

EFFECT OF TEA CONSUMPTION ON BLOOD LIPID PROFILE IN HUMAN

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Abstract: The effect of tea consumption on blood lipid profile and antioxidant status in humans was carried out at the department of Food Science and Nutrition, Aspee college of Home Science, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, on 34 subjects residing at the Sardarkrushinagar, dist. Banaskantha, Gujarat.

Subjects were divided into two groups, experimental group and control group. Experimental group consist of 22 subjects and control group with 12 subjects. Experimental group consisted of volunteers whose daily intake of black tea was more than 3 cups per day whereas; the control group (placebo group) was non tea drinkers. Overnight fasting blood samples were collected and analyzed for lipid profile (Total Cholesterol, Triglycerides, LDL-cholesterol and HDL-cholesterol) in tea drinkers and non tea drinkers.

The result of plasma total cholesterol concentration among tea drinkers (169.28 mg %) was non significantly reduced than non tea drinkers (176.65 mg %). The reduction of plasma total cholesterol concentration among tea drinkers was –3.9per cent than non tea drinkers.

The result of plasma triglycerides concentration among tea drinkers (147.56 mg %) was non significantly reduced than non tea drinkers (160.78 mg %). The reduction of plasma triglycerides concentration among tea drinkers was –8.1per cent than non tea drinkers.

The result of plasma LDL-cholesterol concentration among tea drinkers (86.54 mg %) was significantly reduced than non tea drinkers (100.96 mg %). The reduction of plasma LDL-cholesterol concentration among tea drinkers was –14.0 per cent than non tea drinkers.

The result of plasma HDL- cholesterol concentration among tea drinkers (82.91 mg %) was significantly increased than non tea drinkers (75.68 mg %). Increased of plasma HDL-cholesterol concentration among tea drinkers was –9.3per cent than non tea drinkers.

Keywords: Tea consumption, blood lipid, Human body.

Introduction

Tea, a drink brewed from the dried leaves of *camellia sinensis*, is the most frequently consumed beverage in the world apart from water (Graham *et al.*, 1992). Tea is complex substance containing polyphenols, alkaloids (caffeine, theophylline and theobromine), amino acids, carbohydrates, protein, chlorophyll, volatile compounds, fluoride, minerals and trace elements. Among these, the polyphenols constitute the most exciting group of tea leaf components which exhibit powerful antioxidant activity in vivo and vitro (Wu *et al.*, 2002).

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Antioxidants such as vitamin 'C', 'E' and 'A' range of other plant compounds such as the flavonoids are considered as beneficial compounds (Nijveldt *et al.*, 2001). The major tea catechins are (-)-epigallocatechin gallate (egcg), (-)-epigallocatechin (egc), (-)-epicatechingallate (ecg), (-)-epicatechin (ec) (Ho *et al.*, 1992). A typical cup of tea contains around 140 mg total flavonoids of which 10 mg are catechins; 15 mg of theaflavins and the rest are mainly complex thearubigins (Lakenbrink *et al.*, 2000). The flavonoids in which tea extracts are particularly rich are known to be scavengers of reactive oxygen species (ROS) and free radicals (Bors and Saran *et al.*, 1987). Tea has been considered a medicine and a health beverage since ancient times, but recently it has received a great deal of attention because tea polyphenols are strong antioxidants. Oxidative stress has been shown to be involved in the pathogenesis of numerous diseases, including cancer (Feng *et al.*, 2001, Embola *et al.*, 2002). Tea is also a rich source of flavonoids that constitute 33 % by dry weight of tea. Flavonoids are a large group of phenolic products of plant metabolism with a variety of phenolic structures that have unique biological properties. Flavonoid found in tea shows 20 times more powerful antioxidant activity than vitamin C (Vinson *et al.*, 1995, Craig *et al.*, 1999). Several studies suggest that green and black tea drinking may offer a protection for cardiovascular disorders (CVD). The protection seems to increase with the volume of tea consumed daily (Nakachi *et al.*; 2000). An increase in daily tea drinking of 711 ml was reported to reduce the risk of myocardial infarction by 11% (Peters *et al.*; 2001). Most of the reported studies that examined the effect of green tea drinking in lipid risk factors for CVD have been performed in animals. Considering the importance of tea drinking in human dietary habits worldwide and the high prevalence of CVD, the present research was carried to evaluate the effects of tea drinking on lipid risk factors associated with CVDs.

Materials and Methods

A study determining the effect of tea consumption on blood lipid profile and antioxidant status in humans was carried at the department of Food Science and Nutrition, Aspee college of Home Science, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, district: Banaskantha.

