

Alcohol, Wine, and Cardiovascular Health

Address for correspondence:
Ezra A. Amsterdam, MD
Division of Cardiovascular Medicine
University of California - Davis
4860 Y Street, Suite 2820
Sacramento, CA 95817, USA
eaamsterdam@ucdavis.edu

Matthew L. Lindberg, MD and Ezra A. Amsterdam, MD

Division of Cardiovascular Medicine, University of California-Davis, Sacramento, California, USA

ABSTRACT

Studies evaluating the health benefits of alcohol and wine have demonstrated that moderate consumption is associated with a decrease in all-cause and cardiovascular mortality. Various populations and alcoholic beverages exhibit this effect to different degrees. Alcoholic beverages exhibit multiple mechanisms that may favorably influence cardiac risk potential actions on platelets, antioxidants, fibrinolysis, and lipids. However, other data suggest that the perceived benefit of alcoholic beverages in general, and wine in particular, are the result of socioeconomic confounders. In the absence of more rigorous evidence, it is not currently possible to define the role of wine in human health.

Key words: alcohol, wine, cardiovascular disease

Introduction

The devastating health effects of excessive alcohol consumption have been well described.¹ Alcohol consumption and its consequences are entwined in history, politics, and literature. Humans have always had conflicting emotions about alcohol and its use. In its benevolent form, it is used in religious ceremonies and in the celebration of important events. In its more malicious form, it destroys lives, and costs billions of dollars in harm and lost revenue. Despite these deleterious effects, moderate alcohol consumption may also have health benefits.

Many large epidemiological studies have reported that moderate alcohol consumption is associated with a reduced risk of cardiovascular events. Red wine, and its antioxidant polyphenols, is thought to be particularly protective against cardiovascular disease. This concept was popularized as the “French Paradox” from the Monitoring of Trends and Determinants in Cardiovascular Disease (MONICA) project in which it was found that the French, whose traditional cardiovascular risk factors are at least as great as those of other Western countries, had a lower cardiovascular risk than the latter societies (Figure 1).² Multiple possible mechanisms have been suggested for this finding, such as actions that favorably affect lipid oxidation,³ platelet activity,⁴ and fibrinolytic activity.⁵

It is essential to recognize that the reported benefits of alcohol have been noted predominantly in cohort epidemiological analyses and assessments of isolated effects of alcohol and wine consumption in populations, which leaves them subject to multiple confounding factors. Several authors have suggested that there are numerous socioeconomic and medical factors that may explain the observed health differences between moderate drinkers and abstainers. It has been found that subjects who drink

wine tend to be of a higher socioeconomic class, are more attentive to their health, and have fewer cardiovascular risk factors.⁶ Recent studies have suggested that the health benefits seen in epidemiologic studies may be explained by minimal multivariate analysis, which demonstrates their correlation with these socioeconomic factors.^{6,7} These studies have profound implications for the perceived health benefits of wine. While they suggest that wine may not have a beneficial impact on health at the levels consumed by most people, further investigations suggest that the basic premise is correct: certain components of wine may have potential health benefits, but require purified forms of the compounds ingested at levels far higher than those achieved through usual wine consumption.

Epidemiology

The largest studies of alcohol use and health have been epidemiological cohort trials involving many thousands of patients. Almost all are based on self-reporting through questionnaires of subjects' drinking habits, the responses to which were correlated with their health outcomes. In general, these studies have demonstrated a consistent relationship between alcohol consumption and cardiovascular health across varied populations. The morbidity/mortality curves related to alcohol use appear to be predominantly U- or J-shaped (Figure 2). In general, there is no significant health difference between individuals who consume less than 2 drinks daily and abstainers. While all-cause mortality is lower in those who consume 2–3 drinks daily, it is increased in populations consuming more than 3 drinks daily. For purposes of most of these studies, 1 standard drink is usually defined as 1.2 oz of spirits (hard liquor), 5 oz of wine, or 12 oz of beer.⁸ It is noteworthy

