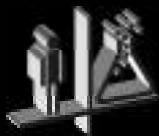


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AMERICAN COUNCIL
ON SCIENCE AND HEALTH

Moderate *Alcohol Consumption* *and Health*

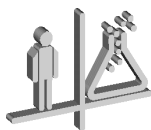
A Report by
THE AMERICAN COUNCIL ON SCIENCE AND HEALTH

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EXECUTIVE SUMMARY



- Moderate drinking is defined as not more than two standard drinks per day for a man age 65 or under, and not more than one standard drink per day for a man over the age of 65 or a woman of any age. A standard drink consists of one 12-ounce can of beer, one 5-ounce glass of wine, or a mixed drink containing 1.5 ounces of 80-proof spirits. Each of these standard servings contains an equivalent amount of alcohol.
- No one should drink alcohol, even in moderation, before operating a motor vehicle or engaging in other activities that involve attention and skill or physical risk. Such activities include operating machinery, boating, swimming, diving, and skiing.
- Some people need to abstain from or minimize their use of alcohol for health reasons. These people include individuals with a personal or family history of alcohol abuse; persons who cannot keep their drinking moderate; women who are pregnant or who are planning to conceive; and individuals who are taking prescription or over-the-counter medications that can interact adversely with alcohol or with other components of alcoholic beverages.
- Among middle-aged and elderly people, moderate drinkers have lower mortality rates than do abstainers. This difference is due largely to the protec-

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tive effect of alcohol against coronary heart disease—a positive effect that appears to outweigh any possible adverse effects of moderate drinking.

- The potential health benefits of moderate drinking in middle-aged and elderly people can be achieved at consumption levels as low as one half of one standard drink per day.
- Among younger people—men who have not reached their 40s and premenopausal women—no beneficial effect of moderate drinking on mortality has been demonstrated. Young people would not be expected to benefit from the consumption of alcoholic beverages because the causes of death that alcohol protects against (primarily coronary heart disease) are rare among young adults. It is possible that moderate drinking by young people might reduce their risk of heart disease in later life, but this has not been demonstrated.
- People who drink alcohol in amounts that exceed the limits of moderation have higher death rates than do moderate drinkers. Heavy drinking is associated with severe risks to the safety of the drinker and others. Heavy drinking is also associated with increased risks of liver disease, high blood pressure, alcohol-related heart diseases, and some types of cancer.
- The consumption of small amounts of alcohol on a regular basis is more healthful than the sporadic consumption of larger amounts of alcohol. The pattern of drinking that includes episodes of heavy intake (e.g., weekend splurges alternating with weekday abstinence) is associated with health and safety risks. This pattern of drinking should not be regarded as truly moderate or healthful, even if the individual's total weekly alcohol intake is within the limits of moderation.
- The choice to drink or not to drink alcoholic beverages should be an individual matter reflecting each person's cultural values, religious beliefs, and personal preferences as well as health considerations. Both moderate drinking and abstention are compatible with a healthy lifestyle. Although moderate drinking has potential health benefits for some people, no one should ever feel pressured to drink alcoholic beverages for health reasons. Those who choose to abstain can attempt to reduce their risk of coronary heart disease in other ways.

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INTRODUCTION

Human beings have been drinking alcoholic beverages for more than 10,000 years. Ancient writings indicate that people have long been aware of both the desirable and undesirable effects of alcohol consumption. In modern times scientific research has confirmed that alcohol can be either beneficial or detrimental to health, depending on how the alcohol is used and the characteristics of the user.

This report from the American Council on Science and Health (ACSH) summarizes the current scientific knowledge about the health effects of drinking alcoholic beverages. Most of the report focuses on moderate drinking because moderate drinking is the only pattern of drinking that has been shown to have potential health benefits. Both heavy drinking and the consumption of alcohol under inappropriate circumstances (e.g., before driving a motor vehicle) are potentially harmful to the drinker and others. Nothing in this report should be construed as an endorsement of excessive or irresponsible alcohol use.

The choice to drink or not to drink alcoholic beverages will always be an individual matter reflecting each potential drinker's cultural values, religious beliefs, and personal preferences as well as health considerations. The purpose of this report is not to encourage or discourage the drinking of alcoholic beverages but rather to provide information that may help individuals to make fully informed choices.



The health effects of drinking alcoholic beverages depend on the amount a person drinks, the person's pattern of drinking, and certain characteristics such as age, sex, and medical condition.

To understand what scientists have learned about the relationships between alcoholic beverages and health, it is necessary to agree on consistent definitions for certain terms. Those terms include the size of drinks and the names for various patterns of drinking.

What is a "drink"?

Table 1 (page 8) shows the standard definition of a "drink" that is usually used in the United States, both in medical journals and in alcohol-education literature aimed at the general public. As the table indicates, a standard-size serving of each of the three major types of alcoholic beverages—beer, wine, and liquor—contains approximately the same amount

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of alcohol. This is an important point. Many people mistakenly believe that beer is less potent than other types of alcoholic beverages, but that is not really true. Although the *percentage* of alcohol in beer is lower than the percentage in wine or liquor, the amount of alcohol *per serving* of beer is not. Beer is usually consumed in 12-ounce servings that contain as much alcohol as the typically smaller servings of wine or liquor.

Table 1: What Is a “Drink”?

One standard “drink” consists of

one 5-oz. glass of wine, or
one 12-oz. can of beer, or
1.5 oz. of 80-proof spirits.

Each of these drinks contains approximately the same amount of pure alcohol—12 to 14 grams.

US Dept. of Agriculture and US Dept. of Health and Human Services. Dietary Guidelines for Americans. Fourth Edition, 1995.

In practice, the alcohol content of beverages as served may differ greatly from the amount in standard-size drinks. Some people tend to pour larger drinks; other people habitually choose smaller servings. If you’re trying to analyze your own drinking pattern, you may want to pour a drink in your usual way and then measure it with a measuring cup to see whether your personal normal serving size is larger or smaller than the standard serving.

How much do Americans drink?

Most American adults drink alcoholic beverages, with beer the most popular choice.¹ About 60 percent of Americans are occasional to moderate drinkers; fewer than 8 percent are heavy drinkers. About 35 percent of American adults abstain from alcohol.¹

Per capita alcohol consumption in the United States increased between the early 1960s and 1980, peaked in 1980–81, and has declined since. Most of the recent decline in alcohol consumption has been due to decreased consumption of distilled spirits (liquor). In the U.S., as in most

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other countries, women usually drink smaller amounts of alcoholic beverages than do men.

What is moderate drinking?

