

Habit of Eating Breakfast Is Associated with a Lower Risk of Hypertension

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Background: The association between skipping breakfast and cardio-metabolic syndrome is well known. However, there are very few Korean studies about the habit of eating breakfast and hypertension. The present study aimed to investigate the relationship between the habit of eating breakfast and hypertension in a healthy Korean population.

Methods: Participants in the 2014 Korea National Health and Nutrition Examination Surveys (KNHANES) were enrolled for this study. Medical history, including hypertension, was measured using a 24-hour recall method. The habit of eating breakfast was estimated from self-reported questionnaires and was classified into two groups: the eating breakfast group, defined as those who ate breakfast more than 5 times per week, and the not eating breakfast group, defined as those who did not eat any breakfast for a week.

Results: The crude odds ratio of skipping breakfast for the prevalence of hypertension was 0.366. However, after adjusting for all considerable confounding factors (age, sex, regular exercise, current smoking, systolic blood pressure, diastolic blood pressure, body mass index, waist circumference, and red blood cell counts), not eating breakfast was associated with a higher risk of HTN (OR = 1.065; 95% CI = 1.057–1.073; p-value < 0.001)

Conclusion: The habit of eating breakfast was associated with a lower risk of hypertension among healthy Korean adults.

Key Words: Breakfast, Hypertension, Korean Population Groups

INTRODUCTION

Breakfast intake is a well-studied subject. The earliest documented studies were from cereal companies in the 1800s and from a pork producer in the 1920s [1,2]. Recent studies provide evidence linking the habit of eating breakfast with a lower risk of weight gain, obesity, and metabolic

syndrome [3]. Furthermore, several studies claimed that the habit of eating breakfast was associated with lower cardio-metabolic risk, including lower risk of type 2 diabetes mellitus (DM) and hypertension [4,5].

However, few Korean studies have examined the relationship between the habit of eating breakfast and cardio-metabolic risk. In 2014, Yoo et al. reported that eating a dairy-cereal breakfast or a high energy and fiber breakfast was associated with a reduced risk of metabolic syndrome, although they did not find a significant relationship between breakfast consumption and hypertension [6]. We theorized there is a relationship between hypertension and the habit of eating breakfast, although there are very few studies examining this association [7].

Therefore, the present study aimed to examine whether

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the habit of eating breakfast is associated with hypertension in a healthy Korean population.

MATERIALS AND METHODS

1. Study population and design

Participants in the 2014 Korea National Health and Nutrition Examination Surveys (KNHANES) were enrolled in this study. The KNHANES has been regularly administered by the Division of Chronic Disease Surveillance of the Korean Centers for Disease Control and Prevention since 1998. The present study was a cross-sectional study. Data were directly collected by household interviews and study staff performed standardized physical examinations [8]. Nutritional status, including dietary information and medical history, was measured using a 24-hour recall method. Regular exercise was indicated as “yes” when the subject exercised for more than 20 minutes at a time, more than three times per week. We excluded subjects for the following reasons: age < 20 years, incomplete answers about social and medical histories, or missing blood pressure, weight, height, waist circumference, or laboratory marker data. Of the larger survey sample, 3880 participants aged 20 years or older were recruited for the present study. All participants provided written informed consent, and the data provided were anonymous. The study was carried out in accordance with the ethical standards of the Helsinki Declaration.

2. Measurement

Blood samples were obtained after more than 8 hours of fasting and were immediately refrigerated, transported to the Central Testing Institute in Seoul, Korea, and analyzed within 24 hours. The serum values of creatinine, lipid and liver enzyme profiles were measured using a Hitachi 7600 automated chemistry analyzer (Hitachi, Tokyo, Japan) using standardized methods.

3. Estimation of eating breakfast

The habit of eating breakfast was estimated from self-reported questionnaires and was classified in two groups. The eating breakfast group included individuals who ate breakfast more than 5 times per week; the not eating breakfast

group included individuals who did not eat any breakfast in a week.

4. Statistics

Statistical analysis was performed through IBM SPSS Statistics version 20 (SPSS Inc., Chicago, IL, USA). Continuous variables, such as age, blood pressure, and laboratory markers, were analyzed through *Student's T tests*. For categorical variables, a *Chi square* test was used to compare frequencies between groups. Multiple logistic regression analysis was used to examine the adjusted odds ratios of the habit of eating breakfast for hypertension. A p-value less than 0.05 was considered statistically significant.

RESULTS

1. Patient characteristics

The demographic and clinical characteristics of the patients were classified into 2 groups according to the habit of eating breakfast, as shown in Table 1. The prevalence of not having breakfast was 13.1% (510/3880). The eating breakfast group was older than the not eating breakfast group (mean age = 57.76 in the eating group; mean age = 41.35 in the not eating group). There was a higher prevalence of hypertension, diabetes mellitus (DM), and dyslipidemia in the eating breakfast group relative to the not eating breakfast group (HTN: 28.2% > 10.8%; DM: 10.5% > 3.9%; Dyslipidemia: 11.0% > 3.7%). There was no significant difference in engagement in regular exercise between the breakfast eating group and the not breakfast eating group (Table 1).