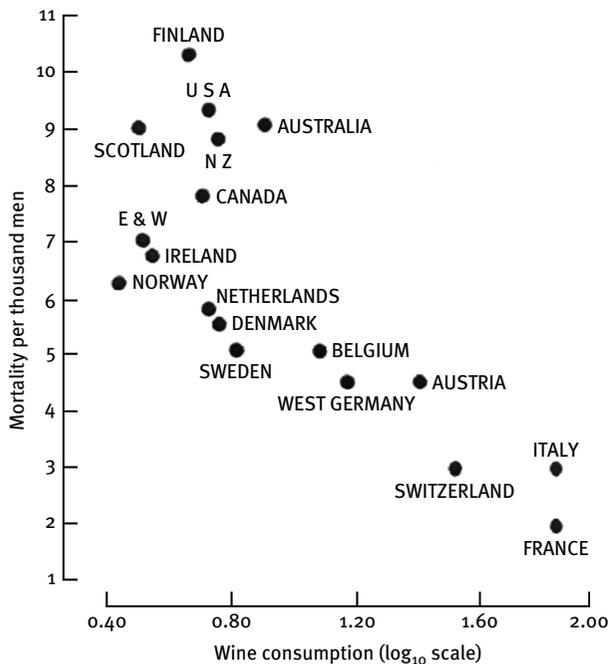


Figure 1: The French Paradox demonstrating lower mortality in France versus other countries in relation to wine consumption. Reprinted with permission from St. Leger et al.²

that in most of these studies participants were primarily males.

The Physician's Health Study included data on alcohol consumption in more than 21,000 subjects.⁹ After a follow-up interval of 11 y, subjects who consumed more than 2 drinks daily had lower risks for angina (56%) and myocardial infarction (MI) (47%) compared with those who consumed 1 drink daily. In another cohort study comprised of 34,014 middle-aged men in eastern France evaluated from 1978 to 1983, it was found that 77% of subjects consumed alcohol (predominately wine) with little difference in the rate of intake between socioeconomic classes.¹⁰ During a 15-y follow-up, moderate drinkers (defined as more than 2 drinks daily) had reduced all-cause mortality (relative risk [RR] = 0.76), which was attributed to a lower cardiovascular death rate. With regard to wine, an intake of 2–5 glasses daily was associated with a 24%–31% reduction in all-cause mortality across socioeconomic classes and tobacco-use groups. Moderate alcohol consumption in hypertensive men also was associated with a reduction in risk for MI, but there was no significant change in cardiovascular or total death rates.¹¹

Although many of the foregoing studies suggest beneficial effects of alcohol consumption, it is also emphasized that these substances have well-established deleterious actions,

among which is direct myocardial toxicity. In his evaluation of hospital admissions for heart failure, Klatsky found that risk of nonischemic congestive heart failure was elevated for those patients consuming more than 6 alcoholic beverages daily (RR = 1.7) with no significant elevation in risk in moderate drinkers (RR = 1).¹² However, the risk of ischemic cardiomyopathy was less in all alcohol users, with heavy drinkers enjoying a risk reduction slightly exceeding that of moderate drinkers (RR = 0.5 and 0.6, respectively). An updated analysis of the Physicians' Health Study also demonstrated that moderate drinking lowered the risk of developing heart failure.¹³

Age

Alcohol consumption poses unique problems for the elderly. Older drinkers are more likely to have chronic illness, including psychiatric disorders, and to use multiple medications, all of which can influence alcohol's effects. Although, a 9-y follow-up of 4,410 patients older than 65 y revealed a low cardiovascular mortality in heavy drinkers (RR = 0.58).¹⁴ Data from the National Health and Nutrition Examination Survey (NHANES) contrast sharply with this finding. The original participants in NHANES were evaluated 20 y after enrollment in the study (1971–1974) and their average age at the time of enrollment was 66 y.¹⁵ Male subjects who were at-risk drinkers (defined as those who consumed more than 2–3 drinks daily, more than twice a week, and had concomitant psychiatric or medical problems) had an increased all-cause mortality (hazard ratio

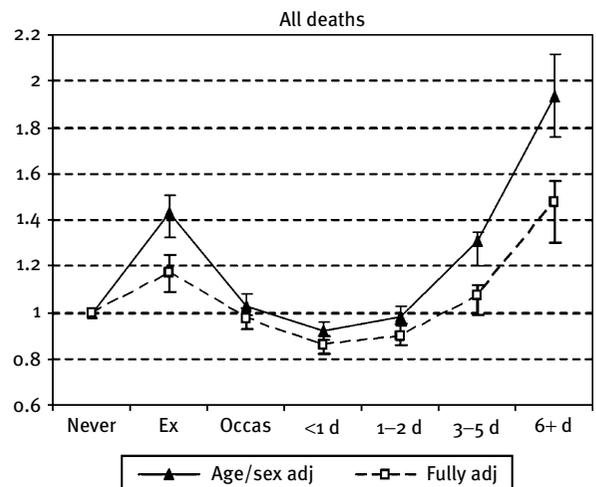


Figure 2: J-shaped mortality curve demonstrating decreased mortality with moderate drinking and higher mortality with heavier drinking. Relative risk scores are listed on the y axis, and alcohol consumption on the x axis. The two data sets are with age and sex adjustment versus full adjustment for multiple variables. Reprinted with permission from Klatsky and Udaltsova.¹⁹

1 : 20) over nondrinkers. Female subjects did not exhibit the same increased hazard ratio, but constituted a much smaller population sample.

