

# Behavioral Factors Related to Sleep Quality and Duration in Adults

Joohee Shim<sup>1</sup> and Seung Wan Kang<sup>1,2,\*</sup>

<sup>1</sup>College of Nursing, Seoul National University, <sup>2</sup>The Research Institute of Nursing Science, Seoul National University, Seoul, Korea

**Background:** The purpose of this study was to measure the sleep quality and duration in healthy adults and to identify any influencing factors.

**Methods:** This study was a descriptive research investigation that evaluated 240 healthy adults at least 19 years of age. The data were assessed using the following self-administered questionnaires: the Pittsburgh Sleep Quality Index (PSQI), the Beck Depression Inventory, the State-Trait Anxiety Inventory-Korean YZ, and the Fatigue Severity Scale.

**Results:** The PSQI global score was  $5.69 \pm 3.23$ , and 59.6% of the participants were classified as having poor quality sleep (PSQI score > 5). The significant risk factors for poor sleep quality were female gender ( $p = 0.021$ ), number of comorbid conditions ( $p = 0.003$ ), depression ( $p < 0.001$ ), fatigue ( $p < 0.001$ ), and anxiety ( $p < 0.001$ ). Stepwise multiple regression analyses showed that significant predictors of poor sleep quality were depression ( $p < 0.001$ ) and fatigue ( $p < 0.001$ ). Participants slept an average of  $6.16 \pm 1.36$  hours a night. A shorter sleep duration was correlated with older age ( $p = 0.010$ ), a higher body mass index (BMI) ( $p = 0.026$ ), a greater depression score ( $p = 0.002$ ), a higher fatigue score ( $p = 0.028$ ), and lower sleep quality ( $p < 0.001$ ). In addition, stepwise multiple regression analyses revealed that factors significantly associated with sleep duration were depression ( $p = 0.002$ ) and BMI ( $p = 0.034$ ).

**Conclusion:** The number of comorbid conditions and the presence of depression and fatigue were risk factors for both low sleep quality and short sleep duration. Therefore, to improve sleep quality, there is a need for comprehensive interventional programs to manage these and any other factors that disturb sleep.

**Key Words:** Sleep, Adult, Depression, Fatigue, Anxiety

## INTRODUCTION

The Korean National Health Insurance Service reported

that the number of patients who have received medical care for sleep disturbances increased from 358,000 in 2010 to 414,000 in 2014, representing a 15.8% rise over this four-year period and an annual increase of 7.6%. In addition, the number of patients per 100,000 who have received medical treatment for sleep problems has increased by 6.4% and is steadily rising [1]. Due to this stable increase in the number of sleep-disturbed patients [2], two of modern society's major health issues are sleep problems and sleep deprivation in adults. Sleep quality includes quantitative aspects, such as the total sleep time, sleep latency, awakening frequency, and subjective and qualitative aspects. People who experience sleep problems are also likely to have poor sleep

Received: September 15, 2016, Accepted: October 10, 2016

\*Corresponding author: Seung Wan Kang

College of Nursing, Seoul National University, Research Institute of Nursing Science, Seoul National University, 103 Daehak-ro, Chongro-gu, Seoul 03080, Republic of Korea  
Tel: 82-2-740-8824, Fax: 82-2-745-7422  
E-mail: drdemian@snu.ac.kr

© This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc/4.0>) which permits unrestricted noncommercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

quality, which may be an important symptom of medical problems; therefore, more attention should be given to patients' sleep quality [3]. Poor sleep quality has additionally been linked to increased medical expenses, work disturbances and an elevated risk for psychiatric disorders [4]; it has a negative effect on general health and also on quality of life [2].

Sleep takes up a great portion of everyday life as well as time during the human lifespan [5]. A recent study has identified that the average number of hours Korean adults 19 years of age and older spent sleeping was 6 h 53 min [6] per day, which decreased from 7 h 49 min in the 2009 data and was ranked the lowest among all Organization for Economic Cooperation and Development (OECD) countries [5]. One's optimal sleep duration differs depending on the social context and also one's personal characteristics [7]. However, inadequate sleep duration results in daytime sleepiness, fatigue, decreased concentration, irritable behaviors, and anger; prolonged sleep deprivation is linked to cardiovascular diseases and psychiatric disorders [7]. Nurses are in an optimal position to assess and evaluate patients' individual sleep quality and the factors affecting their sleep and also to apply interventions to promote better sleep. Promoting qualitative sleep has been considered one of the most important nursing care goals since the Nightingale era [8]; therefore, more attention and research should be carried out to resolve sleep disturbances.