Moderate drinking is probably best defined as the level of drinking that poses a low risk of alcohol-related problems, both for the drinker and for others. It is difficult to give a quantitative definition of moderate drinking because alcohol can have different effects on different individuals. For research purposes, however, and to aid in public education, a numerical estimate is helpful.

The National Institute on Alcohol Abuse and Alcoholism (NIAAA) has defined moderate drinking as not more than two drinks per day for men age 65 and younger and not more than one drink per day for men over the age of 65 and women of all ages. As will be discussed in more detail later in this report, this level of intake appears to pose few health risks for most people and may be beneficial to health for some people.

The upper limit of moderate drinking has been set lower for women than for men because, after consuming comparable amounts of alcoholic beverages, women attain higher blood alcohol levels than do men.^{2,3} The same amount of alcohol has a stronger effect in women because of differences between the sexes in body size, body composition,^{2,4} and the efficiency of alcohol metabolism.⁵ In addition, for reasons that are not well understood, women appear to be more susceptible than men to some of the harmful effects of heavy drinking, most notably liver disease.

The upper limit of moderate drinking has been set lower for men 65 and older than for younger men because the amount of muscle tissue decreases with age, while the amount of fat tissue increases.^{6,7} As a result of these changes in body composition, the same dose of alcohol will produce a higher blood alcohol level in someone over 65 than in a younger adult.

Although moderate drinking is safe for most people, there are important exceptions to this rule. Some individuals need to abstain from alcoholic beverages for health reasons or need to consult with a physician about their possible use of alcohol. These individuals include:

- people with a personal or family history of past alcohol abuse and those who have difficulty restricting their drinking to moderate levels;
- anyone taking a prescription or over-the-counter medication (because some medications may interact with alcohol or with other compo-

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nents of alcoholic beverages in ways that are dangerous to health, anyone who takes a medication should consult with a physician or pharmacist before drinking alcoholic beverages);

- women who are pregnant or who are trying to conceive.

In addition, because even moderate alcohol intake may affect a person's judgment and coordination, anyone who is planning to drive or to participate within the next few hours in other activities involving attention and skill or physical risk (including such activities as boating, swimming, diving, skiing, and operating machinery) should abstain from alcohol.

The importance of drinking patterns

Although people are usually classified as “moderate” or “heavy” drinkers on the basis of their average consumption of alcoholic beverages over time, this information alone does not provide a complete picture of an individual's drinking habits. The pattern of alcohol intake is also very important. Some individuals drink every day, while others drink more sporadically—only on weekends, for example. The health impact of these two intake patterns may differ even if the total amounts of alcohol consumed are the same: The effects of consuming two drinks daily should not be expected to be the same as the effects of consuming 14 drinks on Saturday night and abstaining for the rest of the week.

The pattern of alcohol use that includes occasional episodes of heavy drinking interspersed with periods of abstinence is usually called “sporadic heavy drinking” or “episodic heavy drinking.” (Some people call it “binge drinking,” but many scientists and health educators prefer to avoid this term because the word “binge” means different things to different people.)

Episodic heavy drinking can be very harmful to health even if the drinker's average weekly or monthly alcohol consumption falls within the moderate range. In extreme instances, excessive single-occasion alcohol intake can cause death from respiratory depression due to acute ethanol poisoning.⁸ More commonly, episodes of excessive alcohol intake result in motor-vehicle or other accidents, incidences of violence, or risky forms of behavior such as unplanned and unprotected sex. Sporadic heavy drinking may also increase the drinker's risk of heart attack and stroke.^{9,10}

In the United States the pattern of drinking that includes sporadic episodes of heavy intake is especially common among young people—

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those in their teens and 20s.¹¹ Surveys conducted on college campuses have shown that approximately 40 percent of the students questioned had consumed an excessive amount of alcohol on a single occasion at least once in the two weeks preceding the survey.^{12,13} (In these surveys, consumption on a single occasion of five or more drinks by a man or four or more drinks by a woman was regarded as excessive.)

Because of the health and safety risks associated with episodes of heavy drinking, a drinking pattern that includes such episodes should not be regarded as truly moderate even if the individual's total weekly alcohol intake falls within the established limits of moderation. To use alcohol safely and responsibly, people need to limit their single-occasion drinking as well as their total weekly intake.

POTENTIAL HEALTH BENEFITS OF MODERATE ALCOHOL USE

When most people talk about the benefits of alcoholic beverages, they're usually referring to the pleasant, relaxed feeling and enhanced sociability that often result from drinking. When scientists and health professionals talk about the benefits of alcohol use, however, they are primarily referring to the fact that moderate drinking may reduce the risk of certain diseases, especially coronary heart disease.

Moderate drinking and coronary heart disease

Studies conducted in many parts of the world have consistently shown that the moderate use of alcoholic beverages is associated with a decrease in the risk of coronary heart disease.^{14–26a} This relationship has been observed in both men and women and in different age, geographic, and ethnic groups.^{1,25} It is independent of other risk factors for heart disease such as smoking, dietary habits, and obesity.²⁷

The amount of alcohol needed to cause a reduction in coronary risk is not large; consumption of one or two drinks per day is associated with a reduction in risk of at least 30 percent.^{25,26a,28,29} Some studies show that higher intakes are not associated with additional reductions in coronary risk; in fact, the full preventative effect of alcohol intake can probably be achieved by consuming as little as one half of one standard drink per day.³⁰ The regular consumption of small amounts of alcohol is more protective against heart disease than the consumption of the same amount of alcohol in larger doses taken at less frequent intervals.^{31,32}

Alcohol is believed to protect against coronary disease in at least two

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ways. About half of the total protective effect is a long-term effect mediated through increased levels of high-density lipoprotein (HDL) cholesterol—the so-called “good” cholesterol.^{18,33,34} The other half appears to be due at least in part to a short-term inhibitory effect of alcohol on blood clotting.^{25,35,36} Alcohol may also protect against coronary heart disease through other mechanisms.

All types of alcoholic beverages—wine, beer, and distilled spirits—are associated with reduced risk of coronary heart disease.³⁷ The protective effect appears to be due primarily to alcohol itself, rather than to other components of alcoholic beverages. The possibility of additional beneficial effects due to other constituents (such as antioxidants) in specific alcoholic beverages has not been completely ruled out, however.

A few scientific studies have suggested that wine may be especially protective against heart disease, but many other studies do not support this concept. If there is any special advantage to wine, it probably lies in the manner in which wine is typically consumed: in small amounts, on a regular basis, and often with meals.

Does alcohol protect against strokes and peripheral arterial disease?

Because alcohol protects against heart attacks, it might be expected that it would also protect against other diseases resulting from atherosclerosis*—diseases such as strokes and peripheral arterial disease. The evidence here is not quite as clear, however.

