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Original Article

The relationships between lifestyle factors and hypertension in community-dwelling Korean adults

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Abstract. [Purpose] This study was performed to determine whether certain lifestyle factors are associated with hypertension in community-dwelling Korean adults. [Subjects and Methods] The subjects were 586 males and 1,135 females > 20 years old who had visited a public health promotion center in Seoul, Republic of Korea to take a survey related to lifestyle factors. Hypertension status was defined according to the criteria of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure VII report. [Results] The relationships between lifestyle factors and hypertension status were assessed using multivariate logistic regression analysis after adjusting for age and gender. Only mental stress and economic status significantly predicted hypertension status. [Conclusion] We conclude that sleep duration, education level, frequency of drinking and smoking status were not associated with hypertension status. However, economic status and mental stress were significantly associated with hypertension in community-dwelling Korean adults, regardless of age or gender.
Key words: Hypertension, Lifestyle factors

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INTRODUCTION

Hypertension is becoming a more common problem in the Republic of Korea, likely because people are adopting an increasingly sedentary lifestyle and more Westernized eating habits. In 2015, the sixth Korea National Health and Nutrition Examination Survey reported that the prevalence of hypertension among Korean subjects > 30 years of age was 32.4% in males and 22.2% in females, and these rates have been increasing steadily each year[1)].

Hypertension is a major risk factor for coronary heart disease, heart failure, renal disease, and stroke[2)]. The development of hypertension is related to both genetic and lifestyle factors. Genetic factors include age, gender, body shape, and family history, and lifestyle factors include excessive drinking, smoking, poor eating habits, and reduced physical activity[3–7)]. Ethnicity also appears to affect the prevalence of hypertension[8)], as previous studies have reported an association between ethnicity and hypertension[8–10)]. Although modifying lifestyle factors is important for managing hypertension, very few studies have examined lifestyle factors that are related to hypertension in Korean subjects[11, 12)]. Hence, the purpose of this study was to examine which lifestyle factors are related to hypertension in community-dwelling Korean adults.

SUBJECTS AND METHODS

Our subjects consisted of 586 males and 1,135 females, all > 20 years of age, who had visited a public health promotion center in Seoul, Republic of Korea, to take a survey related to lifestyle factors. Age, gender, sleep duration, mental stress level, education level, economic status, frequency of drinking, and smoking status were categorized according to their self-reported questionnaire data, and blood pressure was measured in all subjects. All subjects provided their written informed consent before participating in this study. The subjects' characteristics are shown in Table 1.

Dependent variables: Hypertension status was determined by measuring blood pressure. The subjects rested in a sitting position for at least 10 min, after which a nurse specialist measured their systolic and diastolic blood pressures using a mercury sphygmomanometer (Alpk, Tokyo, Japan) at the right brachial artery. Three separate blood pressure readings were taken over a 2 min interval, and the mean was calculated[13)]. We defined normal blood pressure as < 140/90 mmHg and hypertension as > 140/90 mmHg, according to the criteria of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure VII[14)].

Independent variables: Each participant's lifestyle factors were identified based on their answers to six questions on

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Table 1. Subject characteristics

Variable		Males (n = 586)	Females (n = 1,135)	Total (n = 1,721)
Age (years)		51.0 ± 11.9	51.3 ± 10.6	51.2 ± 11.1
Height (cm)		170.1 ± 5.7	157.5 ± 5.3	161.5 ± 8.0
Weight (kg)		71.4 ± 9.3	57.2 ± 7.6	61.8 ± 10.5
Systolic blood pressure (mmHg)		136.3 ± 17.4	126.2 ± 18.1	129.7 ± 18.5
Diastolic blood pressure (mmHg)		84.8 ± 12.6	81.1 ± 12.8	82.4 ± 12.8
Body mass index (kg/m^2)		24.7 ± 2.8	23.1 ± 3.0	23.6 ± 3.0
Prevalence of hypertension	Yes	271 (46.2)	329 (29.0)	600 (34.9)
	No	315 (53.8)	806 (71.0)	1,121 (65.1)

