



## Effects of Alcohol Consumption on Hypertension

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### Abstract

Prevention of hypertension and lowering blood pressure with non-pharmacological treatment and lifestyle changes may reduce cardiovascular morbidity and mortality associated with alcohol while they also play an important role in reducing the cost of medical treatment. Reduction of alcohol consumption is one of the recommended lifestyle changes in the JNC VII report. Excessive amounts of alcohol consumption leads to an increase in blood pressure in both normotensive and hypertensive individuals. At the same time, alcohol can lead to resistance to antihypertensive drug treatment. Effects of alcohol on blood pressure is dependent on the amount of alcohol rather than the type of alcohol. As far as heart diseases are concerned, mild-to-moderate alcohol consumption, despite its tendency to increase blood pressure, is associated with decreased risk of coronary artery diseases and ischemic stroke by way of elevating high-density lipoprotein cholesterol levels, reducing fibrinogen and platelet aggregation, and producing positive effects on antioxidants systems. However, increased alcohol consumption is accompanied by increased blood pressure, hemorrhagic and ischemic strokes, alcohol-induced cardiomyopathy, arrhythmia, and sudden cardiac death. Therefore, people with hypertension should avoid or reduce alcohol consumption in addition to drug treatment. A positive relationship has been detected between decreasing alcohol consumption and systolic and diastolic blood pressures. Reducing alcohol consumption provides a 2-4 mmHg reduction in systolic blood pressure levels. For this reason, 1-2 drinks per day for men and up to one drink for women and people with poor health seem to be optimal amounts. People who use alcohol should keep in mind that moderation and unexcessive consumption are the key words in avoiding alcohol related medical conditions.

**Key Words:** Alcohol; Hypertension; Cardiovascular Disease.

### Alkol Tüketiminin Hipertansiyon Üzerine Etkileri

#### Özet

Non farmakolojik tedavi ve yaşam şekli değişiklikleri ile hipertansiyonun önlenmesi ve kan basıncının düşürülmesi, kardiyovasküler hastalıklarla ilişkili morbidite ve mortaliteyi azaltma ve tedavi harcamalarını düşürmede önemli bir rol oynayabilir. Alkol kullanımının azaltılması JNC VII raporunda önerilen yaşam tarzı değişikliklerinden birisidir. Aşırı miktarda alkol tüketimi hem normotansif, hem de hipertansif bireylerde kan basıncında yükselmeye neden olur. Aynı zamanda alkol antihipertansif ilaç tedavisine direnç oluşturabilir. Alkolün kan basıncı üzerine etkisi alkolün türünden çok, alkol miktarına bağlıdır. Kalp hastalığı açısından bakılacak olursa hafif-ılımlı alkol kullanımı her ne kadar kan basıncı artışına eğilim oluştursa da yüksek dansiteli lipoprotein kolesterolü artırması, fibrojeni ve platelet agregasyonunu azaltması ve antioksidan sistemler üzerindeki olumlu etkileri ile azalmış koroner hastalık ve iskemik inme riski ile beraberdir. Bununla birlikte tüketilen alkol miktarı arttıkça kan basıncında yükselme, hemorajik ve iskemik inme, alkolle ilişkili kardiyomyopati, aritmi ve ani kardiyak ölüm riski artmaktadır. Bu nedenle hipertansiyon saptanan kişilerde ilaç tedavisinin dışında yapılması gerekenlerden birisi alkolün bırakılması veya azaltılması olmalıdır. Alkol alımının azaltılması ile sistolik ve diastolik kan basınçlarındaki net azalma arasında belirgin pozitif ilişki olduğu saptanmıştır. Alkol tüketiminin azaltılması sistolik kan basıncında yaklaşık 2-4 mmHg bir azalma sağlamaktadır. Bu nedenle erkeklerde günde 1-2 içki, kadınlar ve çok zayıf kişilerde 1 içkiye kadar miktarlar optimal gözükmektedir. Alkol kullanan kişilerde anahtar sözcüğün ılımlılık, aşırıya kaçmamak olduğu unutulmamalıdır.

