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Is Self-Reported “Moderate” Drinking in the Cardiovascular Benefit Range Associated with Alcoholic Behavior? A Population Based Study

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Abstract

Aims—Identifying a threshold number of drinks/day, beyond which there is a high risk of developing alcoholic behavior, would enable physicians to more confidently support the use of alcohol for CV risk prevention.

Methods—In a randomly selected, population-based sample of 2042 adults, age ≥ 45 , we graded alcohol drinking behavior using the Self Administered Alcoholism Screening Test (SAAST), quantified alcohol amount by questionnaire, and assessed the prevalence of CV disease (coronary, peripheral or cerebrovascular disease) by medical record review.

Results—Although optimal alcohol use (≤ 2 drinks/day) as associated with reduced odds of CV disease, 43% of alcoholics and 82% of problem drinkers reported alcohol use in the optimal range as well.

Conclusions—The association of use of alcohol in the optimal range with alcohol related behavioral problems supports the reluctance in physicians from recommending alcohol use for CV benefit, not withstanding the underreporting of alcohol use by alcoholics.

Keywords

Alcoholism; risk factor; coronary heart disease; alcohol

INTRODUCTION

The amount of alcohol consumption associated with a reduction in cardiovascular (CV) events has been extensively documented by over a 100 observational and 80 metabolic studies, and the CV benefit range is believed to be 1–2 drinks per day.^{1,2} However, due to the medical,

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behavioral and social consequences of excess alcohol consumption, there is reluctance in the medical community to recommend alcohol for CV disease risk reduction. Studies to date have focused on alcohol consumption in terms of quantity of alcohol associated with CV benefit,² and studies evaluating the complex relationship between alcohol quantity, alcoholic consumption behavior pattern and cardiovascular benefits of alcohol are lacking.² Specifically, neither the amount of alcohol associated with alcoholic consumption behavior, nor the association between alcoholic behavior and CV disease, have been adequately studied. We hypothesized that an alcoholic drinking pattern would be associated with a volume much beyond 1–2 drinks per day, and that consumption volume would clearly identify high risk drinking behavior. Identification of a threshold number of drinks per day, below which alcoholic drinking behavior was unlikely, could enable the physician to make more informed recommendations on the use of alcohol for its CV risk reduction benefits. We tested this hypothesis in a randomly sampled, prospectively evaluated population-based community cohort of 2042 persons in Olmsted County, MN.

METHODS

The Mayo Foundation and Olmsted Medical Center Institutional Review Boards approved this study (Olmsted County Heart Function Study) and subjects gave written informed consent.

Study setting

In 2000, 90% of the 112,255 residents of Olmsted County were white. Other characteristics of this population and its unique resources for population-based epidemiological research have been previously described.^{3,4}

Population sampling and data collection

A random sample of Olmsted County residents, ≥ 45 years of age on January 1, 1997 was identified. A sampling fraction of 7% was applied within each gender and age-specific (five years) stratum in the sample. Of the 4203 subjects invited, 2,042 (49%) participated. Participation bias has been evaluated in this cohort: medical record abstraction of 500 participants and 500 non-participants showed no difference in CV disease prevalence between the groups.⁵

Classification of Alcohol Drinking Behavior

Data were collected for each participant through medical record abstraction and by the use of SAAST – self-administered alcoholism screening test. SAAST is a validated screening instrument for the diagnosis of lifetime prevalence of alcoholism, with adequate test retest reliability ($r=0.85$ when SAAST administered twice to 173 psychiatric inpatients at admission and discharge)⁶. It demonstrated a sensitivity of 83%, positive predictive value of 50%, negative predictive value of 96%, and accuracy of 95% in identifying known alcoholics in general practice.⁷ The agreement was 95% for both the long form (35 questions) and short form (9 questions) of SAAST.⁸ It has been found to be a more sensitive indicator of alcoholism than laboratory testing or physical examination.^{9–11} Each question, if answered in the direction of alcoholism, contributes 1 point to the total SAAST score, except for two questions each of which contribute 2 points to the SAAST score. The questionnaire is as follows with (2) next to the questions with a weighted score of 2. Do you feel that you are a normal drinker? (2). Are you always able to stop drinking when you want to? 3. Has your drinking ever created problems between you and your spouse, parent, or near relative? 4. Do you ever drink in the morning? 5. Have you ever been told by a doctor to stop drinking? 6. Have you ever been a patient in a psychiatric hospital or on a psychiatric ward of a general hospital and was drinking part of the problem that resulted in your hospitalization? 7. Have you ever been arrested, even for a few hours, because of driving while intoxicated? 8. Do your close relatives ever worry

or complain about your drinking (2)? Have you ever felt the need to cut down on your drinking (2)?

