Clinical Medicine Journal
Vol. 4, No. 3, 2018, pp. 22-29
http://www.aiscience.org/journal/cmj
ISSN: 2381-7631 (Print); ISSN: 2381-764X (Online)

The Association Between Alcohol Consumption and the Selected Heart Disease Among African Americans: The Jackson Heart Study (JHS)

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Abstract

Objective: The purpose of this study was to examine the relationship between alcohol consumption and selected heart diseases [Coronary Heart Disease (CHD), Myocardial Infarction (MI) and Atrial Fibrillation (AF)]. Methods: Analysis was performed on 5301 individuals in the JHS baseline examination 2000 -2004 to identify relationships between alcohol consumption and selected heart disease in African Americans in the Jackson Heart Study. Binary logistic regression modelling was used to compute the odds ratios for each type of heart disease outcome under investigation. Results: Participants who drank < 1 drink per week got CHD 0.645 times less often than those who drank > 14 drinks per week. Participants who drank < 1 drink per week got MI 0.605 times less often than those who drank > 14 drinks per week. Those who drank 1-7 drinks per week got MI 0.966 times less often than those who drank >14 drinks per week. Those who drank 8-14 drinks per week got MI 0.346 times less often than those who drank > 14 drinks per week. Conclusions: The odds of having CHD are reduced with the reduction in drinking. Participants who drink less than 1 drink of alcohol per week have a significantly reduced risk of having two of the outcome measures of interest (CHD and MI). AF was eliminated from the analysis because of the few numbers of African Americans in the Jackson Heart Study who were diagnosed with the disease.

Keywords

Heart Disease, Alcohol Consumption, African Americans, Jackson Heart Study

Received: May 19, 2018 / Accepted: July 6, 2018 / Published online: August 10, 2018

1. Introduction

In Mississippi, even though cardiovascular disease and risk factors for chronic disease is a public health priority, there has been limited investigation on the relationship between social determinants and community lifestyle factors, such as alcohol consumption and cardiovascular disease (CVD) [1]. CVD encompasses a set of diseases that affect the functionality and structure of the heart and blood vessels within the heart including coronary heart disease (CHD), myocardial infarction (MI), also known as a heart attack, and

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atrial fibrillation (AF), irregular heart beat [2]. CHD is the leading cause of mortality in African Americans. The risk factors for CHD in African Americans are similar to those reported in Caucasians, but the relative impact varies between the two ethnic groups [3-6]. African-Americans have a lower risk of AF than whites despite their higher exposure to AF risk factors, such as hypertension and obesity [7, 8]. The low risk of AF in African Americans is paradoxical considering that African Americans have a higher prevalence of the risk factors known to increase the likelihood of AF. Even though, African Americans present a lower risk of AF than whites, the burden of AF among them, however, is substantial with 1 in 9 receiving a diagnosis of AF before they reach 80 years of age [9, 10].

Recent studies have highlighted a link between heart disease and a number of risk factors for the disease, including non-modifiable factors such as age, sex, and family history, modifiable risk factors, such as use of alcohol and tobacco, and intermediate risk factors including cholesterol, hypertension, diabetes and obesity [11-12]. While a family history of CVD and genetic predisposition are established risk factors, lifestyle factors, including alcohol consumption, also play an important role in the etiology of CVD [13]. Alcohol consumption is prevalent in the United States, with an estimated 109 million Americans who reportedly drink alcohol; researchers believe that alcohol may be related to risk for CVD [14-16].

Research has shown that in middle-aged men who are light to moderate drinkers, there is an inverse association between alcohol consumption and death from coronary heart disease that can be explained, in large part, by the HDL cholesterol level, which increases with alcohol consumption [17]. Mortality from coronary heart disease increases at concentrations of high density lipoprotein cholesterol over 1.75mmol/l [18]. The mortality was highest among heavy drinkers, but an increase was found among light drinkers also. [19]. One study reported an inverse relationship between moderate alcohol drinking and MI [19]. Another study found that moderate alcohol drinking was inversely related to all cause and cardiovascular mortality in men who had survived a first MI [20]. Infrequent use of alcohol was also reported to be associated with a lower incidence of AF [21]. However, there is not sufficient research regarding alcohol use and heart disease in African Americans.

