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Relationships between alcohol intake and atherogenic indices in women

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BACKGROUND: Light-to-moderate alcohol consumption is known to reduce the risk of coronary artery disease.

OBJECTIVES: The purpose of this study was to investigate relationships of alcohol intake with atherogenic indices, such as the ratio of low-density lipoprotein cholesterol to high-density lipoprotein cholesterol (LDL-C/HDL-C ratio) and the ratio of triglycerides to high-density lipoprotein cholesterol (TG/HDL-C ratio), in women.

METHODS: Subjects (14,067 women, 20-45 years) were divided by alcohol intake into three groups of nondrinkers, occasional drinkers, and regular drinkers, and each drinker group was further divided into lower- (<22 g ethanol/drinking day) and greater- (≥22 g ethanol/drinking day) quantity drinkers. Atherogenic indices were compared among the alcohol groups.

RESULTS: Odds ratio (OR) for high LDL-C/HDL-C ratio or high TG/HDL-C ratio calculated after adjustment for age, body mass index, smoking, and habitual exercise was significantly lower ($P < .05$) than a reference level of 1.00 in regular or occasional lower- and higher quantity drinkers vs. nondrinkers (OR for high LDL-C/HDL-C ratio, 0.28 (95% confidence interval [95% CI], 0.18-0.44) in regular lower-quantity drinkers, 0.18 (95% CI, 0.12-0.28) in regular higher quantity drinkers, 0.71 (95% CI, 0.61-0.83) in occasional lower-quantity drinkers, and 0.53 (95% CI, 0.44-0.64) in occasional higher quantity drinkers; OR for high TG/HDL-C ratio, 0.52 (95% CI, 0.32-0.85) in regular lower-quantity drinkers, 0.67 (95% CI, 0.47-0.96) in regular higher-quantity drinkers, 0.61 (95% CI, 0.50-0.76) in occasional lower-quantity drinkers, and 0.63 (95% CI, 0.50-0.79) in occasional higher-quantity drinkers. Both LDL-C/HDL-C ratio and log-transformed TG/HDL-C ratio were significantly greater in smokers than in nonsmokers. Both in smokers and nonsmokers, LDL-C/HDL-C ratio and log-transformed TG/HDL-C ratio were significantly lower in regular lower- and higher-quantity drinkers than in nondrinkers. In nonsmokers, LDL-C/HDL-C ratio and log-transformed TG/HDL-C ratio tended to be lower and greater, respectively, in regular greater-quantity drinkers than in regular lower-quantity drinkers.

CONCLUSION: In women, alcohol drinking is inversely associated with atherogenic indices irrespective of smoking status, and the inverse association of alcohol drinking with LDL-C/HDL-C ratio is stronger than that with TG/HDL-C ratio.

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Atherosclerosis is characterized by accumulation of lipids in the arterial wall. Atherogenic lipoproteins are thought to be both necessary and sufficient for the development of atherosclerotic plaque, and detrimental blood

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cholesterol profiles such as high levels of low-density lipoprotein cholesterol (LDL-C) and low levels of high-density lipoprotein cholesterol (HDL-C) are major determinants of the risk for cardiovascular disease, particularly coronary artery disease.[1–3] Thus, ratio of LDL-C to HDL-C (LDL-C/HDL-C ratio), a classical atherogenic index, is known to be a crucial risk factor of cardiovascular disease.[4,5] The ratio of triglycerides to HDL-C (TG/HDL-C ratio) has been demonstrated to be a better predictor of coronary artery disease than lipid alone and to be even stronger for predicting myocardial infarction than the LDL-C/HDL-C ratio.[6,7] The TG/HDL-C ratio has been shown to be associated with insulin resistance[8] and metabolic syndrome[9] and is thought to reflect atherogenic small dense LDL particles.[10] However, small dense LDL has rarely been used in epidemiological studies because of the complexity of its measurement.

