Evaluation of Green Tea on Lipid Profile of Hypercholesterolemic Patients: A Case Study

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Summary

Purpose: The aim of this study was to investigate the effects of green tea supplementation on the lipid profile of hypercholesterolemic subjects: A case study

Method: 32 hypercholesterolemic subjects were selected comprises of 23 male & 07 female of age between 35-60 yrs. The acceptability of green tea was ranked out using 9-point hedonic scale. Chemical analysis of green tea sample was also done to estimate the polyphenols, tannin and caffeine content and it was found to be 10.2, 16.5 and 3.5 grams respectively. The subject taken was divided into two groups experimental and control. 3 cups of green tea (200ml each) per day was supplemented to experimental group for 30 days. General information such as age, educational status, income group, activity, disease history, dietary pattern etc was collected from a questionnaire. The subjects belonging to experimental group also did daily record of food intake. To estimate the effect of green tea on hypercholesterolemia subjects the anthropometric and of lipid profile analysis before and after supplementation was done.

Results: No significant difference in height, weight and BMI was observed after supplementation. The significant reduction in total cholesterol and LDL levels in experimental subject was observed after supplementation. There was a reduction of 8.36% and 15.6% was observed in total cholesterol and LDL cholesterol levels of subject respectively.

Conclusion: The results suggest that we can recommend the moderate use of green tea in daily routine life to treat or prevent hypercholesterolemia to some extents.

Key words: Green tea, Cholesterol, Polyphenol, Flavonoids, Caffeine, Anthropometric.

Introduction

High plasma cholesterol has been ranked as one of the greatest risk factors contributing to prevent the prevalence and severity of coronary heart disease. Having too much cholesterol in blood is not a disease in itself but can lead to various heart problems like atherosclerosis and

increases the risk of other heart disease and heart attacks. Atherosclerosis is the harding and narrowing of arteries in the major vascular systems. Increasing trends of physical inactivity due to white collar occupation and passive recreation promote obesity, atherosclerosis and one of those is hypercholesterolemia. Increased fat intake elevates total and lipoprotein cholesterol (1,2,3) which is a prerequisite risk factor for the development of heart diseases. Lipid profiles are risk indicators of coronary heart disease (4). Strong correlations have been shown between increased plasma total cholesterol, low density lipoprotein and increased incidence of coronary heart disease (5, 6).

Food containing natural occurring phytochemical is still the best health insurance. Flavonoid is a large class of phytochemicals also called polyphenols. Polyphenols are colourless and water soluble compounds, contributing to astringency and bitterness of flavour. Polyphenols have recently attracted attention because of their physiologic activity. Many foods like garlic, ginger, citrus fruits, soy, some medicinal plants, herbs etc. contains these antioxidant in abundant. Green tea, long consumed in Asian countries, contains low-molecular weight polyphenols consisting mainly of flavanol monomers. Tea polyphenols inhibit the oxidation of LDL and thus play role in preventing or slowing the development of coronary heart diseases (7). It have also a variety of pharmacological effects such as antioxidative(8), antimutagenic (9), anticarcinogenic (10), anticancer promoting (11), anti-inflammotry and hypolipidemic effects (12). Catechin the major component of green tea extract reduces the body fat in humans (13). Excess of cholesterol in blood seem to cause atherosclerosis .

Tea flavonoids are potent antioxidant that are absorbed from the gut after consumption and significantly increase the antioxidant capacity of the blood (14).One of the green tea polyphenols epicatechin was found to be able to significantly inhibit the production of thromboxane, one of the compound required for platelets aggregation (15). Catechins with a galloyal moiety may prevent hypertriglycerolemia (16) and inhibit tumour cell productions as well as promote the destruction of leukaemia cells.

Caffeine in tea is essential for the characteristic good taste of tea and gets readily bound with the polyphenols in tea and consequence remains unabsorbed into the digestive tract. Caffeine has synergistic effect with Ibuprofen in relieving pain. If regular caffeine is stopped abruptly, symptoms such as headaches, irritability and fatigue may occur (17).

Tannin is an astringent, soluble polyphenolic compound of plant origin that binds and precipitates proteins and various organic compound including amino acids and alkaloids. Tannins have shown potential antiviral (18), antibacterial (19) and antiparasitic effects (20). In a study it was found that the tannins isolated from the stem bark also have anti-inflammatory and antiulcer activity in rodents showing a strong antioxidant property with possible therapeutic application (21).

