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Association of Dietary Factors in Hyperlipidemia - A Review

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ABSTRACT

Hyperlipidemia is characterized by an elevation of lipid profile and/or lipoproteins in the serum or blood. Raised cholesterol is one of important influencing factor in majority of cardiovascular diseases. Diet has huge impact on this condition and certain dietary factors and hyperlipidemia are directly proportionate. Epidemiological studies carried out throughout world revealed this association. Some studies specify considerable geographic variations in the incidences of hyperlipidemia. However the variations in hyperlipidemia incidences at different populations might be due to their dietary variations. Higher intakes of carbohydrates possibly increase the risk of hyperlipidemia. Green tea has found significant action on increasing level of high density lipoprotein together with a decreasing low and very low lipoprotein cholesterols. Current attempt has been made to establish an association between dietary factors and the manifestation of hyperlipidemia. These studies were limited to a few in numbers and results obtained can be considered as lead for further well stratified studies to confirm the findings as well as to bring into light certain new facts about the relation between dietary factors and hyperlipidemia.

KEYWORDS

Cholesterol, Dietary factor, Hyperlipidemia, Nutrition

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Due to growing modernization and lifestyle changes throughout the globe, people are deprived of good health. Various lifestyle diseases are increasing alarmingly, carrying bad impact on health. Substantial proportions of global disease burden are attributable to various major risk factors and raised total cholesterol is one among such factors leading to cardiovascular disorders in both developing and developed countries.^[1] Hyperlipidemia is a medical condition characterized by an elevation of any or all lipid profiles and/or lipoproteins in the blood.^[2] Hyperlipidemia as a result of genetic problems is referred as primary while arises as a result of other underlying diseases called as secondary hyperlipidemia. It has significant influence on atherosclerosis and considered as one of the main risk factor for cardiovascular diseases.^[2] It is specifically characterized by alterations occurring in serum lipid and lipoprotein profile factors like Total cholesterol, Triglycerides, HDL, LDL and VLDL. Elevated serum cholesterol is a modifiable risk factor that is associated with an estimated 4.4 million deaths each year and accounts for a considerable proportion of ischemic strokes and heart disease worldwide.^[3] Global variations in the prevalence of elevated cholesterol among patients with history of hyperlipidemia are associated with country-level economic development and health system indices.^[4] In 2008, the global prevalence of raised total cholesterol among adults (≥ 5.0 mmol/l) was 39% (37% for males and 40% for females). The prevalence of elevated total cholesterol was highest in the WHO Region of Europe (54% for both sexes), followed by the WHO Region of the Americas (48% for both sexes). The WHO African Region and the WHO South East Asian Region showed the lowest percentages (22.6% for AFR and 29.0% for SEAR).^[5] Prevalence of Coronary Artery Diseases (CAD) rises with increase in cholesterol and triglyceride levels.^[6] Hypertriglyceridemia is found to be an independent risk factor for major coronary events after controlling for low-density lipoprotein (LDL) and high-density lipoprotein (HDL) cholesterol. Hypertriglyceridemia combined with elevated LDL cholesterol and high LDL: HDL cholesterol ratio (>5) increased the Coronary Heart Diseases (CHD) event risk by approximately six folds.^[7] The prevalence of abnormal lipid profile was observed to be higher in males than in females. The increase of prevalence of hypercholesterolemia and hypertriglyceridemia was more prominent in 31-40 age group than in $<$ or $=30$ age group.^[8] Few research articles are reported on effectiveness of dietary changes on serum lipids and cardiovascular diseases.^[9,10,11] This article attempts to review such published articles focused on dietary factors and their relation with lipid levels.

