The impact of sleep duration on NAFLD score in Korean middle-aged adults: a community based cohort study

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The impact of sleep duration on NAFLD score in Korean middle-aged adults: a community based cohort study

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ABSTRACT

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Purpose: Many physicians have studied the relationship between sleep duration and NAFLD. Although accumulated evidence indicates that sleep duration and sleep quality may potentially trigger the development of non-alcoholic fatty liver disease (NAFLD), no studies have explored this causality. In this study, we aimed to analyze whether there is a significant difference between the various risk factors of NAFLD and also to investigate the effect of sleep duration on the incidence of NAFLD in Korean middle-aged adults through the cohort.

Methods: All participants were selected from the cohort of the Korean Genome and Epidemiology Study (KoGES) for a 10-year period. The original cohort consisted of 5,427 participants who were 40 to 69 years of age. NAFLD was defined by Fatty Liver Index (FLI), NAFLD liver fat score (NLFS), Hepatic Steatosis Index (HSI) or Lipid Accumulation Product (LAP). The LAP value was found to be the most sensitive and specific based on the FLI by the ROC curve. Sleep duration was categorized into the following groups: those sleeping less than 6 hours, those sleeping at least 6 hours but less than 7 hours, those sleeping 7 hours to 8 hours, and those who slept more than 8 hours. The four sleep duration groups were compared using the χ^2 test and ANOVA. Multiple

logistic regression analysis was used to assess the relationship between sleep duration and NAFLD defined by NAFLD scores after several confounding factors. ANCOVA was also used to verify the differences in means of NAFLD scores according to sleep duration.

Results: In a cross-sectional study, being compared to the reference group, the odds ratio for NAFLD was 2.230 (1.304-3.813) for the group of people who slept more than 8 hours, 1.869 (1.298-2.691) for 7 hours to 8 hours and 1.662 (1.122-2.463) for at least 6 hours but less than 7 hours after adjusting for several confounding factors.

In the cohort study, the odds ratio for the incidence of NAFLD was 1.462(1.029-2.077) for the group of people who sleep more than 8 hours, 1.271(1.001-1.615) for 7hours to 8 hours after adjusting for age, sex, BMI, SBP, DBP, TG, HDL, FDG, smoking, physical activity, daytime napping and night-time shifting ($p<0.01$),

Conclusion: These findings are evidence of the relationship between long sleep duration and the elevation of NAFLD scores, and support the causality of sleep duration and incidence of NAFLD in Korean middle-aged adults.

Key words : KoGES, NAFLD, Sleep duration, Cohort study

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I. INTRODUCTION

The population of South Korea has the shortest average sleeping time among people in OECD countries. Programs that aim to improve the quality of life as well as improve sleep quality are being pursued at the national level, and studies are being conducted to find out its clinical significance. The results of a Korean cohort study showing that short sleep times increase the risk of hypertension and metabolic syndrome have been reported and are explained by the fact that complex and various metabolic abnormalities related to insulin resistance are associated with clinical features.[1] Although the effect of insulin resistance on sleep duration has not yet been clarified, in light of these prior findings, a positive link between insulin resistance and sleep duration may be expected. From the same perspective, recent studies have pointed to hyperinsulinemia and insulin resistance as pathogenic factors in NAFLD.[2] Also, the prevalence of nonalcoholic fatty liver

disease in Korean adults is increasing steadily with changes of lifestyle. The deposition of fat without alcohol may have various effects on the liver, and the correlation between NAFLD and risk factors for chronic diseases such as abdominal obesity, blood sugar control disorder, hypertension, and lipid abnormality has been revealed.[3-5]

In the light of these findings, we inferred that NAFLD is closely associated with sleep duration. Although the mechanisms between NAFLD and sleep duration are as yet unknown, recent researches have disclosed some possible links between NAFLD and sleep duration. Several studies noted that inadequate sleep is known to be associated with several poor health outcomes. Interestingly, inadequate sleep could also be another risk factor for NAFLD, as observed in several epidemiologic studies, even though the results were inconsistent.[6-8] Studies have also been carried out on specific gender and age groups in China, Japan, and South Korea that have revealed that NAFLD is also associated with lifestyle and occupational characteristics, including sleeping time and quality.[9-12]

However, most of the studies that have reported the relationship between sleep duration and nonalcoholic fatty liver disease have not explained the causal relationship, and there is controversy about the correlation between each factor, especially in South Korea.[12, 13] In order to assess the possible causal relationship between sleep duration and NAFLD, this study was conducted to study the influence of several risk factors and useful diagnostic tools using accessible indicators.

