Relationships among personality traits, metabolic syndrome, and metabolic syndrome scores: The Kakegawa cohort study

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A R T I C L E   I N F O

A B S T R A C T

Objective: Metabolic syndrome and the presence of metabolic syndrome components are risk factors for cardiovascular disease (CVD). However, the association between personality traits and metabolic syndrome remains controversial, and few studies have been conducted in East Asian populations.

Methods: We measured personality traits using the Japanese version of the Eysenck Personality Questionnaire (Revised Short Form) and five metabolic syndrome components—elevated waist circumference, elevated triglycerides, reduced high-density lipoprotein cholesterol, elevated blood pressure, and elevated fasting glucose—in 1322 participants aged 51.1 ± 12.7 years old from Kakegawa city, Japan. Metabolic syndrome score (MS score) was defined as the number of metabolic syndrome components present, and metabolic syndrome as having the MS score of 3 or higher. We performed multiple logistic regression analyses to examine the relationship between personality traits and metabolic syndrome components and multiple regression analyses to examine the relationship between personality traits and MS scores adjusted for age, sex, education, income, smoking status, alcohol use, and family history of CVD and diabetes mellitus. We also examine the relationship between personality traits and metabolic syndrome presence by multiple logistic regression analyses.

Results: "Extraversion" scores were higher in those with metabolic syndrome components (elevated waist circumference: P = 0.001; elevated triglycerides: P = 0.01; elevated blood pressure: P = 0.004; elevated fasting glucose: P = 0.002). "Extraversion" was associated with the MS score (coefficient = 0.12, P = 0.0003). No personality trait was significantly associated with the presence of metabolic syndrome.

Conclusions: Higher "extraversion" scores were related to higher MS scores, but no personality trait was significantly associated with the presence of metabolic syndrome.

1. Introduction

Metabolic syndrome involves a number of risk factors for cardiovascular disease (CVD) and type 2 diabetes mellitus (DM), including dysglycemia, elevated blood pressure, elevated triglycerides, reduced high-density lipoprotein cholesterol (HDL-C) levels, and obesity [1]. In a meta-analysis, metabolic syndrome was shown to increase the risk of cardiovascular mortality by two-fold and of all-cause mortality by 1.5-

fold [2]. The number of metabolic syndrome components present is also related to coronary artery disease [3–5]. Additionally, it has been reported that metabolic syndrome and the number of components in Japanese individuals are related to cardiovascular and all-cause mortality [6]. As a predictor of CVD, it is still unclear whether metabolic syndrome can predict CVD beyond the individual components [7,8]. Some articles mentioned that the MS score is more useful than a diagnosis of metabolic syndrome as a risk factor of CVD [3,5]. However in

Japan, CVD is the second most common cause of death after malignancy [9]. Therefore, it is important to determine risk factors for metabolic syndrome and the number of components. Several risk factors, including smoking status [10], alcohol use [11], and family histories of DM [12] and CVD [13], have been well investigated as risk factors for metabolic syndrome; psychological factors have also been reported to be related to CVD [14].

"Neuroticism" and "extraversion" are well-known personality traits [15] that have been shown to have an impact on cardiovascular risk and mortality; "neuroticism" is related to the risk of death from CVD [16], and is associated with the risk of coronary heart disease [17], while "extraversion" is associated with the risk of stroke [17]. However, in several studies, no association was found between personality traits and all-cause mortality [18,19], or between ischemic heart disease and stroke [20]. "Neuroticism" and "extraversion" are also associated with some metabolic syndrome components. In Japanese individuals, "neuroticism", "extraversion", and "psychoticism" are associated with obesity [21], while "extraversion" is positively related to systolic blood pressure [22]. Therefore, we assumed that metabolic syndrome is one of the pathways between personality traits and CVD.

Several studies, including a systematic review, investigated the relationship between personality traits and metabolic syndrome [23] in non-East Asian populations. Although the systematic review concluded that there was no clear association between personality traits and metabolic syndrome, some personality traits were found to be related to metabolic syndrome in individual studies [23]. Furthermore, to our knowledge, no such study has focused on East Asian populations. East Asian populations have different lifestyles from their non-East Asian counterparts, so the relationship between personality traits and metabolic syndrome in East Asians needs to be clarified in order to identify risk factors for metabolic syndrome.

Therefore, the aims of the present study were to investigate the relationship between personality traits and individual metabolic syndrome components/the number of components/metabolic syndrome in Japanese individuals.

