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Association of alcohol consumption with coronary artery disease severity

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SUMMARY

Background & aims: The ingestion of small to moderate alcohol consumption amounts has been associated to cardiovascular protection. This study aimed to evaluate the association between alcohol consumption and coronary artery disease severity.

Material and methods: Cross-sectional Study with patients undergoing coronary angiography. Age, cardiovascular risk factors (smoking, systemic arterial hypertension, dyslipidemia and diabetes) and alcohol drinking habit were investigated. Alcohol consumption was divided in three categories: nondrinker, moderate alcohol consumption (less than 15 g ethanol/day for women or 30 g ethanol/day for men) and heavy alcohol consumption. Coronary artery disease severity was assessed through the Friesinger Score (FS) in the coronary angiography, by interventional cardiologists blinded to alcohol consumption.

Results: The final sample included 363 adults; of those, 228 were men (62.81%). Mean age was 60.5 ± 10.9 y. Unadjusted analyses identified sex, age, hypertension, diabetes, dyslipidemia and alcohol consumption as the main covariates associated with the Friesinger score. Lower Friesinger scores were also observed in moderate alcohol consumption when comparing to those who do not drink (RR 0.86; 95% CI 0.79–0.95).

Conclusion: Among patients with suspected coronary artery disease undergoing coronary angiography, moderate alcohol consumption is associated to a lower coronary artery disease severity than heavy drinking.

1. Introduction

Atherosclerotic disease is a major cause of mortality and incapacity worldwide. Alcohol is part of the human diet since the beginning of civilization, but there is still much controversy regarding its effects on cardiovascular health. While heavy drinking is associated to increased mortality, the ingestion of small to moderate amounts has been associated to cardiovascular protection [1], including lower mortality, lower risk of stroke [2] and a better prognosis after an acute myocardial infarction [3].

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Anti-oxidant and anti-inflammatory properties, as well as effects in lowering LDL-cholesterol [4], increasing HDL-cholesterol [5] and in the coagulation cascade may mediate these beneficial effects [6]. One study showed that alcohol consumption was associated to lower atherosclerotic burden in the proximal aorta [7], but there are very few studies quantifying coronary burden and assessing alcohol consumption.

Considering the probable positive effects of alcohol consumption in the cardiovascular system, this study aimed to evaluate the hypothesis that a moderate alcohol consumption is associated to a lower coronary artery disease (CAD) severity in patients undergoing coronary angiography.

2. Methods

Patients 18 years and older that were undergoing coronary angiography to investigate coronary artery disease in The Center for Cardiovascular Diagnosis and Intervention, Sao Lucas Hospital (Porto Alegre, Brazil) were invited to participate in this cross-sectional study. Patients that were not capable of answering the study questionnaire were excluded from the study. Data were collected from October 2008 to December 2009. This study is a sub analysis of a greater project undertaken in the institution with patients undergoing to cardiac catheterization. The research protocol was approved by the Ethics and Research Committees of the Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS), number 08/04211, and all participants signed an informed consent.

Socio-demographic characteristic and cardiovascular risk factors (smoking, hypertension, dyslipidemia, diabetes mellitus and family history of cardiovascular heart disease) were collected using a structured questionnaire. Age was categorized in quartiles according to the statistical distribution of the sample.

2.1. Alcohol consumption

Data concerning alcohol consumption were also collected through direct individual interview. We used a standardized questionnaire including questions about alcohol consumption (dichotomous), type of beverage (wine, beer, spirits), frequency and quantities/doses. Total intake of ethanol was estimated by the average and the alcohol content of each drink (beer 6%, wine 12%, and distilled spirits 40%) multiplied by ethanol density (0.8) [8]. For purposes of analysis in this study, alcohol consumption was divided into three categories: non-drinkers, moderate drinkers (up to 15 g/day of ethanol for women and 30 g/day for men) and heavy drinkers (beyond the moderate dose).

Coronary artery disease severity was measured by the Friesinger score (FS) [9] during coronary angiography. This score quantifies arteriographic irregularities in the right, anterior descendent and left circumflex coronary arteries [9–12]. All coronary lesions were assessed by interventional cardiologists blinded to alcohol consumption data.

Data analysis used the STATA 12.0 software (Stata Corporation, College Station, TX, USA). Descriptive statistics were used to describe the demographic, clinical, and socioeconomic characteristics of the sample. Unadjusted analyses were accomplished to provide a summary of statistics and a preliminary assessment of the association between the predictor variable and the outcome (the Friesinger scores). This study considered the Friesinger scores as a count variable and a multivariate Poisson regression model was fitted to assess covariates for the outcome. This strategy allowed estimating rate ratios among comparison groups and their respective 95% confidence interval. It corresponds to the ratio of the arithmetic mean of Friesinger scores between comparison groups. For example, taken into account the variable sex, a RR of 1.20 (Table 2) means that males had a 1.20 times higher mean of Friesinger scores than females. The multivariate model considered all the variables presenting a P value $\leq$ 0.25 in the unadjusted analyses (bivariate analyses); those variables were retained in the final models only if they had a P-value $\leq$ 0.05 after adjustment.

