

Relationship of Dietary Protein with Consequences of Cardiovascular Diseases- Review

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Abstract

Studies suggest that different sources of protein have different effects on cardiovascular disease. The effects of white meat from poultry and fish are known to differ from those of red meat from beef and pork. Diets containing substantial amounts of red meat, and products made from these meats, appear to increase risk of CHD. Data indicate that substitution of white meat (poultry and fish) for red meat provides health benefits. In addition, consumption of animal products may have opposing effects on CHD and hemorrhagic stroke. Thus, dietary recommendations should emphasize both the amount and sources of protein. One should distinguish poultry and fish from beef and pork. Also, eggs and dairy products should be distinguished from meats. There is little evidence that moderate consumption of eggs has material adverse effects on chronic diseases, and moderate consumption of dairy products may have complex effects, including benefits and risks. In many situations, the partial displacement of the carbohydrate staple source of energy, such as grain products with animal products, may have neutral or beneficial health effect. The use of plant source of protein and fat, such as nuts, legumes, soy, and vegetable oils, may provide even greater health benefits and should therefore be considered simultaneously.^[1] the relevant research linking nutrition and CVD with focus on protein will be reviewed further. Different sources of protein appear to have different effects on cardiovascular disease which will be reviewed.

Key Words: Cardiovascular diseases, diet, protein

Introduction

Cardiovascular disease (CVD) is the leading cause of death in many countries and remains one of the major diseases strongly affected by the diet. In 2016, the estimated prevalence of CVDs in India was estimated to be 54.5 million. One in 4 deaths in India are now (2019) because of CVDs with ischemic heart disease and stroke responsible for >80% of this burden.^[2] Cardiovascular disease (CVD) remains the leading cause of death in the United States, responsible for 840,768 deaths (635,260 cardiac) in 2016. From 2006 to 2016, the US death rate from CVD decreased by 18.6% and from coronary heart disease by 31.8%.^[3] CVD

is caused by the accumulation of vascular plaques which are a result of number of factors, one of which is nutrition.

Yancy WS Jr has examined the effects of higher-protein diets on weight loss compared with diets lower in protein. Proponents of several popular diets (especially the Atkins Diet) have long claimed that higher amounts of dietary protein not only facilitate weight loss but also improve cardiovascular risk factors.^[4]

Low versus High Protein diet for CVD

Given the same intake of total energy and dietary fat, an increase in the percentage of energy from protein relative to carbohydrates is associated with a decreased risk.^[5] This result is consistent with evidence from metabolic studies that replacement of dietary carbohydrate with protein has a favorable effect on plasma lipoprotein and lipid concentrations.^[6] A Swedish study of 43396 women indicates that increasing protein intake by 10% (or 5 g of protein) while decreasing carbohydrate intake by 10% (or 20 g carbohydrates) is associated with a significant increase in CVD incidences. Substituting carbohydrates mostly with animal protein, thereby changing the overall protein: carbohydrate intake ratio is associated with poorer health outcomes. Multiple other large studies suggest a positive correlation between diets low in protein and lower rates of aging-related disease.^[7] NHS (Nurses' Health Study; including 85168 women) and the 20-year follow-up of the Health Professionals' Follow-up Study (including 44 548 men), diets high in animal-based protein and fats and low in carbohydrates are associated with higher mortality in both men and women.^[8] It is possible that the benefits of a lower protein intake in the population ≤ 65 years are due, in part, by the low IGF-1 levels.^[9] In older individuals instead the higher protein intake could help to maintain a healthy weight and preserve muscle mass and other functions thereby preventing frailty and the diseases and mortality associated with it.^[10] This hypothesis is supported by results in mice: a low-protein but high-carbohydrate diet is the most effective for metabolic health, but old mice on a low-protein diet struggle to maintain weight and become increasingly frail.^[11] Experimental studies in rabbits or rat done by Kritchesky which suggested that cholesterol-free, purified diets containing proteins of animal rather than vegetable sources were hypercholesterolemic and atherogenic.^[12] However, this cholesterol-raising effect was not observed in other species of animals (eg, pigs) or humans.^[13]

