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Self-awareness of fast eating and its impact on diagnostic components of metabolic syndrome among middle-aged Japanese males and females

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Objective. The aim of the present study was to examine the association between subjects with self-awareness of fast eating and diagnostic components of metabolic syndrome in Japanese middle-aged male and female.

Patients and Methods. Subjects consisted of 3208 males (average age 50.6 years) and 2055 females (average age 50.0 years). Associations between subjects with self-awareness of fast eating and multiple components of metabolic syndrome (waist circumference, body mass index [BMI], blood pressure, and related blood sample tests) were evaluated.

Results. Significantly more males (57.7%) acknowledged themselves as "fast eater" than females (46.5%). Self-reported fast eaters showed significantly elevated body weight, BMI, and waist circumference in both genders. However, only male self-reported fast eaters showed high levels of blood pressure, fasting blood glucose, uric acid, and low-density lipoprotein (LDL)-cholesterol.

Conclusion. Fast eating is associated with diagnostic components of metabolic syndrome. The effect of acknowledging themselves as fast eater presents a higher impact on males than on females in the middle-aged Japanese population. The present study indicates that finding subjects with self-awareness of fast eating may lead to the prevention of developing metabolic syndrome.

Key words: metabolic syndrome, eating speed (fast eating)

The epidemic spread of the type 2 diabetes and its complications are becoming one of the major global health concerns. This epidemic speed is likely to be correlated with an increasing prevalence of obesity. In Japan, the rate of obesity increased from 0.8% (1976-1980) to 2.0% (1991-1995) within only a 15-year period (Yoshiike et al. 2002). Not only the obesity does induce diabetes but also multiple metabolic disorders. In addition to elevated blood glucose, obese individuals tend to exhibit elevated blood pressure and dyslipidemia. These multiple conditions are regarded as metabolic syndrome.

Metabolic syndrome is associated with the development of diabetes, atherosclerosis, and cardiovascular diseases, and it is therefore important to clarify methods which may prevent to the progression of the metabolic syndrome into a more severe state such as diabetes or cardiovascular events (Tokunaga et al. 1991; Nakayama et al. 1997; Ishikawa-Tanaka et al. 2002). Among the various factors, contributing to the development of this

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syndrome, maladaptive eating behaviors have been suggested to have a strong association (Shigeta et al. 2001; Maruyama et al. 2008; Udo et al. 2014). These include binge eating, irregular eating of meals, meal skipping, and fast eating (Sierra-Johnson et al. 2008; Roehrig et al. 2009; Udo et al. 2014). Of these behaviors, eating speed is considered to have a strong impact on the development of obesity and metabolic syndrome. From a therapeutic point of view, also eating is slowly generally accepted as a simple yet effective treatment of obesity (Otsuka et al. 2006; Hsieh et al. 2011).

However, the definition of the "fast eating" is unclear and difficult to evaluate in everyday clinical scene. On the other hand, there are many subjects who consider themselves as "fast eater". If their self-awareness as "fast eater" have clinical relevance, it is possible to distinguish the subjects who are at high risk of developing metabolic syndrome and thus possible to make early clinical intervention.

In the present study, we designed to examine the associations between subjects who are aware of their fast eating and diagnostic components of metabolic syndrome in Japanese middle-aged males and females, and also to evaluate the difference between the genders.

Material and Methods

Participants. Participants were those who had health checkups at Hidaka Hospital, Gunma, Japan. A total 5263 subjects (male: n=3208; with average age of 50.6 years, interquartile range 9.6; female: n=2055; with average age of 50.0 years, interquartile range 9.6.) participated in this study.

Data collection. The health check included physical examination, anthropometric measurements, waist circumference, and serum blood analysis, including fasting glucose, glycated hemoglobin (HbA1c: National Glycohemoglobin Standardization Program values) levels, and uric acid. Height and weight was measured using a standard stadiometer and scale with participants in light clothing. Body mass index (BMI) was calculated as weight/height^2 (kg/m^2). Blood pressure was measured using a standard mercury sphygmomanometer. Measurements were performed by trained staff. A questionnaire based on yes/no selection asking "Do you consider yourself to be a fast eater?" was used to collect information on self-awareness of fast eating.

Statistical evaluation. The normality of the data was examined by the Shapiro-Wilk test. As all variables showed non-normal distribution, data were expressed as "median (interquartile range)". Discrete variables were analysed with the chi-square test. Comparison of the fast and non-fast eaters in each category was assessed using the Mann-Whitney U test. All statistical analyses were performed using SPSS software (version 21, IBM). P-values less than 0.05 were considered to be statistically significant.

