Original Article

# Gender differences in the association of high-sensitivity C-reactive protein with metabolic syndrome and diabetes mellitus in a Japanese population: Jichi Medical School Cohort Study II

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**Abstract**

**Background**

Recently, some studies showed that metabolic syndrome (MetS) is associated with inflammation, indicated by high-sensitivity C-reactive protein (hsCRP), but there have been few population-based studies, especially in Japan. Herein, gender-specific relationships between MetS, diabetes mellitus (DM) and hsCRP in a general Japanese population were examined.

**Methods**

This cross-sectional study included 6436 males and females examined between 2010 and 2017 as part of the Jichi Medical School Cohort Study Ⅱ. Total subjects were divided into tertiles according to hsCRP values and the odds ratios (ORs) in MetS and DM were compared by gender.

**Results**

There exists a dose–response relationship between hsCRP levels and prevalence of MetS in both males and females. The conditional (adjusted) ORs of DM for given MetS status were not statistically significant, on the other hand, all the conditional ORs of MetS for given DM status were statistically significant ($p<0.01$) for both males and females (males: ORs for the second and third tertiles, DM- 1.7[95% confidence interval, 1.2-2.4], 2.4[1.8-3.4], DM+ 2.8[1.8-4.2], 3.1[2.1-4.5]; females: DM- 3.2[1.9-5.4], 5.4[3.2-9.9], DM+ 2.9[1.6-5.4], 4.2[2.3-7.5]). Furthermore, it was statistically shown that the conditional ORs of females are greater than those of males (female-to-male ratios of ORs for the second and third tertiles, 1.9, $p=0.023$; 2.2, $p=0.005$).

**Conclusion**

Inflammation, as measured by hsCRP, was elevated in both males and females with MetS in this Japanese population; however, hsCRP was elevated in patients with DM, probably because of high prevalence of MetS in patients with DM. hsCRP is a more suitable predictor of MetS for females than males.

(Keywords: cohort study, diabetes mellitus, gender differences, high-sensitivity C-reactive protein, metabolic syndrome)

## Introduction

Metabolic syndrome (MetS) is characterized by a cluster of metabolic risk factors, such as high blood pressure, hyperglycemia, dyslipidemia, and abdominal obesity, and is closely associated with cardiovascular morbidity and mortality in general populations[1-5]. So far, most research efforts have been directed toward early detection and treatment of individuals with established MetS to prevent the development of cardiovascular disease (CVD). MetS was first defined by the World Health Organization in 1999[6],

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followed by another definition proposed in 2001 by the third report of the National Cholesterol Education Program (NCEP) Expert Panel on the Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults [Adult Treatment Panel (ATP) III][7]. Additional definitions have since been proposed by other organizations or associations; in Japan, a definition of MetS was determined in collaboration with eight scientific associations in 2005[8].

Several studies have reported that high-sensitivity C-reactive protein (hsCRP) is a marker of CVD[9-13], as well as a precursor of diabetes mellitus (DM) and other metabolic disorders[14]. Moreover, mild chronic elevation of hsCRP, even within the clinically "normal" range, has been shown to be independently predictive of future cardiovascular events[10, 12]. Some cross-sectional studies have shown that elevated hsCRP levels significantly correlate with features of MetS, including adiposity, hyperinsulinemia, insulin resistance, hypertriglyceridemia, and low high-density lipoprotein-cholesterol (HDL-C) levels[15, 16]. Another study also demonstrated that high levels of hsCRP are related to increased accumulation of visceral and subcutaneous fat depots[17].

Examination of the relationship between MetS and hsCRP in Western countries has revealed higher hsCRP levels among females with MetS, indicating that its measurement adds valuable prognostic information regarding risk of CVD in healthy American females[18]. In addition, it has been shown that females with cardiometabolic risks (*i.e.,* MetS, DM, or hypertension) usually present higher hsCRP levels than males with MetS -related diseases, suggesting gender differences in inflammatory marker regulation[19]. Unfortunately, only a few studies have investigated the relationship between MetS and hsCRP in Japanese populations. Of them, Tamakoshi et al.[20] reported that components of MetS were associated with hsCRP elevation in healthy working males, and Oda et al.[21] tried to develop an hsCRP cutoff level indicative of MetS in outpatient males and females. Moreover, Ishikawa et al.[22] reported a proportionate increase in MetS incidence and hsCRP levels, although gender differences were not discussed. As exemplified by the studies mentioned above, gender-adjusted analyses or study of single-gender cohorts are important in medical research as gender differences often lead to differences in disease susceptibility[23-25]. In the present study, we aimed to determine whether the high hsCRP in MetS in a general Japanese population, which was reported by Ishikawa et al.[22], was observed in each sex.

