

Mental Health Status of Korean Adolescents according to Daily Sleep Time and Subjective Sleep Satisfaction

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ABSTRACT

Objectives : Insufficient sleep could have harmful effects on mental health. We examined the mental health status of Korean adolescents according to daily sleep time and subjective sleep satisfaction using a nationwide representative sample of Korean adolescents.

Methods : Data from the 2016 Korean Youth Risk Behavior Web-based Survey was used. Sleep duration on weekdays and subjective sleep satisfaction during the past week were asked. Participants' perceived health, happiness, stress, depressive mood, and suicidality during past 12 months were also investigated. Participants were classified by mean duration of daily sleep time and the level of sleep satisfaction, and the odds of having mental health problems were compared.

Results : Compared to adolescents who slept more than 6 hours per day and satisfied with their sleep, adolescents who slept less than 6 hours per day and/or dissatisfied with their sleep were less likely to perceive themselves healthy and happy. They were also more likely to have severe stress, depressive mood, and suicidality, with highest odds ratios among adolescents with both short and dissatisfying sleep.

Conclusions : Given the significant associations between sleep insufficiency and mental health problems, attention to the sleep shortage among Korean adolescents is needed. Prospective studies are warranted to elucidate the causal relationships between subjective and objective sleep insufficiency and psychiatric conditions.

KEY WORDS : Adolescents · Behavior · Depression · Suicidal ideation · Sleep satisfaction.

INTRODUCTION

Sleep is an essential component of life. The importance of sleep for health and quality of life has been emphasized.^{1,2)} Sleep is associated with subjective satisfaction, objective time, efficiency, and awakening during day time.³⁾ Sufficient sleep can be defined in various ways including objective sleep measures and subjective sleep satisfaction. To date, research on insufficient sleep has been reported mainly in the domain of objective sleep time and subjective sleep satisfaction.

The time of sufficient sleep in the objective domain may

vary with age. The National Sleep Foundation (NSF) has recommended a sleeping time of 14–17 hours for newborns, 8–10 hours for adolescents, 7–9 hours for adults, and 7–8 hours for seniors.⁴⁾ However, sleeping time in adolescents is actually much lower than that in other age groups due to academic and entertainment reasons.⁵⁾ In addition, there might be some individual differences in sufficient sleep time. It has been reported that short sleepers are satisfied with 4 hours of sleep, while long sleepers are satisfied with sleep more than 10 hours.^{6,7)} Thus, it is hard to find an absolute standard time for sufficient sleep. On the other hand, sleep satisfaction in the subjective domain also has been hard to measure because

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it includes a wide range of sleep quality.^{8,9)} Therefore, in order to determine the sufficient sleep, it is necessary to evaluate the subjective sleep satisfaction as well as the objective sleep time.

Previous studies have shown that short sleep time and sleep dissatisfaction are associated with physical and mental problems. Several studies have also reported that cardiovascular disease, obesity, depression, learning difficulty and memory problems in adults are associated with sleep deprivation (less than 7–8 hours for 24 hours).^{10–12)} Short sleep time and sleep dissatisfaction in adolescents are also associated with hypertension, obesity, depression, and suicidal idea.^{13,14)} Association between sleep and adolescent suicidal behavior has been reported, highlighting the potential role of sleep intervention in the prevention of adolescent suicide.¹⁵⁾

Adolescence is a transitional stage of physical and psychological development generally confined to the period from puberty to adulthood. Sleep during this period can have many effects on physical, mental, and social development.^{16–19)} Furthermore, insufficient sleep in adolescents due to schooling might persist, leading to sleep disturbances. Few studies have evaluated complex effects of objective and subjective sleep on adolescents. Epidemiological studies on the relationship between mental health status and sleep of adolescents are also insufficient. Therefore, the purpose of this study was to investigate independent and complex effects of objective and subjective sleep on mental health status of adolescents in South Korea.

METHODS

This study used data from the 2016 Korea youth behavior web-based survey (KYBRS).²⁰⁾ The study population was a nationwide sample population extracted from middle and high school students. Sampling was performed using a systematic method for middle and high school students to stratify the population in order to minimize sampling error. All subjects read the explanation of the survey. A total of 65,528 students from 400 junior high schools and 400 high schools participated in this study. The response rate was 96.4%. Their average age was 14.99 ± 1.74 (SD) years (range, 12 to 18 years). Online surveys of health behavior of young people were conducted under the approval of the Institutional Review Committee of Korea Centers for Disease Control and Prevention (2014-06 EXP-02-P-A).

