

Association between alcohol consumption and sleep difficulty in a nationwide Korean survey

In Cheol Hwang^{1*}, Yujin Park^{2*}, Hong Yup Ahn³, Kwan Jung Kim⁴, So-Jung Park⁵

¹Department of Family Medicine, Gil Medical Center, Gachon University College of Medicine, Incheon, Korea, ²Healthcare Data Center, Kangbuk Samsung Hospital, Sungkyunkwan University School of Medicine, Seoul, South Korea, ³Department of Statistics, Dongguk University, Seoul, Korea, ⁴Business Strategy Department, DKI Technology, Inc, Seoul, Korea, ⁵Department of Family Medicine, National Cancer Center, Goyang-si, Korea

* These are co-first authors.

Background: The data on the association between alcohol intake and sleep quality in a community-based setting are lacking. This study examined overall sleep difficulty according to alcohol habits among Korean adults. **Materials and Methods:** We analyzed data from 4937 adults who responded to questions about sleep difficulty and drinking habits from the 2019 Korea National Health and Nutrition Examination Survey. Multivariate logistic regression analyses were used to calculate the odds ratios (ORs) and 95% confidence intervals (CIs) for substantial sleep difficulty based on the frequency or amount of alcohol consumption in total and age- and sex-stratified subgroup analyses. **Results:** Approximately 8.5% of the study population had substantial sleep difficulty. Individuals who drank <1 per week (frequency) or 1–2 cups per time (amount) had the lowest prevalence of substantial sleep difficulty, even compared with nondrinkers. Among drinkers, the association between alcohol use and sleep difficulty was significant in a dose-dependent manner (*P* for trend: 0.003 in frequency and < 0.001 in amount). Subgroup analysis revealed that significant linear relationships were robust for adults aged <50 years ([ORs] 1.20 [95% CIs 1.03–1.40] for frequency and 1.25 [1.10–1.42] for amount) and females (1.26 [1.10–1.44] for amount). **Conclusion:** Alcohol consumption is associated with increased sleep difficulties, especially in younger adults and women, underscoring the need for targeted interventions and in-depth research on the effects of alcohol on sleep.

Key words: Alcohol consumption, cross-sectional study, public health, sleep quality

How to cite this article: Hwang IC, Park Y, Ahn HY, Kim KJ, Park SJ. Association between alcohol consumption and sleep difficulty in a nationwide Korean survey. *J Res Med Sci* 2024;29:73.

INTRODUCTION

Sleep problems are of increasing public concern globally because they are associated with an increased risk of serious medical conditions (e.g., cardiovascular disease and certain cancers) and emotional and cognitive function impairments, significantly harming both individuals and the social economy.^[1] Globally, approximately 10% of adults are affected by an insomnia disorder, with another 20% experiencing occasional insomnia symptoms.^[2] According to the recent data, the number of patients treated for sleep disorders in South Korea increased by an average of 4.7% per year from 2018 to 2022, while the average treatment cost per patient increased by 8%

per year.^[3] Insomnia is associated with several factors, including chronic alcohol consumption.^[2] In addition, the proportion of high-risk drinkers – defined as those consuming seven or more drinks per occasion at least twice a week – increased from 12.6% in 2019 to 14.2% in 2022,^[4] which may further influence the prevalence and severity of sleep disturbances.

Emerging evidence suggests that alcohol consumption can significantly disrupt the sleep architecture and efficiency. Alcohol reduces sleep onset latency and the percentage of rapid eye movement sleep during the total sleep period and increases the frequency of waking during sleep.^[5] Sleep

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DOI:

10.4103/jrms.jrms_805_23

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Address for correspondence: Prof. So-Jung Park, 323 Ilsan-ro, Ilsandong-gu, Goyang-si 10408, Gyeonggi-do, Korea.

E-mail: caleb@ncc.re.kr

Submitted: 08-Dec-2023; **Revised:** 17-Jul-2024; **Accepted:** 29-Aug-2024; **Published:** 31-Dec-2024

disturbance by alcohol consumption has also been linked to circadian rhythm abnormalities. Animal studies indicate that alcohol disrupts circadian timing through its effects on photic and nonphotic phase resetting.^[6] In healthy adults, alcohol consumption has been shown to blunt the overall normal diurnal variation in core body temperature rhythm^[7] and decrease salivary melatonin levels.^[8] Poor sleep quality can also contribute to increased alcohol use as a coping mechanism. In the United States, approximately 1 of every 10 adults reports using alcohol as a means to manage symptoms of insomnia.^[9] This complex interaction underscores the importance of considering both sleep and alcohol consumption in discussions about physical and mental health.