Data are mean ± standard deviation or n (%)

a self-reported questionnaire. All questions had four possible answers, except for smoking status, which had three. The questions and their possible responses are as follows: sleep duration (<5, 6, 7, or > 8 hours), mental stress (very low, low, high, or very high mental stress), education level (elementary or lower, middle, high school, or college or higher), economic status (very poor, poor, rich, or very rich), frequency of drinking (non-drinker, once per month, 2–3 times per month, or > 4 times per month), and smoking status (non-smoker, ex-smoker, or current smoker).

Covariate variables: Age (used without modification) and gender were included in the analysis as covariates to control for their effects.

Statistical analysis: All results are provided as mean ± standard deviation. Multivariate logistic regression analyses were performed to assess whether the lifestyle factors were related to hypertension status after adjusting for age and gender. A p-value < 0.05 was considered statistically significant. All statistical analyses were conducted using SPSS for Window ver. 18.0 software (SPSS Inc., Chicago, IL, USA).

RESULTS

The results of the multivariate logistic regression analyses for healthy and hypertensive groups are shown in Table 2. The odds ratios (ORs) and 95% confidence intervals (CI) for the relationship between hypertension and sleep duration using < 5 hours sleep as the comparison were 0.596 (0.291–1.219, p = 0.156) for 6 hours sleep, 0.576 (0.271–1.222, p = 0.151) for 7 hours sleep, and 0.611 (0.311–1.203, p = 0.154) for > 8 hours sleep. Thus, sleep duration was related to hypertensive status. The ORs for mental stress, using very low mental stress as the comparison were 1.565 (0.839–2.917, p = 0.159) for low, 1.047 (0.343–3.195, p = 0.936) for high, and 2.648 (1.356–5.173, p = 0.004) for very high mental stress. The ORs for education level, with elementary school or lower as the comparison were 0.832 (0.485–1.427, p = 0.504) for middle school, 0.661 (0.418–1.047, p = 0.077) for high school, and 0.727 (0.435–1.216, p = 0.224) for college or higher. Thus, education level was related to hypertensive status. The ORs for economic status, with very poor as the comparison were 0.464 (0.246–0.876, p = 0.018) for poor, 0.442 (0.230–0.848, p = 0.014) for rich, and 0.786 (0.444–1.390, p = 0.407) for very rich. The ORs for frequency of drinking, with non-drinkers as the comparison were 0.832 (0.484–1.429, p = 0.504) for once per month, 1.111 (0.592–2.084, p = 0.743) for 2–3 times per month, and 1.330 (0.604–2.929, p = 0.479) for > 4 times per month. Thus, frequency of drinking was not related to hypertensive status. The ORs for smoking status, with non-smokers as the comparison were 0.920 (0.455–1.861, p = 0.816) for ex-smokers and 0.781 (0.353–1.729, p = 0.542) for current smokers. Thus, smoking status was not related to hypertensive status.

DISCUSSION

The purpose of this study was to examine the association between lifestyle factors and hypertension in community-dwelling Korean adults. According to the multivariate logistic regression results, hypertensive status was only associated with economic status and mental stress in community-dwelling Korean adults.

Numerous studies have demonstrated that sleep duration is associated with metabolic syndrome, including high blood pressure[15]. However, we found no association between sleep duration and hypertension in Korean adults. Nevertheless, we did not investigate other aspects of sleep quality, such as the presence of sleep apnea or other factors that could disrupt the sleep-wake cycle. Therefore, further studies using more detailed sleep quality measures should be performed to precisely determine how sleep quality affects hypertension.

Lyra et al. reported that low education level and low economic status are associated with an increased risk for hypertension[16]. However, only economic status, and not education level, appeared to be associated with hypertension in the present study. This may be because the majority of our subjects were high school graduates; therefore, the number of subjects in the lower categories may have been too small to show an effect. Nevertheless, economic status retained its effect on hypertension, as shown in a previous study.