Results

The mean ages of the participants were 50.6 years for male (n=3208) and 50.0 years for female (n=2055). Among these participants, the percentage of those who reported him/herself to be fast eater were 57.7% (n=1850) in the males and 46.5% (n=955) in the females ($p<0.001$).

Association between self-reported fast eaters and each diagnostic component of metabolic syndrome (obesity, blood pressure, glucose tolerance, and dyslipidemia) were evaluated in both males (Table 1) and females (Table 2).

Three physical aspects related to obesity (body weight, BMI and waist circumference) were significantly high in both the male and female self-reported fast eaters (Table 1, 2).

When comparing blood pressure, the male self-reported fast eaters showed a significantly elevated systolic and diastolic blood pressure. However, there were no significant differences in both systolic and diastolic blood pressures between the self-reported fast eaters and non-fast eaters among the female subjects.

Glucose tolerance showed a similar tendency to that of blood pressure in both genders. Although HbA1c levels showed no significant difference between the self-reported fast and non-fast eaters, in both males and females, only the male self-reported fast eaters showed significantly high fasting glucose levels.

Lipid metabolism comparison between the self-reported fast and non-fast eaters of each gender showed that the male self-reported fast eaters presented a significant difference in three categories (higher levels of low density lipoprotein (LDL)-cholesterol and triglyceride, lower levels of high density lipoprotein (HDL)-cholesterol), whereas the female self-reported fast eaters showed significantly higher levels of triglycerides (TG) and lower levels of HDL-cholesterol.

Other factors, such as liver function (evaluated by asparate aminotransferase - AST) and alanine transaminase - ALT), kidney function (evaluated by blood urea nitrogen [BUN], creatinine and estimated glomerular

Table 1
Baseline characteristics of male participants according to eating-speed categories

	Eating speed		P value
	Not fast (n=1358)	Fast (n=1850)	
Age	51.0 (14.0)	49.5 (13.0)	< 0.001
Body weight (kg)	65.6 (1.9)	70.2 (13.9)	< 0.001
Body mass index (kg/m^2)	22.8 (3.6)	24.1 (3.9)	< 0.001
Waist circumference (cm)	83 (10)	86 (11)	< 0.001
Systolic blood pressure (mmHg)	118 (18)	119 (18)	< 0.001
Diastolic blood pressure (mmHg)	77 (15)	78 (14)	< 0.001
Total cholesterol (mg/dl)	205 (43)	207 (42)	
HDL-cholesterol (mg/dl)	57 (19)	53 (17)	< 0.001
LDL-cholesterol (mg/dl)	123 (41)	126 (42)	0.004
Triglycerides (mg/dl)	109 (75)	119 (72)	< 0.001
Fasting blood glucose (mg/dl)	100 (13)	101 (13)	0.027
HbA1c (%)	5.2 (0.0)	5.2 (0.0)	
Uric acid (mg/dl)	6.0 (1.6)	6.2 (1.5)	< 0.001

Values are expressed as median (interquartile range).

filtration rate [eGFR]) and inflammation (evaluated by C-reactive protein - CRP), showed no significant differences between the self-reported fast and non-fast eaters in both genders. However, uric acid was significantly higher among the self-reported fast eaters in both males and females.

Discussion

Metabolic syndrome consists of obesity, elevated blood pressure, glucose intolerance, and dyslipidemia. The major problem of this syndrome is that it increases the risk of developing cardiovascular disease and diabetes (Bassi et al. 2014). Therefore, prevention and treatment of metabolic syndrome ultimately leads to the prevention of cardiovascular diseases and type 2 diabetes. In this study, we investigated the positive associations between subjects who are aware of their fast eating and the diagnostic components of metabolic syndrome among middle-aged healthy Japanese males and females.

The negative impact of fast eating on body weight is well established (Hill and McCutcheon 1984; Shigeta et al. 2001; Otsuka et al. 2006; Shah et al. 2014; Udo et al. 2014). It is considered that fast eating will induce overeating due to the lack of satiety in the hypothalamic nucleus, known as the satiety centre of the brain (Morton et al. 2006). Also, it has been reported that eating speed has a correlation with calorie intake i.e. fast eaters tend to take more calories (Shah et al. 2014). However, definition of "fast eating" is unclear and it is difficult for clinicians to find fast eaters. Therefore, if fast eaters can be identified by simple question asking "Do you consider yourself to be a fast eater?", it would be clinically beneficial.

Strikingly, in this study, both male and female self-reported fast eaters showed high body weight, BMI, and waist circumference. Aside from obesity, other components of metabolic syndrome (blood pressure, glucose tolerance, and dyslipidemia) showed more significant associations with male self-reported fast eaters rather than with female self-reported fast eaters.

