Effects of Moderate Intake of Alcohol on Coronary Heart Disease

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Abstract

The french paradox is caused by an inconsistency with scientific experimentation: The French have a very high intake of saturated fat and cholesterol, which is associated with coronary heart disease, yet they have un-commensurately low levels of deaths due to this disease. It has been proposed that alcohol, as a part of the French diet, is the factor that helps decrease the risk of heart disease in the French population by 20-30%. Research has been gathered from many medical journals to create a larger and more accurate perspective to determine if alcohol has any effect on coronary heart disease. Experiments indicate that alcohol does indeed have protective effects on the cardiovascular system through various mechanisms including: High-density lipoprotein (HDL) increases, Apolipoprotein A1-A2 increase, Hemostatic factors, and insulin sensitivity increase.

Introduction

The French Paradox, a term coined by Serge Renaud in 1986, has stymied scientists for years. The paradox is presented by the fact that France is one of the world's highest consumers of saturated fat and cholesterol-containing foods. Yet, as a whole, the French people have lower rates of coronary heart disease than the rest of the Western world (cited in Ferrieres, 2004; cited in Agarwal, 2002). This presents a paradox since it has been firmly established that large amounts of cholesterol and saturated fat increase the risk for Coronary heart disease (Shestov, et al, 1993). How could a nation that consumes more cholesterol and saturated fats than the United States of America still have a significantly lower CHD mortality rate?

One possible explanation for this conundrum was proposed in 1986: the French have a larger intake of alcohol consumption than Americans. It was, therefore, hypothesized that alcohol, through various biological mechanisms, can lower the risk for Coronary heart disease (Rimm, 1999). The detrimental effects of alcohol have been tested and proven. However, most of these terrible effects stem from long term alcohol abuse and binging. Perhaps viewing alcohol from a moderate intake perspective will present different data. The purpose of this paper is to research and assess this hypothesis to determine if a moderate intake of alcohol has a deterrent effect on coronary heart disease.

Method

This is a meta-analysis of more than twenty papers including many original experiments. The information gathered in this paper has been collected from numerous sources including databases such as PROquest and JSTOR. Additionally, a great deal of information was gathered from medical journals publicly available on the internet or in libraries. All of this information was read, analyzed, and compared to determine each piece's respective authority and veracity. Each article was also assessed in accordance with its respective levels of diversity and sample size significance.

Results

In this review, the words "moderate intake of alcohol" will be used. This term obviously excludes excessive consumption of alcohol as well as total abstinence from alcohol. For laypeople, the term "moderate intake of alcohol" has a wide and subjective purview that will always fall somewhere between abstinence and excessive alcohol consumption. For the purposes of the experiments referenced herein, moderate intake of alcohol refers to 15-30 milligrams of ethanol (the alcohol found in what are commonly considered alcoholic beverages, such as beer, wine and spirits) per day. This is the amount typically contained in one to two alcoholic beverages. Any alcoholic consumption below or above 15-30 milligrams may have similar effects. However, this level of consumption it is not within the purview of this research paper.

When focusing on the intake of a moderate amount of alcohol (15-30 mg of ethanol), several experiments have found positive effects that alcohol exerts, directly or indirectly, on coronary heart disease. Graphically, it is represented as a J or U shaped curve. Below is a summary of the effects of alcohol on relative risk of death (Tabl1 1). Some experiments show that moderate levels of alcohol intake will decrease the risk of coronary heart disease by as much as 20 to 30 percent (Rimm et al, 1999b; Emberson & Bennett, 2006; Pearson, 1996). There are numerous mechanisms proposed for this decreased risk. Some have greater scientific support than others. This paper will present those mechanisms that have sufficient scientific ground upon which to stand. The various mechanisms that will be discussed are:

High-density lipoprotein increase; Apolipoprotein A-1 and A-2 increase; Change in lipoprotein size; Increase in fibrinolytic activity; Decrease in fibrinogen; Decreases in platelet aggregation; and Increasing insulin sensitivity.

Apolipoprotein A-1 A-2 Increase

In a process similar to High density lipoprotein increase, moderate intake of alcohol is hypothesized to increase the transport rates and concentration of Apolipoproteins A-1 and A-2. These proteins are produced in the liver and are part of the large complex of HDL that helps start the process of removal of "bad cholesterol" from the blood stream by HDL (De Oliveira e Silva et al, 2000; van der Gaag et al, 2016; Frank & Marcel, 2000).

