

## Research Paper

## Cohort Study on Sleep Duration and Smoking in Bandare-Kong (Iran): A Cross-sectional Population-based Study (Findings From a Persian Cohort Study)

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**ABSTRACT**

**Background:** Smoking has many dangerous effects on health, one of which can be related to sleep. This study investigates the relationship between smoking and sleep duration in a city in the South of Iran.

**Materials and Methods:** This descriptive-analytical cross-sectional study is a part of the Bandare-Kong non-communicable disease cohort study, conducted on 3736 participants aged 35–70 years. Sleep data and smoking were extracted through a standard questionnaire based on self-reported information. The data were analyzed via the SPSS software (version 26) using the multivariable linear regression model. Meanwhile,  $P < 0.05$  was considered statistically significant.

**Results:** The mean sleep duration was longer for smokers compared to nonsmokers ( $6.04 \pm 1.54$  vs  $5.92 \pm 1.43$ ;  $P = 0.031$ ). Of 893 smokers, 220 people slept for 7 to 8 h. Meanwhile, 618 people had a short sleep ( $< 7$  h), and 55 people had a long sleep duration ( $> 8$  h). Of 2843 nonsmokers, 639 people slept for 7 to 8 h, 2067 people had a short sleep ( $< 7$  h), and 137 people had a long sleep ( $> 8$  h). Based on the regression model, among males, the mean sleep duration was 0.4 h longer for smokers than nonsmokers ( $B = 0.40$ , 95% confidence interval: 0.23%, 0.56%;  $P < 0.001$ ). Also, among females, the mean sleep duration was 1.11 h longer for smokers compared to nonsmokers ( $B = 1.11$ , 95% confidence interval: 0.82%, 1.40%,  $P < 0.001$ ).

**Conclusion:** Smoking is associated with longer sleep duration for both sexes. It is recommended to conduct longitudinal studies to assess the association between sleep quality components, including sleep duration and smoking in future studies.

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## Introduction

**S**leep is an essential aspect of life that can be considered a major criterion for evaluating an individual's current health position [1]. Adequate sleep duration varies in the lifespan and from person to person; however, based on sleep-specific guidelines, 7 to 8 h of sleep has been advised for adults [2, 3]. Both short and long sleep are associated with several health-related outcomes like hypertension, obesity, diabetes mellitus, cardiovascular disorders, stroke, and mortality.

Smoking poses significant negative health risks, such as cancer, respiratory diseases, and heart-related issues [4]. One notable consequence of smoking is its influence on sleep. Studies indicate that smoking is linked to a higher occurrence of sleep disturbances, and these sleep issues contribute to serious health challenges associated with various physical and mental conditions, which place a financial burden on society [5].

Smokers face more sleep issues compared to non-smokers, and those trying to quit often report significant sleep disturbances, which may also arise after they begin smoking. However, there is limited understanding of how starting to smoke affects sleep problems. Some studies suggest that smoking may alleviate stress, implying that certain elements of smoking might have a positive impact on sleep [6].

The relationship between smoking and poor sleep quality has been established [7]. Nicotine products and sufficient sleep do not go well together. Based on a systematic review and meta-analysis [8], smokers are 47% more likely to experience sleep-related issues than non-smokers.

The association between smoking and sleep duration is complex and multifactorial. In the relationship between smoking and sleep-related issues, age differences cannot be ignored. Quality and sleep patterns change with aging [9]. A systematic review found that physical activity was positively associated with sleep quality among different categories of populations [10]. Poor sleep is significantly associated with low socioeconomic status [11]. Previous findings showed that impaired sleep is the consequence of a person's overweight and obesity [12], and the association between sleep duration and depression has been confirmed [13].

Considering the importance of adequate sleep and the irreparable effects of smoking on health, this study investigates the relationship between sleep duration and smoking in the population aged 35 to 70 years, living in Bandare-Kong, a city in the south of Iran.