In the present study, enrolled subjects were residing at the Sardarkrushinagar Dantiwada (district: Banaskantha). Basic information, anthropometric measurements, medical history and their dietary pattern were obtained through questionnaire method.

Required analytical tests were performed at the laboratory, Aspee College of home science Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar.

Total 34 male selected ages between 35 to 50 years, took part in the present study. The volunteers were divided into two groups. First group *i.e.* Tea drinkers (>3 cups per day) consist of 22 subjects and the second group *i.e.* non tea drinkers of 12 subjects. Subjects were randomly allotted to either of group. All the volunteers were informed about the purpose and detailed procedure of the experiments.

The tea consumed is always brewed in a teapot and consumed in small teacups (100 mleach). Because of the standard tea preparation and drinking among the population, the survey asked participants to report how many cups of tea usually drank per day.

Table1: Characteristics of the subjects

Group	Treatment	Number of subjects
Experimental	Tea drinkers	22
Control	Non tea drinkers	12

Diet Instruction

One week dietary records of all the subjects were obtained prior to baseline measurements. All subjects were instructed to maintain usual dietary habits throughout the study and to complete one week dietary records, which were to be returned at baseline and during the experimental periods.

Biochemical Estimation

12 to 14 hours fasting blood samples were collected in EDTA vial from each subject by venipuncture. The blood samples were centrifuged at 3000 rpm for 10 minutes to separate the plasma. Plasma was transferred into another tube and stored in refrigerated at 4°C for biochemical estimations. The Following biochemical estimations were carried out by using diagnostic kit method (Accucare™ Enzymatic Colorimetric Test).

Sample: EDTA plasma.

1. Total cholesterol

Plasma total cholesterol was analyzed by using autokit method supplied by Accucare™ based on the method given by Tietz *et al.* (1973).

2. Triglycerides

Plasma triglyceride was analyzed by using autokit method supplied by Accucare based on the method given by Buccolo *et al.* (1973).

3. Low Density Lipoprotein (LDL)

Plasma Low Density Lipoprotein (LDL) was analyzed by using autokit method supplied by Accucare based on the method given by Okada *et al.* (1996).

4. High Density Lipoprotein (HDL)

Plasma High Density Lipoprotein (HDL) was analyzed by using autokit method supplied by Accucare based on the method given by Natio *et al.* (1984).

Statistical Analysis

The data pertaining to various characters were subjected to statistical analysis on computer at Computer Laboratory of Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar.

In the present study lipid profile (Total cholesterol, Triglycerides, HDL-c and LDL-c) of tea drinkers were compared with non tea drinkers by two sample 't' test.

Results and Discussion:-

The results for total cholesterol and triglycerides are presented in table 2 and discussed as under in different heads.

Table 2: Results of plasma total cholesterol & plasma triglycerides

Subjects	Numbers	Plasma Total Cholesterol (mg %)	Plasma Triglycerides (mg %)
Tea drinkers	22	169.28 ± 12.12	147.56 ± 20.40
Non tea drinkers	12	176.65 ± 9.94	160.78 ± 16.80

Values are mean ± S.D.

Significant difference between tea drinkers and non tea drinkers at 5 per cent level ($p \leq 0.05$).

Plasma Total Cholesterol

Cholesterol is present in tissues, in serum and plasma either as cholesterol or as cholesterol esters bound to proteins. Cholesterol is an essential structural component of cell membranes and outer layer of plasma lipoproteins and is the precursor of all steroid hormones, including sex and adrenal hormones, bile acids and vitamin 'D'. Cholesterol measurements are used to evaluate the risk of developing coronary artery occlusion, atherosclerosis, myocardial infarction and cerebrovascular disease. Coronary atherosclerosis correlates with a high cholesterol level. Cholesterol concentrations are increased in primary hypercholesterolemia; secondary hyperlipoproteinemia, including nephritic syndrome; primary biliary cirrhosis; hypothyroidism and in some cases diabetes mellitus. Low cholesterol concentrations may be found in malnutrition, malabsorption, advanced malignancy and hyperthyroidism. Serum

cholesterol concentration depends on many factors including age and gender (Tietz *et al.*, 1987). It is the major core lipid of LDL and HDL. Normal value of total cholesterol is <200 mg/dl, above 200 mg/dl is borderline, high risk for coronary heart disease and therefore, this parameter is studied in the present study.

The result of plasma total cholesterol concentration among tea drinkers (169.28mg %) was non significantly reduced than non tea drinkers (176.65mg %). The reduction of plasma total cholesterol concentration among tea drinkers was -3.9 per cent than non tea drinkers.