Moderate alcohol consumption is known to be associated with lower risk of cardiovascular disease.[11–14] Reduced cardiovascular risk in drinkers is mainly explained by alcohol-induced increase in HDL-C levels.[15–17] In addition, LDL-C levels have been shown to be lower in drinkers than in nondrinkers.[15,16] Consequently, LDL-C/HDL-C ratio is thought to be inversely associated with alcohol intake. The TG/HDL-C ratio has recently been reported to be also lower in male drinkers than in male nondrinkers,[18] although the level of TG is known to be greater in drinkers than in nondrinkers.[15,16,19] Premenopausal women have better protection than men from cardiovascular disease, and estrogen is involved in the better blood lipid profiles in women.[20] The rate of drinkers and amount of alcohol consumption are generally lower in women than in men, and there has been limited knowledge on the relationships between alcohol intake and atherogenic indices in women. The purpose of this study was, therefore, to clarify relationships between alcohol intake and representative atherogenic indices, LDL-C/HDL-C ratio and TG/HDL-C ratio, in women.

Methods

Subjects

The subjects were 14,067 Japanese women aged ≥20 and <45 years who had received periodic health examinations at workplaces in Yamagata Prefecture in Japan. A cross-sectional study was performed using a local population-based database for the aforementioned subjects. This study was approved by the Ethics Committee of Yamagata University School of Medicine.

In a questionnaire at the health checkup, subjects who were receiving treatment for any illnesses were requested to state the names of diseases. Those receiving drug therapy for dyslipidemia were excluded from the subjects of this study. Histories of alcohol consumption, cigarette smoking, and habitual exercise (almost every day with exercise for 30 min or longer per day) were also surveyed by questionnaires. Average alcohol consumption of each subject per week was reported on questionnaires during health examinations. Frequency and amount of habitual alcohol drinking were asked in the questionnaire as "How frequently do you drink alcohol?" and "What amount of alcohol per day do you drink on average?" Frequency of weekly alcohol drinking was categorized as "every day" (regular drinkers), "sometimes" (occasional drinkers), and "never" (nondrinkers). Overall subjects, who had annual health checkup examinations, were classified into the three groups of nondrinkers, regular drinkers, and occasional drinkers. Subjects in each drinker group (regular or occasional drinkers) were further divided by alcohol intake into three subgroups as described in the section "Measurements."

Measurements

Usual daily alcohol consumption was calculated in terms of the equivalent number of "go," a traditional Japanese unit of amount of sake (rice wine). The amounts of other alcoholic beverages, including beer, wine, whisky, and shochu (a traditional Japanese distilled spirit), were converted and expressed as units of "go." One go approximately corresponds to 180 mL of sake, 500 mL of beer, 240 mL of of wine, 60 mL of whisky, and 80 mL of shochu. Amount of daily alcohol drinking was categorized as "null," "less than 1 go per day," "1 go or more and less than 2 go per day," "2 go or more and less than 3 go per day," and "3 go or more per day." One "go" contains about 22 g of ethanol, and this amount was used to separate greater-quantity drinkers from lower-quantity drinkers. The subjects were divided into three groups according to usual ethanol consumption per drinking day (nondrinkers; lower-quantity drinkers: <22 g of ethanol per day; greater-quantity drinkers: ≥22 g ethanol per day). Because the population of heavy smokers (≥20 cigarettes per day) was small, subjects were classified into nonsmokers and smokers, and no further detailed classification was done for the smoker group.

Height and body weight were measured while subjects wore light clothes at the health checkup. Body mass index (BMI) was calculated as weight in kilograms divided by the square of height in meters. Fasted blood was sampled from each subject, and serum HDL-C, LDL-C, and TG were measured by enzymatic methods using commercial kit, such as cholestest N-HDL, cholestest LDL, and pureauto S TG-N (Sekisui Medical Co., Ltd, Tokyo, Japan), respectively. Because total cholesterol was not included in the health checkup examination, non-HDL-C was calculated with the use of Friedewald's formula[21] as non-HDL-C (mg/dL) = LDL–C (mg/dL) + 0.2 × TG (mg/dL) when TG levels were <400 mg/dl. Subjects showing TG levels ≥400 mg/dL (n = 22) were excluded in analysis of non-HDL-C. Hemoglobin A1c was determined by the latex cohesion method with a commercial kit (Determiner HbA1c; Kyowa Medex, Tokyo, Japan).