1. Measurements

1) Sleep time and sleep satisfaction

Mean sleep time on weekdays was evaluated through the

following questions : “What time did you usually go to bed and wake up on weekdays for the recent seven days? (___ hour ___ minutes, each).” According to these answers (go to bed time and wake up time), daily sleep time was calculated. Previous studies in adolescents have reported that sleep time of less than 6 hours in 24 hours can have adverse health effects.^{21–23)} Especially, sleep time of adolescent in Korea is 5.7 hours on average, which has much lower sleep time compared to Australia and Germany, which is an average of 8 hour.^{24–26)} Therefore, answers were classified into two groups according to weekday sleep time less than 6 hours and more than 6 hours. Perceived sleep satisfaction was assessed with the following questions : “Do you think that you get adequate sleep to recover from fatigue?” Response options included very satisfactory 1), satisfactory 2), average 3), unsatisfactory 4), and very unsatisfactory 5). These answers were further classified into two groups : above average sleep satisfaction group (response options 1–2 : satisfactory sleep) and average or below average sleep satisfaction group (response options 3–5 : dissatisfactory sleep). To examine the combined effect of sleep time and sleep satisfaction, variables were combined and participants were classified into four groups : 1) satisfactory sleep with sleep time ≥ 6 h ; 2) satisfactory sleep with sleep time < 6 h ; 3) dissatisfactory sleep with sleep time ≥ 6 h ; and 4) dissatisfactory sleep with sleep time < 6 h.

2) Mental health

Perceived health was evaluated with the following question : “How healthy do you usually feel?” Response options were : 1) very healthy, 2) healthy, 3) average, 4) unhealthy, and 5) very unhealthy. Respondents were categorized into two groups : above-average health group (response options 1–2) and average or below average health group (response options 3–5). Perceived happiness was evaluated with the following question : “How happy do you usually feel?” Response options were : 1) very happy, 2) happy, 3) average, 4) unhappy, and 5) very unhappy. Based on their answers, respondents were categorized into two groups : above average happiness group (response options 1–2) and average or below average happiness group (response options 3–5). Perceived stress was assessed with the following question : “How stressful do you usually feel?” Response options were : 1) very much, 2) quite much, 3) average, 4) not so much, and 5) not at all. Respondents were categorized into two groups : above-average stress group (response options 1–2) and average or below average stress group (response options 3–5). Depressive mood for the last 12 months was evaluated with the following question : “Have you experienced sadness or despair to the degree that

stopped your daily routine for two weeks in the past 12 months?” Suicidality was assessed with the following questions : “Have you ever thought about committing a suicide in the past 12 months?”, “Have you ever planned a suicide in detail in the past 12 months?”, and “Have you ever attempted a suicide in the past 12 months?” Response option for these questions was “yes” or “no”.

2. Covariates

Socio-demographic variables such as sex, age, residential area, residential type (i.e., residence with family, with relatives, with friends/alone/in a dormitory, and in a facility), socio-economic status [i.e., high 1), high-middle 2), middle 3), low-middle 4), and low 5)], presence or absence of part-time job, the degree of academic achievement [i.e., high 1), high-middle 2), middle 3), low-middle 4), and low 5)] were investigated. Among them, socioeconomic status and academic achievement were reclassified into three groups : high 1), middle (2–4), and low 5) for statistical analysis.

3. Statistical analysis

For socio-demographic characteristics, means were calculated for continuous variables while frequencies (%) were calculated for categorical variables. Participants were categorized according to sleep time and satisfaction. Groups differences in socio-demographic characteristics were compared using Analysis of Variance (ANOVA) for continuous variables and chi-square test for categorical variables. To clarify the relationship of sleep time and satisfaction with mental health status, binary logistic regression analysis was performed. Each mental health problem was used as a main outcome variable. We calculated-both adjusted and non-adjusted odds ratio (OR) and 95% confidence intervals (CIs) to determine significance in difference between groups. The group with satisfactory sleep and sleep time ≥ 6 h was defined as the control group. Additionally, to investigate independent association of sleep time and sleep satisfaction with mental health status, logistic regression analyses also were performed using sleep time (or sleep satisfaction) as a main independent variable. Statistical analysis was performed using SAS version 8.02 (SAS institute Inc, Cary, NC, USA). Statistical significance level was set at $p < 0.05$. The 2016 Korea youth behavior web-based survey (KY-BRS),²⁰ the data we used, was analyzed by population parameters, clustering, stratification, and sample weights, which were calculated based on probability of distribution by region, sex, grade, and school type according to national statistics of middle- and high- school student population.