Sleep studies have been conducted in a patient population considered likely to develop sleep problems, such as stroke patients [9], chronic epilepsy patients [10], female cancer patients [11], patients with other specific medical conditions, and older adults [12-15]. However, few sleep studies have focused on healthy adults, which would prove useful in comparisons with specific patient populations because the comparison would determine the degree of sleep disturbances in these specific populations. Therefore, a sleep study on healthy, community-dwelling adults should be a valuable reference.

It is a common issue in modern society to experience short total sleep hours [16], and this problem has drawn attention to the physical, psychological and behavioral problems that are associated with short sleep hours. Several previous studies have identified an association between the amount of

sleep and cardiovascular diseases, stroke, coronary calcification, and inflammatory marker changes [17]. Additionally, inadequate sleep is linked to an increased body mass index (BMI), changes in the hormonal levels that regulate hunger, a higher incidence of insulin resistance due to problems with glucose metabolism [16], an elevated risk of diabetes, daytime behavior disorders, and increased mortality [17]. Although previous studies have described sleep quality and identified influencing factors in various countries, including Korea [9-13], Japan [18], the United States (US) [15], and Iran [2], there is a lack of research describing sleep quality along with sleep duration. Improved sleep quality is defined as increased total sleep duration, decreased sleep arousals and improved awareness of sleep quality [17]. Therefore, a thorough understanding of sleep duration and its influencing factors is required to eliminate the factors that negatively affect sleep quality improvement.

Increasing the quality of sleep is a key element in improving quality of life. Understanding one's sleep and influencing factors enriches the clinical knowledge of nursing professionals and provides a good basis for delivering effective nursing interventions. This study aimed to evaluate sleep quality and duration and to identify their influencing factors with the hope of widening the knowledge of nurses in assessing and evaluating patients' individual sleep quality.

## MATERIALS AND METHODS

### 1. Study design

This study was a descriptive, cross-sectional study conducted to understand the sleep quality and sleep duration of healthy adults and to identify related factors.

### 2. Participants

Healthy adults over the age of 19 who visited an electroencephalogram center located in Seoul, Korea, were chosen to participate in this study. Inclusion criteria were as follows:

- 1) Those who understood the study purpose and had consented to study participation.
- 2) Those who were able to comprehend and respond to questionnaires with no communication disabilities.
- 3) Those with no history of psychiatric problems who

were able to answer the survey questions.

Sample size was calculated using the G\*Power 3.1.9.2 program with a regression analysis, a significance level of  $\alpha = .05$ , a medium effect size of .15, and a test power calculation  $(1 - \beta) = 0.95$ . The suggested sample size was 172, but a total sample size of 250 was chosen to account for expected dropout rates. Excluding 10 samples with missing responses, this study included an analysis of 240 participants' data.

### 3. Tools

#### 1) General characteristics

Age, gender, educational level, job status, BMI, comorbidity, depression, fatigue, and anxiety were investigated to determine participant general characteristics.

#### 2) Sleep quality

The Pittsburgh Sleep Quality Index (PSQI) was developed by Buysse et al. [3] and is a self-report assessment tool that evaluates sleep quality over a one-month period. It consists of 19 items with 7 components (subjective sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbances, use of sleep medications, and daytime dysfunction). Each component is scored on a scale from 0-3, with the total score ranging from 0-21; higher scores denote a poorer sleep quality. The participant is found to have a sleep disorder if the total score is higher than 5. The evaluation of validity and utility of the original tool showed a Cronbach's  $\alpha = 0.83$ , while the current study had a Cronbach's  $\alpha = 0.86$ .

#### 3) Depression

The Beck Depression Inventory (BDI) was developed by Beck et al. [19] and translated by Lee and Song [20]; this questionnaire was used to assess the depression level of each participant. The BDI is a self-report tool that contains 21 questions. Each question is scored on a scale from 0-3 with the total score ranging from 0-63; a higher score denotes a more severe level of depression. Scores are grouped as follows: 0-9, normal; 10-15, mild depression; 16-23 moderate depression;  $\geq 24$ , severe depression. An evaluation of the validity and utility of the original tool revealed a Cronbach's  $\alpha = 0.78$  in healthy adults and .85 in patients

diagnosed with depression; the Cronbach's  $\alpha$  for the current study was .98.

