding mental health (anxiety and depression), there is a decreasing trend in Mean score of sleep quality of female and male in the moderate and high depression and anxiety groups compared to the low anxiety and depression groups (Figure 1). In addition, the severity of mental health problems (anxiety and depression scores) increases in those with long sleep duration (oversleeping) compared to normal sleep; and this trend decreases from poor to good sleep quality in both male and female (Figure 2).

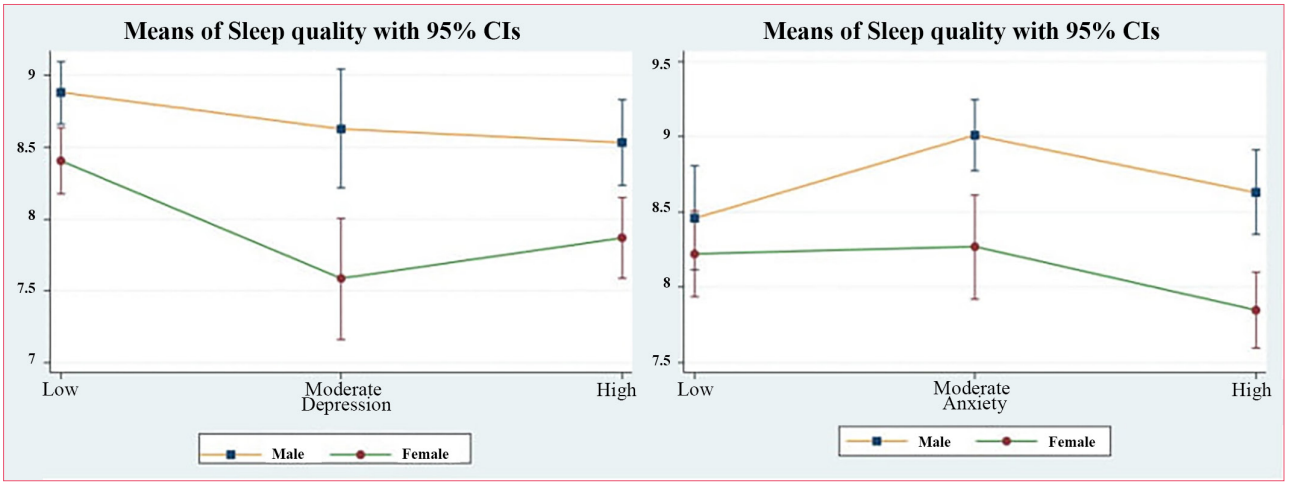

Figure 1. Mean score of sleep quality (0-10) across anxiety and depression status by sex groups

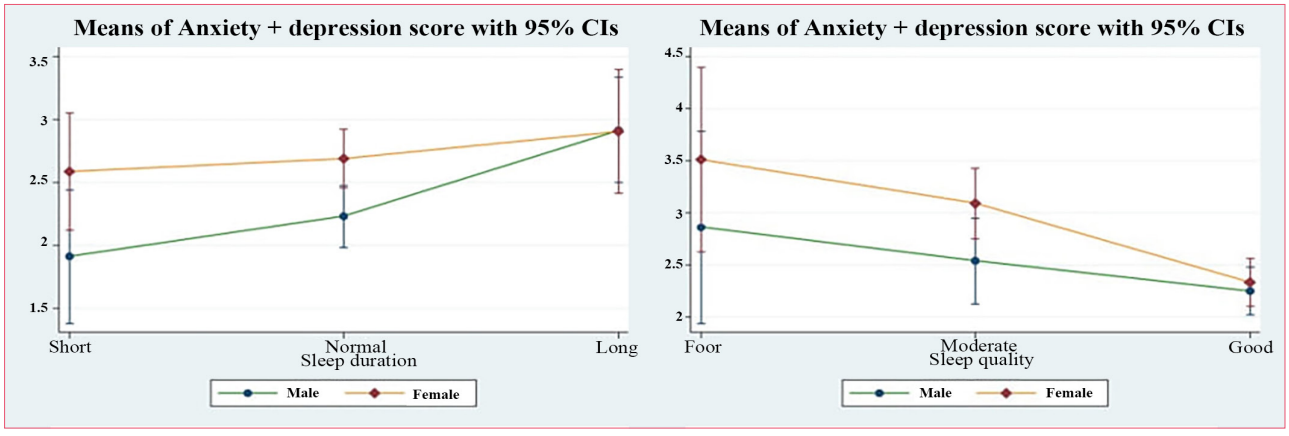

Figure 2. Means of Anxiety + depression score across sleep quality and duration by sex groups

