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Sleep Duration and Mental Health among Korean Adults Population

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ABSTRACT

The purpose of this study was to investigate the association between Weekday and weekend sleep duration and perceived stress and suicidal ideation. Data was obtained by the Korea National Health and Nutrition Examination Survey seventh (2017) using a rolling sampling design involving a complex, stratified, multistage, and probability-cluster survey of civilian non-institutionalized Korean residents. We conducted a cross-section study of a total of 5,818 subjects (2,579 males and 3,239 females) who were aged 18 years and older. We found that the odds of poor perceived stress in groups with weekday sleep duration of six hours or less was 1.348 times higher (p-value: 0.001) than that in groups with sleep duration of 7-8 hours on weekday. The odds of suicidal ideation in groups with weekend sleep duration of six hours or less was 1.682 times higher (p-value: 0.029) than that in groups with sleep duration of 7-8 hours on weekend. Poor sleep duration appears to be closely associated with poor perceived stress and suicidal ideation. Based on the findings of our study, effective prevention and intervention programs should be established with improving their awareness of the serious consequences of sleep problems educating reasonable working time and pay close attention to those who have poor perceived stress and suicidal ideation.

1. Introduction

Adequate sleep duration is an important determinant of health in a fundamental activity of everyday life. Both short (typically defined as < 7 hours) and long sleep durations (typically defined as ≥ 9 hours) have been found to be important predictor and reported a U-shaped association for a wide range of disease outcomes, including cardiometabolic diseases, mental disorders, cancer, and all-cause mortality (Cappuccio et al., 2010; Jike et al., 2018; T. Z. Liu et al., 2017; Lo, Groeger et al., 2016; Rangaraj & Knutson, 2016; Zhao et al., 2013) Especially, short sleep duration is recognized to have an adverse effect on stress, depression or suicide in addition to adverse effects

on hypertension, diabetes, and cardiovascular disease (Cappuccio et al., 2011; Gangwisch, 2014; Kim et al., 2013; Kim et al., 2013; Shan et al., 2015).

In the community health survey (Kwon, 2019), after a slight increase between 2008 and 2009, it showed a decreasing trend in both 2013 and 2017, showing values of 8.19% in 2008, 9.65% in 2009, 8.95% in 2013, and 6.96% in 2017, respectively. In the Korea Welfare Panel, after a slight increase to 2.82% in 2012, 3.35% in 2013, and 3.35% in 2014, it continued to decrease to 2.34% in 2015, 2.08% in 2016, and 1.63% in 2017. The suicide attempt rate increased to 0.66% in 2007, 1.02% in 2008, and 1.03% in 2009 according to the National Health and Nutrition Examination Survey, and then bottomed out at 0.86% in 2010, 0.82% in 2011, 0.60% in 2012, and 0.56% in 2013 (Kwon, 2019). In 2015 and 2016, they maintained similar levels at 0.61% and 0.59%, respectively, but rose to 0.71% in 2017 (Kwon, 2019). In addition, the suicide rate in 2013 was 28.5 per 100,000 populations, an increase of 26.5% from the previous 10 years with the highest among the Organization for Economic Cooperation and Development (OECD) countries ("Statistics Korea, 2013). According to the results of the Korean National Health and Nutrition Survey (Ministry of Health and Welfare, 2015), the suicide rate was 4.6% in 2013 and 5.1% in 2015, almost the same level as 4.7% in 2017.

One potential explanation by which poor sleep duration is related to suicide-related behaviors is that poor sleep duration is indirectly associated with suicide-related behaviors through poor mental Health (McCall et al., 2010). An alternative explanation is that poor sleep duration is directly related to suicide-related behaviors beyond effects of poor mental health (Chellappa & Araujo, 2007; Sjostrom et al., 2007). Taken together, these findings have led to the designation that poor sleep duration are generally near-term risk factors for suicide. In addition, poor perceived stress has been identified as a predictor of depression and depressive symptoms (Laures-Gore & Defife, 2013) as not only exerts a direct effect but also has an indirect effect on depression and depressive symptoms (Y. Liu et al., 2016) that may results in suicide-related behaviors. Guo LN et al. (Guo et al., 2018) study showed that poor perceived stress and risk of depression resulted in a positive correlation ($r = 0.82$, $P < 0.01$).