## Materials and Methods

### Study population

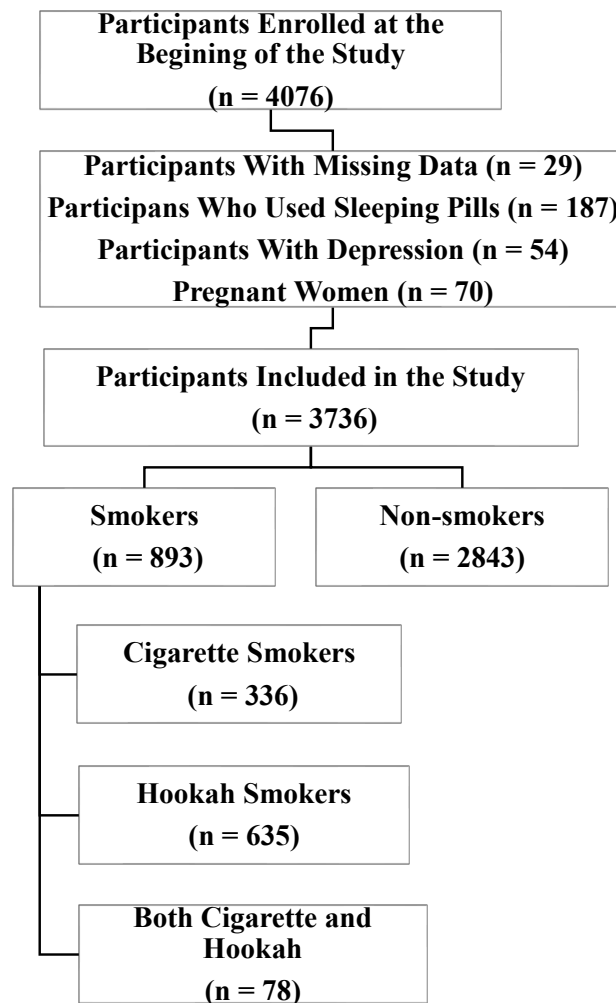
This descriptive-analytical cross-sectional study is a part of the Bandare-Kong non-communicable disease cohort study, conducted on 4076 participants aged 35–70 years to assess the prevalence, tackle the rising incidence of non-communicable diseases in Iran, and identify the risk factors associated with them was launched in the year 2016 as one of the components of the prospective epidemiological research studies in Iran (PERSIAN) cohort study. The exclusion criteria comprised pregnant women, individuals with incomplete data, those who used sleeping pills, and subjects who maintained that they were depressed. A total of 3736 subjects were included in our final analysis (Figure 1).

### Study measures

The dependent variable of sleep duration is a quantitative variable asked from the participants. In other words, it is the average sleep time of the participants in a 24-h period. Also, based on the findings of our previous study [1], responses were divided into 3 categories as follows: Short sleep (<7 h), normal sleep (7-8 h), and long sleep (>8 h). Subjects who used cigarettes or hookah were classified as smokers and other variables were age, gender, marital status, residence, socioeconomic status, job, education, body mass index, and physical activity. The data were extracted through a standard questionnaire based on self-reported information.

### Statistical analysis

Categorical variables have been described with number and percentage (%) and continuous variables are shown by the Mean±SD. The independent samples t-test was used to compare continuous variables in 2 groups (smokers/nonsmokers). Moreover, the chi-square test was used to examine the association between 2 categorical variables. The multivariable linear regression model was used to find the relationship between sleep duration and smoking by adjusting all the potential factors for sleep duration. The multivariable regression model was stratified by gender. All the analyses were conduct-



**Figure 1.** Flowchart of the sampling procedure

ed with SPSS software, version 26. Meanwhile,  $P < 0.05$  was considered statistically significant.

## Results

Table 1 reports the characteristics of participants divided into smokers and nonsmokers. Of 3736 participants, 893 (23.9%) subjects were smokers. The mean sleep duration was longer in smokers than in non-smokers ( $P = 0.031$ ). Of 893 smokers, 220 people slept for 7 to 8 h, 618 people had a short sleep ( $< 7$  h), and 55 people had a long sleep ( $> 8$  h). Of 2843 nonsmokers, 639 people slept for 7 to 8 h, 2067 people had a short sleep ( $< 7$  h), and 137 people had a long sleep ( $> 8$  h). Figure 2 shows the distribution of sleep duration across smoking.

According to Table 2, by adjusting the effect of age, education, body mass index, job, marital status, and physical activity, the mean sleep duration was longer for

both male and female smokers than their counterparts ( $P < 0.001$ ). In other words, among males, the mean sleep duration was 0.4 h longer for smokers than non-smokers ( $B = 0.40$ , 95% CI, 0.23%, 0.56%). Also, among females, the mean sleep duration was 1.11 h longer for smokers than non-smokers ( $B = 1.11$ , 95% CI, 0.82%, 1.4%).