A previous report has indicated that fast eating has more impact on males than females with type 2 diabetes or dyslipidemia in the Japanese population (Takayama et al. 2002). The present study showed that this is also the case in healthy middle-aged Japanese subjects with self-awareness of fast eating.

One of the most interesting results in this study is that blood pressure and glucose tolerance, which are the two major factors of metabolic syndrome, were significantly high only in the male self-reported fast eaters. There are multiple reports showing associations between fast eating and obesity (Shigeta et al. 2001; Otsuka et al. 2006; Shah et al. 2014; Udo et al. 2014) or fast eating and glucose tolerance (Sakurai et al. 2012; Ohkuma et al. 2013; Radzeviciene and Ostrauskas 2013). By studying the effects of fast eating on diabetic patients, Ohkuma

Table 2
Baseline characteristics of female participants according to eating-speed categories

	Eating speed		P value
	Not fast (n=1358)	Fast (n=1850)	
Age	49.0 (15.0)	49.0 (13.0)	
Body weight (kg)	51.7 (9.8)	54.3 (10.8)	< 0.001
Body mass index (kg/m^2)	20.9 (3.7)	22.0 (4.2)	< 0.001
Waist circumference (cm)	76 (11)	79 (12)	< 0.001
Systolic blood pressure (mmHg)	113 (19)	113 (20)	
Diastolic blood pressure (mmHg)	70 (15)	70 (15)	
Total cholesterol (mg/dl)	210 (45)	210 (48)	
HDL-cholesterol (mg/dl)	69 (22)	66 (20)	< 0.001
LDL-cholesterol (mg/dl)	117 (41)	120 (45)	
Triglycerides (mg/dl)	75 (47)	79 (51)	0.019
Fasting blood glucose (mg/dl)	94 (11)	95 (11)	
HbA1c (%)	5.1 (0.3)	5.1 (0.3)	
Uric acid (mg/dl)	4.4 (1.3)	4.5 (1.2)	0.002

Values are expressed as median (interquartile range).

et al. (2013) have reported that fast eating significantly increases HbA1c levels, and Otsuka et al. (2008) have reported that fast eating increases insulin resistance only in men. Here, we showed that in case of male self-reported fast eaters, it increases fasting blood glucose level without affecting HbA1c levels. Based on the report by Otsuka et al. (2008) the underlying mechanism of this result may be due to the increase of insulin resistance. Since we conducted this study in healthy subjects, it can be considered that fast eating affects fasting glucose prior to affecting HbA1c levels.

In this study, only male self-reported fast eaters showed higher levels of glucose tolerance and blood pressure. This is possibly related to their lipid levels. The male self-reported fast eaters showed higher LDL-cholesterol, TG, and lower HDL-cholesterol levels, whereas the female self-reported fast eaters happened to be less severe than males (only lower level of HDL-cholesterol, higher level of TG and LDL-cholesterol level was not affected). Elevation of LDL-cholesterol is considered to be one of the most important risk factors for the development of cardiovascular diseases (Hoogeveen et al. 2014). Therefore, the increase of LDL-cholesterol level observed only in the male self-reported fast eaters maybe related to the elevation of blood pressure also seen only in the male self-reported fast eaters. Further studies are required to elucidate the relationship between fast eating, elevated LDL-cholesterol level, and blood pressure.

Another interesting result observed was the elevated uric acid level in the self-reported fast eaters of both genders. It is impossible to avoid influence of uric acid in human since it is the physiological byproduct of cell turnover. Many high calorie foods are rich in purines that are broken down to uric acid. Therefore, high uric acid levels are expected to be present in patients with metabolic syndrome (Costa et al. 2002).

The relationship between uric acid and hypertension has been suggested since the 19th century (Mahomed 1897) and this suggestion has continued in numerous studies up to the present (Gertler et al. 1951; Breckenridge 1966; Brand et al. 1985; Culleton et al. 1999). Recent studies have revealed the underlying mechanism of uric acid entry in inducing the vascular smooth muscle proliferation, which leads to the thickening of arteriolar walls, thus developing atherosclerosis and ultimately resulting in the development of hypertension (Mazzali et al. 2002; Kanellis et al. 2003; Kang et al. 2005). Also, a recent study on mice indicated that elevation of uric acid could be a cause, not a consequence, of metabolic syndrome (DeBosch et al. 2014). Our results indicate that in addition to the elevated LDL-cholesterol levels, elevation of uric acid in fast eaters may have an effect on developing metabolic syndrome and elevating blood pressure.

We have not performed a follow-up study and further study is required. However, our study indicates that detecting subjects with habit of fast eating in early stage by asking simple question may be effective in decreasing the risk of developing metabolic syndrome, and ultimately preventing the development of the type 2 diabetes or cardiovascular disease.

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