II. MATERIALS AND METHODS

1. Study population

The Korean Genome Epidemiology Study (KoGES)

The Korean Genome Epidemiology Study (KoGES), conducted by the Centers for Disease Control and Prevention (CDC), was a principal cohort study providing valuable evidence for the prevention of major chronic diseases such as hypertension, obesity, and diabetes in South Korea. In order to identify major genetic and environmental risk factors associated with contracting diseases, they established a prospective cohort project that laid the foundation for the general population and long-term track record of disease outbreaks and changes in the living environment. A large-scale cohort was conducted for the general population aged 40 to 69 years, and biomarkers such as epidemiological data, blood, urine, and genomes were collected through surveys and examinations related to health and lifestyle, and then a periodic follow-up was produced in Korea for 10 years.[14] This study has been evaluated as a good cohort to identify the incidence and risk factors of chronic diseases. Recently, research on aging has been added, as have brain magnetic resonance imaging and cognitive function tests.[15] Among the 8841 40-69-years-old middle-aged Korean men and women who participated in the cohort study for more than 3 years, those who were diagnosed with sleep disturbances, taking sleep-related drugs or who had a history of hepatitis or positive serologic markers for hepatitis B and C were excluded. High-risk drinking groups of 40g or more alcohol intake per

day for women and 60g or more alcohol intake per day for men were excluded. Finally, excluding missing values, 5427 subjects were studied.

2. Definition

A. Sleep duration

The American Society for Sleep Research has identified the period 7hours to 8 hours as the recommended sleeping time for middle-aged people and 6 hours to 7 hours as adequate sleeping time. Based on these criteria, we divided the participants into 4 groups: those sleeping less than 6 hours, those sleeping at least 6 hours but less than 7 hours, those sleeping 7 hours to 8 hours, and those who slept more than 8 hours.

B. NAFLD

We used indexes that can predict NAFLD using only highly accessible biomarkers and disease history.

(A) Fatty Liver Index (FLI)

We used FLI, a validated surrogate maker, as a standard for diagnosing NAFLD in the first period data. The formula used to calculate the FLI is as follows:

$$FLI = \frac{e^{(0.953 \times \log e\, TG + 0.139 \times BMI + 0.718 \times \log e\, GGT + 0.053 \times WC - 15.745)}}{1 + e^{(0.953 \times \log e\, TG + 0.139 \times BMI + 0.718 \times \log e\, GGT + 0.053 \times WC - 15.745)}} \times 100$$

According to the report by Bedogni et al., we categorized the study participants into 3 groups based on the value of FLI which varies from 0

to 100: FLI<30, described as not having NAFLD; FLI 30 to 59, defined as intermediate FLI; and FLI ≥60, defined as having NAFLD. NAFLD can be excluded if it is less than 30, and NAFLD can be diagnosed as sensitivity of 82% and specificity of 76% if it is 60 or more. This index has been validated by comparison with US sensitivity of 90% and specificity of 83%.[16-17]

(B) Lipid Accumulation Product (LAP)

Recent studies suggest that the lipid accumulation product is significantly associated with metabolic abnormalities. The aim of this study was to assess the accuracy of the lipid accumulation product (LAP) as an effective screening tool for diagnosing NAFLD in the general population. LAP was calculated as follows:

$$LAP = [WC - (65 \text{ in men}, 58 \text{ in women})] \times TG$$

To obtain a deeper understanding of the relationship between LAP levels and the prevalence of NAFLD, we next divided the study population into 4 groups according to LAP quartiles referring to the previous study, and the highest quartile defined as having NAFLD.[18-20]

(C) NAFLD Liver Fat Score (NLFS)

NAFLD Liver Fat Score was derived from a Finnish population. The gold standard was magnetic resonance spectroscopy (MRS). The score incorporates simple variables, but may be a test to take into account when assessing steatosis easily on the bench without referring to radiology.[21,22] NAFLD can be excluded if it is less than -0.640.