Wolfe showed that exchanging protein for carbohydrate significantly reduced LDL cholesterol and triacylglycerol levels and increased HDL. Favorable effects on plasma lipids of substitution of protein for carbohydrates were also observed among subjects with familial hypercholesterolemia and normolipidemia.^[14] Jenkins conducted a 1 month study of a high-wheat protein diet (27% energy from protein) compared with a control diet (16% energy protein) and found significant decreases in triacylglycerol and oxidized LDL cholesterol on the higher-protein diet.^[15] A study by Samaha compared a low carbohydrate, high-protein Atkins diet (22% energy from protein) with a low-fat diet (16% energy from protein) on severely obese subjects. The higher-protein group had significantly lower triacylglycerols compared with the lower-protein group. However, the higher-protein group lost more weight, and this may have accounted for these differences.^[16] At 12 months, participants in the higher

protein and low-carbohydrate diet experienced great reduction in triacylglycerol levels but fewer declines in HDL cholesterol levels compared with the low-fat group. In addition, Farnsworth^[17] and Skov^[18] found a significant decrease in triacylglycerols with higher-protein diets, whereas Parker found a significantly lower LDL cholesterol level with a higher-protein diet. It is known that low-fat, high-carbohydrate diets reduce LDL if substituted for saturated or trans fats, but these diets also reduce HDL levels and raise fasting triacylglycerols.^[19] Recently, Kelemen et al reported that a higher consumption of vegetable protein was associated with a significantly decreased CHD mortality compared with equivalent amount of energy from carbohydrates or animal protein in the Iowa Women's Health Study.^[20]

Vegetarian versus Non Vegetarian sources of protein for CVD

According to Campbel, casein is 5-fold more atherogenic than soy protein during a 6-month feeding period^[21] possibly because casein intake increases cholesterol levels, whereas soy protein decreases cholesterol levels in the serum or possibly because of uncharacterized ingredients that accompany these proteins.^[22,23] Terpstra proposed that cow milk-derived lactalbumin increases atherosclerosis >2-fold over corn- or wheat-derived protein.^[24] Terpstra also proposed that animal protein from 12 different sources elevated cholesterol levels compared with 11 kinds of plant-derived protein, thus making it likely that these effects translate to other animal- and plant-based proteins.^[21] Higher intakes of poultry, fish, and nuts were instead associated with lower risk.

Red Meat and Beef

In a study^[25] done by Fraser GE higher beef consumption was significantly associated with increased risk of fatal ischemic heart disease in men but not in women. In a case-control study^[26] it was seen that higher meat and butter consumption was associated with increased risk of myocardial infarction in women. In the Iowa Women's Health Study, higher consumption of red meat was significantly associated with increased CHD mortality.^[28] Frequent consumption of processed meat has been consistently shown to increase the risk of diabetes in prospective studies.^[29]

Poultry and fish

In the Nurses' Health Study²⁷, consumption of poultry/fish and low-fat dairy products was associated with a lower risk. Whereas consumption of red meat and high-fat dairy products was associated with increased risk of CHD. A recent meta-analysis indicates that frequent intake of fish is associated with reduced risk of coronary death.^[30] and also a decreased risk of ischemic stroke.^[31] Similarly, Huet al found that intake of poultry or fish was associated with a significantly decreased risk of CHD.^[27]

Egg

In the Nurses' Health Study and Health Professionals' Follow-up Study, consumption of one egg per day was not significantly associated with risk of either CHD or stroke.^[32] However,

among diabetic patients, even moderate consumption of eggs and cholesterol was associated with significantly increased CHD risk. ^[33]

Dairy products

Recently, the Coronary Artery Risk Development in Young Adults study reported a strong inverse association between dairy consumption and insulin resistance syndrome among young obese adults. ^[34] In the Health Professionals' Follow-up, a modest inverse association was found between dairy consumption, primarily low-fat dairy, and risk of type 2 diabetes. ^[35] In the Nurses' Health Study, the ratio of high-fat dairy to low-fat dairy product consumption was positively associated with the risk of CHD. ^[27]

Nuts

Wien et al have shown that the substitution of nuts for carbohydrates improves insulin sensitivity and blood lipids and facilitates weight loss. ^[38] This further helps in maintaining the cardiovascular health.