It is difficult for scientists to pinpoint the relationship between moderate drinking and stroke because there are two different kinds of strokes, with different causes. One type of stroke, called an *ischemic stroke*, is much like a heart attack, except that it involves blockage of arteries in the brain rather than blockage of arteries supplying blood to the heart. The other type of stroke, called a *hemorrhagic stroke*, is caused by a very different mechanism that involves bleeding in the brain.

Because alcohol has beneficial effects on HDL cholesterol and inhibits blood clotting, it would be expected to reduce the risk of ischemic stroke. But the same anticlotting effect that reduces the risk of ischemic stroke would be expected to increase the risk of hemorrhagic stroke. The overall impact of alcohol intake on the risk of stroke depends, therefore, on the type of stroke that predominates in a particular population. Among

* Fatty deposits in the wall of an artery that cause narrowing of the artery. If such deposits are large enough, they may completely block blood flow through that artery.

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middle-aged to elderly Westerners—people among whom ischemic stroke is the predominant type of stroke—the overall impact of moderate drinking is probably protective.^{15,38–40a}

Much less is known about peripheral arterial disease than about heart attacks and strokes. Alcohol is probably protective against this disease as well.

Diabetes

Several studies have indicated that the risk of developing the form of diabetes mellitus that begins in adulthood (type 2 diabetes) is lower—perhaps by about one third—in moderate drinkers than in abstainers.^{41–44} The mechanism for this apparent protective effect has not been established.

Other potential benefits

Research studies have suggested several other potential benefits of moderate drinking, but the evidence for these effects is less extensive than that for the diseases mentioned above.

People who drink alcoholic beverages have a lower risk of gallstones than do abstainers.^{45–49} Alcohol intake has also been associated with a reduced risk of rheumatoid arthritis in women (nothing is known about its effect in men).^{50,51} Two studies have associated the drinking of alcoholic beverages with reduced susceptibility to the common cold.^{52,53} And in at least some population groups, moderate alcohol intake appears to be linked with better psychological health and with better self-reported general health than is either heavy drinking or abstention.^{54,55,56}



POTENTIAL HEALTH RISKS OF ALCOHOL INTAKE

The potential benefits of drinking alcoholic beverages must be weighed against the potential risks associated with alcohol use. These risks vary with the amount of alcohol consumed.

The hazards of heavy drinking

Heavy drinking is harmful to health and safety in a wide variety of ways. The hazards associated with heavy drinking include traffic crashes and other accidents¹; increased risks of several types of cancer (especially cancers of the liver, pharynx, larynx, and esophagus)⁵⁷; high blood pressure^{58–60}; adverse effects on the cardiovascular system¹; liver

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disease⁶¹; pancreatitis^{62,63}; and—if heavy alcohol intake occurs during pregnancy—fetal alcohol syndrome.^{1,64}

These health risks are not exclusive to alcoholics. Anyone who consumes alcohol heavily is at risk, especially if this pattern of consumption continues for many years. *The health and safety risks associated with heavy drinking are so extreme that they outweigh any possible benefit of alcohol.*

Are there potential risks from moderate alcohol use?

Moderate drinking is a very different matter from heavy drinking. Many of the health problems linked to heavy drinking have not been shown to occur in moderate drinkers; if such health problems do occur in moderate drinkers, the risk is far lower than in heavy drinkers. The sections that follow evaluate the scientific evidence pertaining to various health risks that may be associated with moderate drinking.

Injury and other consequences of intoxication

The drinking of alcohol may impair motor coordination, balance, attention, perception, and judgment.¹ Some degree of impairment may occur even after the consumption of only one or two drinks.

The effects of small amounts of alcohol on judgment and coordination vary among individuals. People of small body size are more strongly affected than those of larger body size because smaller people attain higher blood alcohol concentrations after consuming the same amount of alcohol as their larger compatriots. For the same reason, women and elderly men are more strongly affected than younger men. People who rarely drink alcohol are more strongly affected than those who drink regularly, simply because the infrequent drinkers are less accustomed to alcohol's effects.

Despite these differences, however, *everyone* is affected by alcohol, at least to some extent. For this reason, *no one* should operate a vehicle or carry out other risky or demanding activities (operating machinery, boating, swimming, diving, or skiing) while under the influence of even a small amount of alcohol.

To be safe, anyone who has consumed alcohol should wait until his or her blood alcohol level has returned to zero before performing such activities. The question, then, is how long does it take for this to happen? The answer depends on how much alcohol a person has consumed.

The human body has a limited capacity to metabolize alcohol. The more someone drinks, the longer it takes for his or her body to break down

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the alcohol and for the blood alcohol concentration to return to zero. In general, it takes about two hours for the body to metabolize the amount of alcohol in one standard-size drink.³ People should take these facts into account when deciding how soon it is reasonable to drive or engage in possibly risky activities after drinking alcoholic beverages. Larger amounts of alcohol call for longer waiting periods.

In order to take advantage of the potential health benefits of moderate drinking without endangering themselves or others, those who choose to enjoy alcoholic beverages must act responsibly when deciding when and where to drink.

Breast cancer

The possibility that drinking moderate amounts of alcohol might increase a woman's risk of breast cancer has received much attention from the news media. The scientific evidence on this point is not as compelling as the news reports may make it seem, however.

It is true that in some scientific studies the consumption of alcohol at a level of about one drink per day has been associated with an increase of about 10 percent in the risk of breast cancer.^{66,67} Scientists are not sure whether the alcohol actually causes this slight change in breast cancer risk, however.

The mere fact that two things are associated with one another does not necessarily mean that one causes the other. The relationship could as easily be due to a third factor associated with both of them.* Also, the smaller an association is, the harder it is to tell whether that association is due to a true cause-and-effect relationship between the two factors or to something else.

A 10-percent difference in the risk of a disease is quite a small difference. It is extremely difficult for scientists to determine whether an effect of this magnitude reflects a true cause-and-effect relationship or is due to other factors—factors such as difficulties in measurement or differences in the lifestyles of drinkers and abstainers. Failure to consider these confounding factors could create the impression of an association with alcohol intake even if no independent effect exists.⁶⁸

At this time it remains unclear whether the association between

* To understand how a third factor can cause an association, consider this example: If you observe a group of people walking on an American street, you will find that the people carrying handbags are, on average, shorter than the people not carrying handbags. But there is no direct cause-and-effect relationship between height and handbag-carrying. The relationship is due to a third factor—sex. Practically all of the people who carry handbags are women, and women tend to be shorter than men.

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moderate alcohol intake and breast cancer is a causal one. Thus, this association should be regarded as a theoretical risk rather than an established one.