## Discussion

Smoking was associated with more sleep duration when adjusting for the confounders (age, education, body mass index, job, marital status, and physical activity). The results of studies on the relationship between smoking and sleep duration are contradictory. Some studies, consistent with the results of the present study, suggest that smoking may reduce stress, meaning that some elements of smoking may have a positive effect on sleep [6, 14]. Lawati et al. did not find a relationship between these two variables in young people 18–24 years

**Table 1.** Subjects' characteristics regarding smoking

Variables	Mean±SD/No. (%)		P	
	Smokers (n=893)	Non-smokers (n=2843)		
Sleep duration (h)	6.04±1.54	5.92±1.43	0.031	
Short sleep (<7)	618(16.5)	2067(55.3)	0.027	
Normal sleep (7-8)	220(5.9)	639(17.1)		
Long sleep (>8)	55(1.5)	137(3.7)		
Age (y)	49.84±9.67	47.58±9.21	<0.001	
<50	462(12.4)	1743(46.7)	<0.001	
≥50	431(11.5)	1098(29.4)		
Gender	Male	627(16.8)	1017(27.2)	<0.001
	Female	266(7.1)	1826(48.9)	
Marital status	Single	91(2.4)	295(7.9)	0.9
	Married	802(21.5)	2548(68.2)	
Residence	Urban	759(20.3)	2426(65)	0.787
	Rural	134(3.6)	415(11.1)	
Socioeconomic status	Low	391(10.5)	1030(27.7)	<0.001
	Middle	179(4.8)	599(16.1)	
	High	321(8.6)	1202(32.3)	
Job	Unemployed	347(9.3)	1676(44.9)	<0.001
	Occupied	546(14.6)	1167(31.2)	
Education level (y)	<6	645(17.3)	1854(49.7)	<0.001
	6-12	231(6.2)	776(20.8)	
	>12	17(0.5)	211(5.7)	
Body mass index (BMI) (kg/m <sup>2</sup> )	<25	394(10.6)	984(26.5)	<0.001
	≥25	489(13.2)	1849(49.8)	
Physical activity	Low	252(6.8)	685(18.4)	0.015
	Normal to vigorous	640(17.2)	2154(57.7)	

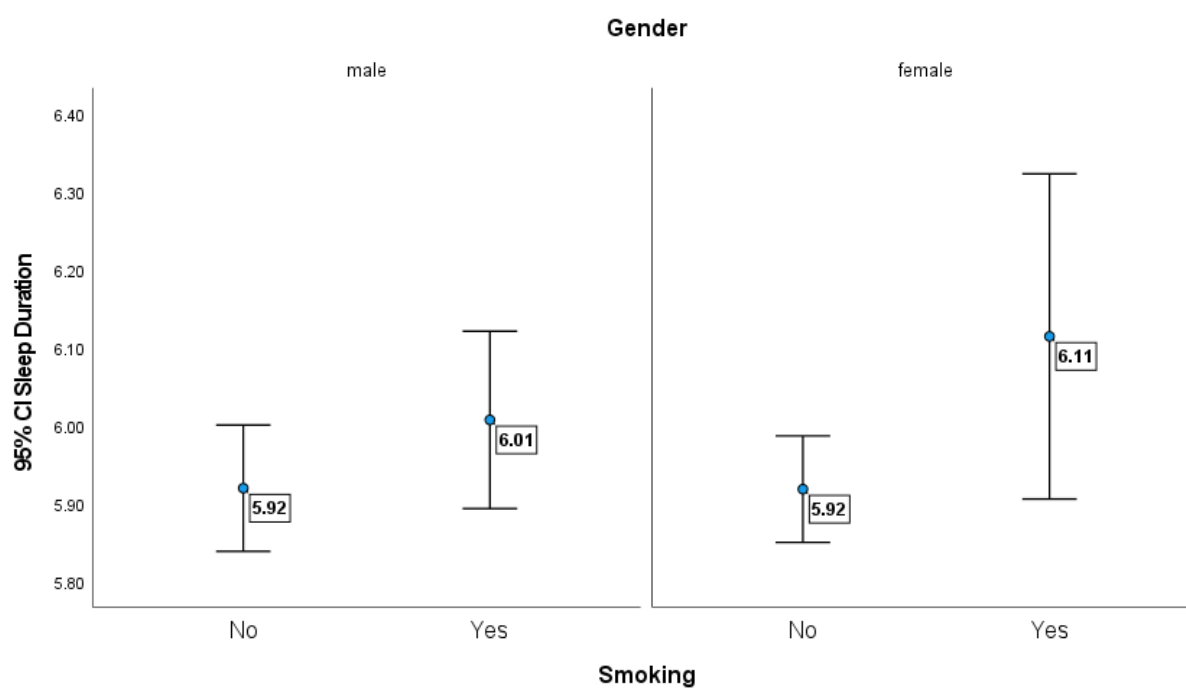
Notes: Quantitative variables were reported with Mean±SD and categorical variables were described using frequency and percentage (No. (%)). Meanwhile, the P for comparing the mean of quantitative variables in two groups is based on the independent samples t-test and the chi-square test was used to determine the association between two categorical variables.