2. Methods

2.1. Participants and procedure

We conducted a cross-sectional study using baseline data from the Kakegawa cohort study, a prospective cohort study in Kakegawa city, Japan that was approved by the ethics review committee of Tohoku University (2009-150). Between June 2009 and October 2011, participants were recruited by a flyer inserted in the local newspaper. The inclusion criteria were age over 30 years and currently living in Kakegawa city. After receiving the flyer, people who were interested in joining the study contacted the authors by post, telephone, fax, or e-mail and made appointments for medical examinations. Next, we sent the respondents an explanation of the study, an informed consent form, a questionnaire, and a urine test kit by post. Informed consent was obtained from all of the participants at the health center after they received an explanation of the study objectives and methods by trained staff. In total, 1535 participants were enrolled. Two participants withdrew their consent, and 220 participants had some missing variables, such as basic characteristics, metabolic syndrome components, and scores on the Japanese version of the Eysenck personality questionnaire-revised, short form (EPQ-RS); these participants were excluded, leaving a total of 1322 participants (831 women; mean age ± standard deviation [SD] = 51.1 ± 12.7 years) for analysis. The study protocol was approved by the institutional review board of Tohoku University.

We collected the questionnaires and urine samples, took blood samples, and measured height, weight, waist circumference, and blood pressure during the medical examinations. Blood pressure was measured twice, and the average of the two values was used.

2.2. Definition of metabolic syndrome

According to the American Heart Association/National Heart, Lung, and Blood Institute (AHA/NHLBI) Scientific Statement [24], metabolic syndrome was defined as the presence of three or more of the following five components: elevated waist circumference (≥ 90 cm for men, ≥ 80 cm for women); elevated triglycerides (≥ 150 mg/dL or on drug treatment for elevated triglycerides); reduced HDL-C (< 40 mg/dL for men, < 50 mg/dL for women or on drug treatment for reduced HDL-C); elevated blood pressure (≥ 130 mmHg systolic blood pressure or ≥ 85 mmHg diastolic blood pressure or on antihypertensive drug treatment in a patient with a history of hypertension); and elevated fasting glucose (≥ 100 mg/dL or on drug treatment for elevated glucose). Next, we calculated the metabolic syndrome score (MS score), which was defined as the number of metabolic syndrome components present (range, 0–5).

2.3. Questionnaire

Participants completed a questionnaire regarding their age, sex, income, education, smoking status, alcohol use, personal history, medication history, and family history. We measured personality traits using the EPQ-RS [25]. The EPQ-RS has 48 items to which participants are asked to respond either "Yes" or "No". The EPQ-RS measures the following four personality traits: "neuroticism", "extraversion", "psychoticism", and "lie". The score of each personality trait is calculated based on a 12-item scale, and thereby ranges from 0 to 12. "Neuroticism" represents anxiousness and low self-esteem; "extraversion" represents sociability, liveliness, and surgency; "psychoticism" represents tough-mindedness, aggressiveness, coldness, and egocentricity [26]. "Lie" was originally made for correction of personality scores for "faking good", but gradually recognized as one of the personality dimensions representing genuine conformity to social rules and mores [27]. In a previous study, the reliability and validity of the Japanese version of the EPQ-RS were confirmed [25].

2.4. Statistical analyses

The participants' characteristics and personality scores were compared between those with and without metabolic syndrome using the Student's t-test for continuous variables and the chi-square test for categorical variables.

We investigated the association of each personality score with metabolic syndrome components. The differences in each personality score were then compared between those with and without metabolic syndrome components using Student's t-test. We also performed multiple logistic regression analyses considering each personality score as an independent variable and an individual metabolic syndrome component as a dependent variable. These analyses were adjusted for age (30–39, 40–49, 50–59, 60–69, and ≥ 70 years old), sex, education (junior high school, high school, junior college/vocational school/university dropout, and college/university or higher), income (≤ 5.99, 6.00–11.99, and ≥ 12.00 million JPY/year), smoking status (current, past, and never), alcohol use (current, past, and never), and family history of CVD (present, absent) and DM (present, absent).

To examine the effect of each personality score on MS scores, multiple regression analyses were conducted using each personality score as an independent variable and the MS score as a dependent variable with the same variables described above for adjustment. To examine the relationship between personality traits and the prevalence of metabolic syndrome, we performed logistic regression analyses considering the presence of metabolic syndrome as a dependent variable and the personality score as an independent variable after adjusting for the same variables described above. Each personality score was standardized to the z-score in all multivariate analyses.

We used the SAS package (version 9.4, SAS Institute Inc., Cary, NC,