Olmsted County Heart Function Study (OCHFS) participants were presented the short form (nine-item) SAAST. Two of the nine-item SAAST questions were removed from the study questionnaire for medicolegal reasons. Responses to the two missing items were obtained by review of patient provided questionnaire information obtained at clinical visits and entered in the medical record. Missing item responses were retrieved from the medical record between 1997 and 2003.

We categorized current consumers of alcohol into three categories: Careful alcohol user for a SAAST score of 0, problem drinker for a SAAST score is 1, 2 or 3, indicating that they have had at least one of the behavior attributes of alcoholism and alcoholic if the SAAST score was ≥ 4 .

Quantification of Alcohol Consumption

As a part of participation in the OCHFS each subject completed a self-administered questionnaire which first asked if they have ever used alcohol. A negative answer classified them as Never Drinkers. Then they were asked if they have used alcohol in last 12 months. A negative answer classified them as a Previous Drinker. An affirmative answer to both questions led the subject to three separate sections on beer, wine and liquor. The twelve frequency response categories ranged from 3 or 4 times a day to once a year. The sixteen-quantity response category ranged from 1 drink per day to 16 or more drinks per day. The estimated alcohol content per drink for beer was 12.8 g, for wine 11 g, and for spirits (liquor or whisky) 14 g.¹² The alcohol intake was further categorized into <1 drink/day (<11grams/day), 1–2 drinks per day (11–28 grams/day), and >2drinks/day (≥ 28 grams/day).

Method of recognition of cardiovascular disease

Medical record review was carried out by four trained nurse chart abstractors. Myocardial infarction detected by systematic medical record abstraction and application of WHO or Gillum criteria.¹³ Coronary artery disease, angina, unstable angina, peripheral vascular disease and cerebrovascular disease were diagnosed from physician documentation in the medical record. CV disease was the composite diagnosis if the subject had documented coronary artery disease, angina, unstable angina, cerebrovascular accident, transient ischemic attack, peripheral vascular disease or myocardial infarction.

Statistical Analysis

The statistical package used was JMP, Version 5 (SAS Institute, USA) for all the analyses.

RESULTS

Alcohol Consumption Behavior Groups

Of the 2042 subjects, complete SAAST responses were missing 442 individuals, and these were excluded from the study. Of the remaining 1600 subjects, we identified 188 never drinkers (12%), 198 previous drinkers (12%), 948 careful alcohol users (59%), 244 problem drinkers (15%) and 22 alcoholics (1%). (Table 1)

The mean age among those who ever used alcohol was similar (range = 61–63; pair wise t-tests showed no significant difference). (Table 1) The age of never drinkers (Mean 67; 95% CI = 66,69) was significantly higher ($p < 0.05$) than other groups. Alcoholic drinking behavior was higher in men, with 91% of persons with alcoholic drinking patterns being men. The prevalence of obesity decreased whereas that of current smoking increased with heavier alcohol

consumption behaviors. Current alcohol consumers had lower prevalence of diabetes or hypertension.

Cardiovascular Disease and Alcohol Consumption Behavior

The prevalence of CV diseases showed a U-shaped relationship with alcohol consumption behavior, the lowest CV disease rate being in careful alcohol users while higher rates were observed in past drinkers and among those with heavy drinking patterns (problem drinkers and alcoholic combined). (Table 1) This relationship was present when CV diseases were considered individually as well as when combined. Multivariate analysis of this relationship revealed that careful alcohol use was significantly associated with reduced odds of CV disease (Odds Ratio 0.5; Confidence Interval 0.35, 0.73; $p=0.0003$ (Table 2).

Current guidelines recommend alcohol use in only those who already consume alcohol, and suggest that they do so in moderation (<2 drinks per day).¹⁴ Abstainers are not recommended to initiate alcohol consumption for CV benefits. Therefore we further evaluated the adequacy of this recommendation within in the stratum of careful alcohol users, in order to define the number of drinks per day associated with CV benefit in those who consume alcohol in moderation. Compared to consumption of 0–1 drinks/day, consumption of 1–2 drinks per day was associated with higher odds of CV disease (Odds Ratio 1.59; 95% Confidence Interval 1.01,2.48; $p=0.04$). Subjects consuming >2 drinks per day were even at higher odds of CV disease as compared to those consuming 0–1 drinks per day (Odds Ratio 1.66; 95% Confidence Interval 0.79, 3.22; $p = 0.1$).

