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Original Article

Impact of Green Tea on Cardiovascular Patients Suffering from Endothelial Dysfunction and Myocardial Infarction

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ABSTRACT

Globally tea consumption is common besides water. Green tea has been taken as a health stimulating drink since prehistoric time. From tea group polyphenols of green tea have been examined for cardiovascular disease (CVD) treatment. All around the world scientists have assessed the possible wellbeing profits of green tea for health due to its plentiful catechin, epigallocatechin-3-gallate (EGCG), in current centuries. **Objective:** To conclude the impact of green tea on cardiovascular patients suffering from endothelial dysfunction and myocardial infarction. **Methods:** Total of 21 cardiovascular patients, of both sexes, were randomly selected and followed up, with green tea intake, for two months. Two types of teas were used in the study, commonly available green tea in market and branded green tea. Their anthropometric measurements, body mass index, blood glucose level, blood lipid profile and electro cardio gram were done at the start, after a month and at the end of the trial. **Results:** The results showed that both local and branded green tea has an overall non-significant effect on body weight, blood glucose, LDL, HDL, triglyceride, cholesterol, and cholesterol: HDL and total lipids. As compared to control group both teas were effective in curing CVD. Comparative efficacy of both teas showed that Lipton green tea more significantly lowered the body weight, blood glucose, triglycerides, total lipids, cholesterol, SLDL, HDL and cholesterol: HDL was significantly increased. **Conclusions:** This study concluded that branded green tea is more effective in lowering weight, regulating the level of glucose in blood, modifying the lipid profile hence preventing the risk of CVD.

INTRODUCTION

Innumerable 80 % of all diabetic deaths results owing to atherosclerosis; approximately one third of the cardiac passing away as of diabetes happens due to coronary artery disease [1]. In Indian medicine, plants containing flavonoids have been used to treat diabetes [2]. The flavonoid in green tea has been shown to have insulin-like and insulin-improving properties [3]. On the other hand, epigallocatechingallate, which is the chief nutrient in green tea, diverges by way of insulin; it marks a number of insulin-stimulated kinases through deliberated frequency. Moreover, epigallocatechin normalizes genetic material that translates enzymes by modifying the oxidation-reduction condition of the cell. Thus, epigallocatechin gallate may perhaps be an anti-diabetic mediator [2].

Obesity has enlarged on at terrifying promptness in current survivals, moreover at this time obesity is worldwide wellbeing problem [4]. Since a definite duration tea has been acknowledged to normalize obesity. According to an ancient Chinese quotation: "Drinking tea for a long time will help you live longer and keep in shape without getting too fat or obese." [5]. The possible actions of tea in obesity might probably include, motivation of hepatic lipid breakdown, the reticence of lipases, inflection of hunger [6,7]. It might be possible due to at ease approval for tea as people may took it organic, healthier, and approachable and more appealer compared to medications, isometrics and surgical treatment [8].

To illuminate the obesity preventing consequences of three chief constituents of green tea Zheng et al., (2004) conducted an experiment in which female mice were nourished on foods encompassing two percent green tea fine particles and foods

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encompassing 0.3 percent catechins, 0.05 percent caffeine and 0.03 percent the nine, which resemble, correspondingly, toward their attentiveness in a 2 percent green tea fine particles food, individually in addition to a recipe [9]. Body heaviness and diet ingestion were defined once-a-month throughout this retro, different body organs including intra-peritoneal adipose tissues(IPAT) exist weigh up in addition fat intensities were restrained towards the termination of the retro. The physique heaviness upsurge and heaviness of IPAT were expressively condensed through the foods encompassing green tea and all above-mentioned nutrients. Strikingly, the IPAT heaviness lessened by three fourth percent in the caffeine and catechins equated to the regulator assembly. Serum attentiveness of triglycerides (TG) and non-esterified fatty acids (NEFA) were declined by all these. Furthermore, combinations of all these also diminished NEFA in the serum. The TG intensity in the hepatic cells was expressively decreased by catechins and catechins & theanine in evaluation through the regulator. These consequences designated that at any rate caffeine and theanine were accountable on behalf of oppressive outcome of green tea on physique heaviness upsurge and obese buildup. Furthermore, it was presented that catechins and caffeine were antagonists in heaviness preventive actions [9].