**Anahtar Kelimeler:** Alkol; Hipertansiyon; Kardiyovasküler Hastalık.

### Studies on Alcohol and Hypertension

Although the relationship between alcohol consumption and hypertension was first defined in 1915, this relationship has not been considered until the end of the second half of the 20th century. Conducted among more than 80000 people, Klatsky's research on alcohol use and alcohol prevalence has brought attention to the connection between alcohol and hypertension (3). Epidemiological studies in humans and experimental studies in animals have also shown the relationship between chronic alcohol consumption and prevalence of hypertension. The relationship between alcohol consumption and blood pressure has been observed worldwide in over 60 population studies. Kaiser

Permanente's study has shown that there is a J-curve shaped relationship between alcohol consumption and blood pressure independent of factors like age, sex, obesity, ethnicity, smoking and social class. The study has also revealed that there is a higher tendency for systolic and diastolic blood pressure in people who have a standard daily alcohol consumption of 3 or more times compared to non-users (3). Arkwright et al. have found a linear relation between alcohol usage and blood pressure. Their study has put forward a 3-4 times higher tendency for systolic hypertension in 50% of males who consume a standard dose of alcohol 3 or more times per day (4). The relationship between alcohol and blood pressure is less pronounced in women. NHANES III's

findings reassures the scarcity of the relationship between alcohol and blood pressure in women. However, it has been reported that the average systolic blood pressure was higher in women with more than 30 grams of alcohol consumption compared to those who consume less. But consumption of oral contraceptives with high doses of oestrogen increases alcohol's effect in increasing blood pressure in women (5).

#### Types of Alcoholic Beverages and Hypertension

In terms of the relationship between types of alcohol and blood pressure, Kaiser Permanente's study has determined that drinks like wine, beer, and other spirits have parallel effects on blood pressure changes (3). Other studies have reported similar results with different types of alcoholic beverages. However, it seems that wine consumption is less effective on blood pressure. It has been suggested that red wine has a dual effect on the blood vessels. Alcohol can raise blood pressure but its phenolic components have antioxidant effects and can help blood vessels to relax (6, 7).

A study analysing the relationship between alcoholic beverages and cardiovascular risk factors conducted on 6730 men from France and Northern Ireland has concluded that drinking wine is less effective on blood pressure than drinking beer. Regardless of the consumed amount of alcohol, wine had low fibrinogen while beer was associated with higher levels of PAI-1 activity in this study. It has been argued that there is a more homogeneous pattern of drinking during week days in France and that people usually drink wine while eating. According to the study, there is dense drinking without intensive eating at the weekends in the Northern Ireland and this weekend drinking is usually accompanied by eating salty foods like peanuts and potato chips as well as smoking, all of which have been suggested to contribute to the increase in blood pressure (8).

Some other studies suggest that both red wine and beer increase blood pressure in a likewise manner. Another study asserts that drinking beer increases systolic blood pressure by 2.9 mmHg while this rate is found to be 1.9 mmHg for wine. As far as the relationship between types of alcohol and blood pressure is concerned, the effects of the types of alcohol, accompanying food consumption, and behavioural differences should not be ignored (9).

#### Acute Effects of Alcohol

When we look at the studies of the acute effects of alcohol, we see that there is a vasodilatory response at the beginning stages of alcohol intake though heavy drinkers have been suggested to have rebound hypertension as it is indicated in population studies. Because of heavy alcohol consumption at the weekends as in the case of binge drinking (more than 5 glasses of alcohol consumption in one sitting), for example, heavy drinkers may suffer from higher blood pressures at the beginning of the week as a result of acute alcohol withdrawal. This effect is not observed in those who

have a more homogenous alcohol consumption pattern during the week (10-12).