NLFS= -2.89 + 1.18 x Metabolic Syndrome (yes=1, no=0) + 0.45 x DM (yes=2, no=0) + 0.15 x Fasting insulin + 0.04 x AST + 0.94 x AST/ALT

(D) Hepatic steatosis index (HSI)

HSI is a simple, efficient screening tool for NAFLD that may be utilized for selecting individuals for liver ultrasonography, ruling out NAFLD with a sensitivity of 93.1%, or detecting NAFLD with a specificity of 92.4%, respectively. NAFLD can be excluded if it is less than 36. [21]

HSI= 8 x ALT/AST + BMI + Sex (2 in women, 0 in men) + DM (yes=2, no=0)

3. Statistical analysis

A. In the Cross-sectional Study

The four sleep duration groups were compared using the χ^2 test and one-way analysis of variance (ANOVA). All data were reported as mean ± standard deviations (SD). Multiple logistic regression analysis was used to assess the relationship between sleep duration and NAFLD defined by FLI score after adjusting for age, sex, BMI, SBP, DBP, TG, HDL, FDG, smoking, physical activity, daytime napping and night-time shifting. The LAP value was found to be the most sensitive and specific for the NLFS, HSI, and LAP scores based on the FLI by the AUC area and ROC curve. The difference in NAFLD score, defined by NLFS, HSI, and LAP scores, according to sleeping time was also assessed using analysis of covariance (ANCOVA).

B. In Cohort Study

Multiple logistic regression was used to assess the relationship between sleep duration and incidence of NAFLD, defined by LAP, after adjusting for age, sex, BMI, SBP, DBP, TG, HDL, FDG, smoking, physical activity, daytime napping and night-time shifting. Cox regression analysis was used to calculate the possible risk of developing NAFLD over sleep duration. NAFLD scores were also analyzed by ANCOVA to verify whether the differences in means of NAFLD scores correlated with sleep duration after adjustment for age as covariates. Results are presented as odds ratios (ORs) with 95% confidence intervals. All statistical significance was determined at a p-value < 0.05. In order to see the continuous relation between the mean value of NAFLD score and sleep duration, we draw the spline curve obtained by smoothing the Y axis after receiving the prediction probability through logistic regression.

III. RESULTS

1. Relation between sleep duration and NAFLD

The characteristics of the study population are summarized in Table 1. The total of 5427 participants was included in this study. The mean value of age was 50.76 years. Statistically significant differences according to sleep duration were found with respect to the following variables: WC, SBP, DBP, GTP, Fasting Insulin, HOMA-IR, and FLI. However, the Weight, BMI, Lipid profile, fasting glucose, Hs-CRP and HbA1c did not show any significant differences. The proportion of NAFLD defined by FLI was not significantly different between the four groups (Table 1).

Table1. Baseline characteristics of study population* (n=5427)

	Sleep Duration (hours)				*P* value
	<6h	**6h to <7h**	**7h to 8h**	**>8h**	
Number (n)	810	1494	2731	392	
Age (years)	50.61±8.6	49.49±8.1	50.95±8.6	54.63±9.3	.000*
Gender (Female, %)	58.7	53.1	48.7	53.9	.000†
Weight (kg)	63.18±10.7	64.13±9.9	63.90±10.0	62.30±9.7	.004*
BMI (kg/m2)	24.72±3.2	24.74±3.0	24.56±3.0	24.48±3.2	.148*
WC (cm)	80.97±9.2	81.75±8.7	82.22±8.4	83.35±8.7	.000*
SBP (mm Hg)	118.03±18.2	118.43±17.3	119.90±17.8	124.28±18.8	.000*
DBP (mmHg)	78.04±11.5	78.51±11.3	79.66±11.4	81.05±10.8	.000*
TG (mg/dl)	158.75±100.9	152.66±92.3	161.88±104.9	158.48±86.5	.041*
HDL-C (mg/dl)	45.00±10.6	44.71±9.8	44.22±9.9	44.51±9.3	.180*
GTP (IU/L)	29.75±48.7	29.79±37.8	34.13±61.9	36.34±58.0	.016*
FBG (mg/dl)	87.46±22.5	87.46±20.7	88.00±23.0	89.0±23.5	.632*
Insulin (mcIU/mL)	7.10±3.5	7.29±3.9	7.59±4.9	7.99±6.4	.002*
CRP (mg/L)	0.21±0.5	0.23±0.4	0.21±0.4	0.31±0.8	.000*
HOMA_IR	1.54±0.9	1.60±1.0	1.67±1.2	1.76±1.4	.001*
HbA1c (%)	5.75±0.9	5.73±0.8	5.74±0.8	5.84±0.9	.126*
NAFLD score					
FLI	29.62±23.6	30.34±23.64	31.92±24.2	32.95±23.2	.018*
NLFS	-1.33±1.3	-1.29±1.3	-1.18±1.5	-1.06±1.5	.002*
HSI	33.34±4.5	33.48±4.6	33.21±4.6	32.94±4.6	.125*
LAP	88.90±80.9	85.63±73.0	91.48±79.7	94.58±69.8	.065*
NAFLD (%)					
FLI	13.7	15.4	17.1	16.6	.100†
NLFS	26.0	27.7	29.4	33.1	.014†
HSI	20.6	22.5	19.7	18.8	.076†
LAP	23.9	21.5	16.6	27.7	.000†