## Materials and Methods

Subjects The present cross-sectional study was conducted as part of the Jichi Medical School (JMS) Cohort Study Ⅱ, a population-based cohort study of 6436 subjects (2932 male and 3504 female) started in 2010 to evaluate the relationship between the risk factors of atherosclerosis and CVD in ordinary Japanese people. Data were obtained from 13 rural districts in Japan between April 2010 and December 2017. In each community, a local government office sent personal invitations for mass CVD screenings to all the subjects by mail. In this study protocol, we selected Japanese people who had undertaken the screening of basic health examination that was conducted in accordance with the medical care system for the elderly and obtained informed consent for this study. The subjects were residents in the Shimotsuke (Tochigi), Kakara (Saga), Sue (Yamaguchi), Omori (Akita), Kamiichi (Toyama), Wara (Gifu), Takasu (Gifu), Onabi (Gifu), Nakatsu (Kagawa), Yame (Fukuoka), Miwa (Yamaguchi), Ueno (Gunma), and Saji (Tottori) areas of Japan.

### *Variables*

Patient height, weight, and waist circumference were measured using a standardized method, with 0.1 cm, 0.1 kg, and 0.1 cm units of measurement, respectively. Body height was measured in stockinged feet. Body weight was recorded with the subjects clothed. Waist circumference was measured at navel level while standing, with light exhalation. Body mass index (BMI) was calculated by dividing the body weight by the height squared. Systolic and diastolic blood pressures (BP) were measured with a fully automated sphygmomanometer (Omron HEM-759P; Omron Healthcare Inc., Kyoto, Japan) placed on the right arm of subjects who had been resting while seated for five minutes prior. BP was assessed as the average of measurements repeatedly measured twice in the sitting position after a fifteen seconds interval. Blood specimens were taken after overnight fasting and were sent to an external laboratory (SRL, Tokyo, Japan) to determine total cholesterol, triglycerides, HDL-C, fasting blood glucose, hemoglobin A1c (HbA1c), and hsCRP levels. All the participants included in the present study provided written informed consent prior to inclusion, and the ethics committees of Jichi Medical University (Tochigi, Japan) and other participating institutions approved the JMS Cohort Study II protocol (IRB No. G09-39 [G17-64 revised]).

### *Metabolic Syndrome*

According to the 2005 definition and diagnostic criteria of MetS in Japanese individuals[8], the subjects had to have a waist circumference ≥85cm for males or ≥90cm for females and two or more of the following: triglycerides ≥150mg/dL and/or HDL-C <40mg/dL, systolic BP ≥130mmHg and/or diastolic BP ≥85mmHg, or fasting blood glucose ≥110mg/dL[8, 26]. DM was defined as a fasting blood glucose ≥126mg/dL and/or use of antidiabetic medication.

### *Statistical Analysis*

Data are summarized and presented as means (standard

deviations (SDs)) except for triglyceride and hsCRP levels because their distributions were skewed. Triglyceride and hsCRP data are presented as geometric means transformed from the means of the logarithms of measured values. Comparison of gender differences for each variable was done using unpaired Student's t- and Chi-square tests, with a $P < 0.05$ indicating statistical significance. Statistical tests of correlations between hsCRP and individual components of MetS mentioned above and BMI were performed in males and females, respectively, as a preliminary analysis. By using the results, in order to determine the explanatory variables significantly related to hsCRP, a backward elimination procedure was carried out in multiple regression analysis. The analysis is made with IBM SPSS (ver. 25). To evaluate associations between MetS × DM and hsCRP, we classified hsCRP values into tertiles by using the methods of Ishikawa et al.[22]. Total subjects were divided into tertiles according to hsCRP values with cutoff points of 243 ng/mL and 643 ng/ml. The conditional (adjusted) odds ratios (ORs) of MetS for given DM states and those of DM for given MetS states were compared regarding gender. 95% confidence intervals (CIs) of the conditional odds ratios are calculated by using the delta method.