Some other studies have suggested that amount of consumption during the week is more important than drinking patterns. Sudden cessation of alcohol causes an increase in catecholamine-induced hypertension, renin, and aldosterone in heavy drinkers who share excessive alcohol use. Heavy drinking, especially binge drinking, is very much related to incidence of death from cerebral thrombosis, cerebral hemorrhage, and coronary artery diseases. Although the causal pathway seems to pinpoint hypertension associated with alcohol, this has not been fully described yet (13). INTERSALT defines heavy drinking as  $\geq 300$  ml of absolute weekly alcohol consumption which roughly corresponds to 34g/day. A standard alcoholic drink is considered to be a drink with 8-10g of alcohol in the UK and 12-13g of alcohol in the United States. INTERSALT reports that blood pressure in men consuming 300-499 ml of alcohol per week was higher by 2.7/ .6 mmHg while this was 4.6/3.0 mmHg in men with an alcohol intake of  $\geq 500$  mL per week. Female heavy drinkers ( $\geq 300$  mL of alcohol/week) also have a higher blood pressure than those who do not use alcohol by 3.9/3.1 mmHg. As a result, heavy drinking (3-4 or more drinks/day) is associated with high blood pressure both in males and females (14). Comparing heavy alcohol users with those who do not use alcohol in terms of the Framingham cohort, we see a 7mmHg increase in the mean arterial pressure (15). ARIC study concludes that an alcohol intake of 210 g/week is a risk factor for hypertension independent of sex, race, and age. The same study also reports that low to moderate dose of alcohol consumption does not increase the risk of hypertension in white males while a similar intake increases this risk in black males (16). Another population-based longitudinal study that regards regular alcohol use as 8 or more glasses of alcohol consumption in one sitting reports that while alcohol usage increases the risk of coronary heart disease in both men and women, it increases the risk of hypertension in men (12). Although episodic drinking does not seem to increase the risk of hypertension in women, a prospective study claims that regular heavy drinking habits in women are in line with increased risk of similar issues (5). The study entitled "Heart Disease and Risk Factors in Turkish Adults," which concentrates the long-term effects of alcohol intake by projecting the results and their effects in the future, concludes that excessive drinking increases overall mortality in men by two folds though this is not applicable to female moderate alcohol users. The baseline evaluation of this study reveals that hypertension is less common in light and moderate drinkers compared to heavy drinkers and non-drinkers. The study asserts that future risks of drinking alcohol depend very much on the amount of alcohol used (17). In a study conducted in the UK among 14.077 women between the ages of 30 and 64, it was observed that an alcohol intake of 1-14 units per week decreased the risk of cardiovascular diseases while an alcohol intake of  $\geq 15$  units per week increased the prevalence of hypertension (5).

### Amount of Alcohol Consumption and Hypertension

Each standard daily alcohol consumption increases systolic blood pressure by approximately 0.6-1.0 mmHg and this effect is generally reversible when the alcohol intake is reduced or discontinued. Randomised controlled trials have shown that reducing the consumption of alcohol decrease blood pressure in hypertensive patients regardless of the presence of a related therapy. Changes in life style can provide decrease in blood pressure in people with moderately high hypertension who have excessive alcohol use. Alcohol use reduces the efficacy of antihypertensive drug therapy (18). Reducing excessive alcohol consumption to a moderate level of alcohol intake can provide a good blood pressure control in heavy drinking males with essential hypertension. Studies have determined a significantly positive correlation between reducing average alcohol intake and systolic and

diastolic blood pressures. As far as the general public health is concerned, hypertension treatment guidelines recommend decreasing alcohol consumption on national and international levels to prevent hypertension (2). Recommended limits of alcohol intake have been defined as 1 unit of alcoholic beverage (12 oz/360 ml of beer; 5 oz/150 ml of wine; 1,5 oz/80-proof whiskey) for women; this limit is defined as 2 units of beverage for men. Fermented beverages such as beer and wine contain 2-20% alcohol while distilled spirits or liquors contain 40-50% or more alcohol. Reduction of alcohol consumption results in a decrease in systolic blood pressure by 2-4 mmHg. Considering the fact that even a decrease of 2 mmHg in the mean systolic blood pressure reduces the risk of ischemic heart disease mortality by 7% and stroke mortality by 10%, reducing alcohol consumption is of utmost importance (Table 1) (19).