For decades, research has been documenting that African Americans in Mississippi have rates of diabetes, cardiovascular disease (CVD), and stroke far exceeding those of other populations [22]. The Jackson Heart Study was primarily initiated to investigate the causes of heart disease in African Americans, seeking to analyze the risk factors for the disease, while striving to provide preventative methods through its mission of delivering health promotion education to the community [23-25].

2. Objective

This study sought to identify the association between the frequency of alcohol intake and the prevalence of selected heart disease (CHD, MI, and AF) in a cohort of African American men and women. Since there is not sufficient research regarding frequency of alcohol use and heart disease in African Americans, special emphasis was placed on frequency of alcohol intake for each type of heart disease selected. The Jackson Heart Study, located in Jackson, Mississippi, provides the proper framework to do further investigations into this claim because this population has a high prevalence of cardiometabolic risk factors [26].

3. Methods

We examined data from the Jackson Heart Study, the largest epidemiological study conducted with African Americans to investigate cardiovascular disease. Information from standardized interviews of 5301 African Americans participating in the Jackson Heart Study provided the demographic parameters, behaviors, clinical measures and health outcomes of interest. Data were also collected at Annual Follow-Up and Surveillance visits. Details of the Jackson Heart Study development, procedures, and methods are reported in other research studies [27-29]. The study sought to identify the association between the alcohol consumption and the prevalence of selected heart disease (CHD, MI, and AF) in African American men and women. Observations from all 3360 women and 1941 men who comprised the 5301 JHS cohort were read for the analyses that were computed to address the hypotheses. Observations were excluded from the analyses in cases where there were missing values for the response or explanatory variables. The following hypotheses were tested: H_1: There is a higher prevalence of coronary heart disease than the other selected heart diseases among African Americans. H_2: Male alcohol drinkers have a greater prevalence of coronary heart disease than female alcohol drinkers. H_3: There is a positive association between alcohol consumption and the selected heart diseases.

The data used for analysis were derived from individuals who participated in the JHS baseline examination between the years 2000 and 2004. The data were downloaded to the IBM Statistical Package for the Social Sciences (SPSS 25.0) for statistical analyses [30]. Socio-demographic variables examined were age, sex, education level, marital status, and income level (categorical). Obesity, measured as BMI, was

also examined. The outcome measures under investigation were selected heart diseases represented by: coronary heart disease (CHD) (presence of CHD, 0 = no, 1= yes); myocardial infarction (MI) (history of MI, 0 = no, 1= yes); atrial fibrillation (AF) (persistent or some atrial fibrillation, 0 = no, 1= yes). The independent variable examined was alcohol consumption represented by four groups: (1) abstainers who were virtual non-drinkers, less than 1 drink/week, (2) 1-7 drinks per week, (3) 8–14 drinks per week, and (4) >14 drinks/week).

The Jackson Heart Study data examined in this analysis included the following variables: age, sex, education level, marital status, selected heart diseases, and alcohol consumption (per week). The selected heart diseases were coronary heart disease (CHD), myocardial infarction (MI), and atrial fibrillation (AF). The independent predictor variable, alcohol consumption (number of drinks per week), was categorized as abstainers (<1 drink per week), 1–7 drinks per week, 8–14 drinks per week, and more than 14 drinks per week.

Participants with missing data for the independent predictor variable, alcohol consumption (per week) and covariate variables were excluded from the analyses. Descriptive statistics were calculated for each of the variables and cross tabulations were used to calculate the prevalence rates for the selected heart diseases in both men and women. The selected heart diseases were also transformed into a dichotomous one for the purpose of logistic regression analyses. Normality assumptions were established using the Levene's test for equality variances.