## Results

Table 1 presents characteristics of subjects stratified by presence or absence of MetS. The MetS group consisted of 989 (15.4%) males and females and had a higher proportion of males (24.0%) than females (8.0%). The mean age of those with MetS was 65.4 (SD,10.0) years and 63.6 (11.3) years for those without MetS; there was a significant difference between the groups. Mean BMI, systolic and diastolic BP, fasting blood glucose, and HbA1c levels, but not total cholesterol, were significantly higher (all $P < 0.001$) in those with MetS versus those without MetS [BMI: 26.7 (3.2) versus 22.4 (2.9) kg/m2; systolic BP: 146.5 (18.7) versus 134.4 (20.6) mmHg; diastolic BP: 85.7 (12.0) versus 79.1 (11.4) mmHg; fasting blood glucose: 113.9 (27.0) versus 97.5 (16.6) mg/dL; HbA1c: 6.1 (0.8) versus 5.6 (0.5) mg/dL; total cholesterol: 202.0 (34.6) versus 204.2 (32.9) mg/dL, $P > 0.05$]. hsCRP geometric means were also significantly higher ($P < 0.001$) in the MetS group (geometric mean 698.8 ng/mL; range, 159.4-3064.0 ng/mL) versus the non- MetS group (geometric mean 381.6 ng/mL; range, 113.8-1280.0 ng/mL). Furthermore, the difference between hsCRP values among the subjects with and without MetS was larger than that among those with and without DM.

**Table 1. General characteristics of subjects with or without metabolic syndrome**

| | | Non- MetS | MetS | | |
|---|---|---|---|---|---|
| | Male (*n*) | 2227 | 705 | | |
| | Female (*n*) | 3220 | 284 | | |
| **Male** | mean | SD | mean | SD | *P*-value |
| Age (years) | 64.4 | 11.2 | 64.7 | 10.1 | 0.439 |
| BMI (kg/m$^2$) | 22.6 | 2.7 | 26.1 | 2.8 | <0.001 |
| Systolic BP (mmHg) | 137.9 | 20.3 | 146.9 | 19.0 | <0.001 |
| Diastolic BP (mmHg) | 81.5 | 11.6 | 86.8 | 12.2 | <0.001 |
| Total cholesterol (mg/dL) | 196.5 | 32.4 | 199.4 | 34.5 | 0.052 |
| Triglycerides (mg/dL) § | 94.7 | (57.7–155.4) | 148.6 | (85.2–259.4) | <0.001 |
| HDL-C (mg/dL) | 57.7 | 13.8 | 49.6 | 11.8 | <0.001 |
| Fasting blood glucose (mg/dL) | 100.9 | 19.9 | 114.9 | 27.8 | <0.001 |
| HbA1c (%) | 5.6 | 0.6 | 6.0 | 0.8 | <0.001 |
| hsCRP (ng/mL) § | 459.9 | (134.6–1570.6) | 693.8 | (242.0–1988.7) | <0.001 |
| Antidiabetic medication, n(%) | | 140(6.3) | | 133(18.9) | <0.001 |
| Past history §§ | | | | | |
| Stroke, n(%) | | 60(2.7) | | 27(3.9) | 0.121 |
| Myocardial infarction, n(%) | | 58(2.6) | | 32(4.5) | <0.01 |
| **Female** | mean | SD | mean | SD | *P*-value |
| Age (years) | 63.1 | 11.4 | 67.2 | 9.4 | <0.001 |
| BMI (kg/m$^2$) | 22.3 | 3.1 | 27.9 | 3.7 | <0.001 |
| Systolic BP (mmHg) | 132.3 | 20.5 | 145.4 | 17.9 | <0.001 |
| Diastolic BP (mmHg) | 77.6 | 11.0 | 83.0 | 11.1 | <0.001 |