Association with major food groups

Consumption of vegetables and fruits

Flavonoids from *Embllica officinalis* and *Mangifera indica* effectively reduce lipid levels in serum and tissues of hyperlipidemia induced in rats.^[12] Cross-sectional studies revealed that consumption of fruits and vegetables are inversely related to LDL-

cholesterol concentrations in men and women, independent of age, Keys score, smoking status, exercise, educational attainment, and use of vitamin supplements. Subjects in the highest fruits and vegetable intake groups had LDL concentrations \approx 6–7% lower than those in the lowest fruits and vegetable intake groups.^[13]

Consumption of flesh foods and egg

Consumption of 4 egg yolks/day for 5 weeks benefited serum HDL cholesterol increased without an increase in LDL cholesterol in patients taking cholesterol-lowering statins.^[14] Reduction of triglycerides by 0.19 mmol/L (16.8 mg/dL) by adding 6 eggs to the diet and reduction of triglycerides by 0.09 mmol/L (7.97 mg/dL) by adding 2 eggs was observed to the usual diet.^[15,16]

Consumption of Tea and Coffee

Tea and tea catechins are well documented to improve exogenous hyperlipidemia.^[17,18] One research reported that powdered green tea has a hypolipidemic activity in hepatoma bearing rats.^[19] Green tea catechins are reported to lower liver and aortic cholesterol in the cholesterol-fed rabbit by lowering cholesterol synthesis and up regulating the hepatic LDL receptor.^[20] One cross sectional study has reported an inverse association with increased consumption of green tea and decreased serum concentrations of total cholesterol ($P<0.001$) and triglyceride ($P=0.02$) and an increased proportion of high density lipoprotein cholesterol together with a decreased proportion of low and very low lipoprotein cholesterols ($P=0.02$), which resulted in a decreased atherogenic index ($P=0.02$).^[21] Decrease in mean serum cholesterol with increasing tea consumption where the linear trend coefficient corresponded to a difference of 9.3 mg/dl in men and 5.8 mg/dl in women between drinkers of less than one cup and those of five or more cups/day.^[22]

Consumption of 720 mL/d of filtered, caffeinated coffee leads to a statistically significant increase in the plasma level of total cholesterol ($P=0.001$), which appears to be due to increase of both low-density lipoprotein ($P=0.04$) and high-density lipoprotein cholesterol ($P=0.03$) levels.^[23] Drinking filtered coffee does not affect serum lipid levels but boiled coffee has an effect on serum cholesterol levels amounting to a mean net increase of 10 percent of the base-line level after nine weeks of consumption.^[24]

Role of dietary constituents

Carbohydrate

Low carbohydrate diet (<20g daily) decreased S. triglyceride level and increased HDL on comparison with low fat diet (<30% energy from fat, <300mg of cholesterol daily) administered for 24 weeks.^[25]

Fiber

Randomized crossover study reported that high-fiber diet reduced total cholesterol ($P=0.003$), total: HDL cholesterol ($P=0.001$), LDL: HDL cholesterol ($P=0.015$) on sixty-eight hyperlipidemic adults consumed a test (high-fiber) and a control low-fat (25% of energy), low-cholesterol (<150 mg/d) diet for 1 month each.^[26]

Proteins

Human blood cholesterol level was altered due to substitution of dietary protein for carbohydrate. It significantly ($P<0.02$) reduced mean plasma LDL cholesterol in normal and hyperlipidemic people. It significantly increased mean fasting plasma HDL cholesterol ($P<0.01$) and reduced fasting total triglycerides by in hyperlipidemic peoples ($P<0.05$).^[27] Few smaller studies suggest that increasing dietary protein intake at the expense of carbohydrate may be useful in improving lipid profile in normolipidemic and hyperlipidemic subjects.^[28,29] In meta-analysis, consumption of soy protein rather than animal protein significantly decreased serum concentrations of total cholesterol, LDL cholesterol and triglycerides.^[30] Several studies provide evidence in improvement of lipid profile due to Soy protein intake.^[31,32,33]