In order to identify relationships between alcohol consumption and selected heart disease in African American men and women in the Jackson Heart Study, binary logistic regression modelling was used to compute the odds ratios for each type of heart disease and to develop a model based on significant risk factors. We examined this association in stages: first without adjustment, then adjusting for age and other potential confounders, gender and BMI. We used a stepwise variable selection process with the outcome at $p < 0.05$. All p values were two-tailed.

The equation for the logistic regression line from the output recorded in SPSS follows the form of the logit model:

$$\ln\left(\frac{\hat{p}(x)}{1-\hat{p}(x)}\right) = \beta_0 + \beta_1 x_1 + \cdots + \beta_n x_n$$

where $\hat{p}(x)$ represents the predicted or expected probability that an individual is a 'drinker'(1 or more drinks per week), $\beta_i' s$ are the regression coefficients of the corresponding variables represented by x_i, i = 1,…,n. The Wald chi-squared test indicated which coefficients were significantly different from zero.

4. Results

Females made up the largest number of abstainers, while males outnumbered females in the other alcohol consumption categories (Table 1). Membership in the abstainer category, the 1-7 drinks category, and the 8-14 drinks category increased incrementally as educational level increased. Those who consumed more than 14 drinks per week are distributed among the four education levels without any particular pattern. Participants with a high school diploma, but no college degree, made up the largest group of participants who consumed more than 14 drinks per week. They were followed by participants with less than a high school education, and those with a high school education. The smallest group were participants with a college degree. Married participants made up the largest group of participants who were abstainers. Participants in the 35-54 age group made up the largest group consuming more than 14 alcohol drinks per week. The heaviest drinkers were the middle class participants.

Table 1. Demographic Characteristics by Amount of Alcohol Use.

Characteristics	Abstainer (<1 drink per week)	1-7 drinks per week	8-14 drinks per week	> 14 drinks per week	Sig.	Total
Gender					0.000*	
Female	830 (67.9%)	322 (26.4%)	49 (4.0%)	21 (1.7%)		1222
Male	390 (36.1%)	435 (40.3%)	141 (13.1%	113 (10.5%)		1079
Total						2301
Education Level					0.000*	
Less than High school	112 (43.8%)	87 (34.0%)	23 (9.0%)	34 (13.3%)		256
High school/GED	207 (51.1%)	129 (31.9%)	41 (10.1%)	28 (6.9%)		405
> HS but < Bachelor degree	383 (52.0%)	244 (33.2%)	63 (8.6%)	46 (6.3%)		736
Bachelor degree or higher	516 (57.7%)	292 (32.7%)	62 (6.9%)	24 (2.7%)		894
Total						2291
Marital Status					0.002*	
Never been Married	191 (51.2%)	122 (32.7%)	25 (6.7%)	35 (9.4%)		373
Married	697 (55.1%)	404 (32.0%)	108 (8.5%)	55 (4.4%)		1264
Separated	194 (48.7%)	141 (35.4%)	38 (9.5%)	25 (6.3%)		398
Divorced	41 (40.6%)	39 (38.6%)	12 (11.9%)	9 (8.9%)		101