There are two primary ways that Apolipoproteins assist in the removal of bad cholesterol:

First, in particular, Apolipoprotein A-1 is a cofactor for the enzyme lecithin cholesterol acyltransferase (LCAT) which converts cholesterol into cholesterol esters (http://www.ncbi.nlm.nih.gov/gene/335; Frank & Marcel, 2000). The cholesterol esters are more hydrophobic and help form the sphere of HDL that gets transferred in one of two ways: directly, through specific HDL receptors to the liver; or indirectly through very low density lipoprotein (VLDL) and intermediate density lipoprotein (IDL) conversion. Therefore, an increase in the concentration and transport rates of Apolipoproteins A-1 and A-2 will speed up the process by which the HDL will esterify and remove cholesterol from the blood.

Second, in addition to its role in speeding up the rate of cholesterol removal by HDL, Apolipoprotein A-1 has also been associated with prostacyclin stabilizing factor, which is involved in anticlotting. By stabilizing prostacyclin, better known as Prostaglandin I2 (PGI-2), platelet aggregation is inhibited which helps decrease the chance of clots forming. The positive effects of inhibiting platelet aggregation will be discussed in more detail later in this paper (Yui et al, 1988).

Change in Lipoprotein Size

Experiments have also shown that ethanol can increase particle size of HDL and LDL. Small, dense LDL's have been associated with a risk of Coronary heart disease of three times that of an individual with large "fluffy" LDL. Additionally, an increase in the size of these lipoproteins has been associated with cardioprotection (Mukamal et al, 2007).

All of the above mechanisms hypothesize how alcohol creates a potential downgrade of risk for heart disease based upon changes in lipid profile. More particularly, these hypotheses are based upon increases in HDL-Cholesterol and Apolipoprotein concentrations as well as lipoprotein size.

The Hemostasis Hypothesis

The next set of mechanisms that hypothesize how moderate alcohol consumption has a possible downgrade on heart disease are based on hemostasis. Put simply, these hypotheses suggest that alcohol affects the way the blood clots and breaks down clots, thereby reducing the risk for coronary heart disease.

One possible hemostatic mechanism proposed is that moderate intake of alcohol can decrease fibrinogen concentration (Mennen et al, 1999 Stec et al, 2000). Experiments have shown that the moderate intake of alcohol decrease the levels of circulating fibrinogen by 18-20 percent (Wang, Barker, & Fuller, 1999). This decrease can cause a significant reduction of the risk for coronary heart disease. Fibrinogen is a blood soluble plasma protein that is activated by the enzyme thrombin and produces the protein fibrin. Elevated levels of fibrinogen in the blood can lead to potentially devastating effects on the heart. First, it can cause an increase in platelet aggregation. Second, it will increase fibrin levels which promote coagulation, which leads to an increase in blood clotting. Third, elevated levels of fibrinogen increase plasma viscosity, which is associated with an increased severity of coronary heart disease (Junker et al, 1998; Stec et al, 2000), In some scenarios, these factors can cause acute clot formation and block arteries, including coronary arteries, leading to myocardial infarctions. Finally, elevated fibrinogen levels play a role in atherosclerotic plaque build up. A moderate intake of alcohol will decrease fibrinogen levels thereby decreasing the above factors.

On the antonymic aspect, alcohol has been proven to increase the levels of fibrinolytic activity (Pikaar et al, 1987; Aikens et al, 1998; Sierksma et al, 2001). In addition to alcohol decreasing fibrin building, it is also able to increase fibrin catalysis. Experiments have shown that moderate levels of alcohol can increase levels of plasminogen activator, which converts plasminogen to plasmin, one of the enzymes that catalyzes fibrin clots. As a result, the hemostatic process of fibrinolysis is increased. By increasing the fibrinolytic activity in the body, clots are less likely to form thereby reducing strokes and ischemic incidents. In fact, many medications that treat heart diseases work through similar mechanisms by inhibiting Plasminogen activator inhibitor-1, which acts exactly as its name indicates -- by inhibiting the inhibitor, the activator is increased (Vaughan, 2011).

Another hemostatic aspect of moderate alcohol intake is its effect on platelet aggregation. Experiments have shown that alcohol can decrease platelet aggregation, subsequently decreasing the risk of cardiac incidents (Zhang et al, 2000; Pikaar et al, 1987; Renaud & Ruf, 1996, Parson, 1996). Platelet aggregation is a pivotal player in controlling and carrying out hemostasis. Moreover, it is a significant factor when it comes to atherslerotic heart disease. Atherosclerosis starts with the oxidation of lipoproteins which are responsible for creating lesions on the arterial wall. These lesions expose the endothelium thereby allowing platelet receptors to open to accepting signals that allow platelets to begin adhering to one another. Platelets are also responsible for amplifying the signal that attracts leukocytes such as monocytes and lymphocytes. These cells have been previously proven to advance atherosclerosis through many mechanisms including the uptake of cholesterol up to the point of rupturing. Additionally, platelets contain chemokines within them that are released when platelets are activated. These chemokines are also factors that play a role in the propagation of ahterslerosis (Kaplan & Jackson, 2011; Weber, 2005).