The relationship between alcohol consumption and poor sleep health has been documented in most epidemiologic reports on this issue;^[10] however, these reports were mostly limited by a small sample size^[11] or by focusing on a specific high-risk population for sleep problems (e.g. older adults)^[12] or specific type of sleep disorder.^[13] There is a lack of data on the association between alcohol intake and sleep quality in community populations. Thus, we examined the association between alcohol intake and sleep quality in a nationwide sample of Korean adults, ensuring control over various sleep-affecting factors, to comprehensively understand this relationship.

MATERIALS AND METHODS

Study design and participants

This retrospective, cross-sectional study analyzed data from the 2019 Korea National Health and Nutrition Examination Survey (KNHANES). The KNHANES is a nationally representative annual survey that uses multistage probability sampling to target noninstitutionalized Korean resident citizens. Data collection, encompassing health behavior surveys, health-related interviews, health examinations, and nutrition surveys, was conducted by the Division of Chronic Disease Surveillance of the Korea Disease Control and Prevention Agency. Further detailed information regarding the KNHANES has been published previously.^[14]

Of the 8110 participants in the 2019 KNHANES, the present study included 5500 individuals aged 19 years or older with available data on both sleep difficulties and drinking habits. After excluding individuals undergoing treatment for depression and those diagnosed with critical illnesses (e.g., myocardial infarction, stroke, or cancer), 4937 subjects were included in the final analysis.

Primary outcome

In 2019, KNHANES introduced the sleep difficulty variable, measured using an item from the Korean Health-related Quality of Life Instrument with 8 Items (HINT-8), which

consists of eight items. The HINT-8 is a valid and reliable tool for assessing the health-related quality of life of Koreans.^[15] Participants rated their sleep difficulty during the previous week on a Likert scale from 1 to 4 points, with the options being: “none at all,” “mild,” “moderate,” or “severe.” Higher scores indicate greater sleep difficulty. We considered responses of “moderate” or “severe” as indicative of substantial sleep difficulty.^[16]

Alcohol consumption assessment

Information on alcohol consumption was gathered through a health-behavior survey. The survey included specific questions regarding the frequency of alcohol consumption of any kind in the past year. Participants were asked to select from the following categories: “Never drank alcohol in the past year,” “<1 time per month,” “1 time per month,” “2–4 times per month,” “2–3 times per week,” or “≥4 times per week.” The amount of alcohol consumption was additionally categorized as “1–2 cups,” “3–4 cups,” “5–6 cups,” “7–9 cups,” or “≥10 cups” a time.

Measures

Information on demographics (including age, sex, economic status, EuroQol 5-Dimension [EQ-5D] questionnaire, educational attainment, and marital status), health-related behaviors besides drinking (obesity, current smoking, and aerobic exercise), history of physician-diagnosed diseases (hypertension and type 2 diabetes), depressive mood, and sleep duration were collected during interviews. The interviews were conducted and recorded by trained staff members, such as physicians, medical technicians, and health interviewers, either at a mobile examination center or in each household.^[14] “Low income” was defined as an income less than the median household income,^[17] and “unmarried” individuals included those who were single or separated for any reason. Obesity was defined as a body mass index ≥ 25 kg/m²,^[18] and aerobic exercise as ≥ 2.5 h/week of moderate-intensity activity, ≥ 1.25 h/week of high-intensity activity, or a combination of activities.^[19] In the question on depressive mood, participants were asked to respond “yes” if they felt depressed for more than two consecutive weeks. Health-related quality of life was measured using the EQ-5D. The participants were required to self-report their current health status ranging from 1 to 3 points: “no problem,” “some problems,” or “severe problems.” The EQ-5D consists of five items concerning health status: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. We used the EQ-5D index with a Korean estimated weighted quality value scoring system,^[20] which ranges from –1 (worst health status) to 1 (perfect health status).

Statistical analysis

We calculated descriptive statistics using *t*-tests, ANOVA, or Chi-squared tests and presented them as mean \pm standard

deviation or number (percentage). While considering covariates, we calculated the odds ratios (ORs) and 95% confidence intervals (CIs) for substantial sleep difficulty according to drinking frequency and amount. Analyses were performed using Stata/MP version 17.0 (Stata Corp., College Station, TX, USA). All statistical tests were two sided, and $P < 0.05$ was considered statistically significant.