Quantity of Alcohol Consumed in Different Alcohol Behavior Groups

We have presented the quantity of alcohol consumed in different drinking pattern groups in Table 3. The mean alcohol consumption volume among alcoholics was far greater than among problem drinkers¹ (93 gm/day vs. 16.8 gm/day), and each of these two categories was greater than the three lower consumption groups. The very large range of consumption volume reported by alcoholics suggests the possibility that the mean may be influenced by a small number of persons with very high daily consumption. The differences in alcohol consumption were not statistically significant among never drinkers, past drinkers, or careful alcohol users.

Further categorization of alcohol consumption pattern revealed that 43% of alcoholics, 81% of problem drinkers, 94% of careful alcohol users, and 89% of past alcohol drinkers consumed fewer than 2 drinks per day. Although problem drinkers were three times more likely to drink >2 drinks/day as compared to careful alcohol users (Odds Ratio 3.64; 95% Confidence Interval 2.38,5.55), the majority of subjects in both the groups reported consuming fewer than two drinks per day. Similarly, alcoholics were more likely to have a history of consuming >2 drinks/day compared to careful alcohol users (Odds Ratio 20.92; 95 % Confidence Interval 8.50,53.32), with 43% of alcoholics reported consuming ≤ 2 drinks per day.

DISCUSSION

Principal findings

These observational data suggest that there may be no safe threshold in self reported alcohol consumption volume since the majority of careful alcohol users, problem drinkers and almost half of alcoholics report consuming similar quantities, within the CV benefit range (≤ 2 drinks per day). However, these data suggest that SAAST may be a useful tool in identifying careful alcohol users in whom alcohol use is associated with a lower risk CV disease.

Alcohol and CV disease risk reduction

Moderate (≤ 2 drinks/day) consumption has been associated with decreasing myocardial infarction events, increasing HDL levels, decreasing levels of procoagulants (fibrinogen, vWF), increasing anticoagulant levels (endogenous tPA), antioxidant properties, and decreasing insulin levels.^{2,14} However, the current literature suggests a narrow 'therapeutic index,' where the beneficial effects of alcohol on CV disease risk begin to decline at > 2 drinks per day.^{2,14} Excess consumption is associated with increased mortality due to accidents, liver disease, oropharyngeal and esophageal cancers, cardiomyopathy and stroke.^{1,14} The concern about prescribing alcohol to patients for its beneficial effect on CV disease risk is the possibility that moderate drinking will evolve into problem-drinking or alcoholism. The available evidence is too inconsistent to support the control-of-consumption approach and a more comprehensive understanding of alcohol abuse and prevention is needed.^{15,16}

Although studies indicate that 1–2 drinks per day produces a beneficial effect on CV disease risk, they are not able to take into account the significant increased risk of alcohol related motor vehicle accidents, a major source of morbidity and mortality.¹ As few as 1 to 2 drinks can produce a blood alcohol level above 0.05 mg%, a concentration associated with a threefold increased driving risk.¹

Self reported alcohol consumption

Our findings do not identify a threshold volume, e.g. 2 drinks/day, that would distinguish clearly between persons at low risk from persons at high risk of problem drinking or alcoholism. Indeed, 43% of those with alcoholic drinking behavior and 81% of problem drinkers report consuming ≤ 2 drinks/day.

Clinical relevance of the SAAST questionnaire

Current guidelines in the US do not recommend abstainers to take up alcohol to reduce CV disease risk, but they do state that drinking in moderation may lower CV disease risk, mainly among men over age 45 and women over 55 years. Moderation is defined as one drink/day for women and two drinks/day for men.² These guidelines (from American Heart Association, US department of Agriculture and National Institutes of Health)^{1,12,14} specify the quantity of alcohol but do not specify the importance of assessing alcohol drinking patterns. These guidelines mention the importance of recommending alcohol to those who have displayed the ability to use alcohol responsibly, without defining responsible alcohol use. The current study shows the potential value of SAAST in identifying careful alcohol users, thereby providing clinicians a diagnostic tool. Our results suggest that alcohol use is associated with reduced odds of CV disease in "careful alcohol users", as defined by SAAST. In this group the continuing use of alcohol for its risk reducing benefits is reasonable. Those with a heavier alcohol consumption pattern should be encouraged to reduce or discontinue alcohol use.

Future research

Future research could focus on evaluating the results of our study in a larger cohort (where the results are not limited by small number of alcoholics). The full scale 33 item SAAST questionnaire could be used to better exclude alcoholics and those at high risk for alcoholism if exposed to alcohol, as well as on the interaction between genetics, alcoholic behavior and CV benefit from alcohol.

