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Influence of daily alcohol consumption on serum adiponectin levels in men

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ARTICLE INFO

Article history:
Received 20 June 2012
Accepted 4 September 2012

Keywords:
Alcohol
Adiponectin
Metabolic syndrome

ABSTRACT

Background. The risk of cardiovascular diseases is lower among moderate alcohol drinkers than among both nondrinkers and heavy drinkers. However, factors that can account for the U-shaped or J-shaped relationship between daily alcohol consumption and incident cardiovascular diseases remain obscure.

Purpose. The present cross-sectional study investigated the relationship between alcohol consumption and serum adiponectin levels.

Method. Total adiponectin was measured in 527 males participating in health check-up programs (age range 40–86 years, mean 60.5 years). Based on questionnaire responses, alcohol intake was categorized into three groups: none or occasional (A1); <50 g/day and ≥3 days/week (A2); and ≥50 g/day and ≥3 days/week (A3).

Results. No significant differences in adiponectin levels were observed among the three alcohol consumption groups of subjects without the metabolic syndrome (MetS). In subjects with the MetS, the adiponectin level was significantly higher in the A2 (moderate drinker) group than in both the A1 and A3 groups. MetS subjects in group A2 had higher HDL-C levels than those in A1, but levels in group A3 were not significantly different from those in group A2.

Conclusion. An increased adiponectin level in moderate alcohol drinkers who have MetS may contribute to the U-shaped relationship between alcohol consumption and risk of cardiovascular events, in addition to the involvement of HDL-C.

1. Introduction

The risk of cardiovascular diseases is known to be lower among light to moderate drinkers than among nondrinkers and heavy drinkers. This U-shaped or J-shaped relationship has been documented between daily alcohol consumption and ischemic stroke [1–3], coronary heart disease [4–9], and all-cause mortality [10]. A recent meta-analysis also demonstrated that moderate alcohol consumption has beneficial effects on cardiovascular disease incidence and mortality [11].

Abbreviations: HDL-C, high-density lipoprotein cholesterol; MetS, metabolic syndrome; EDTA, ethylene diamine tetra acetic acid; IRI, immunoreactive insulin; CVs, coefficients of variation; ELISA, enzyme-linked immunosorbent assay; HOMA-IR, homeostasis model assessment of insulin resistance; eGFR, estimated glomerular filtration rate; HbA1c, glycosylated hemoglobin; HPLC, high performance liquid chromatography; JDS, Japan Diabetes Society; NGSP, National Glycohemoglobin Standardization Program; sBP, systolic blood pressure; dBP, diastolic blood pressure; LDL-C, low-density lipoprotein cholesterol; CRP, C-reactive protein.

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0026-0495/$ – see front matter © 2013 Elsevier Inc. All rights reserved.
http://dx.doi.org/10.1016/j.metabol.2012.09.003

There is evidence that light to moderate alcohol consumption may have beneficial effects on type 2 diabetes mellitus [12], an effect that appears to be mediated by decreased insulin resistance [13]. Moreover, light to moderate alcohol intake over the short term increases serum adiponectin [13,14] and high-density lipoprotein cholesterol (HDL-C) levels [15]. It has also been reported that the favorable effects of alcohol intake on glucose metabolism are most prominent in obese mice and in glucose-intolerant human subjects. We recently observed a U-shaped relationship between alcohol consumption and incident myocardial infarction in obese subjects from the general population [16]. However, mediating factors that can fully explain the U-shaped relationship between alcohol consumption and cardiovascular events remain unknown. In particular, the mechanism by which heavy alcohol consumption increases the risk of coronary heart disease has been not identified.

The present cross-sectional study of the general population sought to investigate the relationship between daily alcohol consumption and glucose and lipid metabolism, as well as obesity-related indices, such as serum adiponectin concentrations and HDL-C levels. Furthermore, these relationships were analyzed in subjects with metabolic syndrome (MetS), who represent a segment of the population that is at high risk of cardiovascular diseases.