**Table 1.** Amount of alcohol consumed and potential risks.

Amount	Potential Risks
Mild-moderate alcohol consumption	Decrease in the risk for coronary diseases Decrease in the risk for ischemic stroke
Excessive alcohol consumption	Increase in blood pressure Resistance to antihypertensive treatment
Alcohol consumption 3 or more than 3 three times a day	Increase in blood pressure Increase in triglyceride levels
Heavy alcohol consumption	Hemorrhagic and ischemic strokes Alcohol related cardiomyopathy Increased arrhythmia Risk of sudden cardiac death

### Mechanism Behind Alcohol-Induced Hypertension

The mechanism behind alcohol-induced hypertension is not fully understood yet. However, the possible mechanism underlying chronic high blood pressure related with alcohol use is thought to be the activation of sympathetic nervous system and changes in vascular tonus. Chronic alcohol use may lead to vascular hyper reactivity, vasoconstriction, and increased cytoplasmic calcium accumulation in the smooth muscles accompanied by increased peripheral vascular resistance. Although the exact mechanism is not fully explained, alcohol has direct influence on plasma membrane permeability, sodium transport, and Na<sup>+</sup>/Ca<sup>2+</sup> exchange while it may also cause impaired calcium transport due to secondary abnormalities such as magnesium depletion, which is found in alcoholics (20). At the same time, increased inflammation and angiotensin II levels, endothelial damage caused by NADPH oxidase, CuZn-SOD depletion, down-regulation caused by endothelial NO generation system, and vascular relaxation corruption are among other mechanisms held responsible for high blood pressure caused by alcohol (21).

use of alcohol, especially more than 2 standard drinks a day, results in increased mortality (6, 19). Low doses of alcohol intake has positive effects on high-density lipoprotein cholesterol and lipoprotein metabolism in general as well as antiplatelet effects associated with decreased platelet aggregation. It also increases tissue plasminogen activator levels and antioxidant capacity while it reduces oxidative stress. Low alcohol intake improves insulin resistance and reduces end products of advanced glycation while it protects the cardiovascular system as well (Table 2) (22, 23).

### Alcohol and Target Organ Damage

Epidemiological studies have shown that, despite the predisposition to hypertension, mild-moderate alcohol use is protective against coronary death and ischemic stroke and reduces heart disease mortality. However,

Excessive alcohol consumption increases blood pressure both in normotensive and hypertensive individuals. Alcohol can also create resistance to antihypertensive drug treatment. As for heart diseases, mild-to-moderate alcohol consumption increases blood pressure; it accompanies coronary heart disease and ischemic stroke risk as well. Three or more drinks a day can raise blood pressure and triglyceride levels. The use of higher amounts of alcohol may bring about ischemic and hemorrhagic stroke, alcohol-related cardiomyopathy, increased arrhythmia, and sudden cardiac death. Therefore, while 1-2 drinks per day is the optimal amount for men, in women and people with poor health, 1 drink per day seems to be the ideal limit. The key words for use of alcohol, therefore, are moderation avoiding excessive consumption.

**Table 2.** Effects of low alcohol consumption in low amounts on some of the systems.

Affected System	Potential Effects
Lipid profile	Increase in HDL cholesterol Increase in LDL cholesterol
Risk of thrombosis	Decrease in platelet aggregation Decrease in fibrinogen levels Decrease in tPA levels
Oxidative and antioxidant stress	Decrease in antioxidant capacity Decrease in oxidative stress
Glycosylation	Improvement in insulin resistance Decrease in advanced glycosylation products

HDL: high-density lipoprotein; LDL: low-density lipoprotein , tPA: tissue plasminogen activator

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