**Table 2.** Multivariable regression model to find the relationship between sleep duration and smoking

Variables	Male		Female	
	B (95% CI)	P	B (95% CI)	P
Smoking (reference category: No)				
Yes	0.40 (0.23-0.56)	<0.001	1.11 (0.823-1.40)	<0.001
Age (y) (reference category: ≥50)				
<50	0.02 (-0.153-0.19)	0.811	1.29 (1.113-1.49)	<0.001
Education (y)	0.17 (0.043-0.29)	0.008	0.77 (0.583-0.97)	<0.001
BMI (reference category: <25)				
≥25	0.11 (-0.053-0.26)	0.171	1.43 (1.233-1.62)	<0.001
Job (reference category: Occupied)				
Jobless	0.67 (0.453-0.89)	<0.001	0.63 (0.343-0.91)	<0.001
Marital status (reference category: Single)				
Married	5.13 (4.873-5.39)	<0.001	2.85 (2.643-3.06)	<0.001
Physical activity (Reference category: Normal to vigorous)				
Low	-0.05 (-0.223-0.12)	0.578	1.52 (1.323-1.72)	<0.001

CI: Confidence interval; BMI: Body mass index.

Notes: The dependent variable is sleep duration.



**Figure 2.** Boxplot to compare the distribution of sleep duration by sex and smoking

old [15]. The results of another study showed that the sleep duration in adult smokers was less than in non-smokers. The mean age of smokers in their study was lower than the participants' age of the present study [16]. Nunez et al. showed that smoking was associated with shorter sleep duration, particularly nightly smoking at the ages of 22-60 years [7]. Dugas found a weak association between the sleep quality of smokers and non-smokers [17]. The reasons for the difference between the results of this study and the results of other studies may be related to the different tools used to check sleep duration. In addition, the amount of smoking and the time of the last smoking were not investigated in this study. The age of the participants in this study was higher than in other studies, although this variable was controlled by statistical method. On the other hand, this study did not examine the sleep quality of participants, it is possible that the decrease in sleep quality in smokers leads to staying more in bed, and the participants reported being in bed duration instead of the sleep duration.

In addition, the results showed that the increase in sleep duration in female smokers is more than in male smokers. Women's sleep duration is lower than men [18]. However, it is unclear why the smoker women reported more sleep duration than men in this study. The cause of this finding may be related to more smoking in men than women, or it may be because most of the women were housewives and had more time to sleep or be in bed.

The results of the present study showed that the sleep duration of women who were lower than 50 years was longer than that of women who were over 50 years old, which is related to the effect of menopause on women's sleep [19].

More education was related to longer sleep duration for men and women, which may be due to higher income, having more knowledge to deal with life tensions, and a healthier lifestyle in more educated people, as a result of which more educated people have a better mental state and longer sleep duration.

Jobless participants had more sleep duration which may be related to having more free time. In addition, married men and women had longer sleep duration, which may be related to the difference in their lifestyles from single participants. Also, women who had little physical activity had longer sleep duration. But physical activity was not related to sleep duration in men which is in line with Irish et al.'s findings [20].

## Conclusion

Smoking is associated with longer sleep duration for both sexes. It is recommended to conduct longitudinal studies to assess the association between sleep quality components, including sleep duration and smoking in the next studies.

## Study limitations

One limitation of the present study was the self-reporting nature of data collection. Moreover, this study was conducted on the population of Bandar Kong, which made the results of our study not generalizable. Another limitation of the present study is that the duration of sleep was considered in a 24-h period. However, it would have been better to consider in addition to this variable the amount of sleep at night. Because smokers tend to stay awake at night and sleep during the day, which can lead to problems and diseases.

## Ethical Considerations

### Compliance with ethical guidelines

All ethical principles are considered in this article. The participants were informed of the purpose of the research and its implementation stages. They were also assured about the confidentiality of their information and were free to leave the study whenever they wished, and if desired, the research results would be available to them. A written consent has been obtained from the subjects. Principles of the Helsinki Convention was also observed.

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### Authors' contributions

All authors equally contributed to preparing this article.

### Conflict of interest

The authors declared no conflict of interest.

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