Insulin Sensitivity Increase

Alcohol has been shown to increase insulin sensitivity in insulin resistant individuals. (Sierksma et al, 2003; Joosten et al, 2008; Fachinni, Chen, & Reaven, 1994). There is a correlation between these individuals and higher risk for coronary heart disease. The precise mechanisms for this correlation are unknown but hypothesized as follows (Sparks, Sparks, & Adelhi, 2012). In one hypothesis, muscle and fat tissue resistance to insulin causes an increase in plasma insulin and free fatty acid concentrations. Subsequently, this deadly combination will lead to Very low density lipoprotein (VLDL)-triglyceride secretion , which leads to higher triglyceride plasma levels. Another possible hypothesis suggested is that in insulin resistant individuals, there is a defect that does not allow insulin to properly regulate VLDL-triglyceride secretion thereby leading to hyperglyceridemia. In both of these mechanisms, the end result is an increase in triglycerides found in the plasma which, through an additional mechanism, is associated with coronary heart disease (Hokanson, 2002).

Discussion

Many scientists disagree with these hypotheses set forth above. Some attack the conclusions themselves while others question the experiments based on external biases and statistical errors. One proposed argument is that the control group of abstainers from alcohol in the experiments had been tainted by ex-drinkers who became abstainers due to health risks. These individuals either realized themselves or were directed by medical providers that they had to stop drinking for their overall health and/or their potential for a cardiac event. If this were true, then using these individuals as the control for the experiments would completely ruin the results as these individuals are much more prone to having cardiac problems due to their previous consumption. However, this contention has been accounted for in many experiments. The experiments have made sure that their control groups consisted of individuals who have never been excessive drinkers as well as others that have been lifelong abstainers from alcohol.

Another potential problem that has been raised concerning the experiments is the determination of what type of people make up the moderate alcohol intake group. The concern is that perhaps individuals who are moderate drinkers of alcohol come from healthier homes or have healthier lifestyles. These concerns extend to the possibility that they have potentially better exercise routines, higher education, and better health insurance.

With regard to the claims of cardioprotection by HDL increases, there is some question as to whether increasing HDL will even have any impact in cardiac incidents. According to Dr. Daniel Keene, pharmacologically increasing HDL and its effects did not improve the individual's risk for cardiac incidents (Keene et al, 2014). Now, this is strongly contended by many other experiments and it would seem likely that there is some other explanation for why Dr, Keene did not find any improvement in his experiments. However, this is a curious experiment that should be taken into account.

All in all, there is sound evidence and scientific proof to say with confidence that alcohol exerts some level of cardioprotection by increasing HDL concentrations, in particular the HDL2 and HDL3 subfractions. The mechanism behind this is not fully understood. However, the hypotheses reported above may shed some light on this area. The experiments supporting the cardioprotective effects of moderate alcohol use have been performed with significant numbers of subjects representing all people of all races, sexes and socioeconomic backgrounds. There have been over 40 experiments proving this point. Granted that some of these experiments do have some faults and biases with patients, but taken as a whole, the experiments clearly indicate a significant cardioprotective trait of alcohol. However, this only accounts for roughly 50 percent of alcohol's cardioprotection.

Regarding the other 50 percent of cardioprotection, there is also sound basis to say that alcohol will decrease circulating fibrinogen, increase fibrinolytic activity, and decrease platelet aggregation. All these factors have been proven by proper scientific experimentation. Although some may contest these results because a few of the experiments were conducted in vitro and not on people, the results were sound and the newer experiments have verified this to be true.

With regard to increasing insulin sensitivity there is a lot unknown about the mechanisms by which insulin resistance harms the cardiovascular system and how alcohol increases sensitivity. However, from all the experiments it would seem clear that there is an increase in the sensitivity even if we are not clear about how it happens.

Conclusion

Based on all the evidence and experimentation is seems evident that there are benefits to moderate alcohol intake. To go so far as to recommend alcohol as a remedy or even a supplement to those in risk of coronary heart disease does not fall under the purview of this paper. It may be true that alcohol will reduce the risks for heart disease up to 30 percent. However, we need to be cognizant of the potential risk and damage that alcohol may cause on other parts of the body. To summarize, medical professionals should not be so quick to dismiss alcohol as a deadly drug, rather they should research and weigh the cost versus benefit and advise their patients accordingly.

It would seem clear that since alcohol has cardioprotective attributes, the French paradox is not very paradoxical. The French diet includes a consistent moderate intake of alcohol, which would explain the lower coronary heart diseases rate in France. Although this may not be the only explanation for why the French cardiac mortality rate is much lower, alcohol intake is proven to be a valid hypothesis.

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