The result of the study is in accordance with the findings reported by Maureen *et al.* (2003) they have studied that black tea reduces cholesterol. Total cholesterol, HDL ('good') cholesterol, LDL ('bad') cholesterol and several other lipid levels associated with risk of heart disease were measured at the end of each treatment phase during the study. Total cholesterol levels were 3.8 per cent lower after black tea consumption than after placebo and 6.5 per cent lower than after placebo plus caffeine. LDL-cholesterol levels in tea drinkers were 7.5 per cent lower than in those receiving placebo and 11.1per cent lower than in those receiving placebo plus caffeine.

Plasma Triglycerides

Triglycerides, fatty acid esters of glycerol, represent the major form of fat found in the body; their primary function is to store and provide cellular energy. The concentration of triglycerides in the plasma at any given time is a balance between the rates of entry and removal. Triglycerides are the major lipid in chylomicrons and VLDL (very low density lipoproteins) and serves as energy substrate in liver and peripheral tissues, particularly muscles. Excess energy is stored as triglyceride in adipose tissue. Triglyceride levels in the plasma vary with the age and gender. Moderate increases occur during growth and development. Triglycerides are used for the evaluation of hyperlipidemia; high concentrations may occur with hyperthyroidism, nephrotic syndrome, glycogen storage diseases and diabetes mellitus. Extremely high triglycerides concentrations are common in acute pancreatitis (Tietz *et al.*, 1987). The desirable value of triglyceride is 60 to 165 mg/dl. When triglyceride level is >165 mg/dl, it is known as hypertriglyceridemia, which is a risk factor for atherosclerosis. When serum triglyceride and serum total cholesterol levels are higher than this condition is known as mixed hyperlipidemia.

The result of plasma triglycerides concentration among tea drinkers (147.56 mg %) was non significantly reduced than non tea drinkers (160.78 mg%). The reduction of plasma triglycerides concentration among tea drinkers was -8.1 per cent than non tea drinkers.

The result of the study are in accordance with the findings reported by Alipoor *et al.* (2003) examined that the effect of total and different fractions of Iranian black orthodox tea on blood lipid profile in type-1 diabetic rats. Triglyceride was reduced in total extract received diabetic group ($p < 0.01$). Twenty per cent fraction of black tea significantly decreased triglyceride ($p < 0.01$), total cholesterol ($p < 0.01$) and LDL cholesterol ($p < 0.01$) more than other groups.

Low Density Lipoprotein Cholesterol (LDL-Cholesterol)

The results for LDL and HDL cholesterol are presented in table 3 and discussed as under in different heads.

Table 3: Results of plasma low density lipoprotein and plasma high density lipoprotein

Subjects	Numbers	Plasma Low Density Lipoprotein (mg %)	Plasma High Density Lipoprotein (mg %)
Tea drinkers	22	86.54 ± 9.74	82.91 ± 7.40
Non tea drinkers	12	100.96 ± 8.36	75.68 ± 9.56

Values are mean ± S.D.

Significant difference between tea drinkers and non tea drinkers at 1 per cent level ($p \leq 0.01$).

LDL carries most of the cholesterol in the tissues. High levels of LDL – cholesterol can form harmful deposits called plaques, which can block blood flow. This condition is known as atherosclerosis. High levels of LDL cholesterol have been determined to be associated with an increased risk of heart attack therefore; it is called ‘bad cholesterol.’ normal value of LDL – cholesterol is < 100 mg/ml.

The plasma LDL-cholesterol level of tea drinkers (86.54 mg %) was significantly reduced than non tea drinkers (100.96mg %). The reduction of plasma LDL-cholesterol concentration among tea drinkers was –14.0 per cent than non tea drinkers. Thus, the result indicated that the drinking more than 3 cups of tea per day reduced LDL-cholesterol concentration as compared to non tea drinkers.

The results of the study are in accordance with the findings reported by Davies *et al.* (2003) studied that the black tea consumption reduces total cholesterol and low density lipoprotein cholesterol concentrations in mildly hypercholesterolemia adults. 5 servings per day of black tea reduced total cholesterol 6.5 per cent, LDL cholesterol 11.1 per cent, apolipoprotein b5 per cent and lipoprotein (a) [lp (a)] 16.4 per cent compared to the placebo with added caffeine. Compared to the placebo without added caffeine, total cholesterol was reduced 3.8 per cent LDL cholesterol was reduced 7.5 per cent.