2. Prevalence of hypertension according to habit of not eating breakfast

The crude odds ratio of not eating breakfast for the prevalence of hypertension was 0.366, which indicated a negative association between hypertension and eating breakfast. However, after adjusting for confounding factors, such as age and sex, the odds ratio (OR) reversed (Table 2; OR = 1.125; 95% confidence interval [CI] = 1.121–1.129; p-value < 0.001). Furthermore, after adjusting for all considered confounding factors (age, sex, regular exercise, current smoking, systolic blood pressure, diastolic blood pressure,

Table 1. Baseline characteristic according to the habit of eating breakfast

	Participants eating breakfast (N = 3370)	Participants not eating breakfast (N = 510)	p-value
Age, mean (\pm SD)	57.76 (\pm 15.67)	41.35 (\pm 13.67)	<0.001
Male, N (%)	1368 (40.6)	201 (39.4)	0.612
Hypertension, N (%)	949 (28.2)	55 (10.8)	<0.001
Diabetes mellitus, N (%)	354 (10.5)	20 (3.9)	<0.001
Dyslipidemia medication, N (%)	371 (11.0)	19 (3.7)	<0.001
Regular exercise, N (%)	577 (17.1)	71 (13.9)	0.071
Current smoker, N (%)	473 (14.0)	141 (27.6)	<0.001
SBP, mmHg, mean (\pm SD)	120.02 (\pm 16.99)	113.79 (\pm 15.32)	<0.001
DBP, mmHg, mean (\pm SD)	73.99 (\pm 10.19)	74.62 (\pm 10.70)	<0.196
Height, cm, mean (\pm SD)	160.33 (\pm 9.19)	164.45 (\pm 9.17)	<0.001
Weight, kg, mean (\pm SD)	61.33 (\pm 10.86)	63.41 (\pm 13.02)	<0.001
BMI, kg/m ² , mean (\pm SD)	23.79 (\pm 3.22)	23.33 (\pm 3.68)	0.008
WC, cm, mean (\pm SD)	81.80 (\pm 9.49)	79.83 (\pm 10.20)	<0.001
FBS, mg/dL, mean (\pm SD)	101.53 (\pm 24.33)	96.70 (\pm 17.00)	<0.001
LDL, mg/dL, mean (\pm SD)	113.28 (\pm 32.99)	124.48 (\pm 37.55)	0.004
Hemoglobin, g/dL, mean (\pm SD)	13.93 (\pm 1.49)	14.13 (\pm 1.58)	0.008
RBC, Mil/uL, mean (\pm SD)	4.51 (\pm 0.43)	4.63 (\pm 0.44)	<0.001

SD: Standard deviation, BMI: Body mass index, SBP: Systolic blood pressure, DBP: Diastolic blood pressure, WC: Waist circumference, FBS: Fasting blood sugar, LDL: low density lipoprotein cholesterol, RBC: Red blood cell.

Table 2. Multivariate logistic regression models of not eating breakfast for hypertension

	Odds ratio	95% CI interval	p-value
Model 1*	0.366	0.365–0.367	<0.001
Model 2 [†]	1.125	1.121–1.129	<0.001
Model 3 [‡]	1.065	1.057–1.073	<0.001

*Crude oddsratio of not eating breakfast for hypertension.

[†]Adjusted by Model 1+ age, sex, and diabetes mellitus.

[‡]Adjusted by Model 2+ regular exercise, current smoking, systolic blood pressure, diastolic blood pressure, body mass index, waist circumference, and red blood cell count.

CI: confidence interval.

body mass index, waist circumference, and red blood cell counts), not eating breakfast was associated with a higher risk of HTN (Table 2; OR = 1.065; 95% CI = 1.057–1.073; p-value < 0.001).

DISCUSSION

In this large, population-based study, we found that the habit of eating breakfast was independently associated with a lower risk of hypertension. To the best of our knowledge, this is the first population-based study in Korea examining the relationship between breakfast and hypertension.

Some studies identified a correlation between eating breakfast and the incidence of some diseases. Smith et al. reported that skipping breakfast over a long period time may be associated with cardio-metabolic health [9]. Also, van der Heijden et al. found that the habit of eating breakfast contributed to the prevention of weight gain, unlike omitting breakfast [10]. Furthermore, Yoo et al. identified that breakfast consumption was associated with a reduced risk of metabolic syndrome in a Korean population when classifying the Korean breakfast into two types, a dairy-cereal breakfast pattern and a traditional Korean breakfast pattern [6]. However, this study did not find a relationship between breakfast consumption and the prevalence of hypertension.

The higher total and LDL cholesterol concentrations were observed in Smith et al.'s study [9].

These results might be due to a higher intake of saturated fat in the skipping breakfast group. Another possible explanation is a higher insulin stimulus of hydroxyl methyl glutaryl Co-A (HMG-CoA) reductase. Compared with participants who ate breakfast, those who skipped breakfast had higher fasting insulin concentrations and, therefore, might have higher HMG-CoA reductase [9]. Through these possible mechanisms, skipping breakfast might induce high-

er LDL cholesterol and, therefore, atherosclerosis. Furthermore, recent studies found that skipping breakfast clusters were associated with risk factors of hypertension, such as smoking and lower levels of physical activity [11].

The present study was the largest and first epidemiologic study in Korea to examine the relationship between the habit of eating breakfast and the prevalence of hypertension. Our research included approximately 5,000 participants and 20 million individuals if weighting is considered, so it might reflect Korea's national population. Similarly, we may have counteracted selection bias through validated and randomized selection and weighting methods.

Our study has several limitations. First, since the present study was cross-sectional rather than longitudinal, a causal relationship between breakfast consumption and hypertension could not be definitively established. Furthermore, we did not assess all confounding factors, although we attempted to include as many as possible, including age, medication, smoking, exercise, alcohol, and menstrual irregularity.

In conclusion, the habit of eating breakfast was associated with a lower risk of hypertension among healthy Korean adults. Further large-scale prospective studies are needed to confirm the possible effect of regular breakfast consumption on hypertension and identify the physiologic mechanisms underlying this association.

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