2. Methods

2.1. Study subjects

A total of 527 men underwent a comprehensive health check-up at the Iwate Health Service Association and agreed to participate in the present study. Participants with missing data and age <40 years were excluded. The mean age of the included participants was 60.5 years (range 40–86 years). All participants underwent a routine clinical examination, including a medical history, lifestyle assessment, and fasting blood sampling. Overall, 133 (25.2%) participants were on antihypertensive therapy, 58 (11.0%) participants used cholesterol-lowering therapies, and 41 (7.8%) participants were taking antidiabetic agents or were on a dietary regimen. The study protocols were approved by our institutional ethics committee, and all participants provided written informed consent.

2.2. Blood examination

Following an overnight fast, venous blood samples were taken from the antecubital vein of subjects resting in the sitting position. Samples were collected in vacuum tubes containing EDTA or a serum separator gel. After sampling, the tubes were immediately centrifuged for 10 min at 1500×*g*. Aliquots of serum were stored at −20°C, and routine hematology and biochemistry tests were performed within a few days following blood sampling. Some of the serum was also stored at −80°C for measurement of adiponectin and insulin (immunoreactive insulin, IRI) levels. Total adiponectin concentration was measured using an ELISA kit. The intra- and inter-assay coefficients of variation (CVs) for measurement of adiponectin levels were 2.9% and 3.4%, respectively [17]. The homeostasis model assessment of insulin resistance (HOMA-IR; fasting blood glucose [mg/dl]×blood insulin concentration [μU/ml] / 405) was calculated as an index of insulin resistance [18]. The estimated glomerular filtration rate (eGFR) was calculated according to the equation proposed by the Japan Nephrology Society [19]. Glycosylated hemoglobin (HbA1c) was measured by the HPLC method as a Japan Diabetes Society (JDS) value, and the result is presented as a National Glycohemoglobin Standardization Program (NGSP) equivalent value (transformed by uniformly adding 0.4%).

2.3. Risk factor assessment

Trained nurses measured the systolic and diastolic blood pressures (sBP and dBP, respectively) of patients who were seated and rested using an automatic digital sphygmomanometer placed on the upper arm. The average of two blood pressure measurements was used for the present analysis. A self-reported questionnaire was administered to document subjects' medical history and lifestyle, including daily alcohol consumption. Alcohol consumption was evaluated by selecting from the 7 items of alcohol consumption status [the combination consisted of amount/day (<2 gou or ≥2 gou, where 2 gou =2 units of Japanese sake =50 g ethanol) and frequency in a week (<3 days, 3–6 days, or every day)] listed in Table 1. An ex-drinker was defined as a person who had stopped alcohol intake for at least 1 year prior. Regarding the time span of alcohol consumption, since the participants were involved in an annual health check-up program, the choice of the items for alcohol consumption status was derived from the estimated average over the previous approximately 1 year. For the analysis, daily alcohol consumption was categorized into three groups based on grams of ethanol consumed: none or occasional (A1); <50 g/day and ≥3 days/week (A2); and ≥50 g/day and ≥3 days/week (A3). The smoking index was defined as the product of packs per day and years of smoking (pack-years). Waist circumference was measured at the level of the umbilicus during normal exhalation, with the subject standing upright. When significant fat accumulation caused the umbilicus to sag downward, waist circumference measurements were taken at a level midway between the lower margin of the ribs and the anterior iliac spine.

Hypertension was defined as at least one of sBP ≥140 mmHg, dBP ≥90 mmHg, or current antihypertensive therapy. Dyslipidemia was diagnosed in subjects with serum low-density lipoprotein cholesterol (LDL-C) levels ≥140 mg/dl and/or high-density lipoprotein cholesterol (HDL-C) levels <40 mg/dl

Table 1 – Categories of daily alcohol consumption.

Group	Alcohol consumption status	n	%
A1	Ex-drinker	12	39%
	Non-drinker	84	
	Occasional (≤2 days /week)	109	
A2	Ethanol <50 g/day, 3–6 days/week	80	44%
	Ethanol <50 g/day , everyday	150	
A3	Ethanol ≥50 g/day, 3–6 days/week	29	17%
	Ethanol ≥50 g/day, everyday	63	