In the present time, chronic and degenerative diseases have become frequent even in developing countries due to lot of calorie intake sans vitamins, minerals and antioxidants. Following this as a guiding factor in present research endeavor we here tried to evaluate

scientifically the effect of green tea supplementation on serum cholesterol and HDL LDL & triglyceride levels in hypercholersteremic subjects.

EXPERIMENTAL

Green tea sample

The sample was purchased from the commercial market of of Surat (Gujrat). The brand name of selected sample was "D'ling"-the pure Darjeeling Blend manufactured by Wagh Bhagri Ltd.Packed and marketed by Gujrat tea processor and packer Ltd vipul estate Khokhara, Ahemedabad.

Selection of subjects

The study was conducted on the residential area of Kribho township Surat ,Gujrat. 30 hypercholesterolemic subjects of age between 35-60 yrs comprising 73% males and 27% females were selected by purposive sampling method depending upon their availability and co-operation. A small seminar was conducted to inform the general information of green tea and its health benefits and they were also informed about the supplementation schedule. Sensory evaluation of tea was done to make sure of its acceptability. A questionnaire was also given to subjects to obtain general information regarding age, sex, type of activity included in clinical status, life style and dietary pattern etc. Subjects were divided into two groups experimental and control. Experimental group subjects were supplemented with green tea and no supplement was given to control group.

Chemical analysis

The three main constituents of green tea, caffeine, polyphenols and tannins were also determined & their percentage was calculated using analysed by AOAC, Folin denis and spectrophotometric method respectively. (22,23).

Anthropometric measurement of subjects

It was used to assess BMI, the body weight and heights were measured.BMI is relative body fatness to evaluate risk factors associated with obesity. It is expressed as BMI=weight (kg)/height (m^2).

Supplementation of green tea

The subject were randomly divided into two groups, each consist 15 subjects. Control groups-no supplementation and in Experimental group 3 cups of tea (200ml) per day for 30 day. Each cup containing 2.5g of green tea leaves.

Lipid profile study

To judge the impact of green tea on lipid profile was determined before and after the supplementation period. Blood sample was collected and serum was separated via

centrifugation. The separated serum was processed for lipid profile analysis. Total cholesterol, HDL-cholesterol and triglycerides were determined by different method (6,7,8).

Statistical analysis

The results of estimation of biochemical parameters are reported as mean value, standard deviation, standard error of mean and p<value 0.05 were considered statistically significant.

Results

Evaluation of background information gathered

Before supplementation, for gathering general information about life style, diet, family health and economic status etc. Subjects filled a Performa.