* P values calculated by ANOVA. Data are mean ± SD.

† P values calculated by $\chi 2$ test or linear-by-linear association.

Abbreviations: BMI, body mass index; CRP, c-reactive protein; DBP, diastolic blood pressure; FBG, fasting blood glucose; FLI, fatty liver index; GTP, gamma-glutamyl transpeptidase; HDL-C, high-density lipoprotein cholesterol; HOMA-IR, homeostatic model assessment for insulin resistance; HSI, hepatic steatosis index; LAP, lipid accumulation product; NAFLD, nonalcoholic fatty liver disease; SBP, systolic blood pressure; TC, total cholesterol; TG, triglyceride; WC, waist circumference.

Table2. OR and CI for NAFLD defined by FLI score according to sleep duration

Model	*Sleep Duration (hours)*			
	<6h	**6h to <7h**	**7h to 8h**	**>8h**
Model I	1	1.143 (0.896-1.458)	1.299 (1.040-1.623) *	1.255 (0.906-1.740)
ModeI II	1	1.085 (0.846-1.391)	1.166 (0.930-1.464)	1.154 (0.826-1.613)
Model III	1	1.662 (1.122-2.463) *	1.869 (1.298-2.692) †	2.230 (1.304-3.813) †

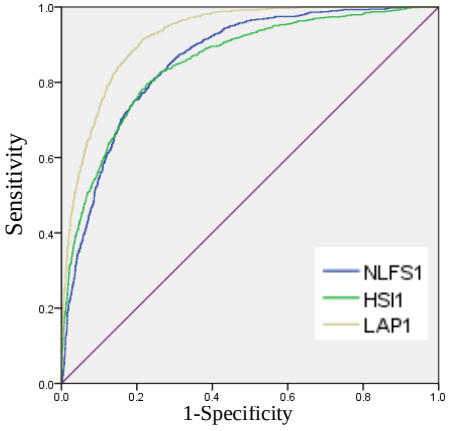
* P values <0.05, † P values < 0.01

Model I: unadjusted

Model II: adjusted for age and sex

Model III: adjusted for age, sex, BMI, SBP, DBP, TG, HDL, FDG, physical activity, smoking, daytime napping and night-time shifting

Table 2 shows the association between NAFLD defined by FLI and sleep duration. Compared with the group with the shortest sleep duration, the ORs and 95% CIs were 2.230 (1.304-3.813) for the group of people who sleep more than 8 hours, 1.869 (1.298-2.691) for 7 hours to 8 hours and 1.662 (1.122-2.463) for at least 6 hours but less than 7 hours after adjusting for age, sex, BMI, SBP, DBP, TG, HDL, FDG, physical activity, smoking, day-time napping and night-time shifting (Table 2).



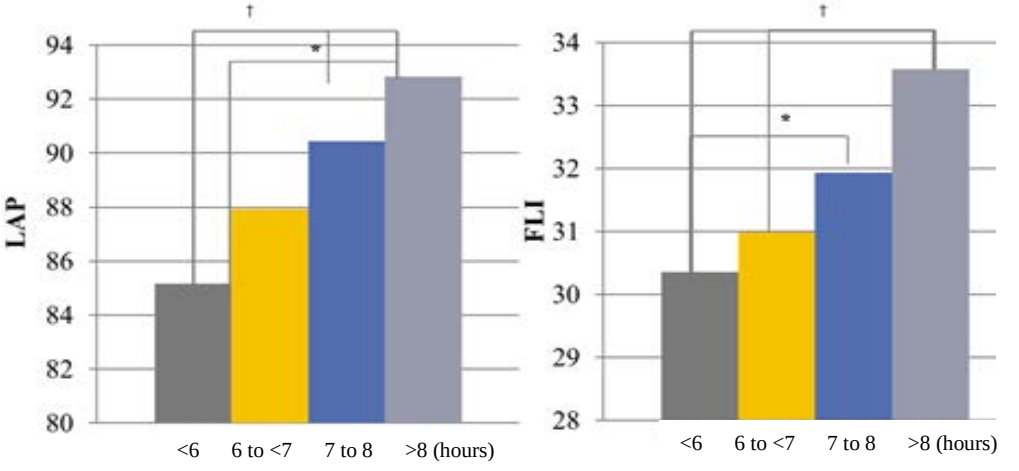
Model	Area	95% CI
NLFS	0.859†	0.847-0.871
HSI	0.854†	0.840-0.868
LAP	0.924†	0.916-0.932