#### 4) Anxiety

The translated version of the Spielberger State-Trait Anxiety Inventory (STAI-Y) [21], which is called the State-Trait Anxiety Inventory-Korean YZ (STAI-KYZ, translated by Hahn et al.) [22], was used to assess anxiety. This self-reporting tool consists of 40 items that are scored on a 4-point Likert scale. The total score ranges from 20-80, with a higher score indicating a higher anxiety level. The original tool was evaluated for validity and utility and showed a Cronbach's  $\alpha = 0.92$  for state anxiety and 0.90 for trait anxiety; the current study was found to have a Cronbach's  $\alpha = 0.74$  for state anxiety, 0.63 for trait anxiety and 0.79 for the total anxiety score.

#### 5) Fatigue

The Fatigue Severity Scale (FSS) was developed by Krupp et al. [23] and is a self-reporting tool with nine items scored on a Likert scale from 1-7. The mean of all scores is considered to be the final score, and a higher score denotes a higher level of fatigue. An evaluation of the validity and utility of the original tool showed a Cronbach's  $\alpha = 0.81$  in systemic lupus patients and .81 in multiple sclerosis patients; for the current study, the Cronbach's  $\alpha = 0.94$ .

### 4. Data collection

Data collection took place from March 2015-March 2016 with community-dwelling adults who met the study's inclusion criteria. Data were collected by the study researcher and two medical laboratory technologists who had received training on the study's purpose, study tools, precautions, and survey-taking methods. Posters were displayed for participant recruitment, and a one-on-one interview method was used to minimize dropouts from missing responses. The average total time each participant took to complete the BMI measurements and survey was about 20 minutes.

### 5. Ethical considerations

Data collection for the current study took place after approval from the Institutional Review Board of Seoul National University (IRB No. 2013-93). The study's pur-

pose, method and efforts for protection of privacy were explained to each participant, and the data were collected from those who provided signed informed consent.

## 6. Data analysis

The collected data were analyzed using the Statistical Package for the Social Sciences (SPSS), version 23.0, as follows:

- 1) The frequency, percentage, mean, and standard deviation were calculated using the participants' general characteristics, sleep quality and sleep duration time.
- 2) Differences in sleep quality, sleep duration and the sub items of sleep quality according to the general characteristics were analyzed with an independent t-test and a one-way analysis of variance (ANOVA). After using a Levene verification of equal variance, the data were analyzed with both a one-way ANOVA and Bonferroni post-hoc comparisons.
- 3) Correlations between variables were analyzed using Pearson's correlation.
- 4) A multiple linear regression model was used to analyze sleep quality and its predictors.
- 5) The reliability of the tools used to measure depression, fatigue and anxiety were analyzed with Cronbach's  $\alpha$ .
- 6) The default significance level was set as  $p < 0.05$ .

## RESULTS

### 1. General characteristics

The mean age of the participants was  $43.63 \pm 15.43$  years, and the largest age group included those who were younger than 30 years of age ( $n = 62, 25.8\%$ ). 164 (68.3%) females and 76 (31.7%) males participated, and 72.1% had undergraduate degrees. At the time of the data collection, 163 (67.9%) were economically active and 77 (32.1%) did not have a job. Among these 77 unemployed participants, 40 (16.7%) were housewives. The mean BMI was  $23.42 \text{ kg/m}^2$ . There were 135 participants (56.3%) with no significant prior medical history, and the remaining 105 (43.7%) did have medical histories. The mean depression score was  $6.70 \pm 6.71$ , the average fatigue rating was  $2.91 \pm 1.42$ , while the mean anxiety was  $76.33 \pm 18.35$  (Table 1).

### 2. Sleep according to general characteristics

The sleep quality of participants as rated using the PSQI showed an average score of  $5.69 \pm 3.23$ , and the mean sleep duration was  $6.16 \pm 1.36$  h. Sleep quality was significantly different according to gender and the number of comorbid conditions. Men had better sleep quality than women ( $p = 0.021$ ), and those with only one existing medical condition experienced better sleep quality than those with five ( $p = 0.003$ ). Sleep duration was significantly related to the number of diagnosed medical conditions but was not significantly different by gender, educational level, job status, or BMI. Participants aged 31-40 years had the longest sleep duration ( $6.69 \pm 1.06$  h) while those from 51-60 and  $>60$  years reported the shortest sleep durations ( $5.84 \pm 1.56$  h and  $5.97 \pm 1.38$  h,  $p = 0.02$ , respectively). Respondents with one and no medical conditions had the longest sleep duration ( $6.42 \pm 1.28$  h and  $6.26 \pm 1.33$  h, respectively), and those with four conditions and five or more health conditions had the shortest sleep duration ( $5.00 \pm 1.28$  h and  $5.22 \pm 1.50$  h, respectively) ( $p = 0.021$ ) (Table 1).