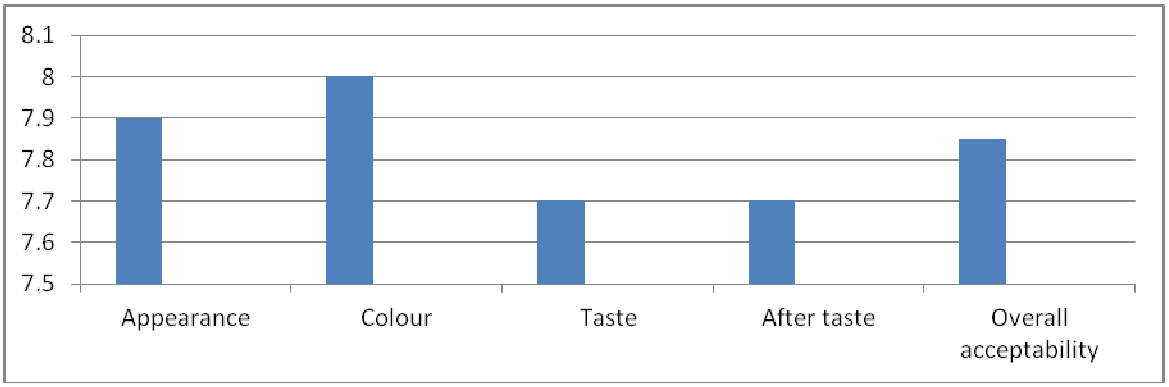
Table 1: General profile of subjects

S.No.	Characteristics	Male	Female	Total	Percentage
1.	**No. Of subjects**	22	8	30	
2.	**Age**				
	35-50yrs	12	7	19	63.3%
	50-60yrs	10	1	11	36.7%
3.	**Educational status**				
	Literate	22	8	30	100%
	Illiterate	-	-	-	-
4.	**Income**				
	<Rs.18,000	-	-	-	-
	>Rs.18,000	22	8	30	100%
5.	**Occupation**				
	Service	22	-	22	73.3%
	Non-employer	-	8	8	26.7%
6.	**Activity level**				
	Sedentary	9	-	9	30%
	Moderate	13	8	21	70%
7.	**Disease History**				
	Hypertention	10	1	11	36.6%
	Heart problem	2	-	2	6.6
	Family history of CVD	7	1	8	26.6
8.	**Personal habbits**				
	Smoking	2	-	2	6.6%
	Alcohol	8	-	8	26.6%

Organoleptic evaluation

The purpose of doing the organoleptic evaluation was to judge the acceptability of the product so that subjects can able to consume it easily for 30 days or could make it a part of normal routine diet. The product was on 9 point Hedonic scale for different attributes.

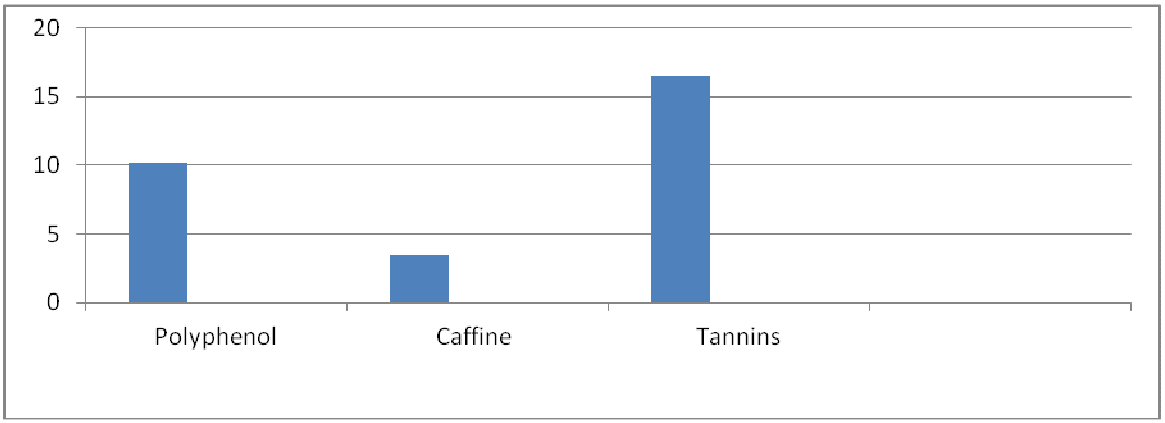
Fig 4.1: Result of organoleptic evaluation of green tea by subjects



Chemical analysis of green tea

Polyphenol, caffeine and tannin content of green tea was found to be 3.5 and 10.2g/100g respectively.

Fig 4.2: Result of chemical analysis of green tea



Evaluation of anthropometric measurement and dietary pattern of subjects

There is no significant difference in mean weight of subjects of experimental group before and after supplementation and no difference is seen in initial and final reading in each group.

Table 4.2: Mean weight and BMI of subjects before and after supplementation (mean ±SEM,n=30).

Particular	Experimental group	Control group
Height (m)		
Initial	1.62±0.08	1.63±0.05
Final	1.62±0.08	1.63±0.05
Weight (gm)		
Initial	66.6 ±12.24	70.85± 10.04
Final	65.2± 11.02	74.21± 9.10
Body Mass Index (kg/m^2)		
Initial	25.37± 4.35	26.63± 3.91
Final	24.88± 4.02	27.89± 4.45

According to BMI, 40% subjects are normal, 43.3% are overweight, 13.3% are Grade I obese and 3.3% are Grade II obese. But the mean value of BMI of both the groups falls in overweight category, both after and before supplementation schedule.

Dietary pattern of subjects:

The information regarding consumption of fat, including its type and frequency of use was also gathered through questionnaire.