†P values < 0.01

Abbreviations: AUC, area under curve;
ROC: receiver operating curve;
FLI, fatty liver index

Figure1. AUC and ROC curve of FLI for the prediction of fatty liver (value = 0.924, 95% CI: 0.916-0.932)

The NAFLD was defined based on the FLI, and the effective area of LAP, NLFS, and HSI is obtained based on this. When the ROC curve is drawn, the effective area of the LAP is 0.924 (0.916-0.932), which is the most sensitive and specific definition (Figure 1).



*P-value <0.05 and †P-value <0.01; calculated by the Bonferroni post hoc test

Figure2. NAFLD score according to sleep duration by ANCOVA

In the ANCOVA study, the mean value of FLI and LAP according to the sleep duration was calculated by the Bonferroni post hoc test. The two scores of the group sleeping more than 7 hours were higher than those of the group with the shortest sleep duration (Figure 2).

2. Relation between sleep duration and new onset NAFLD

Table3. OR and CI for NAFLD defined by LAP according to sleep duration

Model	***Sleep Duration (hours)***			
	<6h	**6h to <7h**	**7h to 8h**	**>8h**
Model I	1	1.055 (0.850-1.310)	1.168 (0.960-1.420)	1.270 (0.963-1.674)
Model II	1	1.067 (0.859-1.326)	1.165 (0.958-1.418)	1.227 (0.929-1.622)
Model III	1	1.054 (0.812-1.369)	1.271 (1.001-1.615) *	1.462 (1.029-2.077) *