Unfortunately, with rapid economic growth in South Korea, poor perceived stress is increasing and thus Korean adult's population may be more vulnerable to poor perceived stress which may result in suicide-related behaviors. However, there is a lack of research examining the negative effects of poor sleep duration on suicide-related behaviors in the Korean population. Therefore, the purpose of the present study was to determine the effects of short weekday and weekend sleep duration on suicide-related behaviors, based on perceived stress and suicidal thoughts in the general South Korean adults population.

2. Methods

2.1 Study Sample

To evaluate the relationship between Weekend and Weekday sleep duration and perceived stress and suicidal ideation the present study analyzed data from the seventh Korea National Health and

Nutrition Examination Survey (KNHANES) assessment performed by the Korean Ministry of Health and welfare. The survey had three components: a health interview survey, a health examination survey, and a nutrition survey and employed stratified, multistage probability sampling units that were based on geographic area, gender, and age, which were determined by the household registries of the 2005 National Census Registry. The survey was approved by the Institutional Review Board of the Korea Disease Control and Prevention Agency.

The survey target population was all non-institutionalized South Korean civilian individuals aged 1 year or older. KNHANES surveys have been conducted periodically between 1998 and 2005 and annually since 2007. Although the seventh KNHANES was conducted for two years (2016-2017), this study only used KNHANES database for 2017 due to limitations of available variables.

We excluded information from 1,544 individuals aged 1-17 years and included information from 8,127 individuals aged 18 years and older. We further excluded 765 individuals without information on socioeconomic status and health risk and behavior variables, and 18 individuals without information on sleep duration, suicidal ideation. Thus, a total of 5,818 individuals were selected for this analysis. As KNHANES data are released to the public for scientific use, ethical approval was not needed for this study.

Chi-square tests and multiple logistic regression analysis were used to analyze whether general characteristics, health status, and health risk behaviors as well as weekend and weekday sleep duration were related to perceived stress level and suicidal ideation. We further performed subgroup analyses by gender, BMI, and age by gender. Statistical analysis software SAS Version 9.2 (SAS Institute, Inc., Cary, NC) was used for data analysis.

2.2 Dependent Variable

2.2.1 Perceived stress

Perceived stress level was assessed with the question: “How much do you feel stress in your daily life?”. The response ‘I feel very much.’ or ‘I feel a lot’ was considered to indicate ‘I feel stressed’, and the response ‘I feel a little bit’, ‘I hardly feel it.’ was considered to indicate ‘I do not feel stressed’, thus dichotomizing the response for multiple logistic analysis.

2.2.2 Suicidal Ideation

In this study, self-reported data regarding suicidal ideation was extracted from responses to the question “Have you ever seriously considered suicide in the last year?” Suicidal ideation was categorized as either “yes” or “no.”

2.3 Independent Variable

2.3.1 Weekday sleep duration

Weekday sleep duration was assessed by self-reported responses to the question: “What time did you usually get into and become a dragonfly on a weekday (or work day)?”. Responses were assigned to one of three subcategories: $\leq$ 6 hours, 7-8 hours, and $\geq$ 9 hours.

2.3.2 Weekend sleep duration

Weekend sleep duration was assessed by self-reported responses to the question: “What time and when did you usually enter the dragonfly during the weekend (or the day you don’t work, the day you don’t work)?”. Responses were assigned to one of three subcategories: ≤ 6 hours, 7-8 hours, and ≥ 9 hours (Kim et al., 2013).

2.4 Covariates

2.4.1 Socio-Demographic Factors

Based on previous studies (An et al., 2015; Tae et al., 2019; Yadav et al., 2017), residential region, gender, age, household income, education, and marital status were included in the analysis as socio-demographic factors. The age variable was divided into six groups: 18-29, 30-39, 40-49, 50-59, 60-69, and 70 years or older. Household income was calculated by dividing household monthly income by the square root of household size. Survey subjects were ranked from lowest to highest incomes and grouped into four household income quartiles. Education level was categorized into four groups: elementary school or lower, middle school, high school, and college or higher. Residential regions were categorized into Metropolitan (Seoul), Urban (within city boundaries: Daejeon, Daegu, Busan, Incheon, Kwangju, or Ulsan) and Rural (not within city boundaries). Spouse existence was categorized into two groups: Yes or No including separated/divorce.