RESULTS

A total of 4937 participants aged ≥ 19 years were included in this study. Among them, 416 participants (approximately 8.5%) had substantial sleep difficulty. Table 1 shows the characteristics of participants according to sleep difficulty. The mean ages of participants with and without substantial sleep difficulties were $51.8 (\pm 18.6)$ and $48.6 (\pm 16.1)$ years, respectively. Individuals with substantial sleep difficulties reported shorter sleep durations and lower EQ-5D index (6.2 ± 1.8 h and 0.894 ± 0.160 , respectively) than those without sleep difficulties (7.0 ± 1.2 h and 0.961 ± 0.081 , respectively). In addition, participants with sleep difficulties were more likely to have more comorbidities, lower socioeconomic status, and were more often women, unmarried, depressed, and current smokers than those without sleep difficulties.

Approximately 8.5% of the study population had substantial sleep difficulty. We found J-shaped patterns in the participants' drinking habits [Figure 1]. Individuals who drank < 1 time per month (frequency) or 1–2 cups a time (amount) had the lowest prevalence of substantial sleep difficulty, notably even lower than that of nondrinkers. Table 2 presents the

association between alcohol consumption and substantial sleep difficulty, with ORs and 95% CIs revealing patterns similar to those shown in Figure 1. Individuals consuming alcohol ≥ 4 times per week had the highest OR among drinkers (OR [95% CI]: 1.28 [1.11–1.47]). Those drinking 5–6 cups a time had the highest OR (1.32 [1.05–1.63]), followed by the group consuming ≥ 10 cups (1.24 [1.09–1.41]). Unexpectedly, nondrinkers had higher ORs than the reference groups for drinkers (1.41 [0.96–2.07] in frequency and 1.38 [0.98–1.95] in amount). Among drinkers, the relationships between drinking frequency/amount and sleep difficulty were significant in a dose-dependent manner (R^2 [P for trend]: 0.138 [0.003] in frequency and 0.140 [< 0.001] in amount).

Table 3 shows the results of the association between alcohol consumption and sleep difficulty stratified by age and sex. Those linear relationships were robust in the groups aged < 50 years (1.20 [1.03–1.40] in frequency and 1.25 [1.10–1.42] in amount) and females (1.26 [1.10–1.44] in amount). The remaining groups showed a linear relationship as well, even though it was not statistically significant.

DISCUSSION

In this nationally representative study, we found that alcohol consumption was associated with substantial sleep

Table 1: Characteristics of participants by sleep difficulty

	Substantial sleep difficulty		P
	No (n=4521)	Yes (n=416)	
Demographics			
Age (years)	48.6 \pm 16.1	51.4 \pm 18.6	0.001
Women	2,332 (51.6)	259 (62.3)	<0.001
Low income (median)	1770 (39.3)	227 (54.7)	<0.001
Low education level (middle school or less)	883 (20.4)	144 (36.9)	<0.001
Unmarried	1324 (29.3)	179 (43.0)	<0.001
Health-related behaviors			
Obesity ^a	1539 (34.0)	153 (36.8)	0.260
Current smoking	869 (19.2)	104 (25.0)	0.005
Aerobic exercise ^b	1,978 (45.7)	159 (40.8)	0.061
Comorbidities			
Hypertension	915 (20.2)	124 (29.8)	<0.001
Type 2 diabetes	348 (7.7)	46 (11.1)	0.016
EQ-5D	0.961 (0.081)	0.894 (0.160)	<0.001
Depressive mood	354 (7.8)	105 (25.2)	<0.001
Sleep duration (h)	7.0 \pm 1.2	6.2 \pm 1.8	<0.001

^aBMI ≥ 25 kg/m² according to Asia-Pacific criteria; ^b ≥ 2.5 h/week moderate-intensity activity, ≥ 1.25 h/week high-intensity activity, or a considered combination of activities, as suggested by the Korea National Health and Nutrition Examination Survey. Data are presented as mean \pm SD or n (%). EQ-5D=EuroQol 5-dimension; BMI=Body mass index; SD=Standard deviation