Characteristics	Abstainer (<1 drink per week)	1-7 drinks per week	8-14 drinks per week	> 14 drinks per week	Sig.	Total
Widowed	93 (60.0%)	47 (30.3%)	7 (4.5%)	8 (5.2%)		155
Total						2291
Age					0.191	
21-34	81 (46.0%)	68 (38.6%)	12 (6.8%)	15 (8.5%)		176
35-44	306 (53.1%)	183 (38.1%)	48 (8.3%)	39 (6.8%)		576
45-54	345 (50.9%)	225 (33.2%)	64 (9.4%)	44 (6.5%)		678
55-64	306 (54.8%)	179 (32.1%)	47 (8.4%)	26 (4.7%)		558
65-74	146 (56.6%)	85 (32.9%)	18 (7.0%)	9 (3.5%)		256
75-84	36 (66.7%)	16 (29.6%)	1 (1.9%)	1 (1.9%)		54
85 and over	0 (0.0%)	1 (100.0%)	0 (0.0%)	0 (0.0%)		1
Total						2301
Income					0.029*	
Low Income	227 (51.1%)	138 (31.1%)	40 (9.0%)	39 (8.8%)		444
Lower Middle Class	375 (53.7%)	222 (31.8%)	60 (8.6%)	41 (5.9%)		698
Upper Middle Class	341 (52.7%)	224 (32.4%)	51 (10.2%)	31 (1.6%)		647
Affluent	121 (56.0%)	70 (32.4%)	22 (10.2%)	3 (1.4%)		216
Total						2005

P < .05, difference is significant
Only cases that have values for the response or explanatory variables are included in the analyses

We examined alcohol status based on the selected cardiovascular diseases of interest (Table 2). Overall, of the three cardiovascular diseases examined, CHD had the highest prevalence (5.6%), followed by MI (4.2%). Of the four alcohol groups, CHD had the highest prevalence (8.3%), followed by MI (7.5%). Participants who were classified as abstainers accounted for 4.5% of the CHD cases, 3.1% of the MI cases, and 0.3% of the AF cases. Participants who consumed 1-7 drinks per week accounted for 6.4% of the CHD cases, 5.2% of the MI cases, and 0.1% of the AF cases. Participants who consumed 8-14 drinks per week accounted for 6.9% of the CHD cases, 4.8% of the MI cases, and 0.0% of the AF cases. Participants who consumed more than 14 drinks per week accounted for 8.3% of the CHD cases, 7.5% of the MI cases, and 0.3% of the AF cases. There is a significant difference among the four alcohol groups in the prevalence of MI ($p < .05$), with participants who consumed more than 14 drinks per week accounting for the largest number of cases.

Table 2. Selected Cardiovascular Diseases by Alcohol Status.

Alcohol Status	Presence of CHD	Number of Participants Examined	Presence of MI	Number of Participants Examined	Presence of AF	Number of Participants Examined
Abstainer < 1 drink per week	55 (4.5%)	1209	38 (3.1%)	1211	4 (0.3%)	1218
1-7 drinks per week	48 6.4%)	748	39 (5.2%)	749	1 (0.1%)	756
Drinks per week	13 (6.9%)	189	9 (4.8%)	189	2 (1.1%)	190
>14 drinks per week	11 (8.3%)	133	10 (7.5%)	133	0 (0.0%)	124
Total	127 (5.6%)	2279	96 (4.2%)	2282	7 (0.3%)	2298
Sig.	0.629		0.029*		0.197	

*P < .05, difference is significant
CHD = coronary heart disease; MI = myocardial infarction; AF = atrial fibrillation
Only cases that have values for the response or explanatory variables are included in the analyses

Table 3 describes the prevalence of the selected heart diseases among the JHS cohort. About 7.1% of the JHS participants had CHD. About 5.5% of them had MI, and 0.3% had AF.

Table 3. Prevalence of Selected Heart Disease.

Heart Disease	Frequency	Percentage
Coronary Heart Disease	375	7.1
Myocardial Infarction	290	5.5
Atrial Fibrillation	18	0.3

N = 5301

Alcohol consumption was significantly associated with having CHD (OR = 1.244, 95% CI: 1.006, 1.538). For every one unit increase in alcohol consumption, the odds of having CHD was 1.24 times more. Age was significantly associated with having CHD (OR = 1.068, 95% CI: 1.050, 1.086). For every one unit increase in age, the odds of having CHD was 1.07 times more. Gender was significantly associated with having CHD (OR = 2.310, 95% CI: 1.524, 3.501). The odds of CHD occurring in women were 2.31 times that of the odds of CHD occurring in men. BMI was significantly associated with having CHD (OR = 1.033, 95% CI: 1.007, 1.060. For every one unit increase in BMI level, the odds of having CHD are increased by 1.01 times (Table 4).