2.4.2 Health Status and Behavior Factors

Based on previous studies (An et al., 2015; Li et al., 2019; Tae et al., 2019; Yadav et al., 2017), questions about alcohol use, smoking status, and walking days per week were assessed by the health interview survey and included as covariates in our analyses. Self-reported data regarding perceived body shape was extracted from responses to the question “What do you think your body is currently?” Perceived body shape was categorized as either “yes” or “no.” The response ‘It is very thin.’ or ‘It is a little thin’ was considered to indicate ‘thin’, The response ‘It is normal.’ was considered to indicate ‘moderate’, and the response ‘It is a little obese.’, ‘It is very obese.’ was considered to indicate ‘obese’.

3. Results

3.1 General characteristics

Table 1 presents characteristics of the study population. Of the 5,818 participants included in our study, there were 1,596 (29.1%) participants who feel stressed and 287 (4.7%) participants who have suicidal ideation. Of those who have feel stressed, 542 (34.0%) participants reported six hours or less, and 222 (27.5%) participants reported nine hours or more on weekdays (p-value: 0.000) and 327 (32.1%) participants reported six hours or less, and 488 (29.8%) participants reported nine hours or more on weekends (p-value: 0.092). Of those who have suicidal ideation, 105 (5.4%)

participants reported six hours or less, and 50 (5.1%) participants reported nine hours or more on weekdays (p-value: 0.186) and 87 (7.4%) participants reported six hours or less, and 77 (4.2%) participants reported nine hours or more on weekends (p-value: 0.002).

Table 1. General characteristics of subjects included for analysis

	Total		Perceived Stress			Suicidal ideation		
	N	%**	Yes	%***		Yes	%***	
Sleep Duration (weekday)*					0.00			0.19
≤6	1,684	28.7	542	34.0		105	5.4	
7-8	3,286	57.8	832	27.0		132	4.2	
≥9	848	13.5	222	27.5		50	5.1	
Sleep Duration (weekend)*					0.09			0.00
≤6	1,067	16.7	327	32.1		87	7.4	
7-8	3,036	51.9	781	27.7		123	4.0	
≥9	1,715	31.4	488	29.8		77	4.2	
Residential region					0.83			0.49
Metropolitan	1,171	20.2	321	29.2		46	3.8	
Urban	1,485	27.1	398	28.4		68	4.7	
Rural	3,162	52.6	877	29.4		173	5.0	
Gender					0.00			0.08
Male	2,579	49.8	652	27.2		116	4.1	
Female	3,239	50.2	944	31.0		171	5.2	
Age					<.001			<.001
18-29	758	19.2	290	37.9		36	4.7	
30-39	851	17.7	299	35.8		29	3.6	
40-49	1,060	20.1	288	27.0		23	2.1	
50-59	1,140	19.7	302	26.5		52	4.4	
60-69	1,028	12.8	206	19.8		67	7.2	
≥70	981	10.6	211	21.7		80	8.5	
Household Income					0.65			<.001
Low	1,123	15.2	324	30.3		129	12.4	
Middle low	1,395	23.0	387	29.9		73	4.6	
Middle high	1,594	29.7	428	29.1		40	2.6	
High	1,706	32.2	457	27.9		45	3.0	
Education level					0.09			<.001
≤ Elementary school	1,207	14.2	321	27.9		113	10.3	
Middle school	612	9.3	144	24.9		37	6.0	
High school	1,802	33.4	497	28.7		93	5.4	
≥ College	2,197	43.1	634	30.7		44	1.9	
Spouse existence					<.001			0.18
Yes	4,775	75.2	1,211	26.5		226	4.4	
No	1,043	24.8	385	36.9		61	5.5	
Self-rated Health					<.001			<.001
Good	1,559	28.3	273	18.6		38	2.4	
Normal	3,125	54.4	844	29.6		108	3.5	
Bad	1,134	17.3	479	44.6		141	12.0	