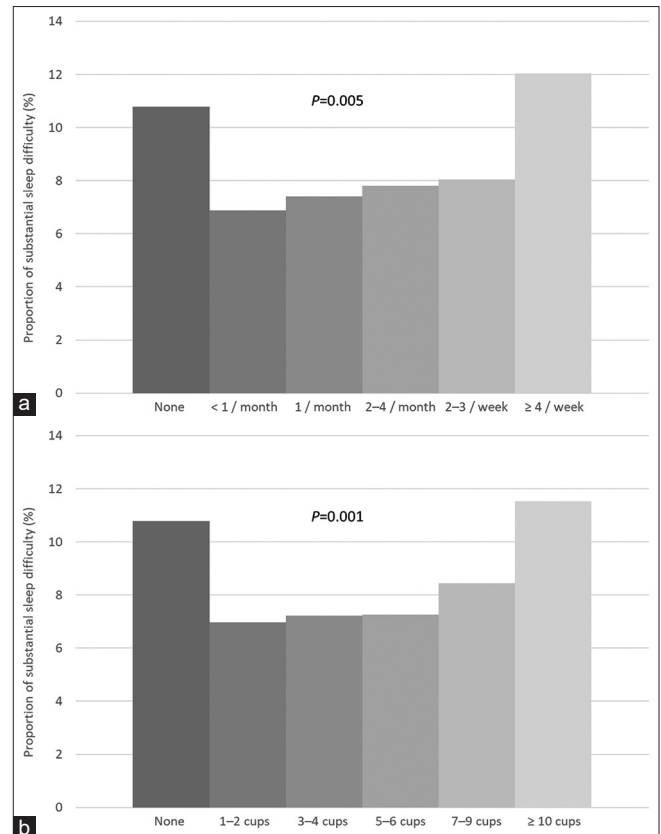


Figure 1: Proportion of substantial sleep difficulty by drinking frequency and amount. (a) Drinking frequency, (b) Drinking amount

Table 2: Odds ratios and 95% confidence intervals for substantial sleep difficulty according to drinking frequency and amount

Frequency	OR ^a (95% CI)	P	Amount	OR ^a (95% CI)	P
None	1.41 (0.96–2.07)	0.080	None	1.38 (0.98–1.95)	0.069
<1 per month	1		1–2 cups	1	
1 per month	1.24 (0.80–1.93)	0.339	3–4 cups	1.11 (0.76–1.63)	0.583
2–4 per month	1.17 (0.98–1.41)	0.083	5–6 cups	1.32 (1.05–1.65)	0.016
2–3 per week	1.15 (1.00–1.33)	0.065	7–9 cups	1.18 (1.00–1.39)	0.044
≥4 per week	1.28 (1.11–1.47)	0.001	≥10 cups	1.24 (1.09–1.41)	0.001
For trend	1.17 (1.06–1.30)	0.003	For trend	1.20 (1.08–1.32)	<0.001

^aMultivariate logistic regression analysis adjusted for demographics (age, sex, economic status, educational attainment, and marital status), health-related behaviors (obesity, current smoking, and aerobic exercise), comorbidities (hypertension and type 2 diabetes), EQ-5D, depressive mood, and sleep duration. OR=Odds ratio; CI=Confidence interval; EQ-5D=EuroQol 5-dimension

Table 3: Subgroup analysis of trends for substantial sleep difficulty by drinking habits

	Increased frequency		Increased amount	
	Adjusted ^a OR (95% CI)	P	Adjusted ^a OR (95% CI)	P
Age group (years)				
<50	1.20 (1.03–1.40)	0.018	1.25 (1.10–1.42)	0.001
≥50	1.16 (1.00–1.35)	0.053	1.13 (0.95–1.33)	0.163
Sex				
Male	1.18 (0.99–1.40)	0.062	1.11 (0.95–1.29)	0.194
Female	1.14 (0.99–1.30)	0.068	1.26 (1.10–1.44)	0.001

^aMultivariate logistic regression analysis adjusted for demographics (age, sex, economic status, educational attainment, and marital status), health-related behaviors (obesity, current smoking, and aerobic exercise), comorbidities (hypertension and type 2 diabetes), EQ-5D, depressive mood, and sleep duration. Nondrinkers were excluded from the analysis. OR=Odds ratio; CI=Confidence interval; EQ-5D=EuroQol 5-dimension

difficulty in a dose-dependent manner among younger adults and women. Similarly, Zheng *et al.* reported that higher alcohol consumption was associated with poorer sleep quality among Chinese adults.^[21] The authors used four sleep parameters – insomnia, daytime sleepiness, sleep duration, and snoring – but did not find a linear relationship between insomnia and alcohol amounts, which supports our results. However, the study's implications are restricted by its inclusion of a large proportion of individuals with lower socioeconomic status and lack of consideration of critical confounders, such as depressive mood.

