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Relationship between age and cardiometabolic index in Japanese men and women

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KEYWORDS
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Abstract
Background: Cardiometabolic index (CMI) is a new discriminator of the risk of diabetes and has been reported to be associated with the degree of atherosclerosis. However, it is unknown whether and how age influences CMI.
Methods: The subjects were Japanese men (n = 35684) and women (n = 18793) aged ≥35 and ≤70 years who had received periodic health examinations at workplaces. CMI and its association with diabetes were compared among different age groups in men and women.
Results: CMI was much higher in men than in women (median: 1.06 vs. 0.59). In men, CMI was significantly higher in the middle-aged (40—49 and 50—59 years) groups than in the youngest (35—39 years) and oldest (60—70 years) groups and was significantly higher in the oldest group than in the youngest group. In women, CMI tended to be higher with an increase of age, and log-transformed CMI was significantly correlated with age (Pearson's correlation coefficient: 0.235, $p < 0.01$). Both in men and women, odds ratios of CMI (high vs. not high) for diabetes were significantly higher than the reference level in all of the age groups and tended to be lower with an increase of age. The above relationships among age, CMI and diabetes were also found in multivariate analyses adjusting for histories of smoking, alcohol drinking and regular exercise.
Conclusions: Age influences CMI differently in men and women, and the association between CMI and diabetes became weaker with an increase of age both in men and women.

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Introduction

Cardiometabolic index (CMI), calculated as a product of waist-to-height ratio (WHtR) and triglycerides-to-HDL cholesterol ratio (TG/HDL ratio), has been proposed as a new index for discriminating the risk of diabetes [1]. CMI has been shown to be associated with the degree of atherosclerosis in peripheral arterial disease [2]. To evaluate the risk of diabetes in the future in normoglycemic individuals, diabetes-associated indicators other than glucose and glucose-related measures are required, and an index comprising plural variables is useful for evaluating the risk of diabetes more generally than an index comprising a single variable. CMI comprises three variables, WHtR, triglycerides and HDL cholesterol, while other previous indices, including LDL cholesterol-to-HDL cholesterol ratio, TG/HDL ratio and lipid accumulation product (LAP) comprise two variables. Thus, CMI is thought to reflect more general risk of future diabetes than the other indices. CMI is useful to detect such a case as showing a borderline level (a little lower [WHtR and triglycerides] or higher [HDL cholesterol] than each of their cut-off values) of each variable and having a general risk for diabetes and cardiovascular disease. Furthermore, CMI has a merit of using WHtR, which is more suitable to evaluate abdominal obesity than waist circumference alone [3,4].

Age and gender are major determinants of the risk of cardiovascular disease [5,6]. Both adiposity and blood lipids are influenced by age and gender, partly explaining the associations of age and gender with cardiovascular risk [7,8]. Prevalence of diabetes also depends on age and gender [9,10]. However, it is not known whether and how CMI, which consists of adiposity and blood lipids, differs by age and gender. In this study, CMI and its relationships with hyperglycemia and diabetes were compared among different age groups of Japanese men and women.

Methods

Subjects

The subjects were Japanese workers aged $\geq$35 and $\leq$70 years (35,684 men and 18,793 women) who had received periodic health examinations at workplaces in Yamagata Prefecture in Japan. This study was approved by the Ethics Committee of Yamagata University School of Medicine. Histories of alcohol consumption, cigarette smoking, regular exercise (almost every day with exercise for 30 min or longer per day), medication and illness were surveyed by questionnaires. Those who had been receiving drug therapy for dyslipidemia were excluded from subjects of this study. Classifications of smokers and drinkers by average daily consumption of cigarettes and alcohol, respectively, were done as described previously [11].

Measurements

Height and waist circumference at the navel level according to the definition of the Japanese Committee for the Diagnostic Criteria of Metabolic Syndrome [12] were measured. Fasted blood was sampled from each subject, and serum triglycerides and HDL cholesterol were measured by enzymatic methods using commercial kits, Pureauto S TG-N and Cholestest N-HDL (Sekisui Medical Co., Ltd, Tokyo, Japan), respectively. CMI was calculated as a product of WHtR and TG/HDL ratio. The cut-off values for CMI used were 1.625 for men and 0.800 for women [1]. Blood haemoglobin A1c was used for evaluation of glycemic status. Haemoglobin A1c was determined by the latex cohesion method using a commercial kit, Determiner HbA1c (Kyowa Medex, Tokyo, Japan). Haemoglobin A1c values were calibrated by using a formula proposed by the Japan Diabetes Society (JDS) as haemoglobin A1c (National Glycohemoglobin Standardization Program) (%) = 1.02 $\times$ haemoglobin A1c (JDS) (%) + 0.25% [13]. Coefficients of variation for reproducibility of each measurement were $\leq$3% for triglycerides and $\leq$5% for HDL cholesterol and haemoglobin A1c. According to the criteria by the American Diabetes Association [14], subjects with hyperglycemia, including diabetes and prediabetes, were defined as those with haemoglobin A1c level being $\geq$5.7% and/or with a history of drug therapy for diabetes. Subjects with diabetes were defined as those with haemoglobin A1c level being $\geq$6.5% and/or with a history of drug therapy for diabetes. Thus, subjects with hyperglycemia were also included in those with diabetes.

Statistical analysis

Statistical analyses were performed using a computer software program (SPSS version 16.0 J for Windows, Chicago IL, USA). Proportions of each variable were compared between men and women using the Chi-square test for independence. In univariate analysis, means of each variable were compared between men and women by using unpaired Student's t test. In multivariate analysis, mean levels of each variable were compared

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