Nutrition, Metabolism & Cardiovascular Diseases (2013) 23, 876–882

Available online at www.sciencedirect.com

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journal homepage: www.elsevier.com/locate/nmcd

Nutrition, Metabolism & Cardiovascular Diseases

Reading nutrition labels is associated with a lower risk of metabolic syndrome in Korean adults: The 2007–2008 Korean NHANES

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Received 9 February 2012; received in revised form 21 June 2012; accepted 22 June 2012
Available online 10 November 2012

KEYWORDS
Nutritional labels;
Insulin resistance;
Socioeconomic status;
Metabolic syndrome

Abstract *Background and aims:* Several studies demonstrated that reading nutrition labels was associated with healthier food choices, despite some controversy. This study investigated the association between the use of nutrition labels and metabolic syndrome (MetS) in Korean adults.

Methods and results: This cross-sectional study included 7756 individuals who participated in the 2007–2009 Korean National Health and Nutrition Examination Survey (KNHANES). A self-reported questionnaire was used to determine participant's awareness of nutrition labels. Modified Asian criteria based on a harmonizing definition of MetS were adopted. Individuals in the group that read nutrition labels (the Reading Group) were youngest and leanest, but their daily caloric intake fell between that of the group that did not read nutrition labels (the Non-Reading Group) and the group that did not know about them (the Not-Knowing Group). The prevalence of MetS was 16.8% in the Reading Group, 27.2% in the Non-Reading Group, and 47.3% in the Not-Knowing Group. In comparison to participants in the Reading Group, the odds ratios (95% confidence interval) for MetS in the participants in the Non-Reading Group and Not-Knowing Group were 1.85 (1.60–2.14) and 4.44 (3.79–5.20), respectively, when not adjusted. The relationship between the use of nutrition labels and MetS remained statistically significant even after adjusting for covariates such as age, sex and

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http://dx.doi.org/10.1016/j.numecd.2012.06.007

socioeconomic status including household income and education level [1.27 (1.05—1.53) in the Non-Reading Group and 1.34 (1.05—1.70) in the Not-Knowing Group].
Conclusion: Reading nutrition labels appeared to be associated with a lower prevalence of MetS in a nationally representative sample of Korean adults.

Introduction

Over the last several decades, increased household income and growth of the fast-food industry have led to increased consumption of energy-dense foods and increased daily caloric intake, especially in developing countries [1,2]. In turn, the prevalence of obesity and obesity-related disorders such as metabolic syndrome (MetS) and cardiovascular diseases has also increased [2—5]. The relationship between this change in dietary patterns and public health problems has led to the creation of legislation concerning the provision of nutrition information, including worldwide regulation of nutrition labels [6—8]. The disclosure of nutrition information in packaged foods and foods served in restaurants was anticipated to be associated with reduced caloric intake and fat consumption, resulting in a positive effect on public health [9—11]. However, contrary to this anticipation, several studies have reported mixed findings regarding the effectiveness of food labeling [12—14]. Furthermore, the prevalence of obesity and obesity-related disorders continues to rise despite efforts, such as food labeling regulations, to reduce fatty population.

MetS is an obesity-related disorder characterized by abdominal obesity, high blood pressure, dyslipidemia, and impaired fasting glucose [15]. The prevalence of MetS in adult populations varies from 20% to 30% depending on age, ethnicity, and diagnostic criteria, but has rapidly increased in recent decades [16]. Although its pathophysiology is not completely understood, low socioeconomic status and high caloric intake are important risk factors for MetS [17,18]. That said, there is little evidence that awareness of nutrition labels is associated with MetS independently of caloric intake and socioeconomic status.

This study investigated the relationship between the use of nutrition labels and the prevalence of MetS after adjusting for age, body mass index (BMI), insulin resistance, daily caloric intake, and socioeconomic status, including household income and education level.

Methods

Study sample

This study was based on data obtained from the 2007—2009 Korean National Health and Nutrition Examination Survey (KNHANES) which was performed by the Korean Ministry of Health and Welfare between 2007 and 2009. Only 2007 and 2008 data were used in this study, because blood pressure data for the 2009 KNHANES were not yet available when this study was conducted. Subjects participating in the KNHANES completed a four-part questionnaire composed of a Health Interview Survey, a Health Behavior Survey, a Health Examination Survey, and a Nutrition Survey. The 2007 and 2008 KNHANES included 14,338 participants. The present study excluded participants younger than 19 years of age ($n = 3825$), those who did not do an overnight fast ($n = 1146$), those without laboratory data ($n = 221$), and those who did not indicate whether or not they read nutrition labels ($n = 1132$). Subjects with a known diagnosis of any malignancy ($n = 258$) were also excluded. After these exclusions, 7756 subjects were included in the final analysis.

Data collection

At the time that the 2007—2009 KNHANES were conducted, the Korean Ministry of Health and Welfare informed participants that they had been randomly selected as a household to voluntarily take part in this survey. According to the National Health Enhancement Act supported by the National Statistics Law of Korea, all contacted individuals had the right to refuse to participate. All participants and their parents (if applicable) provided written informed consent to use their blood samples for further analyses. The Institutional Review Board of Gangnam Severance Hospital, Yonsei University College of Medicine, in Seoul, Korea, approved this study. Physical examinations were performed by trained medical staff following standardized procedures. Height and body weight were measured in light indoor clothing without shoes to the nearest 0.1 cm and 0.1 kg, respectively. Waist circumference was measured at the narrowest location between the iliac crest and the lower border of the rib cage. BMI was represented as the ratio of weight to height squared (kg m^{-2}). Blood pressure was measured on the right arm using a standard mercury sphygmomanometer (Baumanometer, USA). Two systolic and diastolic blood pressure measurements were collected at 5 min-intervals and averaged for analysis. After an overnight fast, blood samples were collected from the subjects' antecubital veins. Levels of fasting plasma glucose, triglyceride, high-density lipoprotein cholesterol (HDL-C) (ADVIA 1650, Siemens, USA), insulin (Gamma Counter, Hewlett Packard, USA), and white blood cell (WBC) counts (ADVIA 120, Siemens, USA) were measured. Data from a quantitative food-frequency questionnaire based on the 24-h recall method were collected. Daily caloric intake was calculated with Can-Pro 2.0 software developed by the Korean Nutrition Society. This software package was designed to assess nutrient intake according to the volume, main ingredients, and recipes of food which Koreans most frequently consume [19].

Definitions of awareness of nutrition labels, metabolic syndrome, and insulin resistance

The KNHANES contained the following question to be answered by selecting one of the following: 'Do you read