Many studies have reported that drinking and smoking are strongly associated with an increased risk for hypertension[17, 18]; however, our results show that drinking frequency and smoking status were not associated with hypertension in Korean adults. Notably, we did not include duration, amount, or type of drinking and smoking. Thus, future studies should investigate drinking and smoking behaviors in more detail to

Table 2. Multivariate logistic regression analyses results for the healthy and hypertensive groups of community-dwelling Korean adults (n = 1,721)

Prevalence of hypertension as compared to healthy individuals		ß	Standard error	Odds ratio	95% confidence interval	p
Sleep duration	<5 hours	Ref.		1.000		
	6 hours	−0.518	0.365	0.596	0.291–1.219	0.156
	7 hours	−0.552	0.384	0.576	0.271–1.222	0.151
	>8 hours	−0.492	0.345	0.611	0.311–1.203	0.154
Mental stress	Very low	Ref.		1.000		
	Low	0.448	0.318	1.565	0.839–2.917	0.159
	High	0.046	0.569	1.047	0.343–3.195	0.936
	Very high	0.974	0.342	2.648	1.356–5.173	0.004**
Education level	Elementary school or lower	Ref.		1.000		
	Middle school	−0.184	0.275	0.832	0.485–1.427	0.504
	High school	−0.414	0.234	0.661	0.418–1.047	0.077
	College or higher	−0.318	0.262	0.727	0.435–1.216	0.224
Economic status	Very poor	Ref.		1.000		
	Poor	−0.768	0.325	0.464	0.246–0.876	0.018*
	Rich	−0.816	0.332	0.442	0.230–0.848	0.014*
	Very rich	−0.241	0.291	0.786	0.444–1.390	0.407
Frequency of drinking	Non-drinker	Ref.		1.000		
	Once per month	−0.184	0.276	0.832	0.484–1.429	0.504
	2–3 times per month	0.105	0.321	1.111	0.592–2.084	0.743
	>4 times per month	0.285	0.403	1.330	0.604–2.929	0.479
Smoking status	Non-smoker	Ref.		1.000		
	Ex-smoker	−0.084	0.360	0.920	0.455–1.861	0.816
	Current smoker	−0.247	0.406	0.781	0.353–1.729	0.542

*p < 0.05; **p < 0.01, tested by multivariate logistic regression analysis after adjusting for age and gender

pinpoint the cause for this discrepancy between the present and previous studies.

Interestingly, in our study, subjects with very high mental stress were 2.648 times more likely to have hypertension, compared with those with very low mental stress. Thus, mental stress appears to play a significant role in the development of hypertension in Koreans. Esler et al. reported that high physical or emotional stress, along with chronic stress, may cause or exacerbate a number of psychological and physical conditions, such as anxiety, depression, obesity, and metabolic syndrome including hypertension[19]. Our results support this notion that hypertensive subjects are more likely to have higher mental stress levels than those of healthy individuals.

This study had several limitations. First, it was a retrospective and cross-sectional study, so we could not determine cause-and-effect relationships. However, we were able to examine the interrelationship between lifestyle factors and hypertension. Second, because the two-pronged approach of focusing on dietary habits and physical activity is well established for preventing and treating hypertension, we did not investigate the amount, quality, and variety of dietary patterns or the type, intensity, duration, and frequency of physical activity. Third, because the participants were from different schools, we could not determine whether educational background is associated with hypertension. Fourth, given that the lifestyle factors were self-reported, the findings are subject to the limitations and possible biases of self-reported data. Fifth, the subjects were recruited from a single health center in Seoul, Republic of Korea during a medical checkup. Therefore, they are not necessarily representative of the Korean adult population. However, the large number of subjects and the focus on Korean adults remain as strengths of this study.

Our results allow us to tentatively conclude that sleep duration, education level, frequency of drinking, and smoking status were not associated with hypertension. In contrast, low economic status and high mental stress were associated with hypertension, regardless of age and gender, in a community-based sample of Korean adults.

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