| | | | | | |
|---|---|---|---|---|---|
| Total cholesterol (mg/dL) | 211.4 | 31.8 | 208.7 | 34.0 | 0.192 |
| Triglycerides (mg/dL) [§] | 87.0 | (55.2–137.4) | 140.1 | (86.7–226.4) | <0.001 |
| HDL-C (mg/dL) | 64.1 | 14.8 | 54.5 | 12.3 | <0.001 |
| Fasting blood glucose (mg/dL) | 96.0 | 13.6 | 111.3 | 24.8 | <0.001 |
| HbA1c (%) | 5.6 | 0.5 | 6.2 | 0.8 | <0.001 |
| hsCRP (ng/mL) [§] | 335.3 | (103.0–1091.4) | 711.6 | (242.3–2090.2) | <0.001 |
| Antidiabetic medication, n(%) | | 126(3.9) | | 57(20.0) | <0.001 |
| Past history [§§] | | | | | |
| Stroke, n(%) | | 35(1.1) | | 16(2.2) | <0.001 |
| Myocardial infarction, n(%) | | 26(0.8) | | 16(2.2) | <0.001 |

[§]These data are summarized by the geometric mean and ranges (instead of standard deviations, SD).

[§§]Data were obtained by questionnaire.

[§§§]The unpaired Student's t-test (two-sided) was used for comparing two groups, non-MetS and MetS, by using basic variates in this table except antidiabetic medication, stroke, and myocardial infarction, and with respect to these variables the chi-square test was employed.

[§§§§]MetS, metabolic syndrome; BMI, body mass index; BP, blood pressure; HDL-C, high-density lipoprotein-cholesterol; HbA1c, Hemoglobin A1c; hsCRP, high-sensitivity C-reactive protein.

hsCRP correlated significantly ($p < 0.005$) with waist circumference ($r = 0.23$), BMI ($r = 0.21$), systolic BP ($r = 0.07$), triglyceride ($r = 0.14$), HDL-C ($r = -0.18$) in males. hsCRP correlated significantly ($p < 0.0001$) with waist circumference ($r = 0.36$), BMI ($r = 0.36$), systolic BP ($r = 0.15$), diastolic BP ($r = 0.36$), fasting blood glucose ($r = 0.17$), triglyceride ($r = 0.22$), HDL-C ($r = -0.23$) in females. hsCRP correlated significantly with all metabolic indexes in females, but less so in males.

Stepwise multivariate regression analysis of hsCRP and MetS risk factors demonstrated [y = 0.7003 + 0.0281 (waist circumference) + 0.0008 (triglyceride)] ($R^2 = 0.055$, $p<0.01$) in males and [y=2.9307+0.0171 (waist circumference) + 0.0568 (BMI) + 0.0056 (fasting blood glucose) + 0.0015 (triglyceride)-0.0077 (HDL-C)] ($R^2$=0.170, $p<0.01$) in females.

Figure 1 illustrates a dose–response relationship between hsCRP level and prevalence of MetS. Total subjects were classified into tertiles according to their hsCRP values, with estimated cutoff points, 243 ng/mL and 643 ng/mL. The proportions of MetS cases as distributed in hsCRP value tertile were 13.6%, 24.2%, 30.9% and for males and 2.8%, 8.7%, and 14.3% for females in the first, second, and third tertiles, respectively. Compared to the first hsCRP tertile (reference), MetS ORs in males and females were significantly higher in the second tertile (males: OR = 2.0; 95% CI, 1.5-2.6; females: OR = 3.3; 95% CI, 2.2-4.9) and third tertile (males: OR = 2.8; 95% CI, 2.2-3.6; females: OR = 5.9; 95% CI, 4.0-8.5) (Figure 1).

