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Metabolic syndrome epidemic among Korean adults: Korean survey of Cardiometabolic Syndrome (2018)

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HIGHLIGHTS

- The prevalence of metabolic syndrome (MetS) in Korea has remained stable since 2007.
- The prevalence of MetS was higher in middle-aged men and women aged ≥60 years.
- As the family income and educational level decreased, the prevalence of MetS increased.

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ABSTRACT

Background and aims: Little information exists on the prevalence of metabolic syndrome (MetS) in Korea since 2007. We aimed to provide up-to-date estimates of the prevalence of MetS and its trend in the general adult population in Korea.
Methods: We compared the prevalence and pattern of MetS among participants in the Korean National Health and Nutrition Examination Surveys (KNHANES) IV (2007–2009), V (2010–2012), and VI (2013–2015), aged ≥19 years. Data from the 2005 census of the Korean population were presented according to age standardization.
Results: The overall age-standardized prevalence of MetS in 2013–2015 was 20.3% (95% confidence interval [CI], 19.6%–21%). Since 2007, the overall prevalence of MetS has remained stable, whereas the prevalences among men and women, respectively, have increased and decreased slightly. By contrast, the prevalence of MetS among men aged 19–49 years has shown an increasing tendency since 2007. Moreover, nearly 40% of women aged ≥60 years had MetS in 2013–2015. Among the five components of MetS, only elevated fasting glucose level has shown an increasing trend since 2007 in both men and women. As the family income and educational level decreased, the prevalence of MetS increased.
Conclusions: The overall prevalence of MetS has remained stable since 2007. However, the prevalence of MetS was higher in middle-aged men and women aged ≥60 years. Considering the close association between MetS and socioeconomic status, age- and sex-specific strategies should be developed at the national level for the treatment and prevention of MetS in Korea.

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1. Introduction

Metabolic syndrome (MetS) refers to a cluster of specific cardiovascular disease risk factors whose underlying pathophysiology is thought to be related to insulin resistance; these factors include central obesity, dyslipidemia, impaired glucose tolerance, and hypertension [1]. MetS is common and is increasing in prevalence worldwide, which relates largely to the increasing number of individuals with obesity and a sedentary lifestyle [2–4]. WHO Expert Consultation reported that MetS is an educational concept that focuses attention on complex multifactorial health problems, is a pre-morbid condition rather than a clinical diagnosis, and has limited practical utility as a diagnostic or management tool and that there is limited utility in epidemiological studies in which different criteria of MetS are compared [5]. However, previous research clearly demonstrates that the presence of the MetS is associated with poorer health outcomes. Subjects with MetS are associated with arterial aging [6] and higher risk of cardiovascular events [7,8] and 3.5–5 times more likely to develop type 2 diabetes mellitus (DM) [9]. MetS is also related to chronic kidney disease [10], some cancers, and even all-cause mortality [11]. Consequently, MetS is now both a public health and a clinical problem. Thus, investigating updated prevalence trends may be important, given the potential impact of MetS on its related health complications in the population.

Earlier surveys reported an association between socioeconomic position and MetS [12–14]. Socioeconomic status is assumed to influence lifestyle, that is, unhealthy dietary habits, sedentary lifestyle, smoking, excessive alcohol consumption which in turn modify MetS risk. A previous study demonstrated that the prevalence of MetS in Korea markedly increased over the 1998–2007 period (from 24.9% in 1998 to 31.3% in 2007) [4,15]. The observed increasing prevalence of MetS in Korea since 1998 might be explained by the rapid lifestyle changes over a relatively short period. Korea experienced a major economic crisis in 1998, followed by a rapid and impressive economic recovery. However, no data on the recent trends of MetS prevalence in Korea are available even though the socioeconomic status and some health promotion programs such as Health Plan 2020 have undergone some changes since 2007 [16].

Thus, we aimed to investigate the prevalence of MetS and its trend by using representative data from the most recent nationwide survey in Korea. We also investigated the prevalence of MetS according to socioeconomic status in the Korean population.