3. Results

Of the 382 patients that underwent coronary angiography to investigate coronary artery disease, 19 patients had not answered the question about alcohol beverage and were excluded. Thus, the final sample was constituted of 363 participants; of those, 228 were men (62.81%) and 135 women (37.19%). Mean age was 60.5 ± 10.9 y (range from 23 to 89 years). The characteristics of the sample regarding sex, alcohol consumption and cardiovascular risk factors are shown in Table 1. Table 2 describes alcohol categories. In general, non-drinker subjects were more likely to be females and non-smokers (Chi-square test).

According to the unadjusted analyses, sex, age, hypertension, smoking status, diabetes, dyslipidemia and alcohol consumption were associated with the Friesinger score and included in the adjusted model (Table 3). In the multivariate model, higher Friesinger scores were observed for males (rate ratio 1.22; 95% confidence interval 1.21–1.33), those with hypertension (RR 1.20; 95% CI 1.08–1.34), diabetes (RR 1.09; 95% CI 1.01–1.19), dyslipidemia (RR 1.10; 95% CI 1.01–1.19) and with increasing age. Sociodemographic factors also associated with Friesinger scores; lower scores were observed in non-smokers (RR 0.80; 95% CI 0.72–0.89) and ex-smokers (RR 0.89; 95% CI 0.79–0.99) when comparing with smokers. Lower Friesinger scores were also observed in moderate alcohol consumption when comparing to those who do not drink (RR 0.86; 95% CI 0.79–0.95).

4. Discussion

Among patients undergoing coronary angiography for the diagnosis of coronary artery disease, moderate alcohol drinking was associated with a lower CAD severity as measured by the FS. Age, sex, smoking, hypertension, diabetes and dyslipidemia were the other independent risk factors for CAD severity. Interestingly, in our study we observed a J curve pattern, showing association with lower CAD severity in moderate drinkers when compared to both non-drinkers and heavy drinkers. Moderate alcohol

Table 1
Sex, age, alcohol consumption and other risk factors in the studied population.

Variables	N	%
Sex		
Female	135	37.19
Male	228	62.81
Age (years)		
23–52	83	22.87
53–59	94	25.90
60–67	94	25.90
68 or more	92	25.34
Smoking		
Current	69	19.06
Non-smoking	172	47.51
Previous	121	33.43
Hypertension	281	77.41
Diabetes	99	27.35
Dyslipidemia	189	52.21
Alcohol consumption		
Nondrinker	229	63.09
Moderate	111	30.58
Heavy	23	6.34

Table 2
Sample characteristics according to alcohol consumption categories.

Variables	Alcohol consumption		
	Nondrinker n (%)	Moderate n (%)	Heavy n (%)
*Sex**			
Female	109 (80.74)	25 (18.52)	1 (0.74)
Male	120 (52.63)	86 (37.72)	22 (9.65)
Age (years)			
23–52	46 (55.42)	29 (34.94)	8 (9.64)
53–59	64 (68.09)	24 (25.53)	6 (6.38)
60–67	61 (64.89)	29 (30.85)	4 (4.26)
68 or more	58 (63.04)	29 (31.52)	5 (5.43)
*Smoking***			
Current	36 (52.17)	25 (36.23)	8 (11.59)
Non-smoking	124 (72.09)	40 (23.26)	8 (4.65)
Previous	69 (57.02)	45 (37.19)	7 (5.79)
Hypertension			
No	44 (53.66)	34 (41.46)	4 (4.88)
Yes	185 (65.84)	77 (27.40)	19 (6.76)
Diabetes			
No	159 (60.46)	87 (33.08)	17 (6.46)
Yes	69 (69.70)	24 (24.24)	6 (6.06)
Dyslipidemia			
No	107 (61.85)	55 (31.79)	11 (6.36)
Yes	121 (64.02)	56 (29.63)	12 (6.35)

*Statistically significant $p < 0.00$ (Chi-square test); **Statistically significant $p = 0.01$ (Chi-square test).

consumption is known to be associated in literature also to lower mortality [1,13].

Kohsaka et al., found association of moderate alcohol consumption to a coronary atherosclerotic burden in the proximal thoracic aorta, explaining in part, the low risk of ischemic stroke in the moderate alcohol consumers in this study [7]. Kiechl et al. described a lower risk of atherosclerosis among the moderate consumers of alcohol comparing to non-drinkers and to patients that drink more than the moderate doses [14].

There is still controversy regarding the mechanisms through which moderate alcohol consumption exerts its beneficial effects. It is known that alcohol consumption influences an ample range of vascular functions [15], including anti-oxidant effects, HDL-cholesterol increases [16–18] inhibition of platelet aggregation, plasma viscosity reduction, fibrinogen concentration reduction and improvement of endothelial function and insulin resistance [16]. There is also a decrease in white cell counts and levels of inflammatory markers.

Inflammation plays a central role in the development of atherosclerosis [1]. Inflammatory markers are also influenced by regular and moderate alcohol consumption, which may mediate the observed reduction of atherosclerotic burden. In fact, regular alcohol consumption may reduce C-reactive protein levels and leukocyte counts [16], and this appears to be an important mechanism for the benefits observed with alcohol consumption.

