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Socioeconomic status risk factors for cardiovascular diseases by sex in Korean adults

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Abstract. Background: Socioeconomic status (SES), defined as occupation, education, and income, has been regarded as one of the main risk factors affecting the prevalence of cardiovascular disease (CVD). This study investigates what SES contribute to predict the risk of CVD according to sex for Koreans.
Methods: Data of the Fourth Korean National Health and Nutrition Examination Survey was analyzed following the complex survey design, using multiple logistic regression models.
Conclusions: Those who satisfied 3, 4, and all criteria of the metabolic syndrome(MS) components were 18.5%, 9.5%, and 2.9%. Whereas in males, there were no significant SES risk factors for any clustering of MS components, in females, all the SES risk factors were negatively associated with the clustering of MS components. Also, the number of MS components increased, the odds ratio increased with regard to education, and was no longer significant with regard to household income or occupation. In order to decrease the risk of CVD, Korean females in lower education level need to be implemented.

1 Introduction

Metabolic syndrome (MS), characterized by a cluster of cardiovascular risk factors such as obesity, insulin resistance, dyslipidemia, and hypertension ((World Health Organization (WHO) 1999)), has received a great deal of attention due to its relationship to the risk of cardiovascular disease (CVD) and its worldwide epidemic status (Alberti et al. 2006). Socioeconomic status (SES), defined as occupation, education, and income (Shavers 2007), has been regarded as one of the main risk factors affecting the prevalence of MS that eventually leads to CVD (Brunner et al. 1997).

A few studies have examined the association between one of SES variables and the prevalence of MS among Koreans (Kim et al. 2005; Park et al. 2007; Park et al.

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2012). However, the diagnostic tool of MS itself did not fulfill the function of predicting for the risk of CVD; instead the clustering of the five MS components has predicted CVD well among Koreans (Kim et al. 2004). Therefore, we investigated the relationship between SES and clustering of MS components based on the sex of Koreans, to better understand the contributions of SES to MS as a way of predicting the risk of CVD.

2 Method

2.1. Study Population

This descriptive cross-sectional study used the Fourth Korean National Health and Nutrition Examination Survey (KNHANES IV 2010) data conducted by the Korean Centers for Disease Control and Prevention (KCDC) from 2007 to 2009. This survey used a stratified, multistage probability sampling design to extract a representative sample of civilian, non-institutionalized Koreans. The respondents' data were assigned weights to assure the equal probability of being sampled and to cover missing data. Of the total of 28,471 subjects, 17,424 adults aged 20 years and older who answered questions on all the types of data measured in this study were analyzed.

Table 1. Prevalence of metabolic syndrome according to socio-economic status by sex

	Male			Female		
Mets Component #	3	4	5	3	4	5
	OR[1] (95% CI)			OR[1] (95% CI)		
Education						
Elementary	0.8(0.7,1.1)	0.8(0.6,1.2)	0.8(0.4,1.5)	4.2*(3.1,5.6)	5.7*(3.7,8.7)	12.4*(4.8,31.9)
Middle	0.9(0.7,1.2)	0.8(0.5,1.1)	0.6(0.3,1.2)	2.7*(2.0,3.6)	3.8*(2.5,5.8)	9.5*(3.8,23.8)
High	1.1(0.9,1.3)	1.0(0.8,1.3)	0.8(0.5,1.4)	1.8*(1.4,2.3)	2.5*(1.7,3.7)	5.2*(2.1,12.9)
University	Ref	Ref	Ref	Ref	Ref	Ref
National Basic Livelihood guarantees						
Yes	1.0(0.7,1.4)	1.0(0.7,1.6)	0.8(0.4,1.9)	1.4*(1.1,1.7)	1.5*(1.2,1.9)	1.6*(1.1,2.4)
No	Ref	Ref	Ref	Ref	Ref	Ref

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Household income						
Lower 25%	0.8(0.6,1.0)	0.7*(0.5,0.9)	0.7(0.4,1.4)	1.6*(1.3,2.0)	1.5*(1.2,1.9)	1.1(0.7,1.6)
Lower 50%	1.0(0.8,1.2)	1.0(0.7,1.3)	0.8(0.5,1.4)	1.5*(1.2,1.8)	1.4*(1.1,1.8)	1.2(0.8,1.7)
Upper 50%	1.0(0.9,1.3)	1.0(0.7,1.3)	0.8(0.5,1.4)	1.1(0.9,1.5)	1.1(0.9,1.4)	1.0(0.7,1.5)
Upper 25%	Ref	Ref	Ref	Ref	Ref	Ref
Occupation						
Class I	0.8(0.6,1.0)	1.1(0.7,1.5)	1.2(0.6,2.4)	1.6*(1.1,2.3)	2.5*(1.4,4.4)	2.2(0.8,5.8)
Class II	0.7*(0.5,0.9)	0.7(0.4,1.1)	1.0(0.4,2.3)	1.9*(1.3,2.7)	2.8*(1.6,5.1)	2.4(0.9,6.7)
Class III	0.8*(0.6,0.9)	0.9(0.7,1.2)	0.9(0.5,1.6)	1.7*(1.2,2.5)	2.4*(1.4,4.2)	1.7(0.6,4.7)
Class IV	Ref	Ref	Ref	Ref	Ref	Ref

[1] Model was adjusted for the effect of age, marital status, smoking status, drinking status and physical activity.
* p for trend <0.05

2.2 Measures

SES (as independent variables) included education (elementary, middle, high, and university), household income (by its qurtiles), and occupation. Occupation was categorized into four groups according to skill levels based on education requirements: unemployment (class I), occupation requiring elementary-equivalent skill (class II), occupation requiring middle or high school-equivalent skill (class III), and occupation requiring university or above-equivalent skill (class IV) (International Labour Organization (ILO) 2010).