Table 4.3: Pattern of fat consumption

Particular	Never	Occasionally	Daily
Ghee	61.9%	23.80%	14.3%
Butter	70%	30%	-
Cheese	78.5%	21.5%	-
Ice-Cream	6.6%	93.4%	-
Dry fruits	-	90.75%	9.24%

Table 4.4: Type of oil consumed on routine

Type of oil	No.of subjects (%)
Sunflower	28.6
Sundrop	23.80
Groundnut	23.80
Cottonseed	9.50
Corn	4.8
Safloa	4.75
Soybean	4.75

Biochemical evaluation

Before supplementation of green tea to subjects, value of lipid profile of subjects were examined and then were compared with values obtained after supplementing 3 cups of tea (200ml) per day for 30 days. The values obtained were statistically analyzed.

Table 4.6: Contraction of lipid fractions before and after supplementation

Parameters	Groups	Pre Suppl. Value	Post Supp.Valuel	% Diff.	T Value
Total Cholesterol	Exp.	250.93(mg/dl)	229.4(mg/dl)	8.36	1.68
	Control	263.2(mg/dl)	268.57(mg/dl)	-	-
	*Exp./ Control				
High density lipoprotein	Exp.	38.3(mg/dl)	42.0(mg/dl)	8.8	1.16
	Control	35.86(mg/dl)	35.13(mg/dl)		
	*Exp./ Control			16.35	0.576
Low density lipoprotein	Exp	153.6(mg/dl)	129.5(mg/dl)	15.6	2.19
	Control	164(mg/dl)	168.8(mg/dl)		
	*Exp /Control			23.28	3.12
Triglycerides	Exp	314.86(mg/dl)	257.73(mg/dl)	18.14	1.48
	Control	303.4(mg/dl)	312(mg/dl)		
	* Exp. /Control			17.39	1.69

*Significant difference

Discussion

In this work we have studied the effects of green tea supplementation on lipid profile of humans. The chemical analysis of tea was also done to estimate its polyphenols, caffeine and tannin content. This content analysis gives a rough idea about their effective concentration in green tea that seems to be responsible for resulting in alteration of the lipid profile in hypercholesterolemia subjects. It also suggests that this amount of caffeine (3.5g %) present in green tea is entirely safe for the subjects with or without heart problem. The results are in agreement with the study of Michael J et al found that the average blood cholesterol level and systolic blood pressure decreased with increased amounts of tea consumption. This benefits was attributed to high concentration of flavonoids, which reduced blood clotting and deposition of cholesterol in blood vessels Hollman et al 2001

Normal function of the endothelium of heart plays an important role to preventing CVDs. Atherosclerosis impairs its function and brings impairment in the ability of blood vessels to relax (vasodilator). Truswell et al. found that higher the LDL-C level, greater is the risk of heart diseases; conversely higher level of HDL-C, lower the risk. LDL_C is the major vehicle for the transport of cholesterol to all the cells of the body. Heinecke et al. found that oxidised LDL may play a role in the pathogenesis of atherosclerosis and increased risk of CVDs. In the present study after supplementation of green tea for 30 days, the total cholesterol and LDL values were significantly reduced when compared with control than before at 0.05 and 0.01 levels as judged by student ‘t’ test, which is good indicator for minimizing the risk factor

in heart disease. HDL on the other hand scavenges excess cholesterol from the tissue. Significant difference was shown in HDL levels. M. atsumoto et al. reported that tea polyphenols prevents elevations in serum and liver lipids, decreased serum total cholesterol or antherogenic index and increased fecal excretion of total lipids and cholesterol when high fat diet is accompanied to the subjects. Significant decreasing trends have been found in mean serum triglyceride have been obtained between experimental groups compared with control. The subjects did daily dietary record during intervention period so that amount and type of food they consumed, could be estimated. But no relevant information was found, as most of the subjects did not record their diet daily. The mean values of anthropometric measurements suggest that almost all subjects were overweight and also there was no significant difference in BMI, in pre and post supplementation values.

Conclusion

Consumption of green tea did not increase weight but helpful to reduction of total cholesterol and LDL. So, Green tea can be consumed in daily routine in moderate amount to treat or prevent hypercholesterolemia & other cardiac disorder as well to some extent.

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