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Prevalence and correlates of metabolic syndrome and its components in elderly Korean adults

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ABSTRACT

Purpose: This study examined the determinants of the prevalence of factors related to five components of metabolic syndrome in the elderly.
Methods: The study used raw data (2010–2012) from the Korea National Health and Nutrition Examination Survey-V. The 3971 study subjects were community-dwelling elderly adults aged over 65 years. The criteria for the metabolic syndrome were based on those of the American Heart Association/National Heart, Lung and Blood Institute, and the waist circumference cutoff points for these factors were adapted from the standard suggested by the Korea Society for the Study of Obesity in 2005.
Results: The overall prevalence of metabolic syndrome in Korean elderly adults was 43.6% (35.3% in men and 50.2% in women). Metabolic syndrome was 2.32 times more prevalent in women relative to men (95% confidence interval [CI]: 1.85–2.90, $p < 0.001$), 1.26 times more prevalent in urban, relative to rural, residents (95% CI: 1.09–1.45, $p = 0.002$), 1.43 times more prevalent in ex-smokers (95% CI: 1.14–1.80, $p = 0.002$) and 1.45 times more prevalent in smokers (95% CI: 1.11–1.54, $p = 0.007$) relative to nonsmokers, and 1.16 times more prevalent in sedentary, relative to active, subjects (95% CI: 1.02–1.32, $p = 0.028$).
Conclusion: The results indicated that the prevalence of metabolic syndrome in elderly Korean adults was high, suggesting that the prevention and management of metabolic syndrome in the elderly should be addressed via individual components.

1. Introduction

Metabolic syndrome (MetS) is an important global public health issue (Kassi et al., 2011). MetS includes complex components, such as central obesity, elevated blood pressure, dysglycemia, high triglyceride (TG) levels, and low high-density lipoprotein cholesterol (HDL-C) levels (Eckel et al., 2005; Reaven, 1988), and is related to type 2 diabetes and cardiovascular disease, increasing the risk of mortality (Ford, 2004; Scuteri et al., 2005; Wannamethee et al., 2005).

In general, the prevalences of MetS and individual components of the syndrome are considered to increase with age (Scuteri et al., 2005; Butler et al., 2006; Xi et al., 2013). The prevalences of MetS in elderly Korean adults, despite some differences in the data and criteria used, are 50.8–63.2% in women and 21.7–41.7% in men, which is higher than those of elderly adults elsewhere (Kim, 2013; Lee et al., 2009; Lee & Kwon, 2010; Lim et al., 2011; Yun, 2010).

Higher morbidity and mortality rates for cardiovascular diseases, such as coronary artery disease, stroke, and diabetes, have been reported in elderly adults diagnosed with MetS. In particular, the increased prevalence of MetS and its individual components leads to a higher incidence of cardiovascular disease and related mortality in elderly individuals, relative to that of other age groups, as physiological changes and various chronic diseases occur with age (Scuteri et al., 2005; Dominguez & Barbagallo, 2007; Shin et al., 2009).

Individual components of MetS have been reported to exert a greater effect on the incidence of cardiovascular disease and mortality in the elderly relative to that observed in younger adults (Butler et al., 2006; Sinclair & Viljoen, 2010). Therefore, a strategy to address the individual components of MetS, rather than overall morbidity, is required to ensure efficient management of MetS in the elderly (Kim, 2013; Denys et al., 2009). This is because treatment and management should focus on individual components, even though the 3 of the 5 risk factors for MetS are also diagnostic criteria for MetS, highlighting the need for research examining the factors related to MetS according to the components of the disease.

Many Korean studies have involved adult populations that included the elderly, but studies demonstrating a higher prevalence of MetS in the elderly are lacking. Although some studies have examined MetS in the elderly (Kim, 2013; Lee & Kwon, 2010; Lim et al., 2011; Yun, 2010), the samples were from specific areas, and related causes of MetS were not considered.

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Therefore, this study aimed to provide basic data for use in the development of prevention and management programs for MetS by identifying the prevalence of individual components and the factors related to the disease using data from the Korea National Health and Nutrition Examinations Survey (KNHANES), which included the national population.

2. Methods

2.1. Study design and subjects

This study involved cross-sectional analysis using raw data (2010–2012) from the KNHANES-V, which was conducted by the Korean Centers for Disease Control (CDC). The KNHANES is a national survey, for which representativeness and reliability have been demonstrated, designed to produce national-, city- and provincial-level statistics concerning health status, health-related awareness and behavior, and food and nutrition intake. A multistage random cluster process was used to recruit the study sample from 16 provinces. Full details of the subject recruitment strategies have previously been described elsewhere (Korean Center for Disease Control and Prevention, 2012). KNHANES information includes socioeconomic status and health, nutrition, physical measurement, and blood test results. In total, 4059 individuals aged 65 years or older were potentially eligible to participate in the study. However, 88 were excluded, as they did not provide anthropometry, blood pressure, or blood test data. Ultimately, 3971 participants were included in the time series analysis. Written informed consent was obtained from all subjects, and ethical approval for the survey was granted by the research ethics committee of the Korea CDC (approval numbers: 2010: 2010-02CON-21-C; 2011: 2011-02CON-06-C; and 2012: 2012-01EXP-01-2C).