The prevalence of MS and the diagnostic component numbers (as dependent variables) were based on the guidelines suggested by the International Diabetes Federation (IDF) (Alberti et al. 2006). Central obesity was defined according to ethnicity-specific waist circumference (WC) with a combination of two or more of the following risk factors: elevated triglyceride (TG); elevated blood pressure (BP); and elevated fasting glucose (FG). For the ethnicity-specific WC, this study used 90 cm for men and 85 cm for women (Lee et al. 2007).

Other potential confounding variables of demographic and health behavior variables included sex, age, marital status, smoking, alcohol drinking, and physical activity.

2.3. Statistical analysis

Characteristics of the study subjects were displayed as mean values with standard deviations for continuous variables or numbers with percents for categorical variables. The numbers of MS components were analyzed using multiple logistic regression

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models before and after adjusting for the confounding variables. Statistical analysis was performed using SAS version 9.1.3 (SAS Institute, Cary, NC, USA).

3 Results

As for the general and MS characteristics of the study subjects, women were 57.6%, the overall mean age was 48.3 years, and the majority were married (72.8%). Of the subjects, 26.5% were current smokers, 41.9% were current drinkers, and 44.1% did not engage in physical activity. Concerning the three indicators of SES, 26.6% of the subjects had an elementary education and 26.5% had a university education; 19.9% were categorized as low income (lowest 25%) and 27.9% as high income (upper 25%); 43.1% were unemployed (class I) and 11.7% were in the highest occupation level (class IV). The prevalence of MS was reported by 18.5% of the subjects. Those who satisfied 4 criteria and all criteria of the IDF definition were 9.7% and 2.9%, respectively.

Table 1 shows the number of MS components (≥ 3, ≥ 4, and ≥ 5 components) based on the SES of males and females, respectively. In males, there were no increases in the odds ratio for the prevalence of MS as the number of MS components increased. However, in females, the odds ratio for the prevalence of MS increased significantly with regard to education, and was no longer significant with regard to household income or occupation.

4 Discussions

In this study, education was negatively associated with the prevalence of MS in males, and all SES levels measured were negatively associated in females. However, after adjusting for age, all the lowest SES levels were positively associated in males, and any SES remained negatively associated in females. A previous cohort study on the educational disparities of Koreans with MS (Kim et al. 2005) demonstrated that the education level was higher in younger subjects and men; on the other hand, the prevalence of MS according to education was higher in older adults, older females, and younger males. This supports the claim that age obscures the effects of education on the prevalence of MS, especially in men. Thus, stratifying SES according to age and sex is necessary to better understand the impact of SES on health outcomes across the study population.

The present study showed different results as for males; occupation was positively associated in this study whereas household income or income was positively associated in previous studies (Kim et al. 2005; Park et al. 2007; Park et al. 2012). This could be explained by the different diagnostic criteria used for MS. This study used IDF whereas the previous studies used the original or a revised version of the Third Report of The National Cholesterol Education Program Adult Treatment Panel (NCEP ATP Ⅲ), which showed a different MS prevalence with 17.1% based on IDF in this study and 24.1% according to NCEP ATP Ⅲ (Park et al. 2012). Because the

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diagnostic tools for MS themselves did not meet their clinical usefulness for predicting the risk of CVD when assessed using the receiver operating characteristic (ROC) curve, and instead the clustering of the five MS components had more clinical usefulness among Koreans (Kim et al. 2004), the results of the association between SES and the five MS components need to be given more attention.

In this study, only lower education was significantly associated with increasing the risk of clustering of the five MS components in females, but not any SES in males. The strongest effect of education on the prevalence risk of CVD was consistent with most studies of other races (Bohonar et al. 2011), showing that it is the most powerful SES determinant of CVD risk. The effect of education was exaggerated especially among females in this study, which might be due to the overall inferior social status of females compared to males in Korea, which leads to having fewer opportunities to acquiring formal health-related education and utilizing that knowledge to implement a healthy lifestyle or behavior. On the other hand, employment and income have been generally regarded as mechanisms of reverse causation such as poor health influencing the loss of employment and income (Shavers 2007) although the causal relationship has not been explored due to the limitations of the cross-sectional study design.

In conclusion, this study found that education, among the SES indicators assessed, was the strongest SES determinant associated with the risk of CVD, and was statistically significant in females, not in males. These results suggest that less educated Korean females need to be given more attention in order to reduce the risk of CVD

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