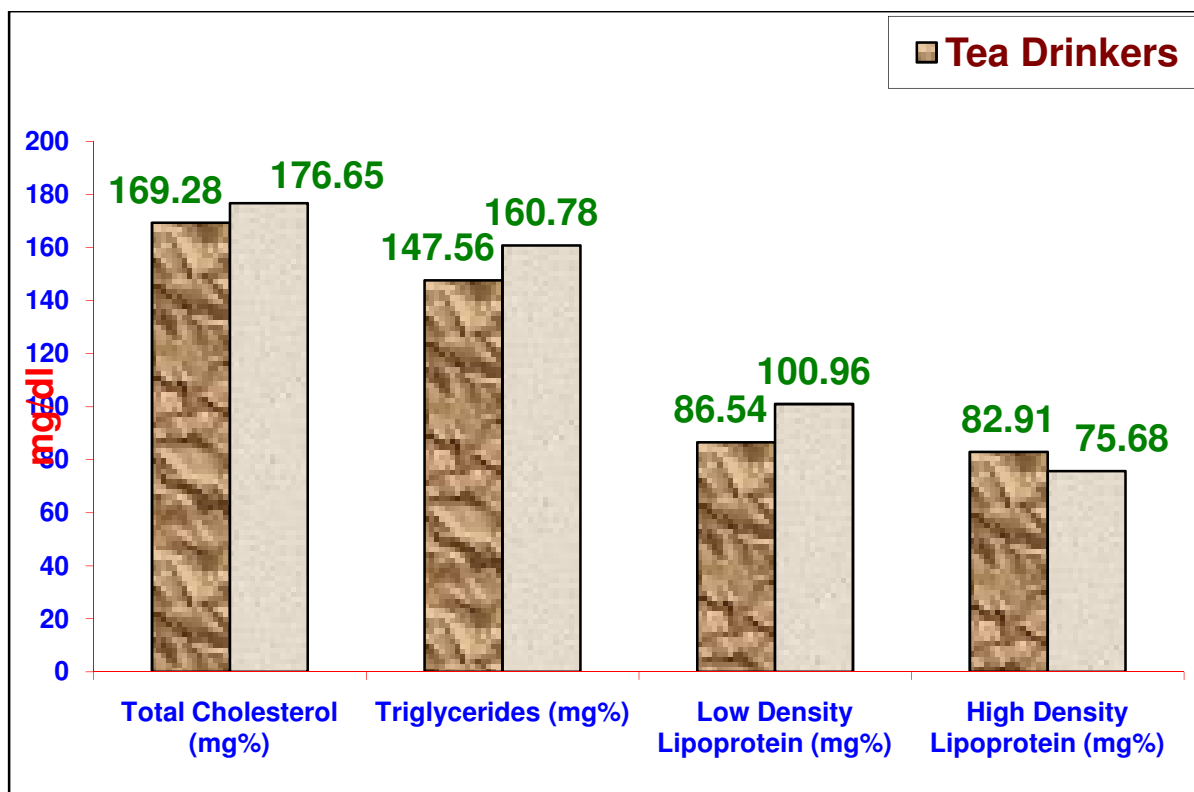
High Density Lipoprotein Cholesterol (HDL – Cholesterol)

HDL carry cholesterol away from the arteries and back to the liver, which it is destroyed or recycled. So, this cholesterol is called ‘good cholesterol.’ The normal value of HDL – cholesterol is >50 mg/dl. Less than 35 mg/dl is a major factor for heart disease. HDL – cholesterol is used to evaluate the risk of developing coronary heart disease (CHD). The risk of CHD increases with lower HDL cholesterol concentrations.

The significantly increased of plasma HDL–cholesterol level of tea drinkers (82.91 mg %) than non tea drinkers (75.68 mg %). Increase plasma HD–cholesterol level among tea drinkers was -9.3 per cent than non tea drinkers. Thus, the result indicated that the drinking more than 3 cups of tea per day increased HDL–cholesterol concentration as compared to non tea drinkers.

The study showed that the effects of drinking green tea on cardiovascular and liver diseases. Increased consumption of green tea was associated with decreased serum concentrations of total cholesterol ($p \leq 0.01$) and triglyceride ($p \leq 0.01$) and an increased proportion of high density lipoprotein cholesterol together with a decreased proportion flow and very low lipoprotein cholesterol ($p \leq 0.01$), which resulted in a decreased atherogenic index ($p \leq 0.01$) (Imai *et al.*, 1995).

FIG. 1: LIPID PROFILES AMONG TEA DRINKERS AND NON TEA DRINKERS



Summary and Conclusion

In conclusion, the present findings clearly demonstrated that the tea consumption more than 3 cups of tea per day had potential to reduce serum total cholesterol, triglycerides, LDL, blood LPO level and increased the HDL level. Therefore, it can be concluded that the regular consumption of tea an active cholesterol reducing agent, if taken as a part of meal could exert hypocholesterolemic effect which in turn reduced the risk of Coronary Vascular Disease (CVD), especially atherosclerosis.

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