Colorectal cancer

Several epidemiological studies have associated alcohol intake with increased risks of colon cancer and/or rectal cancer.⁶⁹⁻⁷⁴ In some of these studies, increases in risk were observed at intake levels within or not much beyond the limits of moderate drinking. Other studies, however, have not found an association between alcohol intake and colorectal cancer.⁷⁵⁻⁷⁸ At present, therefore, it is uncertain whether any relationship (causal or otherwise) exists between relatively low levels of alcohol intake and the risk of colorectal cancer.

Other cancers

There is little evidence linking moderate drinking to increased risks of cancers other than those mentioned above.

Hypertension

Although heavy drinking increases blood pressure, moderate drinking apparently does not. In some studies, in fact, the blood pressures of moderate drinkers have been found to be lower than those of abstainers. Other studies have not demonstrated this pattern, however.^{1,79}

Liver disease

The level of alcohol intake at which the risk of liver disease begins to increase is uncertain. One recent study indicated that the risk may begin to increase at intake levels of 14 to 27 drinks per week for men and 7 to 13 drinks per week for women.⁸⁰ Other studies, however, have suggested considerably higher thresholds—thresholds well beyond the limits of moderation.⁸¹⁻⁸³

There thus is some possibility of an increase in risk of liver disease at the upper end of the moderate drinking range or at a level not much above it. Because there is wide variation in individuals' susceptibility to alcohol, an amount that some people may tolerate with no ill effects may cause progressive damage in others.

If drinking levels at the upper end of the moderate range are truly risky for sensitive individuals, the risk probably applies primarily to people who drink daily. In contrast to many other adverse effects of drinking, the risk of liver disease thus is greater among daily drinkers than among

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those who drink less frequently but in large amounts.⁶¹

Possible adverse effects during pregnancy

Unlike heavy drinking, moderate drinking during pregnancy does not appear to be associated with an increased risk of birth defects.^{84–86} It may be linked to lower birth weights, however.^{87–90a}

Health authorities in the U.S. advise women who are pregnant or attempting to conceive to abstain completely from alcohol. Because no safe threshold of alcohol consumption during pregnancy has been established, abstinence is the safest course of action. It is also important, however, to recognize that there is little evidence of any serious risk to the fetus from an occasional alcoholic drink. An ironclad rule of zero tolerance for alcohol consumption during pregnancy may lead to unnecessary anxiety—and perhaps even to the termination of otherwise wanted pregnancies—among women whose occasional consumption of small amounts of alcohol is unlikely to have done any harm.^{90a}

Possible effects on fertility

A recent epidemiological study associated moderate alcohol consumption—consumption even at levels as low as one to five drinks per week—with a reduced likelihood of conception among women attempting to conceive for the first time.⁹¹ An earlier study had linked moderate alcohol consumption to a higher prevalence of two types of infertility.⁹² Other studies, however, have found no association between moderate alcohol use and the likelihood of conception.^{93–95} More research thus will be needed before any conclusions can be reached about the possible relationship between moderate alcohol intake and conception.

The shift to heavier drinking

Some individuals cannot successfully drink in moderation. If such persons drink alcoholic beverages at all, they become heavy drinkers, with all the accompanying health, safety, and social risks.

It is impossible to predict in advance which individuals will become problem drinkers. Those with a family history of alcohol problems are more likely than others to be at risk, however.¹ And individuals with a personal history of past alcohol problems are at even higher risk—so high, in fact, that many experts advise that such persons not drink alcohol at all.

The issue of a shift toward heavier drinking is of special importance when considering whether it is ever appropriate to advise abstainers from alcohol to begin to drink moderately for health reasons. The possibility

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that an individual might turn out to be one of the minority who cannot limit drinking to a safe level is a real concern. Unfortunately, there is no way to be sure that someone who begins to drink alcoholic beverages will not become an alcohol abuser. It is possible to predict to some extent whether the risk of alcoholism is high or low for a particular individual, but it is impossible to be certain. A person's decision to begin drinking is thus a very serious one—and that decision should always be based on informed, individual choice.

Possible effects on nutrition

As shown in Table 2 (page 19), alcoholic beverages have a substantial calorie content. One might expect, therefore, that people would gain weight if they took up drinking, even in moderation. In actual practice, however, this does not appear to be the case. Drinkers in the U.S. are no more obese than nondrinkers.^{96,97} Apparently, people compensate for the calories in alcoholic beverages by consuming fewer calories from other foods. It is important for drinkers to remember, however, that alcoholic beverages are foods of low nutrient density: This means that drinks contribute calories but provide few essential nutrients. Foods of low nutrient density should comprise only a small proportion of a person's diet, especially if total calorie intake is low. People who choose to include alcoholic beverages in their diets would be wise to limit their intake of other foods of low nutrient density—foods such as candy, cookies, and soft drinks—in order to leave plenty of room in their diets for more nutritious foods.

EFFECTS ON OVERALL MORTALITY

Many scientific studies have evaluated the relationship between different levels of alcohol intake and total mortality. In general, the overall results of these studies indicate that the relationship is J-shaped, as shown in Figure 1 (page 19).⁹⁸ This means that mortality is lower among people who drink in moderation than among either abstainers or heavy drinkers. There is an important difference, however, between abstinence and heavy drinking: Abstinence is associated with a small increase in mortality, while heavy drinking is associated with a much larger increase. The relationship between alcohol intake and mortality is similar in both sexes, except that the level of intake associated with minimum mortality is lower in women than in men.

Because overall death rates are a weighted average of the rates for

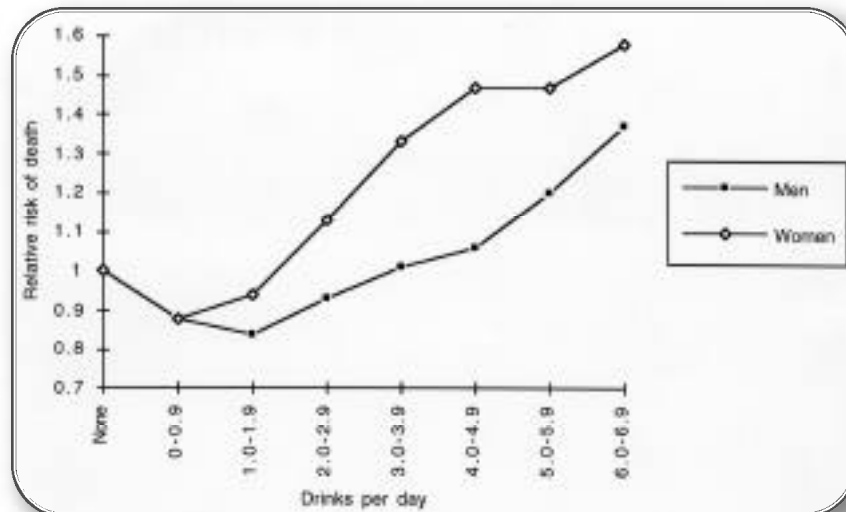
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Table 2. Calorie Counts of Typical Alcoholic Beverages

Beverage and serving size	Calories
Table wine (5 oz.)	105
Wine cooler (12 oz.)	215
Beer (12 oz.)	145
Beer, light (12 oz.)	100
Liquor, 80 proof (1.5 oz.)	100
Liquor, 100 proof (1.5 oz.)	125

Adapted from: Pennington JAT, *Bowes' and Church's Food Values of Portions Commonly Used*, 15th ed., New York: HarperPerennial, 1989.