Conversely, some studies have observed that alcohol consumption protects sleep quality, although this relationship is only significant among older women.^[22,23] Women in mid-to-late life perceive sleep benefits of alcohol use (e.g., alleviation of anxiety, pain, or symptoms of other health conditions) but are aware of the deleterious effect of alcohol on sleep, thus controlling their intake.^[24] The present study found no significant association in older women, which might be explained by the cultural differences in drinking. Women traditionally do not drink in Korea, and there are gender differences in drinking motives.^[25]

Our subgroup analyses revealed that the hazardous effect of alcohol on sleep might affect only younger adults and women. This association between alcohol use and sleep in younger adults is consistent across studies; alcohol use among younger adults has been associated with worse

sleep quality in cross-sectional,^[26] experimental,^[27] and daily assessment studies.^[28] This group tends to have less sleep difficulty in general compared with older adults,^[29] possibly because they have fewer comorbid conditions or experience less prominent changes in circadian rhythm.^[30] However, alcohol use has a relatively stronger effect on sleep quality in younger adults than in older adults. Notably, our findings are consistent with those of the Global Burden of Disease Study 2016, which identified alcohol as the leading risk factor for death and disability among the 15–49 age group, highlighting the substantial health burden of alcohol use in younger populations.^[31] Older people are also more likely to already be taking medication for sleep problems,^[32] which may have contributed to the lack of significant effect of alcohol on sleep. In addition, our sex-stratified results are comparable to those of a large, community-based Chinese study that showed a significant association between alcohol consumption and insomnia, but only in women.^[33] It is well known that women are more vulnerable to the impact of ethanol than men, i.e., women experience higher blood alcohol concentrations after drinking equivalent doses of alcohol per kilogram of body weight.^[34] Alcohol consumption might also impact women's estrogen levels, leading to insomnia.^[35]

Interestingly, our study indicated that nondrinkers had a higher OR for sleep difficulties than drinkers who consumed alcohol the least or drank alcohol the least often. This result may reflect reverse causality. Compared with any drinking

group, nondrinkers were older and poorer and had more comorbidities and lower health-related quality of life, but they smoked less (data not shown). Unhealthy individuals would like to quit drinking and smoking. In a study using alcohol data from two periods,^[21] the significance after adjusting for older alcoholic data was diluted or even disappeared, supporting our hypothesis. A future longitudinal prospective study is needed to clarify this issue.

Our study has several limitations. First, we utilized cross-sectional data, which limit the conclusions regarding the direction and causality of the findings. The association between alcohol use and sleep is bidirectional. Second, this study used self-reported data, which may not correspond with objective measures of sleep (e.g., actigraphy or polysomnography), medication history for sleep difficulties (e.g., hypnotic drugs), or alcohol consumption (e.g., biological markers and breath alcohol tests). In addition, the data collection method chosen for this study may not have provided the most representative sample.^[36] The Division of Chronic Disease Surveillance of the Korea Disease Control and Prevention Agency attempted to target noninstitutionalized Korean residents as evenly as possible, using a multistage probability sampling method. Furthermore, data on the context of alcohol use (e.g., reason for use) may also be helpful in understanding when, how, and for whom alcohol may impact sleep.

CONCLUSIONS

Our study provides evidence that alcohol consumption is associated with substantial sleep difficulties (estimated at 8.5% of the study population), particularly among younger adults and women. This underscores the necessity of adopting an age- and sex-specific approach in both clinical practice and public health strategies to address sleep disorders related to alcohol use. We advocate for longitudinal research to better understand the long-term impacts of alcohol consumption on sleep health. In addition, interventional studies aimed at assessing the benefits of reducing alcohol intake on improving sleep quality would be valuable. These future investigations will be crucial in developing targeted and effective interventions for sleep-related issues associated with alcohol consumption.

Acknowledgments

This work was supported by Gachon University Gil Medical Center (Grant no., FRD2021-14) and Technology Innovation Program (or Industrial Strategic Technology Development Program-Bioindustrial Technology Development - Digital Healthcare) (20008934, Creation and operation model of community medical service environment for metabolic syndrome prevention and disease management) funded by the Ministry of Trade, Industry & Energy (MOTIE, Korea).

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

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