### 3. Participants' sleep quality

Participant sleep quality was analyzed using the PSQI, and it showed a mean score of  $1.16 \pm 0.72$  with 137 (57.1%) participants reporting that they had "generally good" sleep quality and 9 (3.8%) who answered "very poor." The mean sleep latency was  $1.07 \pm 0.96$  h. The respondents' total sleep hours were  $\geq 7$  h (32.5%), 6-7 h (31.7%), 5-6 h (21.7%), and  $\leq 5$  h (14.2%). Given that the recommended amount of sleep per day is  $\geq 6$  h, 126 (52.5%) participants were sleep-deprived. Sleep efficacy was calculated by dividing the actual sleep time by the total time spent lying down. The number of participants who reported a  $\geq 85\%$  sleep efficacy was the highest at 172 (71.7%), and the average score was  $0.49 \pm 0.91$ . The average score for sleep disturbances was  $1.05 \pm 0.40$ , and a majority of the respondents did not take any medications to help them sleep (95.4%). To assess daytime disturbances, scores for daytime sleepiness and disturbed concentration were summed. The mean score for daytime disturbances was  $0.72 \pm 0.52$ , and 111 (46.3%) participants denied daytime disturbances (Table 2).

**Table 1.** Sleep quality and duration according to general characteristics (N = 240)

Variables	Categories	n (%) or		Sleep quality		Sleep duration		
		Mean ± SD	Mean ± SD	t/F (p)	Mean ± SD	t/F (p)		
Age (years)		43.63 ± 15.43	5.69 ± 3.23	.425 (.790)	6.16 ± 1.36	2.99 (.020)		
	<31	62 (25.8)	5.90 ± 3.18		6.18 ± 1.45		b > d	
	31-40	52 (21.7)	5.42 ± 3.01		6.69 ± 1.06			
	41-50	49 (20.4)	5.33 ± 3.30		6.00 ± 1.21			
	51-60	40 (16.7)	5.88 ± 3.51		5.84 ± 1.56			
	>60	37 (15.4)	6.00 ± 3.30		5.97 ± 1.38			
Gender	Male	76 (31.7)	4.99 ± 2.66	5.394 (.021)	6.30 ± 1.28	.97 (.294)		
	Female	164 (68.3)	6.02 ± 3.42		6.10 ± 1.40			
Level of education	≤Middle school	17 (7.1)	5.47 ± 3.26	.207 (.813)	6.18 ± 1.59	.17 (.847)		
	High school	50 (20.8)	5.94 ± 3.77		6.07 ± 1.39			
	≥College	173 (72.1)	5.64 ± 3.07		6.19 ± 1.33			
Job	Employed	53 (22.1)	5.66 ± 3.45	0.370 (.830)	6.01 ± 1.45	1.41 (.230)		
	Self-employed	35 (14.6)	5.34 ± 3.14		5.97 ± 1.40			
	Professional	75 (31.2)	5.99 ± 3.01		6.12 ± 1.40			
	House wife	40 (16.7)	5.80 ± 3.50		6.20 ± 1.22			
	Unemployed	37 (15.4)	5.35 ± 3.23		6.62 ± 1.22			
BMI		23.42 ± 3.34		0.221 (.926)		1.56 (.187)		
	<18.4	17 (7.1)	5.18 ± 2.96		6.75 ± 1.22			
	18.5-22.9	95 (39.6)	5.83 ± 3.51		6.18 ± 1.40			
	23-24.9	62 (25.8)	5.81 ± 2.84		6.21 ± 1.27			
	25-29.9	58 (24.2)	5.5 ± 3.27		6.02 ± 1.43			
	>30	8 (3.3)	5.63 ± 3.54	5.45 ± 1.18				
Disease	0	135 (56.3)	5.38 ± 3.04	3.78 (.003)	6.26 ± 1.33	2.72 (.021)		
	1	53 (22.1)	5.04 ± 3.228		a, b < f		6.42 ± 1.28	a > e, f
	2	25 (10.4)	6.76 ± 2.80		5.74 ± 1.20		b > c, e, f	
	3	13 (5.4)	6.85 ± 3.46		6.01 ± 1.77			
	4	5 (2.1)	6.80 ± 3.77		5.00 ± 1.28			
	≥5	9 (3.7)	9.00 ± 4.18		5.22 ± 1.50			
Depression		6.70 ± 6.71						
Fatigue		2.91 ± 1.42						
Anxiety		76.33 ± 18.35						

SD: Standard deviation; BMI: body mass index.