Tea is the primary source of flavonoids in the Western world. Geleijnse et al., (2002) investigated the link between tea and flavonoid consumption and myocardial infarction in ordinary Dutch people. Intake was evaluated with an authorized food-frequency form. The investigation encompassed individuals with no past myocardial infarction. Facts were investigated, with alteration for oldness, gender, body mass index, smoking rate, schooling level, and regular consumption of liquor, coffee, fat, fiber, vitamin E, and entire energy. In comparison to non-tea drinkers, tea drinkers with a regular consumption >375 mL had a lower risk of myocardial infarction. The contrary link with tea ingestion was solider for serious actions as compared to casual occasions. The ingestion of dietetic flavonoids was considerably contrariwise connected merely with serious myocardial infarction. Increased consumption of tea and flavonoids may help to prevent ischemic heart disease [10].

The objectives of this study are to study the consequence of green tea on weight, body mass index, and blood glucose level and lipid profile of cardiovascular patients and to compare the results of both commonly available green tea in market and branded green tea on cardiovascular patients.

METHODS

It was a clinical comparative study in which clinical consequences on cardiovascular patients (having normal routine diet), of branded green tea as well as locally available green tea, were determined after a follow up of 2 months. The research was initiated at the Institute of Rural Home Economics, University of Agriculture Faisalabad. Cardiovascular patients, for a follow-up of two months with green tea intake, were randomly selected, from Punjab Institute of Cardiology, Lahore. Branded green tea was purchased from Metro (Cash and Carry Pakistan, Lahore) and local tea was purchased from local market of Lahore. Total 21 cardiac patients, of both sexes aged between 40-60 years, suffering from endothelial dysfunction and myocardial infarction were selected randomly. They were further divided into three groups of seven patients each as follows:

Group-1: No treatment (control Group), Group-2: Lipton green tea was given, and Group-3: Locally available was given.

Patients were recommended to prepare a cup of green tea in 200-22mL of water with 2.45-2.50g of green tea (branded/local). They were advised to take three cups of green tea a day regularly for months. Blood lipid profile, ECG and blood glucose level of the patients were checked at baseline, 30^{th} day and at 60^{th} day

The calculations regarding the anthropometric measurements of the patients were recorded. The measurements include gender, age, weight and height. Bodyweight of the patients was recorded by simple weighing balance and the patients were weighed by light clothing without shoes. And height of the patients was measured barefooted using a stadiometer.

Body mass index (BMI) of cardiac patients was determined by using a BMI chart. BMI of the patients was measured with the help of the following formula [11]:

BMI= Weight (kg) / Height (m^2)

BMI of patients was compared to the standards given by the National Institute of health to classify Underweight (<18.5), Normal weight (18.5-24.9), Over-weight (25-29.9), and Obesity (30 or greater) [12].

RESULTS

Body Weight (Kg)

Table 1 provides the body weight analysis for comparing the local and branded green tea for its effects on cardiovascular patients. Treatments and days were shown to be statistically significant (P<0.01), but their interaction treatments x days was not. The Duncan Multiple Range Test was used to examine the mean values (DMR). Body weight was shown to be non-significantly increased after 30 days 90.07±1.37 T0 (Placebo) and lowered after 60 days 80.03±1.22 T2 (Branded Green Tea) when compared to all other treatments and time. No intake (89.97±0.75) was significantly higher than local green tea

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(83.49±0.90) or branded green tea (83.57±0.96) in terms of overall body weight in treatment. However, the total mean of body weight in days increased significantly from baseline (87.99±0.80) to the 20th day (85.55±1.01) and then decreased to the 60th day (83.49±1.22). (Table 2). Figure 1 represents a graphical representation of the fluctuation pattern in the efficacy of local and branded green tea on cardiovascular patients.

Body Mass Index (Kg/cm^2)

Using analysis of variance of body mass index, Table 3 compares the local and branded green tea for its effects on cardiovascular patients. Treatments, as well as their interactions with days, were determined to be non-significant, while days were shown to be significant (P0.05). The Duncan Multiple Range (DMR) Test was used to examine the mean values. In contrast to all other treatments and days, the mean of body mass index was shown to be non-significantly elevated at baseline 30.99±0.47 in T0 (Placebo) and decreased in 60th day of 29.75±0.45 in (T1) in Local green tea. Local green tea (30.46±0.28), branded green tea (30.43±0.27), and placebo (30.10±0.32) were shown to have a non-significant increase in overall body mass index in treatments. However, the total mean of body mass index in days increased significantly from baseline (31.00±0.26) to the 30th (30.00±0.30) and 60th (30.00±0.26) days (Table 4). The graphical representation of the fluctuation trend in the the local and branded green tea for its effects on cardiovascular patients is shown in Figure 2.