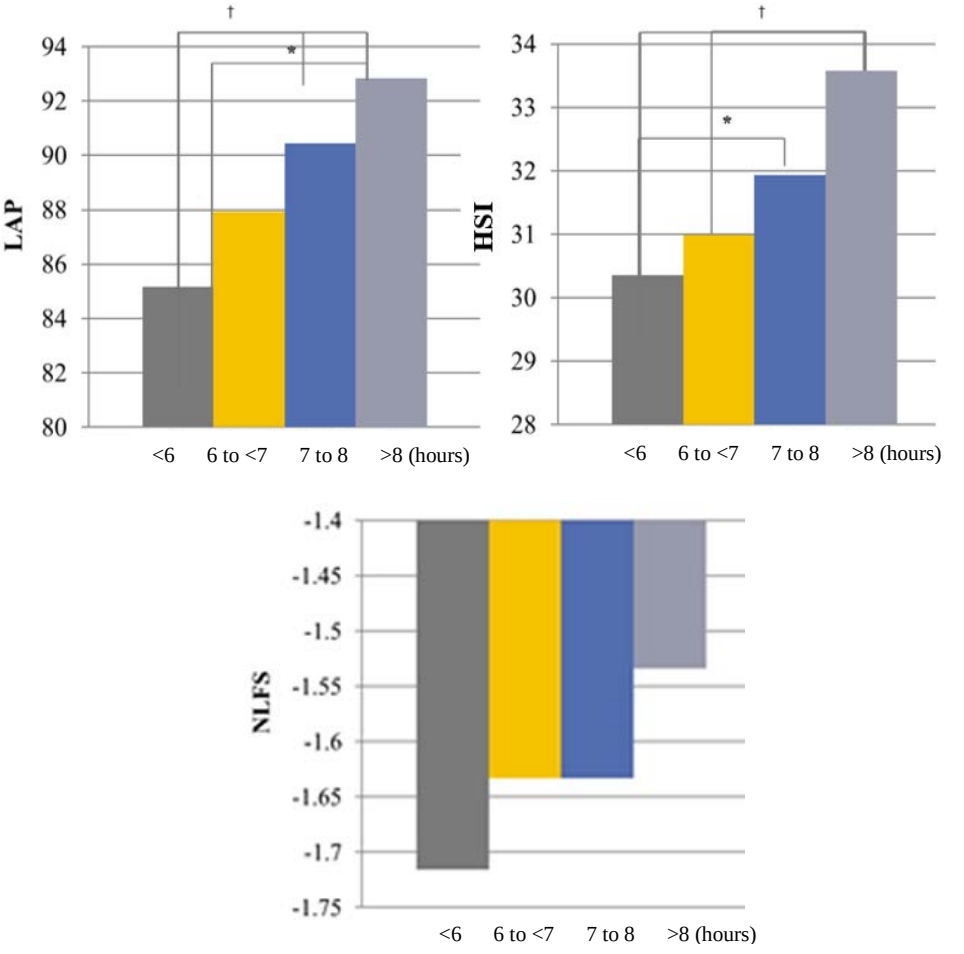
* P values <0.05, † P values < 0.01

Model I: unadjusted

Model II: adjusted for age and sex

Model III: adjusted for age, sex, BMI, SBP, DBP, TG, HDL, FDG, physical activity, smoking, daytime napping and night-time shifting

In the cohort study, the odds ratio for the incidence of NAFLD defined by LAP was 1.462 (1.029-2.077) for the group of people who sleep more than 8 hours, 1.271 (1.001-1.615) for 7 hours to 8 hours after adjusting for age, sex, BMI, SBP, DBP, TG, HDL, FDG, smoking, physical activity, daytime napping and night-time shifting ($p<0.05$). The odds ratio for the group of people who sleep at least 6 hours but less than 7 hours did not have a statistically significant value, which showed a similar tendency to Model 1 and Model 2 (Table 3).



*P-value <0.05 and †P-value <0.01; calculated by the Bonferroni post hoc test

Figure3. Mean NAFLD scores according to sleep duration by ANCOVA

In the ANCOVA study, the average of LAP, HSI and NLFS scores according to the sleep duration over a 10-year period was calculated by the Bonferroni post hoc test. The LAP and HSI scores of the group sleeping more than 7 hours were higher than those of the group with the shortest sleep duration, and the NLFS score was not statistically significant (Figure 3).

Table4. Cox regression analysis - HR and CI for new onset NAFLD defined by LAP according to sleep duration

Cox Hazard Model	***Sleep Duration (hours)***			
	<6h	**6h to <7h**	**7h to 8h**	**>8h**
Model I	1	1.022 (0.8843-1.239)	1.190 (1.001-1.415) *	1.382 (1.085-1.760) †
Model II	1	1.048 (0.865-1.271)	1.196 (1.005-1.423) *	1.295 (1.014-1.652) †
Model III	1	1.148 (0.880-1.497)	1.270 (1.994-1.622)	1.495 (1.059-2.109) *

* P values <0.05, † P values < 0.01

Model I: unadjusted

Model II: adjusted for age and sex

Model III: adjusted for age, sex, BMI, SBP, DBP, TG, HDL, FDG, physical activity, smoking, daytime napping and night-time shifting

We analyzed the Cox 2 regression by considering the number of NAFLDs defined as LAP over a 10-year period and the time it took to develop NAFLD. Compared to the group with the shortest sleep time, the group with a sleep duration of over 8 hours had a Hazard ratio of 1.382 (1.085-1.760) in the unadjusted model and 1.295 (1.014-1.652) in the age- and sex-corrected group ($p<0.01$). In Model 3, the HR of the group who sleep more than 8 hours is 1.495 (1.059-2.109) after adjusting for age, sex, BMI, SBP, DBP, TG, HDL, FDG, smoking, physical activity, daytime napping and night-time shifting ($p<0.05$) (Table 4).

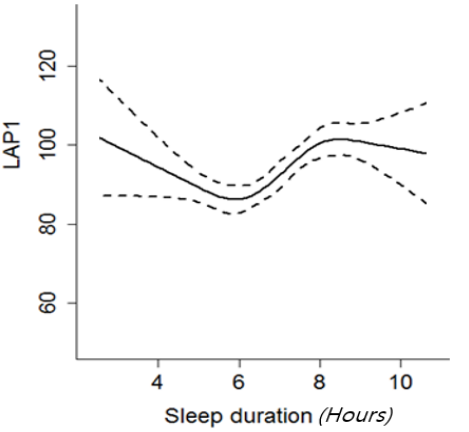


Figure4. Mean value of NAFLD score defined by LAP over sleep duration using spline curve.