Figure 1. Relationship of Usual Alcohol Intake to All-Cause Mortality*



*Data derived from a pooled analysis of 14 cohort studies.

Source: Holman CDJ, English DR, Milne E, Winter MG, Meta-Analysis of alcohol and all-cause mortality: a validation of NHMRC recommendations, *Med J Aust* 1996;164:141-145. Copyright © 1996, *The Medical Journal of Australia*. Reprinted by permission.

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specific causes of death, the relative importance of specific causes of death (especially coronary heart disease) in a particular population influences the relationship between alcohol consumption and mortality in that population. The J-shaped curve has been demonstrated primarily in middle-aged-to-elderly men (and, to a lesser extent, women) living in industrialized societies. These are populations in which coronary heart disease is the leading cause of death.

A J-shaped relationship between alcohol intake and mortality should not be expected in population groups (such as young adults) in which coronary heart disease is an uncommon cause of death. The few available studies that have examined the relationship between alcohol intake and mortality among young adults have not demonstrated lower mortality in moderate drinkers as compared to abstainers.^{99,100} Coronary heart disease is rare among young people, and therefore the cardioprotective effect of alcohol would have little impact on their immediate mortality patterns. It is possible that moderate drinking by young people might reduce their risk of developing coronary heart disease later in life. A meaningful protective effect would not be expected to occur until people reach the age at which the risk of coronary heart disease becomes substantial: in their 40s for men and after menopause for women.

It has been argued that the increase in mortality associated with abstinence in middle-aged and elderly people might be due to unusual characteristics of those who abstain—characteristics such as illness, past alcohol abuse, social isolation, or social deviance. These explanations do not fully account for the difference in total and cardiovascular mortality between abstainers and moderate drinkers, however. This difference has been demonstrated in analyses that separated past drinkers from lifelong abstainers, in analyses in which sick people were excluded from the abstainer group, and in analyses of populations in which so many people abstain that it is unlikely that abstainers are in any way deviant.^{14,20,21,26a,100–104} The difference in mortality between abstainers and moderate drinkers therefore appears to be truly attributable to differences in alcohol use.

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CONCLUSIONS

The health effects of moderate drinking vary among individuals. It is not currently possible—and probably never will be possible—to make blanket recommendations for all members of a population.

For some individuals the drinking of alcoholic beverages poses special health risks. These individuals may need to abstain for health reasons or to consult with a physician before making a decision about whether to drink alcoholic beverages. Specifically:

- It is safest for someone who has a personal history of abusing alcohol or other substances, or who has experienced difficulty in keeping his or her drinking moderate, to abstain completely.
- Anyone who is taking a prescription or over-the-counter medication should consult with a physician or pharmacist before drinking alcoholic beverages. Some medications can interact with alcohol or other substances in alcoholic beverages in ways that are dangerous to health.
- Women who are pregnant or who may become pregnant should limit the use of alcoholic beverages. Abstinence is the safest course of action for any woman who is pregnant or who is planning to conceive. There is, however, little evidence of serious risk to an unborn child from an expectant mother's taking an occasional alcoholic drink.
- Individuals with a family history—but no personal history—of alcohol problems may wish to consult with a health professional before making a decision about the use of alcoholic beverages. The risk of alcohol problems is greater among relatives of alcoholics than in the general population.

For those who do not fall into any of the categories described above, the risks and benefits of moderate drinking vary with age.

For young adults (premenopausal women and men who have not reached their 40s) no beneficial effect of moderate drinking on mortality has been demonstrated. This lack of benefit is to be expected, since the causes of death that alcohol protects against (primarily coronary heart disease) are rare among young adults. It is possible that moderate drinking by young people might reduce their risk of heart disease in later life, but this has not been demonstrated.

For older people (postmenopausal women and middle-aged and elderly men) as a group, moderate drinking is associated with reduced mor-



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tality. This benefit appears to be due primarily to the protective effect of alcohol against coronary heart disease.

The health benefits of moderate drinking can be achieved at relatively low levels of intake: about one half of one standard drink per day. Higher levels of intake do not produce greater benefits.

The upper limits of moderate drinking recommended in the U.S. (two drinks per day for men under age 65; one drink per day for women and for men age 65 and older) have a reasonable scientific basis. Beyond these levels, risks of diseases other than coronary heart disease (diseases such as hypertension and liver disease) begin to increase substantially.

In order to take advantage of the potential health benefits of moderate drinking without endangering themselves or others, people who choose to drink alcoholic beverages must act responsibly when choosing when and where to drink. No one should drink alcoholic beverages, even in moderation, just before driving a motor vehicle or engaging in other activities that involve attention and skill or physical risk.

Despite the potential benefits of moderate drinking, no one should feel pressured to drink alcoholic beverages for health reasons. Moderate drinking is only one of many ways in which an individual can attempt to reduce his or her risk of coronary heart disease. Furthermore, a person's decision to abstain from alcohol—for whatever reason—should be respected. Many people have cultural, religious, or personal reasons for choosing not to drink alcohol, just as other people have a variety of reasons for choosing to drink moderately. Neither choice is wrong, and both choices can be compatible with a healthy lifestyle.