2.2. Definition of MetS

The diagnostic criteria of the American Heart Association/National Heart, Lung and Blood Institute, modified by the National Cholesterol Education Program, Adult Treatment Panel-III in 2001 were adapted for use in the present study (Grundy et al., 2005). The waist circumference value suggested by the Korean Society for the Study of Obesity in 2005 (≥90 cm for Korean men and ≥85 cm for Korean women) was used to define central obesity (Lee et al., 2007). MetS was considered present when more than 3 of the following 5 risk factors were observed:

Waist circumference of ≥90 cm for men or ≥85 cm for women

TG level of ≥150 mg/dL or a prescription for medication

HDL-C level of <40 mg/dL for men or <50 mg/dL for women or a prescription for medication

Systolic blood pressure of ≥130 mm Hg, diastolic blood pressure of ≥85 mm Hg, or a prescription for antihypertensive medication

Fasting plasma glucose (FPG) level of ≥100 mg/dL or a prescription for medication.

2.3. Measurements

Of the factors found to affect the prevalence of MetS in the elderly in previous domestic and foreign studies and those extracted from the KNHANES (2012–2014), sociodemographic variables, health behavior, anthropometry, and blood test data were included in the present study. Sociodemographic variables included sex, age, educational level, and area of residence. Age was classified into two groups: younger (65–74 years) and older (≥75 years) elderly. Educational level was classified into two groups: less well educated (elementary school or lower; 6 years or less) and well educated (middle school or higher; 7 years or more). Area of residence was also classified into two groups: rural and urban.

Health behavior variables included smoking, drinking, and physical activity. Smoking status was classified into three groups: nonsmoker, ex-smoker, and smoker. Drinking status was classified into two groups: nondrinker (has not drunk alcohol for at least 1 year) and drinker (drinks alcohol more than once per year). Physical activity was classified into two groups: active (subjects who followed recommendations advising participation in physical activity for 30 min on more than 5 days per week) and sedentary (subjects who did not follow these recommendations) (Korean Center for Disease Control and Prevention, 2012). This study used self-report questionnaires to collect sociodemographic and health behavior data, but an in-depth interview was conducted by a trained interviewer if subjects experienced difficulty completing the questionnaire because of aging or other reasons.

Anthropometry was measured by a trained examiner. Height was measured to 1 decimal point (0.1 cm) using an extensometer (Seca 225, Germany), and weight was measured to 1 decimal point (0.1 kg) using bathroom scales (GL-6000-20, Seoul, Republic of Korea). Waist circumference was measured to 1 decimal point (0.1 cm), from the middle point between the lowest rib to the highest iliac crest line when the subject exhaled, using a measuring tape. Body mass index (BMI) was calculated by dividing weight (kg) by height squared (m^2), and the threshold for obesity was a BMI of over 25 kg/m^2. Blood pressure was measured three times using a mercury sphygmomanometer (Baumanometer® Desk model 0320, USA) after the subject had been sitting down for 5 min with a tourniquet placed on his or her right arm; the mean value for the 2nd and 3rd blood pressure readings was considered the final blood pressure value.

Blood was extracted from the antecubital vein subsequent to at least 8 h of fasting, refrigerated, and analyzed within 24 h of being moving to the central analysis agency. TG, HDL-C, and FPG were analyzed using an AutoAnalyzer (ADVIA 1650, USA).

2.4. Statistical analysis

Data were analyzed using SPSS for Windows, version 18.0 (SPSS Inc., Chicago, Illinois). Frequencies, percentiles, and means were calculated for sociodemographic and health behavior characteristics, physical measurements, and biochemical tests. Differences between individual MetS components according to sociodemographic and health behavior characteristics were determined using χ^2 tests. Multivariate logistic regression analysis was performed to analyze the factors affecting MetS and its individual components. Statistical significance was defined as a p value of <0.05.

3. Results

Subjects' sociodemographic and health behavior characteristics and anthropometry and blood test results are shown in Table 1. The proportion of women (56.2%) was higher relative to that of men (43.8%), and subjects' mean (± standard deviation) age was 71.5 ± 5.3 years.

Table 2 shows the prevalence rates for MetS and its individual components according to sociodemographic and health behavior characteristics. The overall MetS prevalence rate was 43.6%. The MetS prevalence rate for elderly women (50.2%) was significantly higher relative to that of elderly men (35.3%; $p < 0.001$). Of the prevalence rates for the individual components of MetS, that of elevated blood pressure (66.7%) was the highest, followed by those of low HDL-C (47.7%), elevated FPG (45.4%), central obesity (38.6%), and high TG (32.1%).

The results of logistic regression analysis, performed to identify factors affecting MetS and its individual components, are shown in Table 3. The MetS prevalence rate was 2.32 times higher in women relative to men (95% confidence interval [CI]: 1.85–2.90, $p < 0.001$), 1.26 times higher in rural, relative to urban residents (95% CI: 1.09–1.45, $p = 0.002$); 1.43 times higher in ex-smokers (95% CI: 1.14–1.80, $p = 0.002$) and 1.45 times higher in smokers relative to nonsmokers (95% CI: 1.11–1.54, $p = 0.007$); and 1.16 times higher in sedentary, relative to active, subjects (95% CI: 1.02–1.32, $p = 0.028$). The risk of central obesity was 2.18 times higher in women relative to men (95% CI:

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