	Total		Perceived Stress			Suicidal ideation		
	N	%**	Yes	%***		Yes	%***	
Perceived body shape					<.001			0.29
Thin	972	16.8	284	28.9		58	5.4	
Moderate	2,382	40.1	554	24.4		101	4.1	
Obese	2,464	43.1	758	33.5		128	4.9	
Alcohol use					0.00			0.21
Never	661	9.4	152	23.5		44	6.0	
Drinker	5,157	90.6	1,444	29.7		243	4.5	
Smoking status					0.00			0.01
Smoker	1,021	20.7	333	33.8		69	6.5	
Former smoker	1,240	21.2	301	26.4		58	4.2	
Never	3,557	58.1	962	28.4		160	4.2	
Number of walking day a week					0.03			0.00
Nothing	1,123	17.5	343	32.5		86	7.2	
1-2	981	17.1	286	30.9		48	4.9	
3-4	1,126	19.9	280	26.1		47	4.2	
5-6	955	17.1	258	28.9		27	2.4	
Everything	1,633	28.4	429	28.1		79	4.6	
Working hours a week					<.001			<.001
Inoccupation	1,829	26.2	429	24.8		133	7.1	
1-39	1,504	25.6	387	27.1		75	4.8	
40-49	1,504	29.2	434	30.2		42	2.7	
50	981	18.9	981	36.1		37	4.1	
Total	5,818	100.0	1,596	29.1		287	4.7	

* Unit: hour
** %: Weighted vertical percent
*** %: Weighted horizontal percent

3.2 Association between Sleep duration and perceived stress and suicidal ideation

After adjusting for all of these factors, the odds of poor perceived stress in groups with weekday sleep duration of six hours or less was 1.348 times higher (95% Confidence Interval [CI] 1.126-1.615, p-value: 0.001) than that in groups with sleep duration of 7-8 hours on weekday. The odds of suicidal ideation in groups with weekend sleep duration of six hours or less was 1.682 times higher (95% Confidence Interval [CI] 1.042-2.712, p-value: 0.027) than that in groups with sleep duration of 7-8 hours on weekend (Table 2). In the subgroup analysis by gender, taking 7 hours of sleep as the reference category, we found that groups with sleep duration of six or less on weekday were positively associated with poor perceived stress in both males and the odds of suicidal ideation increased in females with six or less on weekend (Table 3). In the subgroup analysis by perceived stress, taking 7 hours of sleep as the reference category, we found that groups with sleep duration of six or less on weekend were positively associated with suicidal ideation in those without perceived stress (Table 4).

Table 2. Adjusted effect between Sleep duration and perceive stress and suicidal ideation

	Perceived Stress			Suicidal ideation		
	OR	95% CI		*OR*	95% CI	
Sleep Duration (weekday)*						
≤6	1.348	1.126	1.615	0.775	0.508	1.183
7-8	1			1		
≥9	1.007	0.748	1.356	0.941	0.522	1.695
Sleep Duration (weekend)*						
≤6	1.048	0.793	1.386	1.682	1.042	2.712
7-8	1			1		
≥9	0.948	0.785	1.146	0.983	0.601	1.609
Residential region						
Metropolitan	1			1		
Urban	0.935	0.756	1.155	1.271	0.773	2.089
Rural	0.995	0.821	1.205	1.259	0.839	1.890
Gender						
Male	1			1		
Female	1.562	1.312	1.859	1.564	0.922	2.653
Age						
18-29	3.533	2.226	5.606	0.550	0.231	1.309
30-39	2.954	2.029	4.302	0.877	0.411	1.873
40-49	1.828	1.291	2.588	0.516	0.250	1.062
50-59	1.733	1.249	2.404	0.984	0.578	1.675
60-69	0.983	0.730	1.323	1.411	0.927	2.146
≥70	1			1		
Household Income						
Low	1.280	0.988	1.659	1.969	1.157	3.350
Middle low	1.125	0.924	1.369	1.034	0.641	1.668
Middle high	1.004	0.827	1.219	0.694	0.410	1.175
High	1			1		
Education level						
≤ Elementary school	1.261	0.929	1.712	2.615	1.358	5.037
Middle school	0.905	0.666	1.230	2.102	1.151	3.840
High school	0.858	0.724	1.018	2.440	1.574	3.784
≥ College	1			1		
Spouse existence						
Yes	0.919	0.709	1.191	0.435	0.234	0.806
No	1			1		
Self-rated Health						
Good	1			1		
Normal	1.867	1.574	2.215	0.951	0.588	1.538
Bad	3.982	3.143	5.046	1.906	1.139	3.191
Perceived body shape						
Thin	1.075	0.864	1.337	0.854	0.545	1.338
Moderate	1			1		
Obese	1.309	1.130	1.516	0.951	0.662	1.365