RESULTS

Of 65,528 subjects, 25,714 (39.2%) reported satisfactory sleep with sleep time ≥ 6 h, 12,485 (19.1%) reported satisfactory sleep with sleep time < 6 h, 10,437 (15.9%) reported, depression, suicidal ideation, and dissatisfactory sleep with sleep time ≥ 6 h, and 16,892 (25.8%) reported dissatisfactory sleep with sleep time < 6 h. Sociodemographic characteristics were age, sex, area of residence, type of living, socio-economic status, having a part-time job and academic achievement. Data were analyzed by ANOVA with post hoc test. There were significant differences in sociodemographic characteristics of age, sex, area of residence, type of living, SES, having a part-time job and academic achievement among the four groups according to sleep time and satisfaction. (Table 1)

Compared to participants who reported satisfactory sleep with sleep time ≥ 6 h, the other three groups were more likely to report stress, depression, suicidal ideation, suicidal plan, and suicidal attempt. Those in the dissatisfactory sleep group with sleep time < 6 h had the highest ORs of having stressful feeling suicidal plan, and suicidal attempt [ORs (95% CI) : 3.68 (3.51–3.85), 2.66 (2.55–2.79), 2.64 (2.47–2.82), 2.25 (2.04–2.49), and 2.46 (2.16–2.82), respectively]. However, those in the satisfactory sleep group with sleep time < 6 h had the lowest ORs of having stressful feeling, depressive mood, suicidal ideation, suicidal plan, and suicidal attempt [ORs (95% CI)= 1.34 (1.27–1.40), 1.35 (1.28–1.42), 1.37 (1.27–1.48), 1.49 (1.32–1.68), and 1.57 (1.33–1.84), respectively]. Compared to participants who reported satisfactory sleep with sleep time ≥ 6 h, the other three groups were less likely to feel healthy and happy. The dissatisfactory sleep group with sleep time < 6 h had the lowest ORs of feeling to feel healthy and happy [ORs (95% CI) : 0.43 (0.41–0.45) and 0.38 (0.36–0.40), respectively], while the satisfactory sleep group with sleep time < 6 h had the highest ORs of feeling healthy and happy [ORs (95% CI) : 0.82 (0.78–0.87) and 0.77 (0.73–0.81), respectively]. These results generally remained even after controlling for socio-demographic variables shown in Table 1 (Table 2). Additional analyses were performed on variables such as perceived health, perceived happiness and perceived stress to confirm results of changing average points with above-average or average and below average health groups. Results in Table 2 generally remained after recategorizing with differently included average (Supplementary Table 1 in the online-only Data Supplement).

Table 3 showed independent association of sleep time or sleep satisfaction with mental health status. Those with sleep time < 6 h had higher ORs of having stressful feeling, de-

Table 1. Socio-demographic characteristics of participants according to daily sleep time and subjective sleep satisfaction

	Sleep time \geq 6hr/ sleep satisfaction	Sleep time < 6hr/ sleep satisfaction	Sleep time \geq 6hr/ sleep dissatisfaction	Sleep time < 6hr/ sleep dissatisfaction	ANOVA <i>p</i> value
	N=25,714	N=12,485	N=10,437	N=16,892	
	Weighted	Weighted	Weighted	Weighted	
	N=1,208,698	N=623,771	N=494,630	N=858,613	
Age (years), mean (95%CI)	14.51 (14.46–14.55)	15.44 (15.39–15.49)	14.89 (14.83–14.94)	15.86 (15.82–15.90)	<0.0001*
Sex (%)					
Male	60.95	54.34	49.76	39.56	<0.0001*
Female	39.05	45.66	50.24	60.44	
Area of residence (%)					
Large city	41.38	46.73	39.13	46.00	<0.0001*
Small city	52.03	48.13	53.29	49.68	
Rural	6.59	5.13	7.58	4.31	
Type of living (%)					
With family	97.37	94.40	95.91	93.44	<0.0001*
With relatives	0.57	1.25	0.59	0.84	
With friend/alone/in a dormitory	1.68	3.73	3.14	5.23	
In a facility	0.38	0.62	0.36	0.49	
Socio-economic status (%)					
High	10.97	10.57	7.64	8.10	<0.0001*
Middle	87.05	86.68	89.09	87.74	
Low	1.98	2.75	3.27	4.16	
Having a Part-time job	9.51	13.02	14.77	16.12	<0.0001*
Academic achievement (%)					
High	13.46	12.23	13.14	12.77	<0.0001*
Middle	77.71	77.64	75.76	75.58	
Low	8.83	10.12	11.10	11.65	

* : post hoc test : all group were significantly different

Table 2. Mental health status of participants according to daily sleep time and subjective sleep satisfaction