Long Sleep (> 9 h) vs. Normal Sleep (7 < 9 h)

The results of multinomial regression are summarized in Table 3. Moderate anxiety (OR: 1.79; 95% CI: 1.15, 2.80, p = 0.011), high anxiety (OR: 1.66; 95% CI: 1.08, 2.55, p = 0.021), moderate depression (OR: 1.55; 95% CI: 1.04, 2.30, p = 0.030) and high suicidal ideation (OR: 0.61; 95% CI: 0.38, 0.97, p = 0.036) had significant association with long sleep. High depression was not associated with long sleep (OR: 1.01; 95% CI: 0.71, 1.45, p = 0.945). None of the mental health variables had a significant association with insufficient sleep duration.

Table 3. Multinomial Logistic Regression Analysis for the Relation Between Sleep Duration and Mental Health Status

	Insufficient Sleep (<7h) vs. Normal Sleep (7 <9h)						Long sleep (≥9h) vs. Normal Sleep (7 <9h)					
	OR	95% CI	p-value	AOR	95% CI	p-value[c]	OR	95% CI	p-value	AOR	95% CI	p-value[c]
Anxiety*												
Low			Reference						Reference			
Moderate	0.65	0.43,0.99	0.042	0.74	0.49,1.14	0.173	2.54	1.66,3.89	<0.001	1.79	1.15,2.80	0.011
High	0.73	0.51,1.04	0.081	0.83	0.57,1.22	0.342	2.34	1.57,3.51	<0.001	1.66	1.08,2.55	0.021
Depression [b]												
Low			Reference						Reference			
Moderate	0.98	0.65,1.50	0.934	1.11	0.72,1.70	0.642	1.89	1.29,2.76	<0.001	1.55	1.04,2.30	0.030
High	0.75	0.53,1.07	0.108	0.83	0.57,1.20	0.315	1.48	1.07,2.05	0.018	1.01	0.71,1.45	0.945
Suicidal ideation [b]												
Low			Reference						Reference			
High	1.17	0.77,1.78	0.467	1.16	0.75,1.77	0.509	0.70	0.44,1.09	0.112	0.61	0.38,0.97	0.036

CI, Confidence interval; OR, Odds ratio; AOR, Adjusted odds ratio
[a]AOR was adjusted for family size, socioeconomic status, comorbidities, tobacco use and sex
[b]AOR was adjusted for family size, socioeconomic status, comorbidities, tobacco use, sex and employment
[c]Multinominal logistic regression analysis

DISCUSSION

In this study, we aimed to analyze the relation between sleep health metrics (sleep quality and duration) and mental health factors in a population from southern Tehran. Our results indicate that 15.0% of our participants had insufficient sleep and 18.5% had long sleep duration, which is comparable to other studies conducted in Iran.[34, 35] Higher levels of anxiety, moderate depression, and higher suicidal ideation were associated with long sleep duration, while none of these factors were associated with insufficient sleep in our study. Additionally, we found a decreasing trend in the sleep quality of both female and male in participants with poor mental health situations.

The prevalence of sleep duration varies considerably across countries and studies.[36] When considering the threshold of less than 7 hours of sleep, the prevalence of insufficient sleep in our study (15.0%) is relatively low compared to other countries: 54% in Qatar,[37] 43.2% in the Netherlands,[38] 33.2% in the United States (U.S.),[39, 40] 33.0% in Australia,[41] and 33.8% in Kingdom of Saudi Arabia (KSA).[40] The prevalence of prolonged sleep in our study (18.5%) is higher than that found in the U.S. (8.5%),[42] and Qatar (4%),[37] but lower than in KSA (24.8%).[40] This observed diversity between mentioned countries highlights the complex interplay between factors such as culture, lifestyle, geography, SES, prevalence of comorbidities, and sleep patterns across different countries. SES introduces further complexity, influencing access to healthcare, living conditions, and stress levels, all of which can impact sleep duration.[43] These multifaceted interactions underscore the need for cultural and contextual considerations when studying sleep and its effects on health in various populations and across the globe.