Table 4. Association between Alcohol Consumption and CHD Adjusting for Age, Gender, and BMI.

		B	S.E.	Wald	df	Sig.	Exp(B)	95% CI.for EXP(B)	
								Lower	Upper
Step 1[a]	ALC01C1	.218	.108	4.062	1	.044	1.244	1.006	1.538
	AGE01	.066	.009	59.066	1	.000	1.068	1.050	1.086
	GENDER	.837	.212	15.580	1	.000	2.310	1.524	3.501
	BMI01	.032	.013	6.061	1	.014	1.033	1.007	1.060
	Constant	-8.293	.786	111.437	1	.000	.000		

a. Variable(s) entered on step 1: ALC01C1, AGE01, GENDER, BMI01.

Alcohol consumption was significantly associated with having myocardial infarction (OR = 1.347, 95% CI: 1.064, 1.706). For every one unit increase in alcohol consumption, the odds of having myocardial infarction was 1.35 times more. Age was significantly associated with having myocardial infarction (OR = 1.070, 95% CI: 1.049, 1.091). For every one unit increase in age, the odds of having myocardial infarction was 1.07 times more. Gender was significantly associated with having myocardial infarction (OR = 2.737, 95% CI: 1.678, 4.466). The odds of myocardial infarction occurring n women were 2.74 times that of the odds of myocardial infarction occurring in men. BMI was not significantly associated with having myocardial infarction (OR = 1.051, 95% CI: 1.022, 1.080. For every one unit increase in BMI level, the odds of having myocardial infarction are increased by 1.05 times (Table 5).

Table 5. Association between Alcohol Consumption and Myocardial Infarction Adjusting for Age, Gender, and BMI.

		B	S.E.	Wald	df	Sig.	Exp(B)	95% CI. for EXP(B)	
								Lower	Upper
Step 1[a]	ALC01C1	.298	.120	6.133	1	.013	1.347	1.064	1.706
	AGE01	.067	.010	47.558	1	.000	1.070	1.049	1.091
	GENDER	1.007	.250	16.252	1	.000	2.737	1.678	4.466
	BMI01	.049	.014	12.278	1	.000	1.051	1.022	1.080
	Constant	-9.515	.903	111.069	1	.000	.000		

a. Variable(s) entered on step 1: ALC01C1, AGE01, GENDER, BMI01.

Alcohol consumption was not significantly associated with having atrial fibrillation ($p > .05$). Age was significantly associated with having atrial fibrillation. (OR = 1.162, 95% CI: 1.1078, 1.253). For every one unit increase in age, the odds of having atrial fibrillation was 1.16 times more. Gender was not significantly associated with having atrial fibrillation ($p > .05$). BMI was not significantly associated with having atrial fibrillation (Table 6).

Table 6. Association between Alcohol Consumption and Atrial Fibrillation Adjusting for Age, Gender, and BMI.

		B	S.E.	Wald	df	Sig.	Exp(B)	95% CI. for EXP(B)	
								Lower	Upper
Step 1[a]	ALC01C1	.133	.427	.097	1	.756	1.142	.495	2.635
	AGE01	.150	.038	15.254	1	.000	1.162	1.078	1.253
	GENDER	1.250	.850	2.166	1	.141	3.492	.660	18.463
	BMI01	.062	.045	1.895	1	.169	1.064	.974	1.163
	Constant	-17.601	3.576	24.227	1	.000	.000		

a. Variable(s) entered on step 1: ALC01C1, AGE01, GENDER, BMI01.