The vascular endothelium is the stage where the atherosclerotic events evolve [19]. Endothelial dysfunction is a major component in atherosclerosis development and progression, and is also influenced by alcohol consumption. Alcohol may influence the expression of adhesion molecules such as vascular cellular adhesion-1 (VCAM-1), Intercellular-1 adhesion molecule (ICAM-1) and E-selectin [1]. A reduction in oxidative damage, both in circulating lipoproteins and in the coronary endothelial layer (coronary oxidative DNA-damage) has been associated to the benefits of moderate alcohol consumption [20].

Our findings suggest that recommendations about alcohol consumption must take dosage into consideration. Patients must be advised to be careful about the amount of consumption. It is also important to consider that several studies show harmful effects of alcohol abuse: increased arterial hypertension [21–23], triglycerides [18], obesity [24], than cancer [25,26], liver cirrhosis [26], chronic pancreatitis [26,27], and total mortality [28].

Alcohol abuse represents a pro-inflammatory stimuli on the liver and metabolic system provoking a general subclinical inflammatory state that it is known to contribute to atherosclerosis.

Table 3
Unadjusted and adjusted assessment of sociodemographic and clinical variables associating with the Friesinger scores. Poisson regression analysis.

Variable	The Friesinger scores				
	Mean (SD)	RR (95% CI)	*P*	RR_{adj} (95% CI)	*P*
Sex					
Female	6.49 (4.26)	1.00	<0.01	1.00	<0.01
Male	7.82 (3.91)	1.20 (1.11–1.31)		1.22 (1.12–1.33)	
Age (years)					
23–52	5.47 (3.72)	1.00		1.00	
53–59	7.78 (4.09)	1.42 (1.26–1.60)	<0.01	1.28 (1.13–1.45)	<0.01
60–67	7.80 (4.40)	1.42 (1.27–1.60)	<0.01	1.33 (1.18–1.50)	<0.01
68 or more	8.04 (3.61)	1.47 (1.31–1.65)	<0.01	1.38 (1.22–1.56)	<0.01
Smoking					
Current	7.93 (3.39)	1.00		1.00	
Non-smoking	6.70 (4.27)	0.85 (0.76–0.94)	0.01	0.80 (0.72–0.89)	<0.01
Previous	7.92 (4.04)	0.99 (0.90–1.10)	0.98	0.89 (0.79–0.99)	0.03
Hypertension					
No	6.08 (4.05)	1.00	<0.01	1.00	<0.01
Yes	7.68 (4.04)	1.26 (1.15–1.39)		1.20 (1.08–1.34)	
Diabetes					
No	6.93 (4.12)	1.00	<0.01	1.00	0.04
Yes	8.33 (3.85)	1.20 (1.11–1.13)		1.09 (1.01–1.19)	
Dyslipidemia					
No	6.65 (4.29)	1.00	<0.01	1.00	0.02
Yes	7.91 (3.80)	1.19 (1.10–1.28)		1.10 (1.01–1.19)	
Alcohol consumption					
Nondrinker	7.57 (4.06)	1.00		1.00	
Moderate	6.67 (4.13)	0.88 (0.81–0.96)	<0.01	0.86 (0.79–0.95)	<0.01
Heavy	7.91 (3.97)	1.04 (0.90–1.21)	0.58	0.97 (0.83–1.14)	0.75

RR = Unadjusted Rate Ratio; RR_{adj} = Adjusted Rate Ratio.

The context of alcohol consumption should be also considered. It should be associated to a healthy life style, as well as physical activity, a balanced diet, use of appropriate drug therapy when necessary and smoking cessation [3]. In our study, we observed that CAD severity was lower in non-smokers and former smokers, reinforcing the need to advise smoking cessation.

Our study has some limitations that need to be discussed. In cross-sectional designs, temporal relations cannot be established and, thus, we can only report associations between variables, but not establish a causal relation between alcohol consumption and atherosclerosis. Therefore, our study is a hypothesis generating analysis of drinking habits and atherosclerosis. Although we collected information about type of beverage and drinking pattern, the small absolute numbers in each category resulted in low statistical power, precluding detailed analysis on these variables. We were not able to examine the effects of cholesterol and saturated fat, lipids, markers of insulin resistance or relevant biomarkers on the observed association; therefore it is a descriptive hypothesis generating analysis of drinking habits and atherosclerosis. The utilized score FS emphasizes angiographic coronary atherosclerosis; all scores have limitations and none of them has wide clinical acceptance, but FS provides a good reflection of lesion burden. It is widely accepted that angiography underestimates atherosclerosis because it only evaluates the coronary lumen (lumenography); that is, it is limited to assessing protruding plaque but it is unable to consider external remodeling of atherosclerotic plaques (Glagov effect). In favor, it is that the FS is an easily applied and reproducible score, and it is one of the best choices for the angiographic quantification of the coronary artery disease severity.

5. Conclusion

Among patients with suspected coronary artery disease undergoing coronary angiography, moderate alcohol consumption was associated to a lower coronary artery disease severity than heavy drinking.

Conflict of interest

None.

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