	Perceived Stress			Suicidal ideation		
	OR	95% CI		*OR*	95% CI	
Alcohol use						
Never	1			1		
Drinker	1.164	0.915	1.482	1.160	0.672	2.004
Smoking status						
Smoker	1.368	1.078	1.737	2.195	1.309	3.682
Former smoker	1.255	1.011	1.559	1.555	0.892	2.708
Never	1			1		
Number of walking day a week						
Nothing	1.148	0.947	1.393	1.068	0.678	1.683
1-2	1.055	0.860	1.296	1.088	0.682	1.735
3-4	0.873	0.714	1.067	1.025	0.636	1.651
5-6	0.966	0.804	1.161	0.554	0.314	0.978
Everything	1			1		
Working hours a week						
Inoccupation	0.577	0.460	0.724	1.433	0.854	2.404
1-39	0.629	0.516	0.766	1.129	0.679	1.879
40-49	0.774	0.629	0.953	0.960	0.574	1.608
50	1					
Perceived Stress						
Yes				6.987	5.080	9.610
No				1		

Table 3. Stratified analysis by gender

	Perceived Stress				Suicidal ideation			
	OR	95% CI		P-value	*OR*	95% CI		P-value
Male								
Sleep Duration (weekday)*								
≤6	1.391	1.038	1.864	0.028	1.272	0.730	2.216	0.393
7-8	1				1			
≥9	1.186	0.765	1.839	0.444	1.139	0.456	2.843	0.780
Sleep Duration (weekend)*								
≤6	1.058	0.698	1.603	0.789	1.350	0.699	2.604	0.369
7-8	1				1			
≥9	1.019	0.765	1.357	0.896	0.860	0.384	1.925	0.712
Female								
Sleep Duration (weekday)*								
≤6	1.319	1.053	1.652	0.016	0.590	0.330	1.056	0.075
7-8	1				1			
≥9	0.863	0.612	1.218	0.401	0.870	0.415	1.826	0.712
Sleep Duration (weekend)*								
≤6	1.060	0.755	1.487	0.736	2.006	1.035	3.887	0.039
7-8	1				1			
≥9	0.941	0.742	1.195	0.618	1.037	0.562	1.913	0.907

* Adjusted for several basic characteristics, socio-economic status, health risk & behaviors factors.

Table 4. Adjusted effect between sleep duration and suicidal ideation by perceived stress

	Suicidal ideation							
	OR	95% CI		P-value	*OR*	95% CI		P-value
	With Perceived Stress				Without Perceived Stress			
Sleep Duration (weekday)*								
≤6	0.769	0.454	1.302	0.325	0.687	0.335	1.409	0.303
7-8	1				1			
≥9	0.949	0.432	2.082	0.895	0.817	0.312	2.138	0.679
Sleep Duration (weekend)*								
≤6	1.355	0.709	2.587	0.356	3.019	1.490	6.117	0.002
7-8	1				1			
≥9	0.795	0.419	1.510	0.481	1.537	0.726	3.253	0.259

* Adjusted for several basic characteristics, socio-economic status, health risk & behaviors factors.

4. Discussion

In this study considering the factors that could affect poor perceived stress and risk of suicidal ideation, weekday sleep short duration was significantly associated with poor perceived stress and weekend short sleep duration was significantly associated with the risk of suicidal ideation. In our stratified analysis, weekday short sleep duration was significantly associated with the poor perceived stress for both male and female and weekend short sleep duration was significantly associated with risk of suicidal ideation for female, but not in male.