Women

There have been limited studies on the relation of alcohol to health in women. In this regard, it is noteworthy that some effects of alcohol are known to be influenced by gender. Physiologically, women tend to have higher blood alcohol levels than men for comparable amounts of alcohol intake.¹⁶ Alcohol may also contribute to the development of certain types of breast cancer in women.¹⁷

Among the reports of alcohol and women's health, one of the largest and longest running studies is the Nurses' Health Study, conducted over the last 30 y.¹⁸ Data from the 85,709 female nurses demonstrated that women with moderate alcohol consumption had lower all-cause mortality and cardiovascular mortality (RR = 0.83) compared with those who abstained (RR = 0.57). Interestingly, cardiovascular mortality (RR = 0.74) was less even in women who drank heavily, but all-cause mortality in this subgroup was increased (RR = 1.19), predominantly from cirrhosis and breast cancer. An update of a large cohort study of women who consumed modest amounts of alcohol demonstrated total mortality benefit similar to that of men, although the peak risk reduction in females was at a lower daily alcohol consumption (<1 drink daily) compared with men (<1–2 drinks daily).¹⁹

Type of Alcoholic Beverage

Beer, Wine, and Spirits

There is continuing controversy regarding the relative health effects of the major types of alcoholic beverages: spirits, beer, and wine. Most, but not all, studies suggest that red wine uniquely reduces morbidity/mortality compared with other alcoholic beverages.

One of the earliest reports of beverage type and health effects was performed in Denmark and compared health outcomes related to wine, spirits, and beer in a cohort of 13,285 subjects over 12 y (1976–1988).²⁰ Daily moderate wine drinkers (3–5 glasses daily) had a significantly reduced risk of cardiovascular death (RR = 0.47, 95% confidence interval [CI] = 0.24–0.80) compared with nondrinkers. By contrast, subjects reporting a similar amount of spirit intake had an increased risk of cardiovascular death (RR = 1.35, 95% CI = 1–1.83). Beer drinkers had a mild reduction in cardiovascular death (RR = 0.72, 95% CI = 0.61–0.88). Wine drinkers also exhibited a reduction in all-cause mortality (RR = 0.50, 95% CI = 0.27–0.91), while spirit drinkers (RR = 1.36, 95% CI = 1.01–1.84) and beer drinkers (RR = 1.22, 95% CI = 1.02–1.45) fared worse. The results of this study suggest that wine (it is not noted whether the subjects

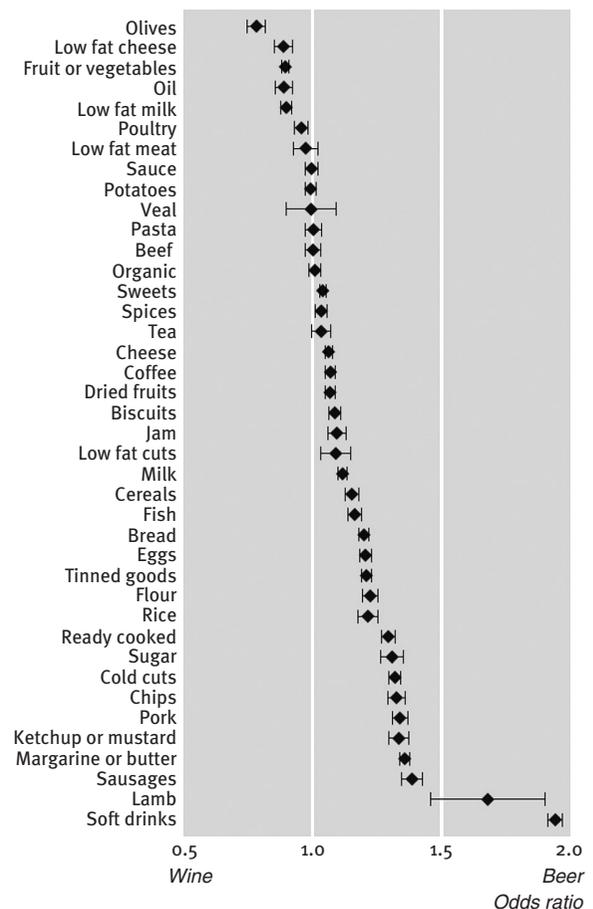


Figure 3: This figure demonstrates that purchase of healthier food items was related to purchase of wine over beer. Odds ratios <1 were items purchased more commonly with wine. Odds ratios >1 indicate items purchased more commonly with beer. Reprinted with permission from Johansen D et al.²⁵