#### 4. Correlations between sleep and different variables

The correlations between different variables and sleep quality and sleep duration are shown in Table 3. Sleep quality had positive correlations with depression ( $r = 0.44$ ,  $p < 0.001$ ), fatigue ( $r = 0.43$ ,  $p < 0.001$ ) and anxiety ( $r = .31$ ,  $p < .001$ ). Higher scores for depression, fatigue and anxiety were correlated with a lower sleep quality. In contrast, sleep duration showed negative correlations with age ( $r = -0.17$ ,  $p = 0.010$ ), BMI ( $r = -0.14$ ,  $p = 0.026$ ), depression ( $r = -0.20$ ,  $p = 0.002$ ), and fatigue ( $r = -0.14$ ,  $p = 0.028$ ). Higher scores for age, BMI, depression, and fatigue were correlated with shorter sleep duration.

#### 5. Sleep-influencing factors

Stepwise multiple regression analyses were used to determine the factors that influence sleep quality and sleep duration. The Durbin-Watson autocorrelation score was 2.045, indicating independence. In addition, the VIF score between independent variables was 1.095, indicating a lack of multicollinearity.

Among factors that were found to be related to sleep, depression and fatigue had a significant influence on sleep quality ( $p < 0.001$ ). Higher depression ( $p < 0.001$ ) and fatigue scores ( $p < 0.001$ ) resulted in a low sleep quality score with a model description power of ( $R^2$ ) = 0.29 (Table 4).

**Table 2.** Participant sleep quality (N = 240)

Variables		Categories	n (%)	Mean ± SD
Subjective sleep quality	0	Very good	37 (15.4)	1.16 ± 0.72
	1	Fairly good	137 (57.1)	
	2	Fairly bad	57 (23.8)	
	3	Very bad	9 (3.8)	
Sleep latency	0	0	77 (32.1)	1.07 ± 0.96
	1	1-2	96 (40.0)	
	2	3-4	41 (17.1)	
	3	5-6	26 (10.8)	
Sleep duration	0	>7 h	78 (32.5)	1.17 ± 1.04
	1	6-7 h	76 (31.7)	
	2	5-6 h	52 (21.7)	
	3	<5 h	34 (14.2)	
		≤6 h	126 (52.5)	
	>6 h	114 (47.5)		
Habitual sleep efficiency	0	≥85%	172 (71.7)	0.49 ± 0.91
	1	75-84%	36 (15.0)	
	2	65-74%	14 (5.8)	
	3	<65%	18 (7.5)	
Sleep disturbance	0	0	14 (5.8)	1.05 ± 0.40
	1	1-9	201 (83.8)	
	2	10-18	25 (10.4)	
	3	19-27	0 (0.0)	
Use of sleep medication	0	Never during the past month	229 (95.4)	0.08 ± 0.42
	1	Less than once a week	5 (2.1)	
	2	Once or twice a week	3 (1.3)	
	3	Three or more times a week	3 (1.3)	
Daytime dysfunction	0	0	111 (46.3)	0.72 ± 0.52
	1	1-2	101 (42.1)	
	2	3-4	24 (10.0)	
	3	5-6	4 (1.7)	
PSQI global score	<5	Good sleep quality	97 (40.4)	
	≥5	Poor sleep quality	143 (59.6)	

PSQI: Pittsburgh Sleep Quality Index.

**Table 3.** Correlations between depression, fatigue, anxiety, and sleep (N = 240)

Variables	X1	X2	X3	X4	X5	X6
X2	.35 (<.001)					
X3	.21 (.001)	.04 (.497)				
X4	-.24 (<.001)	-.14 (.029)	.30 (<.001)			
X5	-.05 (.437)	-.13 (.046)	.64 (<.001)	.35 (<.001)		
X6	.04 (.583)	-.00 (.983)	.44 (<.001)	.43 (<.001)	.31 (<.001)	
X7	-.17 (.010)	-.14 (.026)	-.20 (.002)	-.14 (.028)	-.11 (.088)	-.62 (<.001)

X1: Age, X2: BMI, X3: Depression, X4: Fatigue, X5: Anxiety, X6: Sleep quality, X7: Sleep duration.