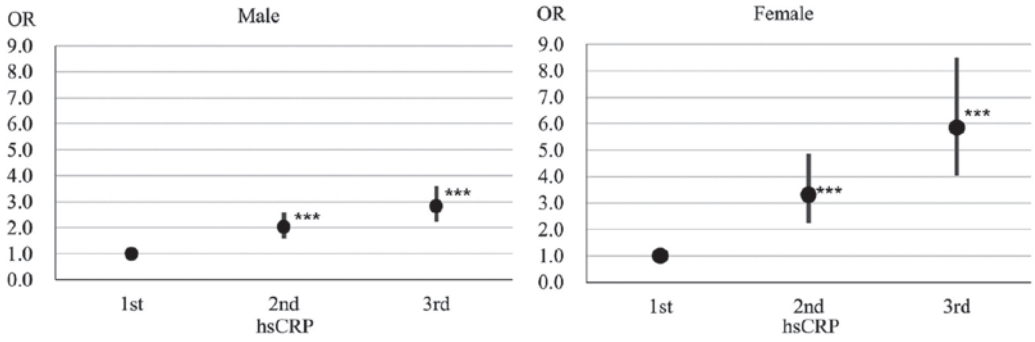


**Figure 1. Odds ratios of metabolic syndrome with respect to hsCRP for male and female.** Odd ratios (ORs) and 95% confidence interval (CIs) of metabolic syndrome (MetS) tertiles and comparison of ORs in second and third tertiles of high-sensitivity C-reactive protein (hsCRP) concentration. The first tertile is the lowest concentration of hsCRP, followed by the second tertile ($2^{nd}$) the next group; and third tertile being the highest concentration of hsCRP. The $1^{st}$ tertile is the reference for ORs. The two-sided test of OR is performed for $H_0$: *OR = 1 versus* $H_1$: *OR ≠ 1*;***P < 0.001. MetS ORs for second and third tertiles were 2.0 (95% confidence interval: 1.6-2.6) and 2.8 (2.2-3.6) for males and 3.3 (2.2-4.9) and 5.9 (4.0-8.9) for females, respectively.

Though DM ORs for both males and females tended to increase in tertile (Figure 2), the conditional (adjusted) ORs of DM for given MetS status shown in Table 2 are not statistically significant, with the exception of that for the third tertile in females without MetS, that is, the ORs with respect to MetS and DM in the 1st tertile are 4.3 (95% CI, 2.8-6.6) for males and 8.6 (4.4-16.9) for females; 7.1 (5.1-9.8) for males and 7.9 (5.1-12.2) in the 2nd tertile; and 5.4 (4.1-7.2) for males and 6.7 (4.6-9.8) in the 3rd tertile. Conversely, all the conditional (adjusted) ORs of MetS for given DM status for both males and females were statistically significant, and from female-to-male ratios of the conditional ORs of MetS for given DM status (F/M ratios) in Table 3, the conditional ORs of MetS for given DM status are statistically more prominent for females than males.

## Discussion

The present study also revealed that higher hsCRP levels were associated with an increased incidence of MetS in Japanese subjects. These results agree with previous studies[14, 27, 28] and suggest that increased inflammation, indicated by heightened hsCRP levels, is strongly associated with MetS. In turn, this supports the notion that inflammation plays an important role in the pathogenesis of diabetes mellitus and atherosclerosis[14, 27, 29].

hsCRP is an inflammatory marker produced by and released from the liver in response to stimulation by cytokines, such as interleukin-6, interleukin-1, and tumor necrosis factor-$\alpha$. Recently, adipose tissue was found to produce and release such cytokines, suggesting a relationship between hsCRP levels and adiposity[30]. These proinflammatory cytokines have also been linked to dyslipidemia, hypertension, and insulin resistance in previous cross-sectional studies[15, 16]. Cytokines also promote *de novo* hepatic fatty acid synthesis, interfere with lipoprotein lipase catabolism of triglyceride-rich