Our findings suggest that men are the dominant source of income in patriarchal Korean society and reflect a busy Korean society. In particular, during the week, men's excessive work at work causes sleep deprivation, leading to increased perceived stress, and magnitude in perceived stress appears to be greater in men than in women.

In Korea, men are highly stressed due to the burdens of work achievement, tension and coping with changes (Han et al., 2002; Kim & Hong, 2022). In particular, due to the slow economic growth of our society and the economic recession, the workplace should experience socio-economic changes such as early retirement, unemployment, and promotion loss (Parish, 2013; Seo, Kim, & Jung, 2016). At the same time, they are under pressure to make money on the burden of economic support (Parish, 2013; Seo et al., 2016).

In addition, due to the change of work in the rapidly changing industrial society, perceived stress is increasing due to workplace crisis such as adaptation problems, competition between peers and juniors, and employment instability (Lee & Heo, 2015), There is a tendency to escape reality by causing negative emotions in men (Lee, 2016). In Korean society, many men tend to hide and tolerate their emotions when exposed to stressful situations, and they tend to rely on substances such as alcohol because of the myth of masculinity in the suppression of negative emotional expressions (Baek et al., 2014).

In particular, repeated exposure to stress can increase depression, lead to skepticism about self-existence, and can also act as a factor for suicidal ideation (Chang & Cha, 2013). Therefore, although

our study did not show any significant relationship with suicidal ideation, perceived stress management is important for reducing depression and suicidal ideation in men.

In addition, although Korean society has expanded women's social advancement more than in the past, the patriarchal Korean society is still in charge of not only social activities but also childcare and housework. This suggests that the lack of sleep duration can lead to suicidal behavior. The increase of women's social advancement led to the recognition of household sharing as a joint role of couples (Owens et al., 2017), but only 17.8% of husbands share the household fairly. In particular, according to the research by Jung et al study (Jung et al., 2015) As the working hours of men increased, male household participation and parenting participation was lower, indicating that the burden of domestic labor and parenting was higher for women.

A study in the Women's Family Division (Ministry of Gender Equality and Family, 2015) showed that although men's participation in domestic labor increased more and more, and that men in the working family were doing more domestic work than men in the non-working family, compared to the number of participants and the time required, women are still more involved in domestic work than man, and gender inequality is still very high.

This suggests that although men's expectations and perceptions of domestic labor and parenting have changed rapidly, men's participation rate is still sluggish and the primary responsibility for parenting remains with women. Therefore, this suggests that policy efforts are needed to raise the awareness of domestic labor and childcare sharing as women expand their social advancement.

This is exploratory study to explore the associations between weekday and weekend sleep duration and perceived stress and suicidal ideation among Korean general adults' population, and the present study has several limitations that are worth noting. First, due to the cross-sectional nature of the data, no causal inference or mechanistic conclusions can be drawn from findings regarding the observed associations between sleep duration and perceived stress and suicidal ideation. Also, there are possibilities of correlations of variables due to methodological limitations of its cross-sectional design putting together the sampling pool based on the variables of population being studied. Third, we used a structured self-rating questionnaire to collect data; although self-reporting is a common and accepted method, we could not completely rule out the possibility of recall bias. Fourth, sleep duration, perceived and suicidal ideation were measured by single items instead of using standard scales. Future studies should use standard scales to measure sleep duration, perceived stress, and suicidal ideation.

5. Conclusion

In conclusion, poor sleep duration appears to be closely associated with poor perceived stress and suicidal ideation. Based on the findings of our study, effective prevention and intervention programs should be established. First, those who reported short sleep are suggested to be educated to improve their awareness of the serious consequences of sleep problems and be provided treatments services to help them restore normal sleep. Second, reasonable working time is also recommended at work and home. Third, we should pay close attention to the those who have poor perceived

stress and suicidal ideation. Future studies utilizing valid and comprehensive measures of sleep may be particularly valuable to evaluate the health risks associated with unhealthy sleep and further longitudinal studies are warranted to gain a better understanding of the interaction between sleep patterns and health status in Korean general adults' population.

Conflicts of interest

No author has any financial or other conflict of interest to declare.

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