2. Materials and methods

2.1. Study population and design

This study was based on data obtained by the Korea National Health and Nutrition Examination Surveys (KNHANES) IV (2007–2009), V (2010–2012), and VI (2013–2015). The details about the survey have been published elsewhere [17,18]. The KNHANES has been annually performed by the Division of Chronic Disease Surveillance of the Korean Centers for Disease Control and Prevention since 1998. The KNHANES is a cross-sectional and nationally representative survey including a health interview and nutrition and health examination surveys to assess the health and nutritional statuses of the Korean population. Among 53,062 participants aged ≥19 years, those who participated in the survey in the period between 2007 and 2015 and had all data required for defining MetS according to the revised National Cholesterol Education Program (NCEP) definition were included in the present study. The characteristics of the participants are shown in Supplementary Table 1. All the participants provided written informed consent to participate in this survey, and we received the data in an anonymized form.

2.2. Data collection

In the health interview, the participants were asked to provide information about health behaviors, including smoking, alcohol intake, physical activity, and stress awareness. Current smokers were defined as those who had smoked > 5 packs of cigarettes during their lifetime and were smoking at the time of the survey. All the other subjects were defined as nonsmokers. Alcohol consumption was assessed by questioning the subjects about their drinking behavior during the month before the interview. High-risk drinking was defined as having ≥7 drinks at one time, more than twice a week, for men (≥5 drinks for women). All the subjects were questioned about whether they exercised with an intensity that left them sweating and with slight difficulty in breathing. Subjects who exercised regularly at a moderate intensity were asked about the frequency at which they exercised per week and the duration of each exercise session. Physical activity was classified according to the presence of regular exercise as moderate-intensity physical activity (requires a moderate amount of muscle fatigue and noticeably increased breathing rate) for a minimum of 30 min each day for 5 days per week. Family income quartiles were calculated on the basis of equivalized income (total household income divided by the square root of the number of household members). Educational level was divided into elementary school, middle school, high school, and college or higher. Height and weight measurements were performed with the participants wearing light clothing and no shoes. Waist circumference was measured at the narrowest point between the upper iliac crest and the lowest rib after normal expiration. Blood pressure was measured by averaging three recordings taken in the morning after at least 10 min of rest in a sitting position. Blood pressure was measured twice, using a mercury sphygmomanometer (Baumanometer; Baum, Copiague, NY), in the sitting position after at least 10 min of rest. Laboratory samples were obtained after a 12-h fast. Blood samples were immediately refrigerated; transported to the Central Testing Institute in Seoul, Korea; and analyzed within 24 h. Fasting plasma glucose, total cholesterol, triglyceride (TG), and high-density lipoprotein (HDL) cholesterol levels were measured with a Hitachi 700-110 chemical analyzer (Hitachi, Tokyo, Japan).

2.3. Definition of MetS

In accordance with the harmonizing worldwide consensus criteria of MetS issued by IDF, NHLBI, AHA, WHF, IAS, and IASO modified National Cholesterol Education Program Adult Treatment Panel III (NCEP-ATP III) criteria [19], MetS was defined as the presence of three or more of the following components: 1) abdominal obesity, defined as a waist circumference of ≥90 cm for males or ≥85 cm for females (following Korean specific cutoffs for abdominal obesity defined by the Korean Society of Obesity) [20]; 2) hypertriglyceridemia, defined as a serum triglyceride concentration of ≥150 mg/dL, or specific treatment for this lipid abnormality; 3) low HDL cholesterol level, defined as a serum HDL cholesterol concentration < 40 mg/dL for males or < 50 mg/dL for females, or specific treatment for this lipid abnormality; 4) high blood pressure, defined as a systolic blood pressure (SBP) of ≥130 mmHg and a diastolic blood pressure (DBP) of ≥85 mmHg, or treatment with antihypertensive agents; and 5) high fasting glucose level, defined as a fasting serum glucose level of ≥100 mg/dL or current use of antidiabetic medication.

2.4. Statistical analysis

All data are presented as mean ± SE or as prevalence (% and SE). Prevalence was analyzed using the direct age standardization method, as prevalence rates can differ by year. The age-standardized prevalence was determined for the Korean population aged ≥19 years in the year 2005, published by the Statistics Korea. To reflect age-counting effects, the prevalence of MetS was standardized by age group for every 5 years.