drank red or white wine), and to a lesser extent beer, have a beneficial influence on cardiovascular mortality while spirits do not. This study was comprised of 45% men and 55% women, all between the ages of 30 and 70 y. There were no demonstrable differences in cardiovascular or all-cause mortality in relation to age or gender.

These findings were re-evaluated in prospective cohort studies in Denmark²¹ and in France,²² which confirmed that moderate wine drinkers had lower all-cause and cardiovascular mortality than beer drinkers and spirit drinkers.

Red Wine versus White Wine

Although wine has been reported to have beneficial health effects compared with other forms of alcohol, it is purported that the red wine varietals have the highest level of health

benefits.²³ However, other studies have demonstrated no significant difference between red and white wines. A large cohort (56,926 men and 72,008 women) in the Northern California Kaiser health system was followed from 1978 through 1998.²⁴ As expected, heavy drinkers (>6 beverages daily) faced increased mortality (RR = 1.4, $p < 0.001$). Moderate wine drinkers (1–2 beverages daily) demonstrated a reduction in coronary mortality (RR = 0.8, $p < 0.001$) versus abstainers, as did moderate beer drinkers (RR = 0.7, $p < 0.001$) and spirit consumers (RR = 0.8). However, when the various types of wine were examined, there was no difference in risk reduction between white, red, and other wines. A recent follow-up of the study patients confirmed the J-shaped mortality curve with data through 2002.¹⁹

Confounders

Though there appears to be significant data that moderate alcohol use, particularly red wine, provides a potential health benefit, there is evidence that this finding may be related to confounding socioeconomic factors. Studies comparing drinkers and nondrinkers have demonstrated increased cardiovascular risk factors in the latter group.⁶ Thus, the average moderate wine drinker is apt to be of a higher socioeconomic class and more health conscious. The average spirits drinker, heavy alcohol user, or nondrinker is more likely to be a smoker and of a lower socioeconomic status.

A large study (over 250,000 subjects) attempted to further quantify the effects of alcohol on health.⁷ While confirming that cardiac risk factors were more common in abstainers than drinkers, this difference was attenuated by adjustments for race, education, nutrition, divorce, and lack of medical care. Earlier, an innovative study of 3.5 mill supermarket transactions in Denmark revealed that those who purchased wine also made healthier food choices, such as olives, fruits, and vegetables (Figure 3).²⁵ Individuals who purchased beer bought more pre-cooked food, sugar, cold cuts, chips, pork, butter, and sausage. A large study of almost 13,000 subjects in this country confirmed that wine drinkers not only had more favorable dietary habits, but also exercised more and had higher levels of formal education than regular consumers of other alcoholic beverages.²⁶

Conclusions

There is abundant epidemiological data suggesting that moderate alcohol use (1–2 drinks daily for men, 1 drink daily for women and the elderly) is associated with a beneficial effect on cardiovascular morbidity and mortality. Red wine, specifically, seems to confer a greater benefit than other alcoholic beverages, which may be related to its high concentration of polyphenols. However, whether the beneficial effect of moderate alcohol intake is causal or

merely an association, remains unclear. On the basis of the available data, it would seem reasonable to recommend that patients who currently drink try to move towards moderate consumption of wine over that of beer and spirits. Importantly, there is currently insufficient evidence to recommend that abstainers initiate drinking for health benefits, or for light drinkers to increase their alcohol consumption.