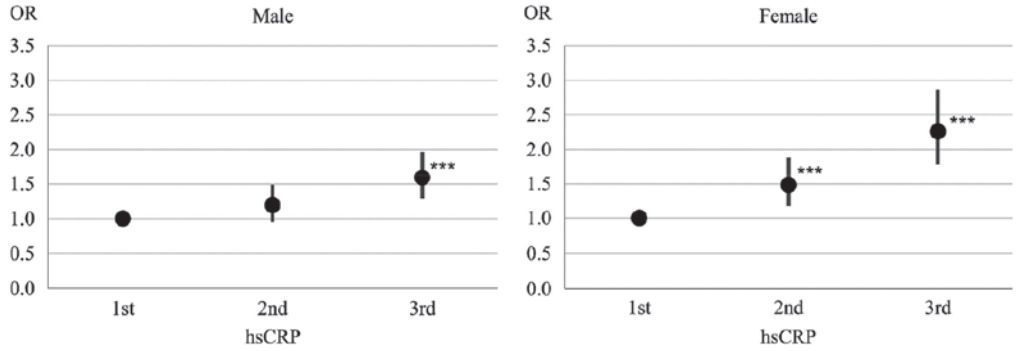


**Figure 2. Odds ratios of diabetes mellitus with respect hsCRP for male and female.**
ORs and 95% CIs of diabetes mellitus (DM) tertiles and comparison of ORs in second and third tertiles of hsCRP concentration. The first tertile is the lowest group of hsCRP concentration, followed by the second tertile and third tertile being the highest group. The first tertile was used as a reference for ORs. the two-sided test of OR is performed for $H_0$: *OR = 1 versus* $H_1$: *OR ≠ 1*; ***P < 0.001. DM ORs for second and third hsCRP tertiles were 1.2 (1.0-1.5) and 1.6 (1.3-2.0) for males and 1.5 (1.2-1.9) and 2.3 (1.8-2.9) for females, respectively.

**Table 2. Conditional odds ratios of diabetes mellitus for given metabolic syndrome status**

| | | Male | | Female | |
|---|---|---|---|---|---|
| | | 2nd tertile | 3rd tertile | 2nd tertile | 3rd tertile |
| MetS - | OR | 0.83 | 1.11 | 1.24 | 1.73 |
| | 95% CI | 0.63–1.10 | 0.85–1.45 | 0.94–1.62 | 1.32–2.27 |
| | *P*-value | 0.195 | 0.436 | 0.124 | <0.001 |
| MetS + | OR | 1.35 | 1.39 | 1.13 | 1.35 |
| | 95% CI | 0.86–2.13 | 0.91–2.14 | 0.53–2.41 | 0.66–2.80 |
| | *P*-value | 0.191 | 0.131 | 0.751 | 0.412 |

MetS, metabolic syndrome; OR, odds ratio; CI, confidence interval.
Subjects were classified into 3 tertiles according to their hsCRP values and the first tertile was a reference.

**Table 3. Conditional odds ratios of metabolic syndrome for given diabetes mellitus and the female-to-male comparison**

| | | Male | | Female | | F/M ratio | |
|---|---|---|---|---|---|---|---|
| | | 2nd tertile | 3rd tertile | 2nd tertile | 3rd tertile | 2nd tertile | 3rd tertile |
| DM- | OR | 1.68[a] | 2.43[b] | 3.18[c] | 5.36[d] | 1.89 (*c/a*) | 2.20 (*d/b*) |
| | 95% CI | 1.20-2.37 | 1.76-3.36 | 1.89-5.38 | 3.22-9.91 | 1.01-3.54 | 1.20-4.02 |
| | *P*-value | 0.003 | <0.001 | 0.001 | 0.002 | 0.023 | 0.005 |
| DM+ | OR | 2.75[e] | 3.05[f] | 2.91[g] | 4.18[h] | 1.06 (*g/e*) | 1.37 (*h/f*) |
| | 95% CI | 1.82-4.15 | 2.07-4.50 | 1.58-5.35 | 2.33-7.50 | 0.51-2.21 | 0.68-2.76 |
| | *P*-value | <0.001 | 0.001 | 0.001 | <0.001 | 0.440 | 0.189 |

DM: diabetes mellitus, OR: odds ratio, CI: confidence interval.
Subjects were classified into 3 tertiles according to their hsCRP values and the first tertile was a reference.
F/M ratio: The Female-to-Male ratio of the partial MetS ORs in the 2nd and 3rd tertiles, *e.g.* 1.89 (*c/a*) =3.18[c]/1.68[a].

lipoproteins, and may also directly impede insulin-stimulated glucose uptake [31, 32]. Moreover, hsCRP is not only a strong marker of CVD[9-13] and ischemic stroke[33, 34], but has also been implicated in initiation of atherosclerosis[35]. However, the link between MetS and CVD is not as straightforward. For example, a prospective study of patients with DM found that the Japanese definition of MetS was not predictive of CVD in males or females, whereas World Health Organization and NCEP-ATP III definitions and criteria showed positive correlations[36]. Another study reported that the risk of developing cardiac disease was 2.2-fold greater in those with MetS, according to NCEP-ATP III criteria[37]. Future studies should investigate this relationship further because the 2005 Japanese definition of MetS does not yet include thresholds associated with risk of CVD.