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REFERENCES

1. NIAAA (National Institute on Alcohol Abuse and Alcoholism), *Ninth Special Report to the U.S. Congress on Alcohol and Health*, Rockville, MD: U.S. Department of Health and Human Services, 1997.
2. NIAAA (National Institute on Alcohol Abuse and Alcoholism), Alcohol and women, *Alcohol Alert No. 10*, 1990.
3. NIAAA (National Institute on Alcohol Abuse and Alcoholism), Alcohol metabolism, *Alcohol Alert No. 35*, 1997.
4. Goist KC Jr, Sutker PB, Acute alcohol intoxication and body composition in women and men, *Pharmacol Biochem Behav* 1985;22:811–814.
5. Frezza M, di Padova C, Pozzato G, Terpin M, Baraona E, Lieber CS, 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.
6. Dufour MC, Archer L, Gordis E, Alcohol and the elderly, *Clin Geriatr Med* 1992;8:127–141.
7. NIAAA (National Institute on Alcohol Abuse and Alcoholism), Alcohol and aging, *Alcohol Alert No. 40*, 1998.
8. Adinoff B, Bone GH, Linnoila M, Acute ethanol poisoning and the ethanol withdrawal syndrome, *Med Toxicol Adverse Drug Exp* 1988;3:172–196.
9. Kauhanen J, Kaplan GA, Goldberg DE, Salonen JT, Beer bingeing and mortality: results from the Kuopio ischaemic heart disease risk factor study, a prospective population based study, *Br Med J* 1997;315:846–851.
10. Palomaki H, Kaste M, Regular light-to-moderate intake of alcohol and the risk of ischemic stroke. Is there a beneficial effect? *Stroke* 1993;24:1828–1832.
11. NIAAA (National Institute on Alcohol Abuse and Alcoholism), Youth drinking: risk factors and consequences, *Alcohol Alert No. 37*, 1997.
12. Wechsler H, Davenport A, Dowdall G, Moeykens B, Castillo S, Health and behavioral consequences of binge drinking in college. A national survey of students at 140 campuses, *JAMA* 1994;272:1672–1677.
13. Wechsler H, Dowdall GW, Maenner G, Gledhill-Hoyt J, Lee H, Changes in binge drinking and related problems among American college students between 1993 and 1997. Results of the Harvard

Moderate Drinking and Health

- School of Public Health college alcohol study, *J Am Coll Health* 1998;47:57–68.
14. Yano K, Rhoads GG, Kagan A, Coffee, alcohol and risk of coronary heart disease among Japanese men living in Hawaii, *N Engl J Med* 1977;297:405–409.
 15. Stampfer MJ, Colditz GA, Willett WC, Speizer FE, Hennekens CH, A prospective study of moderate alcohol consumption and the risk of coronary disease and stroke in women, *N Engl J Med* 1988;319:267–273.
 16. Jackson R, Scragg R, Beaglehole R, Alcohol consumption and risk of coronary heart disease, *Br Med J* 1991;303:211–216.
 17. Rimm EB, Giovannucci EL, Willett WC et al, Prospective study of alcohol consumption and risk of coronary disease in men, *Lancet* 1991;388:464–468.
 18. Criqui MH, Cowan LD, Tyroler HA et al, Lipoproteins as mediators for the effect of alcohol consumption and cigarette smoking on cardiovascular mortality. Results from the lipid research clinics follow-up study, *Am J Epidemiol* 1987;126:629–637.
 19. Shaper AG, Wannamethee G, Walker M, Alcohol and mortality in British men: explaining the U-shaped curve, *Lancet* 1988;ii:1267–1273.
 20. Klatsky AL, Armstrong MA, Friedman GD, Risk of cardiovascular mortality in alcohol drinkers, ex-drinkers and non-drinkers, *Am J Cardiol* 1990;66:1237–1242.
 21. Boffetta P, Garfinkel L, Alcohol drinking and mortality among men enrolled in an American Cancer Society prospective study, *Epidemiology* 1990;1:342–348.
 22. Rehm JT, Bondy SJ, Sempos CT, Vuong CV, Alcohol consumption and coronary heart disease morbidity and mortality, *Am J Epidemiol* 1997;146:495–501.
 23. Camargo CA Jr, Stampfer MJ, Glynn RJ 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.
 24. Klatsky AL, Epidemiology of coronary heart disease—influence of alcohol, *Alcohol Clin Exper Res* 1994;18:88–96.
 25. Pearson TA, Alcohol and heart disease (American Heart Association Science Advisory), *Circulation* 1996;94:3023–3025.
 26. Kannel WB, Ellison RC, Alcohol and coronary heart disease: the evidence for a protective effect, *Clin Chim Acta* 1996;246:59–76.
 - 26a. Thun MJ, Peto R, Lopez AD, Monaco JH, Henley SJ, Heath CW Jr, Doll R, Alcohol consumption and mortality among middle-aged

Moderate Drinking and Health

- and elderly U.S. adults, *N Engl J Med* 1997;337:1705–14.
27. Moore RD, Pearson TA, Moderate alcohol consumption and coronary artery disease. A review. *Medicine* 1986;65:242–267.
 28. Marmot M, Brunner E, Alcohol and cardiovascular disease: the status of the U-shaped curve, *Br Med J* 1991;303:565–568.
 29. Gaziano JM, Buring JE, Breslow JL et al, Moderate alcohol intake, increased levels of high-density lipoprotein and its subfractions, and decreased risk of myocardial infarction, *N Engl J Med* 1993;329:1829–1834.
 30. Maclure M, Demonstration of deductive meta-analysis: ethanol intake and risk of myocardial infarction, *Epidemiol Rev* 1993;15:328–351.
 31. Gruchow HW, Hoffmann RG, Anderson AJ, Barboriak JJ, Effects of drinking patterns on the relationship between alcohol and coronary occlusion, *Atherosclerosis* 1982;43:393–404.
 32. McElduff P, Dobson AJ, How much alcohol and how often? Population based case-control study of alcohol consumption and risk of a major coronary event, *Br Med J* 1997;314:1159–1164.
 33. Langer RD, Criqui MH, Reed DM, Lipoproteins and blood pressure as biologic pathways for effect of moderate alcohol consumption on coronary heart disease, *Circulation* 1992;85:910–915.
 34. Suh I, Shaton BJ, Cutler JA, Kuller LH, Alcohol use and mortality from coronary heart disease: the role of high-density lipoprotein cholesterol. The MRFIT research group, *Ann Intern Med* 1992;116:881–887.
 35. Ridker PM, Vaughan DE, Stampfer MJ, Glynn RJ, Hennekens CH, Association of moderate alcohol consumption and plasma concentration of endogenous tissue-type plasminogen activator, *JAMA* 1994;272:929–933.
 36. Rubin R, Rand ML, Alcohol and platelet function, *Alcohol Clin Exper Res* 1994;18:105–110.
 37. Rimm EB, Klatsky A, Grobbee D, Stampfer MJ, Review of moderate alcohol consumption and reduced risk of coronary heart disease: is the effect due to beer, wine, or spirits? *Br Med J* 1996;731:736.
 38. Gill JS, Shipley MJ, Hornby RH, Gill SK, Beevers DG, A community case-control study of alcohol consumption in stroke, *Int J Epidemiol* 1988;17:542–547.
 39. Wannamethee SG, Shaper AG, Lifelong teetotalers, ex-drinkers and drinkers: mortality and the incidence of major coronary heart disease events in middle-aged British men, *Int J Epidemiol* 1997;26:523–531.