Soy

A meta-analysis of 38 controlled feeding studies in humans done by Anderson JW et al suggested that substitution of soy protein for animal protein significantly decreased total and LDL cholesterol levels. ^[39] However, the effects of soy protein and isoflavones on blood cholesterol in humans are highly variable, and overall effects appear to be modest. ^[40]

Legumes

Legumes are valued worldwide as a sustainable and inexpensive meat alternative and are considered the second most important food source after cereals. Legumes are nutritionally valuable, providing proteins (20–45%) with essential amino acids, complex carbohydrates ($\pm 60\%$) and dietary fibre (5–37%). Legumes also have no cholesterol and are generally low in fat, with $\pm 5\%$ energy from fat, with the exception of peanuts ($\pm 45\%$), chickpeas ($\pm 15\%$) and soybeans ($\pm 47\%$) and provide essential minerals and vitamins. Research has shown that most of the bioactive compounds in legumes possess antioxidant properties, which play a role in the prevention of some cancers, heart diseases, osteoporosis and other degenerative diseases. Bazzano et al found a significant inverse relationship between legume consumption (including peanuts) and risk of CHD. ^[37] It is claimed that including legumes in a health-promoting diet is important in meeting the major dietary recommendations to improve the nutritional status of undernourished as well as over nourished individuals, and to reduce risk for chronic diseases such as cardiovascular disease, diabetes mellitus and cancer. ^[41] Over-nutrition and obesity are associated with increased risk of non-communicable diseases such as diabetes, ischaemic heart disease, stroke, and hypertension. ^[42,43] Legumes phytochemicals such as carotenoids and tocopherols may prevent the risk of CVD. The promising link between the intake of leguminous foods and reduced risk of CVD and CHD has been reported in several prospective cohort studies. Antioxidant properties of natural antioxidants present in legumes may attribute in part to lower incidence of degenerative CVD. The

antioxidant effect may counteract oxidative stress-induced endothelial dysfunction and platelet aggregation, which are two key causes of CVD. ^[44] A number of dietary agents, including soluble fibres and plant sterols lower cholesterol levels in serum. Plant sterols inhibit cholesterol absorption and viscous fibers increase bile acid excretion. ^[45] Legumes are loaded with fiber and provide a good mix of water soluble and insoluble fibers. The soluble-fiber is known to have a cholesterol-lowering effect and thereby can decrease risk of cardiovascular diseases. ^[46] High levels of homo-cystine damage the walls of the arteries; and vitamin B6 and folic acid aid in lowering the levels of homocystine, which in turn can reduce the risk of stroke, heart attack or vascular disease. ^[47] Since Legumes contain high levels of antioxidants, vitamin B6, folic acid and are fairly good sources of thiamin and niacin, they are helpful in reducing the risk of cardiovascular diseases.

The low glycemic index values of legumes means that they are less likely to raise blood glucose and insulin levels, which may also decrease cardiovascular disease risk. ^[48]

Conclusion

Cardio vascular diseases are on a rise and researchers are finding ways of tackling this menace from every angle possible. Protein, as we know is an essential part of our diet. Although in order to reduce the risk factors of developing cardio vascular diseases, it has been proven that exchanging protein for carbohydrate significantly reduced LDL cholesterol and triacylglycerol levels and increased HDL, where less amount of protein is increased in comparison to carbohydrate which is removed. The combination of high protein and low-carbohydrate and low fat diet is the best to maintain heart health.

Although it has been proven that proteins of animal origin are hypercholesterolemic and atherogenic and higher consumption of vegetable protein is associated with a significantly decreased CHD mortality which brings us to the conclusion that one should opt for vegetable sources of protein.

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