References

1. Cook P, Moore M: The economics of alcohol abuse and alcohol-control policies. *Health Aff (Millwood)* 2002;21:120–133
2. St Leger AS, Cochrane AL, Moore F: Factors associated with cardiac mortality in developed countries with particular reference to the consumption of wine. *Lancet* 1979;1:1017–1020
3. Natella F, Ghiselli A, Guidi A, Ursini F, Scaccini C: Red wine mitigates the postprandial increase of LDL susceptibility to oxidation. *Free Radic Biol Med* 2001;30:1036–1044
4. Rand ML, Packham MA, Kinlough-Rathbone RL, Fraser Mustard J: Effects of ethanol on pathways of platelet aggregation in vitro. *Thromb Haemost* 1988;59:383–387
5. Mukamal KJ, Jadhav PP, D'Agostino RB, Massaro JM, Mittleman MA, et al.: Alcohol consumption and hemostatic factors: analysis of the Framingham Offspring cohort. *Circulation* 2001;104:1367–1373
6. Naimi TS, Brown DW, Brewer RD, Giles WH, Mensah G, et al.: Cardiovascular risk factors and confounders among nondrinking and moderate-drinking U.S. adults. *Am J Prev Med* 2005;28:369–373
7. Mukamal KJ, Ding EL, Djousse L: Alcohol consumption, physical activity, and chronic disease risk factors: a population-based cross-sectional survey. *BMC Public Health* 2006;6:118
8. Gordon T, Doyle JT: Drinking and mortality. The Albany Study. *Am J Epidemiol* 1987;125:263–270
9. Camargo CA Jr, Stampfer MJ, Glynn RJ, Grodstein F, Gaziano JM, et al.: Moderate alcohol consumption and risk for angina pectoris or myocardial infarction in U.S. male physicians. *Ann Intern Med* 1997;126:372–375
10. Renaud SC, Gueguen R, Schenker J, d'Houtaud A: Alcohol and mortality in middle-aged men from eastern France. *Epidemiology* 1998;9:184–188
11. Beulens JW, Rimm EB, Ascherio A, Spiegelman D, Hendriks HF, et al.: Alcohol consumption and risk for coronary heart disease among men with hypertension. *Ann Intern Med* 2007;146(1):10–19
12. Klatsky AL, Chartier D, Udaltsova N, Gronningen S, Brar S, et al.: Alcohol drinking and risk of hospitalization for heart failure with and without associated coronary artery disease. *Am J Cardiol* 2005;96:346–351
13. Djousse L, Gaziano JM: Alcohol consumption and risk of heart failure in the Physicians' Health Study I. *Circulation* 2007;115(1):34–39
14. Mukamal KJ, Chung H, Jenny NS, Kuller LH, Longstreth WT Jr, et al.: Alcohol consumption and risk of coronary heart disease in older adults: the Cardiovascular Health Study. *J Am Geriatr Soc* 2006;54:30–37
15. Moore AA, Giuli L, Gould R, Hu P, Zhou K, et al.: Alcohol use, comorbidity, and mortality. *J Am Geriatr Soc* 2006;54:757–762
16. Frezza M, di Padova C, Pozzato G, Terpin M, Baraona E, et al.: High blood alcohol levels in women: the role of decreased gastric alcohol dehydrogenase activity and first-pass metabolism. *N Engl J Med* 1990;322:95–99
17. Longnecker MP: Alcoholic beverage consumption in relation to risk of breast cancer: meta-analysis and review. *Cancer Causes Control* 1994;5:73–82
18. Fuchs CS, Stampfer MJ, Colditz GA, Giovannucci EL, Manson JE, et al.: Alcohol consumption and mortality among women. *N Engl J Med* 1995;332:1245–1250

19. Klatsky AL, Udaltsova N: Alcohol drinking and total mortality risk. *Ann Epidemiol* 2007;17:S63–S67
20. Gronbaek M, Deis A, Sorensen TI, Becker U, Schnohr P, et al.: Mortality associated with moderate intakes of wine, beer, or spirits. *BMJ* 1995;310:1165–1169
21. Gronbaek M, Becker U, Johansen D, Gottschau A, Schnohr P, et al.: Type of alcohol consumed and mortality from all causes, coronary heart disease, and cancer. *Ann Intern Med* 2000;133:411–419
22. Renaud SC, Gueguen R, Siest G, Salamon R: Wine, beer, and mortality in middle-aged men from eastern France. *Arch Intern Med* 1999;159:1865–1870
23. Di Castelnuovo A, Rotondo S, Iacoviello L, Donati MB, De Gaetano G: Meta-analysis of wine and beer consumption in relation to vascular risk. *Circulation* 2002;105:2836–2844
24. Klatsky AL, Friedman GD, Armstrong MA, Kipp H: Wine, liquor, beer, and mortality. *Am J Epidemiol* 2003;158:585–595
25. Johansen D, Friis K, Skovenborg E, Gronbaek M: Food buying habits of people who buy wine or beer: cross sectional study. *BMJ* 2006;332:519–522
26. Paschall M, Lipton RI: Wine preference and related health determinants in a U.S. national sample of young adults. *Drug Alcohol Depend* 2005;78:339–344