Moderate Drinking and Health

40. Rodgers H, Aitken PD, French JM, Curless RH, Bates D, James OF, Alcohol and stroke. A case-control study of drinking habits past and present, *Stroke* 1993;24:1473–1477.
- 40a. Sacco RL, Elkind M, Boden-Albala B, Lin I-F, Kargman DE, Hauser WA, Shea S, Paik MC, The protective effect of moderate alcohol consumption on ischemic stroke, *JAMA* 1999;281:53–60.
41. Gurwitz JH, Field TS, Glynn RJ et al, Risk factors for non-insulin-dependent diabetes mellitus requiring treatment in the elderly, *J Am Geriatr Soc* 1994;42:1235–1240.
42. Perry IJ, Wannamethee SG, Walker MK, Thomson AG, Whincup PH, Shaper AG, Prospective study of risk factors for the development of non-insulin-dependent diabetes in middle aged British men, *Br Med J* 1995;310:560–564.
43. Rimm EB, Chan J, Stampfer MJ, Colditz GA, Willett WC, Prospective study of cigarette smoking, alcohol use, and the risk of diabetes in men, *Br Med J* 1995;310:555–559.
44. Stampfer MJ, Colditz GA, Willett WC et al, A prospective study of moderate alcohol drinking and risk of diabetes in women, *Am J Epidemiol* 1988;128:549–558.
45. Thornton J, Symes C, Heaton K, Moderate alcohol intake reduces bile cholesterol saturation and raises HDL cholesterol, *Lancet* 1983;ii:819–822.
46. Kono S, Shinchu K, Ikeda N, Yanai F, Imanishi K, Prevalence of gallstone disease in relation to smoking, alcohol use, obesity, and glucose tolerance: a study of self-defense officials in Japan, *Am J Epidemiol* 1992;136:787–794.
47. Colditz GA, A prospective assessment of moderate alcohol intake and major chronic diseases, *Ann Epidemiol* 1990;1:167–177.
48. Martinez de Pancorbo C, Carballo F, Horcajo P et al, Prevalence and associated factors for gallstone disease: results of a population survey in Spain, *J Clin Epidemiol* 1997;50:1347–1355.
49. La Vecchia C, Decarli A, Ferraroni M, Negri E, Alcohol drinking and prevalence of self-reported gallstone disease in the 1983 Italian national health survey, *Epidemiology* 1994;5:533–536.
50. Hazes JM, Dijkmans BA, Vandenbroucke JP, de Vries RR, Cats A, Lifestyle and the risk of rheumatoid arthritis: cigarette smoking and alcohol consumption, *Ann Rheum Dis* 1990;49:980–982.
51. Voigt LF, Koepsell TD, Nelson JL, Dugowson CE, Daling JR, Smoking, obesity, alcohol consumption, and the risk of rheumatoid arthritis, *Epidemiology* 1994;5:525–532.
52. Cohen S, Doyle WJ, Skoner DP, Rabin BS, Gwaltney JM Jr, Social

Moderate Drinking and Health

- ties and susceptibility to the common cold, *JAMA* 1997;277:1940–1944.
53. Cohen S, Tyrrell DA, Russell MA, Jarvis MJ, Smith AP, Smoking, alcohol consumption, and susceptibility to the common cold, *Am J Pub Health* 1993;83:1277–1283.
 54. Baum-Baicker C, The psychological benefits of moderate alcohol consumption: a review of the literature, *Drug Alcohol Depend* 1985;15:305–322.
 55. Poikolainen K, Alcohol and overall health outcomes, *Ann Med* 1996;28:381–384.
 56. Power C, Rodgers B, Hope S, U-shaped relation for alcohol consumption and health in early adulthood and implications for mortality, *Lancet* 1998;352:877.
 57. WCRF/AICR (World Cancer Research Fund and American Institute for Cancer Research), *Food, Nutrition and the Prevention of Cancer: A Global Perspective*, Washington, DC: AICR, 1997.
 58. Reisin E, Nonpharmacologic approaches to hypertension. Weight, sodium, alcohol, exercise, and tobacco considerations, *Med Clin North Am* 1997;81:1289–1303.
 59. Klatsky AL, Alcohol and hypertension, *Clin Chim Acta* 1996;246:91–105.
 60. Beilin LJ, Puddey IB, Alcohol, hypertension and cardiovascular disease—implications for management, *Clin Exp Hypertens* 1993;15:1157–1170.
 61. NIAAA (National Institute on Alcohol Abuse and Alcoholism), Alcohol and the liver, *Alcohol Alert No. 19*, 1993.
 62. Malagelada JR, The pathophysiology of alcoholic pancreatitis, *Pancreas* 1986;1:270–278.
 63. Pitchumoni CS, Chronic pancreatitis: a historical and clinical sketch of the pancreas and pancreatitis, *Gastroenterologist* 1998;6:24–33.
 64. NIAAA (National Institute on Alcohol Abuse and Alcoholism), Fetal alcohol syndrome, *Alcohol Alert No. 13*, 1991.
 65. ACSH (American Council on Science and Health), *The Responsible Use of Alcohol: Defining the Parameters of Moderation*, New York: ACSH, 1991.
 66. Longnecker MP, Alcoholic beverage consumption in relation to risk of breast cancer: meta-analysis and review, *Cancer Causes Control* 1994;5:73–82.
 67. Smith-Warner SA, Spiegelman D, Yaun SS et al, Alcohol and breast cancer in women: a pooled analysis of cohort studies, *JAMA*