5. Discussion

Among the three outcomes investigated, the highest prevalence occurred with CHD, followed by MI. Of the four alcohol groups, the highest prevalence occurred with CHD in each category of alcohol consumption, followed by MI. Even among participants who were classified as abstainers, we observed the highest number of the CHD diagnoses, followed by the number of MI diagnoses, and the number of AF diagnoses. A higher number of participants who consumed 1-7 drinks per week were diagnosed with CHD, followed by the number of those who were diagnosed with MI cases, and those who were diagnosed with AF. A higher number of participants who consumed 8-14 drinks per week were diagnosed with CHD, followed by the numbers who were diagnosed with MI, and the numbers who were diagnosed with AF. A higher number of participants who consumed more than 14 drinks per week were diagnosed with CHD, followed by those who were diagnosed with MI, and those who were diagnosed with AF. Alcohol consumption of more than 14 drinks per week accounted for the largest number of cases of MI. These findings differ from previous observational studies that have reported that moderate

alcohol consumption could lead to a reduction in coronary heart disease (CHD) [31].

This study revealed that alcohol consumption, age, gender, and BMI were significantly associated with having CHD. Gender was found to be the strongest predictor of CHD, followed by alcohol consumption, age, and BMI, and the odds of CHD occurring in women were higher than the odds of CHD occurring in men.

Alcohol consumption, age, and gender were significantly associated with having myocardial infarction. BMI was not significantly associated with having myocardial infarction, and gender was the strongest predictor of MI, followed by alcohol consumption, age, and BMI. The odds of myocardial infarction occurring in women were higher than the odds of myocardial infarction occurring in men. The association found between alcohol consumption and MI is consistent with previous research that concluded that there was an increased risk of MI due to excessive alcohol consumption [32]. Researchers reported that myocardial damage could occur as a consequence of the direct toxic effects of alcohol [33, 34].

The findings of our study reveal that alcohol consumption, gender, and BMI were not significantly associated with having atrial fibrillation. Age was significantly associated with having atrial fibrillation. Age was the only predictor of atrial fibrillation that was significant.

Some researchers believe that there are pathophysiological mechanisms that lead to the association between alcohol and AF. They believe that moderate levels of alcohol consumption on a regular basis can increase the risk of obesity, which in turn contributes to the risk of AF [35]. It has also been reported that moderate alcohol consumption can change the structure of the heart, leading to heart chamber damage and atrial fibrillation [36]. Our findings do not support previous conclusions that, even though African Americans present a lower risk of AF than whites, the burden of AF among them was substantial with 1 in 9 receiving a diagnosis of AF before they reached 80 years of age [37]. Only 0.3% of the participants in the JHS experienced AF.

6. Conclusion

Excessive alcohol use is associated with negative health outcomes, like heart disease, and is a preventable cause of disease development. Researchers believe that myocardial damage can occur from excessive consumption of alcohol. In the African American cohort of the Jackson Heart Study, alcohol consumption was found to be associated with the development of MI. The results of this study revealed that African American women had a greater likelihood of developing myocardial infarction than the African American men. It would be important to propose some prevention strategies in the communities on reduction or control of excessive alcohol consumption among African American women as a prevention/intervention option.

Acknowledgements

The Jackson Heart Study is supported and conducted in collaboration with Jackson State University (HHSN268201300049C and HHSN268201300050C), Tougaloo College (HHSN268201300048C), and the University of Mississippi Medical Center (HHSN268201300046C and HHSN268201300047C) contracts from the National Heart, Lung, and Blood Institute (NHLBI) and the National Institute for Minority Health and Health Disparities (NIMHD). The authors thank the staff participants of the Jackson Heart Study.

This work is also supported by the Center of Excellence in Minority Health and Health Disparities (P20MD006899) funded by the National Institute for Minority Health and Health Disparities (NIMHD). The views expressed in this manuscript are those of the authors and do not necessarily represent the views of the National Heart, Lung, and Blood Institute; the National Institutes of Health; or the U.S. Department of Health and Human Services.

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