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Alcohol drinking patterns and biomarkers of coronary risk in the Spanish population

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Abstract *Background and aims:* To estimate the association between patterns of alcohol consumption and biomarkers of coronary heart disease (CHD) risk.
Methods and results: Cross-sectional study among 10,793 individuals representative of the Spanish population aged ≥18 years. The threshold between moderate and heavy drinking was 40 g of alcohol/day in men and 24 g/day in women. Binge drinking was defined as intake of ≥80 g of alcohol in men and ≥60 g in women at any drinking occasion in the preceding 30 days. Analyses were performed with generalized linear models with adjustment for the main confounders, and results were expressed as the percentage change in the geometric mean (PCGM). Compared to non-drinkers, moderate and heavy drinkers had progressively higher serum HDL-cholesterol, with a PCGM ranging from 4.8% (95% CI: 3.7–6.0%) in moderate drinkers without binge drinking (MNB) to 9.6% (5.1–14.2%) in heavy drinkers with binge drinking (HB). Fibrinogen decreased progressively with alcohol intake, from −2.2% (−3.1 to −1.3%) in MNB to −5.8% (−9.4 to −2.0%) in HB. Leptin, glycated hemoglobin and the HOMA-index also decreased with increasing alcohol intake, and particularly with binge drinking.
Conclusions: Moderate alcohol intake is associated with improved HDL-cholesterol, fibrinogen and markers of glucose metabolism, which is consistent with the reduced CHD risk of moderate drinkers in many studies. Heavy and binge drinking were also associated with favorable levels of CHD biomarkers; since these drinking patterns produce substantial health harms, our results should not be used to promote alcohol consumption.

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Introduction

The effect of alcohol on the risk of coronary heart disease (CHD) depends on the drinking pattern [1]. In many prospective studies the intake of small to medium amounts of alcohol has been consistently associated with a lower risk of CHD [2]. Indirect support of a causal protective effect of moderate alcohol intake on CHD derives from short-term trials showing an improvement in CHD biomarkers, in particular an elevation of HDL-cholesterol and a reduction of fibrinogen [3].

The effects of heavy drinking on CHD are more uncertain. The effect of regular heavy drinking (>60 g alcohol/day) is insufficiently known because it is relatively infrequent in most populations and is disproportionately missed in usual cohort studies [1]. As regards irregular heavy drinking, it has been associated with a 45% increase in CHD risk after adjustment for the volume of alcohol consumed; thus, it seems that any cardioprotective effect of moderate alcohol consumption may be negated by irregular heavy drinking occasions [4]. The mechanisms of the cardiovascular effect of heavy drinking are poorly understood; while a few clinical trials suggest that heavy drinking increases HDL-cholesterol [5—7], it may also exert a detrimental effect on thrombosis, blood pressure and atrial fibrillation [8,9].

Short-term trials may not be appropriate to characterize the effect of long-term drinking patterns. Moreover, the effect of each type of beverage on biomarkers of CHD risk has not been well established, because most studies used wine as the alcohol intervention [3]. Therefore, the characterization of the impact of habitual drinking patterns requires information from population-based studies. Unfortunately, most observational studies have focused on regular moderate alcohol consumption, so information on the association between the main drinking patterns, including heavy and binge drinking, and CHD biomarkers is very scarce.

We used data from a population-based study to assess the association of the main drinking patterns and beverage preference with markers of lipid metabolism, hemostasis, inflammation, adipocyte function, and glucose metabolism.

Methods

Study participants

The main methods of the ENRICA study have been reported elsewhere [10]. In brief, this is a cross-sectional study conducted from 2008 to 2010 among 12,948 individuals representative of the non-institutionalized Spanish population aged ≥18 years. The sample was first stratified by province and size of municipality. Second, clusters were selected randomly in 2 stages: municipalities and census sections. Finally, the households within each section were selected by random telephone dialing using the directory of telephone land-lines. Information was collected in three stages. First, a phone interview on socio-demographic variables, lifestyle and diagnosed morbidity; second, a home visit to obtain blood and urine samples; and third, another home visit to obtain a diet history and to measure blood pressure and anthropometric variables.

The ENRICA protocol was approved by the clinical research ethics committees of the University Hospital *La Paz* in Madrid and Hospital *Clinic* in Barcelona.

Study variables

Drinking patterns

The average intake of alcohol was estimated using a diet history, developed from that used in the EPIC-cohort study in Spain, which assesses the regular consumption of alcoholic beverages in the preceding year [11]. Regular heavy alcohol intake was defined as ≥40 g/day in men and ≥24 g/day in women. Lower intakes were deemed to be regular moderate intake [12]. Binge drinking was defined as the intake of ≥80 g of alcohol in men and ≥60 g in women in women at any given drinking session (the entire evening or night) during the preceding 30 days [13]. Non-drinkers included lifetime abstainers and sporadic drinkers.

Because the average alcohol ingested by a binge drinker can be either moderate or heavy, depending upon the alcohol intake on the rest of the drinking occasions, we classified individuals into six drinking patterns: 1) non-drinkers; 2) ex-drinkers; 3) moderate drinkers with no binge drinking (MNB); 4) moderate drinkers with binge drinking (MB); 5) heavy drinkers with no binge drinking (HNB); and, 6) heavy drinkers with binge drinking (HB).

Among drinkers, a preference for a specific type of alcoholic beverage (wine, beer or spirits) was deemed to exist when such drink accounted for over 80% of alcohol intake in the study participant.

Biomarkers of coronary heart disease

Biomarkers of coronary risk were measured in 12-h fasting blood samples. Laboratory determinations were performed in the Center of Biological Diagnostics of the *Clínic* Hospital in Barcelona, using standardized procedures and appropriate quality controls. Biomarkers included total cholesterol, high-density lipoprotein cholesterol (HDL-c), low-density lipoprotein cholesterol (LDL-c), and triglycerides. We also assessed fibrinogen, which is a marker of hemostatic function, high-sensitivity C-reactive protein (hs-CRP), which is an indicator of chronic inflammation, and leptin, an adipocyte hormone.

As regards markers of glucose metabolism, we determined serum glucose, glycated hemoglobin (HbA1c), and insulin. The Homeostatic Model Assessment for Insulin Resistance (HOMA-IR) index was calculated by multiplying glucose in mg/dl by insulin in mU/l and dividing by 405.

Potential confounders

We also assessed variables that are associated with drinking patterns and CHD biomarkers, including demographic variables, tobacco, physical activity and diet, which was assessed with a diet history [11]. Adherence to the Mediterranean diet was summarized with the index of Trichopoulou.

Weight and height were measured with standardized procedures, and body mass index (BMI) was calculated by dividing weight in kg by height in m squared.