As seen in Penalized B-spline, the mean value of NAFLD score defined by LAP was the lowest in the sleep duration of 6 hours. In addition, the mean value of NAFLD tended to increase when the sleep duration was shorter or longer than 6 hours in the cross-sectional study.

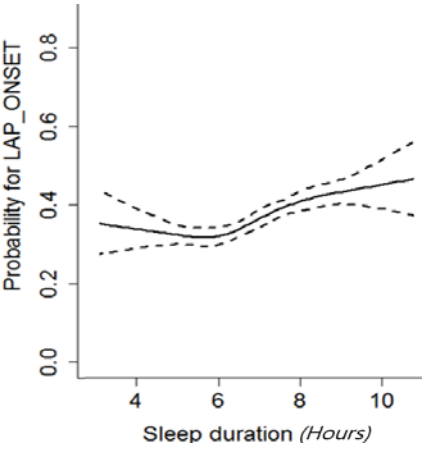


Figure5. Probability of new onset NAFLD defined by LAP over sleep duration using spline curve.

In the cohort study, the probability of new onset NAFLD defined by LAP also the lowest in the sleep duration of 6 hours. When the sleep duration was shorter or longer than the 6 hours, the probability tended to increase.

IV. DISCUSSION

A systematic review and meta-analysis suggested a small but significantly increased risk of NAFLD among participants who had short sleep duration. However, most of the included studies were cross-sectional studies. In addition, the results of these cross-sectional studies show inconsistent results.[9-12]

A Korean cross-sectional study reported that short sleep duration was associated with a higher risk of NAFLD, which is consistent with most studies to date. Nevertheless, the Korean study was restricted to a selected population, so the conclusions cannot be generalized to community-based populations.[12, 13] We also observed that short sleep duration and longer daytime napping were significantly associated with an increased risk of NAFLD, but these findings were only applicable to middle-aged and elderly Chinese people.[23] Based on these studies, we could infer several potential mechanisms that could explain the observed association between NAFLD and short sleep. First, some of the inflammatory cytokines essential for the pathogenesis of NAFLD, such as interleukin-6 and tumor necrosis factor alpha, have been shown to be caused by improper sleep.[24, 25] Second, sleep deprivation can increase appetite as a result of hormone changes, such as increased ghrelin levels and decreased leptin levels. People who get improper sleep also tend to

take less regular exercise because of a busy lifestyle or physical fatigue.[26, 27] Third, studies have shown that the hypothalamic–pituitary-adrenal axis increases plasma levels of corticosteroids and cortisol, which are known to be associated with insulin resistance, affected by abnormal sleep patterns. In addition, cortisol and other glucocorticoids are known to promote lipid mobilization from peripheral adipose tissue, and promote fatty formation in the liver.[28, 29]

Contrary to this hypothesis, a Japanese study suggested that those who slept for 7 hours to 8 hours were more likely to have NAFLD than those who slept for less than 6 hours.[11] Our study also showed a higher NAFLD score for groups with longer sleep duration than for groups with shorter sleep duration after several confounding factors including daytime napping and night-time shifting, suggesting that the longer the sleeping time, the greater the risk of NAFLD. And there are also some hypotheses that support this result. Existing concepts of total energy expenditure include resting metabolic rate, physical activity, and diet-induced thermogenesis. Short sleep duration could have positive or negative effects on all these components as a result of increased waking hours, metabolic disturbances or behavior changes. Obviously, sleeping is less energy consuming than staying awake, even if an individual remains very sedentary during the extra time spent awake, because the metabolic rate when resting is higher than the metabolic rate when sleeping. Thus, energy expenditure would be expected to decrease as sleep duration increases.[30] From an integrative point of view, this study supports both of these hypotheses and trends and reveals the benefit of recommended sleep duration.