## DISCUSSION

This study aimed to investigate the sleep quality and sleep duration of healthy adults and to assess any influencing factors to provide a basis for nursing intervention development

to increase patients' sleep quality. The average sleep quality score was  $5.69 \pm 3.23$ , which was similar to a previous study's report of  $5.7 \pm 2.79$  [24]. Our study result showed a higher score compared to Sohn and Kim's [25] earlier investigation of the reliability and validity of the Korean

**Table 4.** Factors influencing sleep quality and duration (N = 240)

	Variables	B	SE	$\beta$	t	p
Sleep quality	(Constant)	2.43	.41		5.96	<.001
	Depression	0.17	.03	.35	6.10	<.001
	Fatigue	0.74	.13	.33	5.68	<.001
	Adj.R2= .29, F=49.26, p < .001					
Sleep duration	(Constant)	7.71	.61		12.63	<.001
	Depression	-0.04	.01	-.20	-3.09	.002
	BMI	-0.06	.03	-.14	-2.14	.034
	Adj. R2= .06, F=7.36, p < .001					

BMI: Body mass index.

PSQI ( $4.06 \pm 2.08$ ) and an Iranian study ( $5.06$ ) [2]. However, our study respondents displayed a lower average sleep quality score than a previous study that compared healthy adults and obese adults in Korea ( $6.62 \pm 2.45$ ) [26] and another report on middle-aged adults in the United States ( $6.3 \pm 3.4$ ) [27]. These findings may indicate that sleep quality could be affected by various factors, such as ethnicity, geographical location, lifestyle, and culture. Therefore, researchers should consider the characteristics and environmental factors of participants when conducting sleep studies; further research that includes participants with diverse ethnic backgrounds is needed. More than half of our respondents (59.6%) had PSQI scores that were higher than the mid-point, as well as all age groups and the mean PSQI score, indicating poor sleep quality. In all age groups, the average sleep duration was  $6.16 \pm 1.36$ , suggesting that many did not exceed seven hours of sleep each night. In the age group  $\leq 51$  years, the total number of hours spent sleeping was less than six. In addition, the mean sleep duration of this study was even lower than the national results (6 h and 53 min and 7 and 49 min, respectively) [6]. Compared to other OECD countries, such as France (8 h and 50 min) and the US (8 h and 30 min), our study showed significantly shorter sleep duration, indicating a strong need for an evaluation of the influencing factors as well as the development of aggressive nursing interventional methods to increase sleep quality and sleep duration.

Gender and the number of comorbid conditions were significantly related to sleep quality, while age and the number of comorbid conditions were associated with sleep duration. Our study showed similar results as other previous studies [2,24,28] that women had a lower sleep quality than men.

This trend may be due to several factors, including the psychiatric disorder incidence rate, sociocultural factors, gender differences in coping skills [2], menopause [28], bereavement [2], and other cultural lifestyle differences [2]. Further analyses indicated a higher depression score in women ( $7.48 \pm 7.09$ ) than in men ( $5.01 \pm 5.45$ ) ( $p = 0.008$ ) and a higher fatigue score for women ( $3.09 \pm 1.45$ ) than for men ( $2.49 \pm 1.29$ ) ( $p = 0.002$ ), which may have contributed to the gender differences in sleep quality. Therefore, sleep problems in female patients should not be overlooked, and gender differences should be taken into consideration when approaching sleep problems. Healthcare professionals who address female sleep disorders should also assess their patients' psychological factors, such as depression and fatigue. The number of comorbid conditions had a significant relationship with both sleep quality and sleep duration. A higher number of comorbid conditions indicated low sleep quality and a short sleep duration. These findings were similar to those of a previous Japanese study [18] and another study conducted in community-dwelling adults that showed a high incidence of sleep disorders in those with significant prior medical histories [28]. Ancoli-Israel [15] reported that physical and psychological problems, such as cardiovascular and pulmonary disorders, depression and arthritis, were correlated with sleep disturbances; a higher number of comorbid conditions was found to negatively affect sleep quality, and poor sleep quality may lead to an increased mortality rate. Choi and Kim [28] concluded that one of the major problems any patient with any medical condition experiences is disordered sleep and that medical staff members should devote special attention to this matter. Therefore, a careful assessment of sleep should be carried

out in patients with medical conditions, and further sleep research on these various conditions should also be established.