Dependent variable	Sleep time < 6hr/ sleep satisfaction versus Ref.		Sleep time \geq 6hr/ sleep dissatisfaction versus Ref.		Sleep time < 6hr/ sleep dissatisfaction versus Ref.	
	UOR (95% CI)	AOR (95% CI)	UOR (95% CI)	AOR (95% CI)	UOR (95% CI)	AOR (95% CI)
Perceived health (%)	0.82 (0.78–0.87)	0.93 (0.88–0.98)	0.49 (0.46–0.51)	0.53 (0.51–0.56)	0.43 (0.41–0.45)	0.54 (0.51–0.56)
Perceived happiness (%)	0.77 (0.73–0.81)	0.85 (0.81–0.90)	0.45 (0.43–0.48)	0.49 (0.46–0.52)	0.38 (0.36–0.40)	0.45 (0.43–0.47)
Perceived stress (%)	1.34 (1.27–1.40)	1.26 (1.20–1.32)	2.72 (2.58–2.85)	2.54 (2.41–2.67)	3.68 (3.51–3.85)	3.27 (3.12–3.43)
Depressive mood (%)	1.35 (1.28–1.42)	1.25 (1.18–1.32)	2.02 (1.92–2.13)	1.87 (1.78–1.96)	2.66 (2.55–2.79)	2.29 (2.18–2.40)
Suicide idea (%)	1.37 (1.27–1.48)	1.36 (1.26–1.48)	2.19 (2.04–2.35)	2.10 (1.96–2.26)	2.64 (2.47–2.82)	2.55 (2.37–2.74)
Suicide plan (%)	1.49 (1.32–1.68)	1.53 (1.35–1.73)	1.69 (1.47–1.93)	1.70 (1.48–1.95)	2.25 (2.04–2.49)	2.40 (2.15–2.68)
Suicide attempt (%)	1.57 (1.33–1.84)	1.61 (1.36–1.91)	1.90 (1.60–2.24)	1.87 (1.57–2.22)	2.46 (2.16–2.82)	2.54 (2.19–2.96)

Independent variable=group according to sleep time and satisfaction. Ref. : reference group, sleep time \geq 6h/sleep satisfaction was used as reference group. CI : confidence interval, UOR : unadjusted odds ratio, AOR : adjusted odds ratio, with adjustment for age, sex, area of residence, type of living, socio-economic status, having a part-time job and academic achievement.

pressive mood, suicidal ideation, suicidal plan, and suicidal attempt [ORs (95% CI)=1.77 (1.70–1.83), 1.62 (1.56–1.68), 1.57 (1.49–1.65), 1.61 (1.49–1.75), and 1.66 (1.50–1.83), respectively] than those with sleep time \geq 6h. The dissatisfactory sleep group also had higher ORs of having stressful feeling, depres-

sive mood, suicidal ideation, suicidal plan, and suicidal attempt [ORs (95% CI)=2.97 (2.87–3.08), 2.17 (2.10–2.25), 2.20 (2.09–2.31), 1.76 (1.62–1.90), and 1.90 (1.70–2.10), respectively] than the satisfactory sleep group. These results generally remained even after controlling for sleep time, sleep satisfac-

Table 3. Association of sleep time and sleep satisfaction with mental health status

Dependent variable	Sleep time \geq 6hr versus sSleep time $<$ 6hr		Sleep satisfaction versus sleep dissatisfaction	
	UOR (95% CI)	AOR* (95% CI)	UOR (95% CI)	AOR† (95% CI)
Perceived health (%)	0.70 (0.68–0.73)	0.97 (0.93–1.00)	0.48 (0.47–0.50)	0.55 (0.53–0.58)
Perceived happiness (%)	0.65 (0.63–0.67)	0.88 (0.85–0.92)	0.44 (0.43–0.46)	0.51 (0.49–0.53)
Perceived stress (%)	1.767 (1.70–1.83)	1.27 (1.23–1.32)	2.97 (2.87–3.08)	2.57 (2.48–2.66)
Depressive mood (%)	1.62 (1.56–1.68)	1.24 (1.19–1.29)	2.17 (2.10–2.25)	1.85 (1.78–1.92)
Suicide idea (%)	1.57 (1.49–1.65)	1.28 (1.21–1.35)	2.20 (2.09–2.31)	1.98 (1.88–2.09)
Suicide plan (%)	1.61 (1.49–1.75)	1.47 (1.34–1.61)	1.76 (1.62–1.90)	1.63 (1.49–1.78)
Suicide attempt (%)	1.66 (1.50–1.83)	1.47 (1.31–1.66)	1.90 (1.70–2.10)	1.71 (1.51–1.92)