Fats

The effects of dietary fats on total: HDL cholesterol may differ markedly from their effects on LDL. The effects of fats on these risk markers should not in themselves be considered to reflect changes in risk but should be confirmed by prospective observational studies or clinical trials. By that standard, risk is reduced most effectively when trans fatty acids and saturated fatty acids are replaced with *cis* unsaturated fatty acids.^[34]

Sugar

Fructose consumed in moderate to high quantities in the diet increases plasma triglycerides.^[35] A review of 77 published manuscripts evaluating the clinical effect of fructose consumption on blood lipids suggest that intake of normal amounts of fructose has the same effect on tryglyceride. There is no evidence to suggest that ingestion of fructose at levels approaching 95th percentile levels of intake has adverse effects on serum TG in overweight or obesity subjects.^[36]

Vitamins

Antioxidant vitamins C and E therapy in children with heterozygous familial hyperlipidemia independent of the degree of dyslipidemia has found insignificant differences in lipid profile.^[37] Treatment with antioxidant vitamins (vit C and E) should not be recommended for treatment of hypercholesterolemia.^[38]

Body Mass Index (BMI)

BMI has good relationship with cardiovascular risk factors like hyperlipidemia.^[39] A national survey of adults in united state revealed the prevalence of high blood cholesterol and mean levels of cholesterol were higher at BMI levels over 25 rather than below 25 but did not increase consistently with increasing BMI. Rates of low HDL-C increased and mean levels of HDL-C decreased as levels of BMI increased.^[40]

CONCLUSION

Available literature clearly reveals the impact of dietary factors and hyperlipidemia. Higher intake of carbohydrates possibly increases the risk of hyperlipidemia. BMI plays an important role in the causation of hyperlipidemia. Green tea have found definite action on increasing level of high density lipoprotein together with a decreasing low and very low lipoprotein cholesterol resulted decrease in atherogenic index. Importance of other factors including egg, coffee, antioxidant vitamins and sugar are not yet clear due to insufficient evidences and inconsistent results. These studies were limited to a few in numbers and their varying results give rise to a need of more extensive studies in this direction. Results obtained can be considered as lead for further well stratified studies to confirm the findings as well as to bring to light new facts about the relation between dietary factors and hyperlipidemia. Exercise and suitable regulated diet that will check the levels of lipids and help to bring at normal level.

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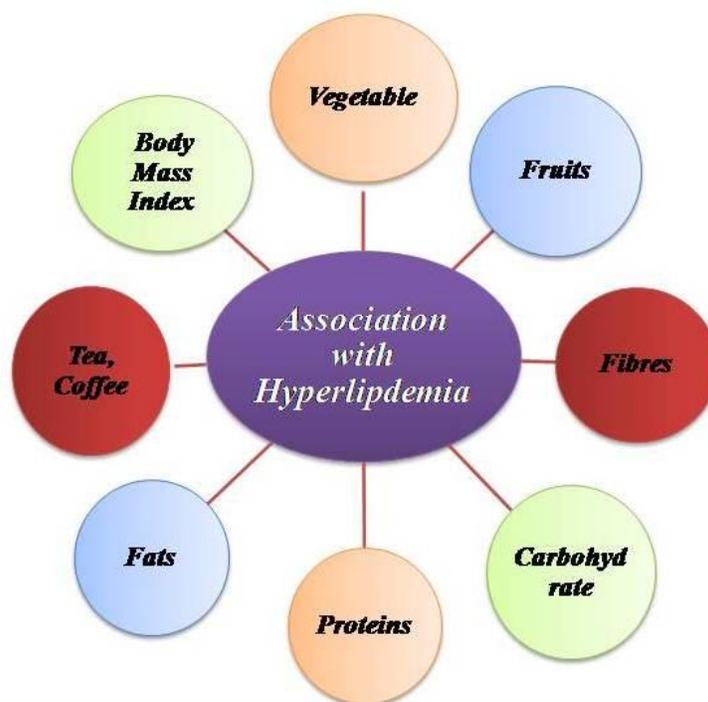
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GRAPHICAL ABSTRACT



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