Age was also significantly related to sleep duration. Participants aged  $\geq 51$  years had the shortest sleep duration, and those in the 31-40-year-old group had the longest. The latter result was unexpected and may be due to a high (42.9%) proportion of the respondents in this age group being unemployed. Economically inactive people are more likely to have regular life patterns and may have longer sleep hours due to not having to wake up early for work and not experiencing work-related stress. Additionally, this finding could also be related to the low incidence of medical conditions in those in the  $<30$  age group (79%) and the 31-40 age group (73%), which leads to fewer sleep disturbances. These medical conditions often cause pain and discomfort or require drugs with unpleasant side effects and can therefore interfere with sleep; the group with more comorbid conditions reported poorer sleep than those with no conditions. Our results also showed that participants older than 51 years had the shortest sleep duration, which was similar to a previous study's results.

Older adults residing in rural areas were more prone to experiencing sleep disturbances as they aged [28]; an Iranian study found that adults who lived in urban areas also had the same problem [2]. These disturbances are related to physiological changes that take place in elderly adults and involve relatively short non-rapid eye movement (NREM) periods [3], the deepest REM sleep stage, and frequently waking from sleep [29]. In addition, physical and psychological disorders and the pain associated with these disorders [12] may also be influencing factors. In this study, the mean BDI score in participants  $\geq 60$  years of age was  $10.05 \pm 9.84$ , indicating that depression may be the biggest risk factor that influences sleep duration. Further analyses indicated that 72.5% of respondents in their 50 s and 81.1% of those in their 60 s had more than one comorbid medical condition; 37.8% of participants older than 60 years reported three or more comorbid conditions, which may have influenced their sleep quality and duration. Therefore, further study should investigate these influencing factors according to various age groups, especially in the elderly population.

Correlation and regression analyses revealed that sleep quality was affected by depression and fatigue, while sleep duration was influenced by depression and BMI. Depression was the predisposing factor that had an effect on both sleep quality and duration, which was similar to reports from the established literature. Previous studies have shown that depression is correlated with low sleep quality, and elderly patients with depression are more likely to have sleep disturbances than people without depression [12]. Many studies have found a strong correlation between depression and sleep problems, and sleep problems have been implicated to both cause and worsen depression [24]. Studies conducted in stroke victims [9], epilepsy patients [10] and female cancer patients [11] have all shown that depression affects sleep and suggested a careful assessment of depression along with any sleep assessment in these populations. Fatigue also influences sleep quality, which is in accordance with previous studies on epilepsy patients [10] and female cancer patients receiving chemotherapy [11].

Our study showed that a high BMI was related to short sleep duration. A study that compared healthy and obese adults reported that obese adults experienced more severe sleep problems and had shorter sleep duration than their healthy counterparts. A French study conducted in an elderly population also found a correlation between obesity and a shortened sleep duration [14]. Sleep deprivation has been linked to an increased intake of fat and carbohydrates and decreased physical activity, which led to obesity [26]. Short sleep hours decreased leptin and increased ghrelin levels, which resulted in an increased appetite and an elevated BMI [16]. In a meta-analysis of 696 BMI scores and sleep hours, short sleep hours were associated with an increased risk for obesity in both adults and children [30]. However, it was difficult to determine the causal relationship between obesity and sleep problems [30], suggesting the need for further evaluation.

This study investigated sleep quality and sleep duration as well as their influencing factors to provide evidence for optimizing sleep quality and also quality of life in general. Our study results should encourage broad-spectrum studies that include various variables in different participants to promote better sleep quality and to prevent sleep deprivation. In addition, based on our study results, we sug-



gest the development of lifestyle intervention programs that can aid in eliminating intervening factors and increasing sleep efficacy.