AOR* : adjusted odds ratio, with adjustment for for age, sex, area of residence, type of living, socio-economic status, having a part-time job, academic achievement, and sleep satisfaction. AOR† : adjusted odds ratio, with adjustment for for age, sex, area of residence, type of living, socio-economic status, having a part-time job, academic achievement and sleep time. CI : confidence interval, UOR : unadjusted odds ratio

tion and socio-demographic variables shown in Table 1 (Table 3)

DISCUSSION

The purpose of this study was to investigate the complex effect of sleep time and satisfaction on mental health status of Korean adolescents. In the current study, insufficient sleep was highly prevalent in Korean adolescents. In a Finnish study on more than 12,000 subjects, the prevalence of insufficient sleep defined as difference of one hour between self-reported sleep and sleep length was 20.4%.²⁷⁾ Results of our study showed that 25.8% of participant experienced insufficient sleep in both sleep time and sleep satisfaction. The high prevalence of insufficient sleep in Korea adolescents reflects Korea's excessive academic pressure.

In addition, this study compared socio-demographic characteristics of four groups according to sleep time and sleep satisfaction. According to objective and subjective sleep domain, these four groups showed significant differences in age, sex, area of residence, type of living, SES, and academic achievement. Consistent with our study results, one meta-analysis has shown a relationship between age and sleep time, revealing that adolescents with short sleep time have older age.²⁸⁾ Interestingly, the prevalence of depression in adolescents also increases with age.²⁹⁾ In the present study, this finding that the short sleep group was older adolescents might have affected poorer mental health, such as depression, even though we adjusted for age. Gender difference in our study describe that male's sleep is better than female. It may be considered that the reason for this difference has been reported to be that female are more likely to be negative when assessing their health than male.³⁰⁾ Some previous studies have also shown that there is a significant relationship between low socio-economic status and depression.^{31,32)} Thus, SES difference in insufficient sleep may be explained by depression, although we adjusted for socioeconomic status. However, these findings suggest that differences in socio-demographic characteristics should be considered when determining effects of sleep time and sleep satisfaction on health status.

The main finding of our study was that short sleep time and sleep dissatisfaction were associated with poorer mental health status. The dissatisfactory sleep group with sleep time $<$ 6h was found to have the poorest mental health whereas the satisfactory sleep group with sleep time \geq 6h was found to have the best mental health. The OR pattern was overwhelmingly positive (OR values $>$ 1.0) for stress, depression, suicidal ideation, suicidal plan, and attempt. These results were also significant when covariates were corrected. Results of the present study are consistent with results of prior studies reporting that sleep problem is significantly associated with depression in adolescence, showing significant correlation with suicide.^{33,34)} Thus, it is important to recognize and manage sleep problem appropriately.

It is notable that the satisfactory sleep group with sleep time $<$ 6h had lower OR values than the dissatisfactory sleep group with sleep time \geq 6h for having stress, depression, suicidal ideation, suicidal plan, and suicidal attempt. These results indicate that subjective sleep satisfaction might have greater impact on mental health than objective sleep time. In previous studies, sleep dissatisfaction has been found to be associated with depression and poor academic performances of adolescents whereas sleep time is not associated with adolescent mental health or academic function.^{35,36)} Previous study on adolescents in Japan has also shown a positive correlation between subjective sleep and mental health status assessed by a 12-item General Health Questionnaire, although sleep time and mental health status have a U-shaped relationship.³⁷⁾ In a

study on older population (range : 62–100 years), sleep complaint also has been found to be a much better marker of mental health status measured by Mental Component Summary (MCS) than sleep time.³⁸⁾

This study has several limitations. First, sleep time was self-reported by respondents. It was not recorded as a sleep polygraph. However, It has been reported there was a moderate correlation between the recorded sleep time and the reported sleep time.^{39,40)} Self-reported questionnaire data also has been widely used in large epidemiological surveys. Second, we did not use standardized measurement tools. Instead, we only used a single-item questionnaire to measure sleep satisfaction, stress, depressive mood, and suicidality. Finally, the cross-sectional design of this study made it impossible to infer causality. Therefore, prospective studies with a standardized measurement of sleep and mental health status are needed in the future.

CONCLUSIONS

Korean adolescents stay up late doing coursework and are exposed to excessive stresses in the competitive society. They are suffering from insufficient sleep, which represent a burden for mental health. Our study results indicated that sleep insufficiency, in particular subjective sleep dissatisfaction was significantly associated with various mental health problems such as depression and suicidal ideation. Therefore, more attention should be paid to subjective sleep satisfaction as well as objectively insufficient sleep of adolescents in order to prevent mental health problems.

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Conflicts of Interest

The authors have no financial conflicts of interest.

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