The results of the present study showed that increased inflammation, as indicated by elevated hsCRP levels, may have a greater effect on DM in females (Figure 2). However, the effects are spurious for both males and females due to confounding MetS and DM, that is, a strong association between MetS and DM as shown in the previous section. While the conditional ORs of DM for given MetS status were mostly insignificant (Table 2), all the conditional ORs of MetS for given DM status were significant in both males and females, and as shown in Table 3, the conditional ORs of MetS for given DM status are statistically more prominent for females than for males. We observed higher levels of hsCRP in females with MetS but higher levels of DM in men than in females. Although a direct relationship between DM incidence and hsCRP levels was not found in the Japanese subjects included in the present study, a prospective study by Thang et al.[38] reported that Mexican females with elevated hsCRP levels had a significantly increased risk of developing both MetS and DM independent of adiposity and insulin resistance. In addition to determining risk of developing MetS and/or DM, their study also suggests that monitoring hsCRP levels can be used as a preventative strategy[38, 39]. Studies investigating the ability of hsCRP to improve MetS and DM risk should be conducted in Japanese populations in the future, because there is a strong association between DM and MetS in both males and females as mentioned in the previous section.

Of the currently available Japanese cohort studies of MetS and hsCRP involving gender-adjusted analyses or single-gender cohorts[20-22], none have compared hsCRP levels between males and females in relation to MetS. Some cross-sectional studies have shown that markers of inflammation, including hsCRP, were more strongly related to insulin resistance and components of MetS in females than in males[34, 40]. Han et al.[14] also demonstrated that hsCRP levels can be used to predict development of MetS in females but not in males. It is possible that these gender differences are related to endogenous synthesis of estrogen, a hormone suspected to play a role in the inflammatory process in females, and/or the tendency of females to have a greater amount of total body adipose tissue, a source of proinflammatory cytokines.

This study had some limitations. One limitation is data regarding use and type of drugs for diabetes mellitus, hypertension, or hyperlipidemia were not available. However, after exclusion of subjects with major past medical histories or medication, the results remained almost identical. In addition, the data used are cross-sectional. To proceed the present study to a more precise one, we have to perform a follow-up survey on hsCRP in J MetS Cohort Study II.

In conclusion, this population-based study of Japanese males and females showed that inflammation, as assessed

by hsCRP levels, is strongly related to MetS, especially in females, whereas the association of hsCRP with DM is spurious. Further research to confirm whether combining MetS and hsCRP has utility in the risk assessment of individual patients should be performed in the future.

**Declaration of interest**

None of the authors have any potential conflicts of interes t associated with this research.

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# 日本人集団での高感度CRPとメタボリックシンドロームおよび糖尿病における連関の性差について：Jichi Medical School Cohort Study II

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**要　約**

メタボリック症候群や糖尿病の患者の体内では炎症が惹起されておりhsCRPが上昇している。自治医科大学コホート研究IIのデータを用いて，hsCRPとメタボリック症候群や糖尿病における男女差の関連について調査した。男女別にhsCRPの値で３群に分け，オッズ比を比較した。男女ともにhsCRPはdose-response的に上昇していた。メタボリック症候群の有無による条件付き（調整した）オッズ比は男女ともに統計学的な有意差はなかったが，糖尿病の有無による条件付きオッズ比は全ての群で男女ともに統計学的に有意（$p<0.01$）であった（男性：DM-, 第２群 1.7［95％信頼区間, 1.2-2.4］，第３群 2.4［1.8-3.4］，DM+，2.8［1.8-4.2］，3.1［2.1-4.5］；女性：DM- 3.2［1.9-5.4］，5.4［3.2-9.9］，DM+ 2.9［1.6-5.4］，4.2［2.3-7.5］）。また，女性のオッズ比は男性のオッズ比よりも統計学的に有意に大きくなっていた（男性のORsに対する女性のORsの比；第２群 1.89，$p=0.023$, 第３群 2.20，$p=0.005$）。hsCRPと糖尿病の関連はメタボリック症候群と糖尿病の関係による見かけ上の関連であった。女性においては男性よりもhsCRPはメタボリック症候群の予測因子として適していると考えられた。
（Keywords：高感度CRP，メタボリックシンドローム，糖尿病，性差，コホート研究）

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