Moderate Drinking and Health

- 1998;279:535–540.
68. Morgan JW, Gladson JE, Rau KS, Position paper of the American Council on Science and Health on risk factors for breast cancer: established, speculated, and unsupported, *Breast J* 1998;4:177–197.
 69. Giovannucci E, Rimm EB, Ascherio A, Stampfer MJ, Colditz GA, Willett WC, Alcohol, low-methionine–low-folate diets, and risk of colon cancer in men, *JNCI* 1995;87:265–273.
 70. Klatsky AL, Armstrong MA, Friedman GD, Hiatt RA, The relations of alcoholic beverage use to colon and rectal cancer, *Am J Epidemiol* 1988;128:1007–1015.
 71. Glynn SA, Albanes D, Pietinen P et al, Alcohol consumption and risk of colorectal cancer in a cohort of Finnish men, *Cancer Causes Control* 1996;7:214–223.
 72. Meyer F, White E, Alcohol and nutrients in relation to colon cancer in middle-aged adults, *Am J Epidemiol* 1993;138:225–236.
 73. Goldbohm RA, Van den Brandt PA, Van't Veer P, Dorant E, Sturmans F, Hermus RJ, Prospective study on alcohol consumption and the risk of cancer of the colon and rectum in the Netherlands, *Cancer Causes Control* 1994;5:95–104.
 74. Chyou PH, Nomura AM, Stemmermann GN, A prospective study of colon and rectal cancer among Hawaii Japanese men, *Ann Epidemiol* 1996;6:276–282.
 75. Tavani A, Ferraroni M, Mezzetti M, Franceschi S, Lo Re A, La Vecchia C, Alcohol intake and risk of cancers of the colon and rectum, *Nutr Cancer* 1998;30:213–219.
 76. Hoshiyama Y, Sekine T, Sasaba T, A case-control study of colorectal cancer and its relation to diet, cigarettes, and alcohol consumption in Saitama Prefecture, Japan, *Tohoku J Exp Med* 1993;171:153–165.
 77. Gerhardsson de Verdier M, Romelsjo A, Lundberg M, Alcohol and cancer of the colon and rectum, *Eur J Cancer Prev* 1993;2:401–408.
 78. Gapstur SM, Potter JD, Folsom AR, Alcohol consumption and colon and rectal cancer in postmenopausal women, *Int J Epidemiol* 1994;23:50–57.
 79. Gillman MW, Cook NR, Evans DA, Rosner B, Hennekens CH, Relationship of alcohol intake with blood pressure in young adults, *Hypertension* 1995;25:1106–1110.
 80. Becker U, Deis A, Sorensen TI et al, Prediction of risk of liver disease by alcohol intake, sex, and age: a prospective population study, *Hepatology* 1996;23:1025–1029.

Moderate Drinking and Health

81. Thaler H, Alcohol consumption and diseases of the liver, *Nutr Metab* 1977;21:186–193.
82. Savolainen VT, Liesto K, Mannikko A, Penttila A, Karhunen PJ, Alcohol consumption and alcoholic liver disease: evidence of a threshold level of effects of ethanol, *Alcohol Clin Exp Res* 1993;17:1112–1117.
83. Norton R, Batey R, Dwyer T, MacMahon S, Alcohol consumption and the risk of alcohol related cirrhosis in women, *Br Med J (Clin Res Ed)* 1987;295:80–82.
84. Polygenis D, Wharton S, Malmberg C et al, Moderate alcohol consumption during pregnancy and the incidence of fetal malformations: a meta-analysis, *Neurotoxicol Teratol* 1998;20:61–67.
85. Olsen J, Tuntiseranee P, Is moderate alcohol intake in pregnancy associated with the craniofacial features related to the fetal alcohol syndrome? *Scand J Soc Med* 1995;23:156–161.
86. Mills JL, Graubard BI, Is moderate drinking during pregnancy associated with an increased risk for malformations? *Pediatrics* 1987;80:309–314.
87. Lundsberg LS, Bracken MB, Saftlas AF, Low-to-moderate gestational alcohol use and intrauterine growth retardation, low birth-weight, and preterm delivery, *Ann Epidemiol* 1997;7:498–508.
88. Shu XO, Hatch MC, Mills J, Clemens J, Susser M, Maternal smoking, alcohol drinking, caffeine consumption, and fetal growth: results from a prospective study, *Epidemiology* 1995;6:115–120.
89. Lazzaroni F, Bonassi S, Magnani M et al, Moderate maternal drinking and outcome of pregnancy, *Eur J Epidemiol* 1993;9:599–606.
90. Windham GC, Fenster L, Hopkins B, Swan SH, The association of moderate maternal and paternal alcohol consumption with birth-weight and gestational age, *Epidemiology* 1995;6:591–597.
- 90a. Abel EL, “Moderate” drinking during pregnancy: cause for concern? *Clin Chim Acta* 1996;246:149–154.
91. Jensen TK, Hjollund NHI, Henriksen TB et al, Does moderate alcohol consumption affect fertility? Follow up study among couples planning first pregnancy, *Br Med J* 1998;317:505–510.
92. Grodstein F, Goldman MB, Cramer DW, Infertility in women and moderate alcohol use, *Am J Pub Health* 1994;84:1429–1432.
93. Florack EI, Zielhuis GA, Rolland R, Cigarette smoking, alcohol consumption, and caffeine intake and fecundability, *Prev Med* 1994;23:175–180.
94. Joesoef MR, Beral V, Aral SO, Rolfs RT, Cramer DW, Fertility and use of cigarettes, alcohol, marijuana, and cocaine, *Ann Epidemiol*

Moderate Drinking and Health

- 1993;3:592–594.
95. Zaadstra BM, Looman CW, te Velde ER, Habbema JD, Karbaat J, Moderate drinking: no impact on female fecundity, *Fertil Steril* 1994;62:948–954.
 96. Gruchow HW, Sobocinski KA, Barboriak JJ, Scheller JG, Alcohol consumption, nutrient intake and relative body weight among U.S. adults, *Am J Clin Nutr* 1985;42:289–295.
 97. Colditz GA, Giovannucci E, Rimm EB et al, Alcohol intake in relation to diet and obesity in women and men, *Am J Clin Nutr* 1991;54:49–55.
 98. Holman CDJ, English DR, Milne E, Winter MG, Meta-analysis of alcohol and all-cause mortality: a validation of NHMRC recommendations, *Med J Aust* 1996;164:141–145.
 99. Andreasson S, Romelsjo A, Allebeck P, Alcohol, social factors and mortality among young men, *Br J Addiction* 1991;86:877–887.
 100. Fuchs CS, Stampfer MJ, Colditz GA et al, Alcohol consumption and mortality among women, *N Engl J Med* 1995;332:1245–1250.
 101. Kono S, Ikeda M, Tokudome S, Nishizumi M, Kuratsune M, Alcohol and mortality: a cohort study of male Japanese physicians, *Int J Epidemiol* 1986;15:527–532.
 102. Cullen KJ, Knuiman MW, Ward NJ, Alcohol and mortality in Busselton, Western Australia, *Am J Epidemiol* 1993;137:242–248.
 103. DeLabry LO, Glynn RJ, Levenson MR, Hermos JA, LoCastro JS, Vokonas PS, Alcohol consumption and mortality in an American male population: recovering the U-shaped curve—findings from the normative aging study, *J Stud Alcohol* 1992;53:25–32.
 104. Goldberg RJ, Burchfiel CM, Reed DM, Wergowske G, Chiu D, A prospective study of the health effects of alcohol consumption in middle-aged and elderly men. The Honolulu heart program, *Circulation* 1994;89:651–659.



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