Several limitations of our study also should be noted. First, sleep duration was recorded only in the baseline data, and the change was not observed. Second, various forms of sleep quality such as sleep segments were not considered. Third, marital status or occupation that could fundamentally affect sleep duration were not mentioned. Fourth and finally, defining NAFLD by means of an index, having biomarkers and disease history without an image study may be both an advantage in terms of accessibility and a disadvantage in terms of accuracy in this paper. Future studies should use a prospective validation design to adjust for these limitations when investigating diverse populations and dealing with various nations. Despite these limitations, our study had several strengths, which were primarily its sampling size, the use of a community-based study population, and the fact that it was the first cohort study to analyze the relationship between sleep duration and NAFLD in South Korea.

V. CONCLUSION

In summary, these findings provide evidence of the relationship between sleep duration and the elevation of NAFLD scores, and support the hypothesis that longer sleep duration causes the incidence of NAFLD in Korean middle-aged adults to increase. Further studies to elucidate the underlying biological mechanism are needed. Additionally, a more comprehensive approach should be undertaken to investigate the association of hepatic steatosis and sleep duration. Despite these weaknesses, our study could provide a rationale for further studies to confirm the possibility of reducing the incidence of NAFLD by maintaining proper sleep duration.

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ABSTRACT (IN KOREAN)

대한민국 중년 인구에서 수면 시간이 비알코올성 지방간질환 발병 위험에 미치는 영향: 지역 사회 기반 코호트 연구

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목 적: 수면 시간과 비알코올성 지방간질환의 관계에 대한 많은 연구가 이루어졌고, 여러 연구 결과 수면 시간과 수면의 질이 비알코올성 지방간질환 의 발병을 유발할 수 있음을 암시하고 있다. 하지만 두 인자 간의 인과 관계에 대한 연구는 아직 밝혀진 바가 없다. 따라서 본 연구에서는 비알코올성 지방간질환의 위험 인자들 사이에 유의한 차이가 있는지를 분석하고, 중년 이상의 한국인을 대상으로 비알코올성 지방간질환 발생률에 대한 수면 기간의 영향을 코호트 연구를 통해 조사 하였다.

방법: 연구 참여자는 10년 간 진행된 한국 유전체 역학 연구 (Korean Genome and Epidemiology study, KoGES)에서 40세에서 69세 사이의 5,427 명의 참가자들을 대상으로 하였으며, 비알코올성 지방간질환의 정의는 지방간 지수 (Fatty Liver Index, FLI), 비알코올성 지방간질환 간지방수치 (NAFLD Liver Fat score, NLFS), 간지방증 지수 (Heapatic Steatosis Index, HSI) 또는

지방축적산물 (Lipid Accumulation Product, LAP)에 의해 정의되었다. 수면 기간은 6시간 미만, 6시간 이상에서 7시간 미만, 7시간에서 8시간 이하 및 8시간을 초과하는 그룹으로 분류하여 카이 검정과 일원분산분석을 사용하여 비교하였으며, 다중 회귀 분석을 이용하여 수면 기간과 비알코올성 지방간질환 사이의 관계를 몇 가지 교란 인자를 조정한 후 평가 하였다. 또한 분산분석을 이용하여 수면 기간에 따라 비알코올성 지방간질환을 나타내는 점수의 평균값 차이를 확인하였다.

결과: 단면 연구에서 기준이 되는 6시간 미만 수면하는 군과 비교하였을 때, 비알코올성 지방간질환 유병률의 교차비는 8시간 초과 수면을 취한 사람들의 경우 2.230 (1.304-3.813), 7-8시간 동안 수면을 취한 군에서1.869 (1.298-2.692), 6시간에서 7시간 미만 동안 수면을 취한 군에서 1.662 (1.122-2.463) 였다. 코호트 연구에서, 비알코올성 지방간질환 발생률에 대한 교차비는 나이, 성별, 체질량지수, 수축기 혈압, 이완기 혈압, 중성지방, 고밀도 지질단백질, 공복 혈당, 흡연, 신체 활동, 낮잠의 유무 및 낮과 밤의 변동성을 조정 한 후 8시간 초과 수면한 군에서 1.462 (1.029-2.077), 7-8시간 동안 수면한 군에서 1.271 (1.001- 1.615) 이었다. ($p < 0.05$)

결론: 이 연구 결과는 긴 수면 기간과 비알코올성 지방간질환 점수 상승과의 상관 관계가 있음을 제시하고, 한국 중년 성인의 수면 시간과 비알코올성 지방간질환의 발병률 간의 연관성을 뒷받침한다.

핵심되는 말: 비알코올성 지방간질환, 수면 시간, 한국인 유전체 역학 연구, 코호트 연구