Limitations

There are several sources of potential selection bias in our observational study including the 49% participation rate, the older age of our cohort, and absence of information regarding SAAST data in 442 subjects. Self reported alcohol consumption likely results in underreporting

of alcohol use. However, self administered questionnaire data reflect the quality of information available to medical practitioners and have been shown to provide useful estimates of alcohol intake in epidemiologic studies.¹⁷ All of these potential biases would lead to an underestimation of alcoholism prevalence estimates. Non-participants in this study may have a higher prevalence of alcoholism. The use of SAAST may introduce an information bias since SAAST is a screening test, not a diagnostic test. In a clinical setting it would be followed by further evaluation. Lack of ethnic diversity limits generalizability of the findings.

Our study is limited by lack of measurement of other confounders especially others drugs of abuse like benzodiazepines, heroine etc., which limits our ability to attribute the effects of alcohol on cardiovascular disease or behavior. However, short of drugs like cocaine, most drugs of abuse do not affect cardiovascular system, and therefore measurement of these agents is unlikely to affect the final results.

Conclusion

We were unable to identify a self reported alcohol consumption volume below which patients would have the cardiac benefit of alcohol and would not run the risk of progressing to problem-drinking or alcoholism. However, our data demonstrate the potential utility of SAAST in identifying “careful alcohol users” who have demonstrated the ability to use alcohol responsibly, and in whom alcohol use is associated with lower CV disease risk.

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Table 1

Characteristics of subject groups with respect to their alcohol consumption behavior

CHARACTERISTIC	Never drinkers	Past Drinkers	Careful Alcohol Users	Problem Drinkers	Alcoholics	p-value (3-Way Analysis)
Sample Size (n=1600)	188	198	948	244	22	
Mean Age (yrs)	67	63	61	61	61	<0.0001
Male (%) n= 755	23	45	46	70	91	<0.0001
Obesity defined as BMI > 30 (%) n=504	43	35	28	33	23	<0.002
Diabetes (%) n=130	14	15	5	9	5	<0.0001
Hypertension (%) n=495	39	38	28	32	23	0.003
Current Smoker (%) n=118	2	8	6	14	32	<0.0001
Past Smoker (%) n=674	13	45	46	49	41	<0.0001
Any Cardiovascular Disease (%) n=285	26	26	15	18	14	0.0002
Specific Vascular Diseases						
Coronary Artery Disease (%) n=206	16	15	11	15	9	0.18
MI (%) n=101	11	8	4	5	0	0.002
Unstable Angina (%) n=79	10	4	4	7	5	0.005
Angina (%) n=135	12	12	7	8	0	0.02
TIA (%) n=34	3	4	2	1	0	0.4
Peripheral vascular disease (%) n=42	4	4	2	2	0	0.26
Cerebral-vascular accident (%) n=26	2	4	1	2	5	0.05

* Abstainers, alcoholics, and (user + NABD) are different from each other p<0.05

Table 2

Multiple logistic regression analysis to estimate the odds of exposure to alcohol consumption (behavior) in subjects with any cardiovascular disease, adjusted for coronary risk factors

	Odds Ratio	Confidence Interval	p-value
Unadjusted model			
Never drinkers	1		
Past Alcohol Users	1.01	0.64, 1.60	0.96
Careful Alcohol Users	0.50	0.35, 0.73	0.0003
Problem Drinker	0.64	0.40, 1.02	0.06
Alcoholics	0.46	0.11, 1.43	.23
Fully Adjusted Model (age, sex, diabetes, hypertension and smoking)			
Never Drinkers	1		
Past Alcohol Users	0.81	0.46, 1.42	0.96
Careful Alcohol Users	0.48	0.30, 0.77	0.002
Problem Drinker	0.49	0.27, 0.86	0.01
Alcoholics	0.34	0.07, 1.24	0.13

Table 3

Quantity of Alcohol Consumption Among Different Behavioral Groups

CHARACTERISTIC	Current Alcohol Consumers			
	Never drinkers	Past Drinkers	Careful Alcohol Users	Problem Drinkers
Sample Size (n=1600)	188	198	948	244
Mean Alcohol in grams per day (95% Confidence Interval)	0	0.7 (-0.7,2.2)	8.2 (6.9,9.5)	16.8 (12.2,21.4)*
< 1 drink per day (%)	0	89	77	65
1-2 drinks per day (%)	0	0	17	16
> 2 drinks per day (%)	0	11	6	19
				57

* p<0.05 in pair-wise comparison