Consistent with previous studies conducted in Iran,[35] We found that lower SES was associated with longer sleep, reflecting the different nature of the relationship between sleep and SES in developing versus developed countries. Additionally, we observed significant sex disparities in sleep duration, with females reporting shorter sleep durations and lower sleep quality compared to males. This is consistent with current literature, which indicate that females tend to report poor sleep quality,[44] partially corresponding to the hormonal difference between males and females, as well as sociocultural impacts that affect females more compared to males.[45]

Sleep health and mental health are inseparable.[46] Several studies have demonstrated bidirectional effects between sleep and mental health.[47, 48] Mental disorders impose a substantial burden on global public health,[49] accounting for 5% of total disability-adjusted life years (DALYs), and 10% of DALYs in Iran.[50] Anxiety disorders in Iran have increased by 67% over the past 30 years, while depressive disorders have doubled. These increasing trends raise the caution for possible effects on overall sleep hygiene in the near future. The consensus among studies suggests that 7-8 hours of sleep per night is associated with optimal health,[51] whereas insufficient and long sleep duration is associated to increased risk of various diseases such as DM, CVDs, HTN, mental disorders, and mortality.[52] Vestergaard et al. suggested that the association between sleep duration and mental health in young adults is "U-shaped" demonstrating impairment of mental health in both insufficient and long sleep.[53] However, different natures of mental disorders such as anxiety and depression require further investigation.

Sleep disturbances are a key symptom of depression.[55] Zhang et al. demonstrated that "subjective" measures of sleep duration show increased odds of depression with longer sleep, while "objective" sleep analyses reveal an inverse relationship, with longer sleep associated with decreased odds of depression. Interestingly, this paradigm is consistent across various studies examining the relationship between objective and subjective sleep duration and mental health factors, such as anxiety and depression.[55] The finding indicate that only self-reported long sleep duration is associated with poorer mental health outcomes. In our study, we not only confirmed the relationship between oversleeping and depression but also demonstrated that poor sleep quality is also associated with poor mental health. Our findings suggest that early detection and appropriate treatment of depression may improve overall sleep hygiene, enhance sleep quality, and reduce oversleeping.Sleep duration is also associated with anxiety disorders in many studies; emphasizing the relation of insufficient sleep and long sleep with anxiety.[55] Nonetheless, fewer studies have highlighted the relationship between long sleep duration with higher anxiety.[56] In our study, we showed that long sleep duration and anxiety were associated. Oversleeping or long sleep and poor sleep quality might point to higher levels of anxiety, and detection of early signs of anxiety, in addition to proper treatments and social support might result in better sleep quality and prevention of oversleeping, and many comorbid disorders accompanied by it.

Sleep disturbances are strongly associated with suicidal ideation,[57] and our findings indicate that long sleep duration may act as a protective agent against suicidal ideation and could be beneficial in addressing suicidal ideation in specific cases. Duan et al. have also demonstrated this protective effect in a different population,[58] suggesting a universal phenomenon.

Current literature supports the idea that insufficient sleep is associated with poor mental health status such as anxiety, depression, and suicidal ideation.[55, 59] However, this was not observed in our study, possibly due to confounding factors not addressed in this research. Additionally, the small sample size may have contributed to this discrepancy.

Limitations

Our study has several limitations. First, our sample of 1,311 participants was drawn from a specific region in southern Tehran, which primarily includes urban residents. Therefore, our findings may not be generalizable to rural populations. Additionally, the sample may not represent the broader population of Iran, as there are significant socioeconomic, cultural, and behavioral differences across regions. The cross-sectional design of our study limits our ability to estimate causal relationships or temporal patterns. Moreover, the subjective nature of the questionnaire may introduce bias, as participants might not have reported their sleep duration or mental health status accurately. This also limits the comparability of our findings with those of other studies. Finally, we did not assess sleep disorders, which may have contributed to bias in our sleep data.

Future studies can focus on longitudinal studies to determine the causal relationship between sleep duration and sleep quality with mental health issues. Considering significant variability between

different regions of Iran, researches focusing on other regions can provide better understanding of the association between sleep problems and mental health issues. We also suggest that future researches include sleep disorders, diet preferences, physical activity, and ethnicity of participants in their study for an improved resolution.

CONCLUSION

We indicated a relationship between long sleep duration and depression and anxiety, while long sleep had an association with decreased suicidal ideation. Sleep disturbances and mental health issues frequently co-occur, both contributing to reduced quality of life. Public health initiatives can promote sleep hygiene through education, and provide mental health support in the population, especially for people with sleep disturbances. While our study only indicates association, addressing both sleep and mental health together may contribute to improved well-being at the population level.

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Conflict of Interests

The authors declare that they have no conflicts of interest related to the publication of this article.

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