## REFERENCES

1. National Health Insurance Service. The average annual growth rate per 100,000 population. Wonju: National Health Insurance Service; 2015.
2. Asghari A, Farhadi M, Kamrava SK, Ghalehbaghi B. Subjective sleep quality in urban population. *Arch Iran Med* 2012;15:95-8.
3. Buysse DJ, Reynolds CF, Monk TH, Berman SR, Kupfer DJ. The pittsburgh sleep quality index: a new instrument for psychiatric practice and research. *Psychiatry Res* 1989;28:193-213.
4. Curcio G, Tempesta D, Scarlata S, Marzano C, Moroni F, Rossini PM, Ferrara M, De Gennaro L. Validity of the Italian version of the Pittsburgh sleep quality index (PSQI). *Neurol Sci* 2013;34:511-9.
5. Eun KS, Cha SE. Gender difference and covariates of sleep time in daily life of Korea. *J Korean Official Statist* 2010;15:82-103.
6. Korea Gallup. Korean living time [Internet]. Seoul: Korea Gallup; 2014 [cited 2016 Oct 7]. Available from: <http://www.gallup.co.kr/gallupdb/reportDownload.asp?seqNo=516>
7. Koo DL, Kim J. The physiology of normal sleep. *Hanyang Med Rev* 2013;33:190-6.
8. Oh JJ, Song MS, Kim SM. Development and validation of Korean sleep scale A. *J Korean Acad Nurs* 1998;28:563-72.
9. Suh MH, Choi-Kwon S. Sleep-wake disturbance in post-stroke patients. *J Korean Biol Nurs Sci* 2009;11:23-31.
10. Kim JS, Hong HS, Na YK. A study of fatigue, depression and sleep disorders in patients with chronic liver disease. *J Korean Biol Nurs Sci* 2012;14:1-7.
11. Seok SH, Jun SE. Factors affecting sleep quality in women with cancer undergoing radiotherapy. *Asian Oncol Nurs* 2016;16:30-7.
12. Shin KR, Kang Y, Prak HJ, Kim K, Jin LH. Depression, somatoform disorders, and quality of life between poor sleepers and good sleepers in community-dwelling older adults. *Korean J Adult Nurs* 2011;23:332-9.
13. Kwon KH, Suh SR. Quality of sleep and its influencing factors in the institutionalized elderly. *Korean J Adult Nurs* 2009;21:34-42.
14. Ohayon MM, Vecchierini M. Normative sleep data, cognitive function and daily living activities in older adults in the community. *Sleep* 2005;28:981-9.
15. Ancoli-Israel S. Sleep and its disorders in aging populations. *Sleep Med* 2009;10:S7-S11.
16. Crispim CA, Zalcman I, Dáttilo M, Padilha HG, Edwards B, Waterhouse J, Tufik S, de Mello MT. The influence of sleep and sleep loss upon food intake and metabolism. *Nutr Res Rev* 2007;20:195-212.
17. Buysse DJ, Grunstein R, Horne J, Lavie P. Can an improvement in sleep positively impact on health? *Sleep Med Rev* 2010;14:405-10.
18. Hayashino Y, Yamazaki S, Takegami M, Nakayama T, Sokejima S, Fukuhara S. Association between number of comorbid conditions, depression, and sleep quality using the Pittsburgh Sleep Quality Index: results from a population-based survey. *Sleep Med* 2010;11:366-71.
19. Beck AT, Steer RA, Carbin MG. Psychometric properties of the Beck Depression Inventory: Twenty-five years of evaluation. *Clin Psychol Rev* 1988;8:77-100.
20. Lee YH, Song JY. A study of the reliability and the validity of the BDI, SDS, and MMPI-D scales. *Korean J Clin Psychol* 1991;10:98-113.
21. Spielberger CD, Gorsuch RL. Manual for the state-trait anxiety inventory: STAI (Form Y). Palo Alto, CA: Consulting Psychologists Press; 1983.
22. Hahn DW, Lee CH, Chon KK. Korean adaptation of Spielberger's STAI (K-STAI). *Korean J Health Psychol* 1996;1:1-14.
23. Krupp LB, LaRocca NG, Muir-Nash J, Steinberg AD. The fatigue severity scale: application to patients with multiple sclerosis and systemic lupus erythematosus. *Arch Neurol* 1989;46:1121-3.
24. Yi H. Sleep quality and its associated factors in adults. *J Korean Public Health Nurs* 2013;27:76-88.
25. Sohn SI, Kim DH, Lee MY, Cho YW. The reliability and validity of the Korean version of the Pittsburgh Sleep Quality Index. *Sleep Breath* 2012;16:803-12.
26. Suk HJ, Na YK, Hong HS. Difference in sleep circadian rhythm and sleep quality between normal-weight and obese group. *J Korean Biol Nurs Sci* 2014;16:309-17.
27. Buysse DJ, Hall ML, Strollo PJ, Kamarck TW, Owens J, Lee L, Reis SE, Matthews KA. Relationships between the Pittsburgh Sleep Quality Index (PSQI), Epworth Sleepiness Scale (ESS), and clinical/polysomnographic measures in a community sample. *J Clin Sleep Med* 2008;4:563-71.
28. Choi H, Kim B, Kim I. Prevalence and risk factors of sleep disturbance in community dwelling adults in Korea. *Korean J Adult Nurs* 2013;25:183-93.
29. Hong SB. Sleep disorders medicine. *J Korean Med Assoc* 2013;56:410-22.
30. Cappuccio FP, Taggart FM, Kandala N, Currie A, Peile E, Stranges S, Miller M. Meta-analysis of short sleep duration and obesity in children and adults. *Sleep* 2008;31:619-26.