Source of Variation	DF	Sum of Squares	Means Squares	F-Value
Treatments	2	580.016	290.008	24.340**
Days	2	212.549	106.274	8.920**
Treatments x Days	4	102.480	25.620	2.150NS
Error	54	643.395	11.915	
Total	62	1538.439		

Table 1: Comparison of Weight between the local and branded green tea for its effects on cardiovascular patients: an analysis of variance
**Significant at P<0.01 NS = Non-significant DF=degree of freedom

Treatments	Baseline	30th Day	60th Day	Overall Mean
T_0	89.99±1.37	90.07±1.32	89.84±1.46	89.97±0.75A
T_1	86.77±1.32	83.10±1.26	80.61±1.23	83.49±0.90B
T_2	87.21±1.33	83.47±1.27	80.03±1.22	83.57±0.96B
Overall Mean	87.99±0.80A	85.55±1.01AB	83.49±1.22A	85.68±0.63

Table 2: Comparison of the local and branded green tea for its effects on cardiovascular patients based on mean weight (KgSE), The statistical significance of sharing similar letters in a row or column is non-significant (P>0.05).

For the overall mean, capital letters are used.T_0 = Placebo, T_1 = Local green tea, T_2 = Branded green tea

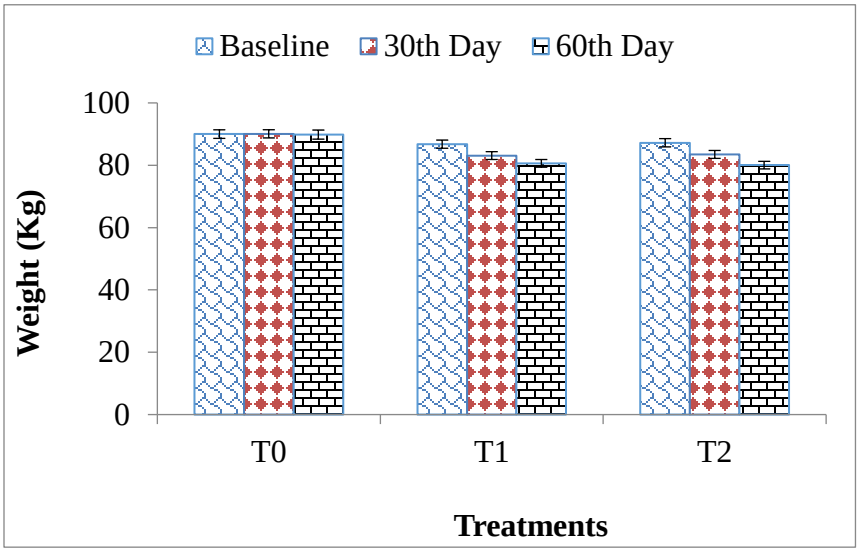

Figure 1: Comparison of local and branded green tea for its effects on cardiovascular patients based on mean weight (KgSE)

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Source of Variation	Degree of Freedom	Sum of Squares	Means Squares	F-Value
Treatments	2	1.745	0.872	0.585NS
Days	2	14.057	7.028	4.714*
Treatments x Days	4	11.640	2.910	1.952NS
Error	54	80.513	1.491	
Total	62	107.955		

Table 3: Comparison of the local and branded green tea for its effects on cardiovascular patients using analysis of variance of body mass index, *Significant at P<0.05 NS = Non-significant

Treatments	Baseline	30th Day	60th Day	Overall Mean
T_0	30.99±0.47	28.93±0.44	30.36±0.46	30.10±0.32
T_1	31.06±0.47	30.57±0.43	29.75±0.45	30.46±0.28
T_2	30.94±0.47	30.48±0.40	29.88±0.45	30.43±0.27
Overall Mean	31.00±0.26A	30.00±0.30B	30.00±0.26B	30.33±0.17

Table 4: Comparison of the local and branded green tea for its effects on cardiovascular patients based on mean body mass index (Kg/cm2SE).

The statistical significance of sharing similar letters in a row or column is non-significant (P>0.05). For the overall mean, capital letters are utilized.
T_0 = Placebo, T_1 = Local green tea, T_2 = Branded green tea

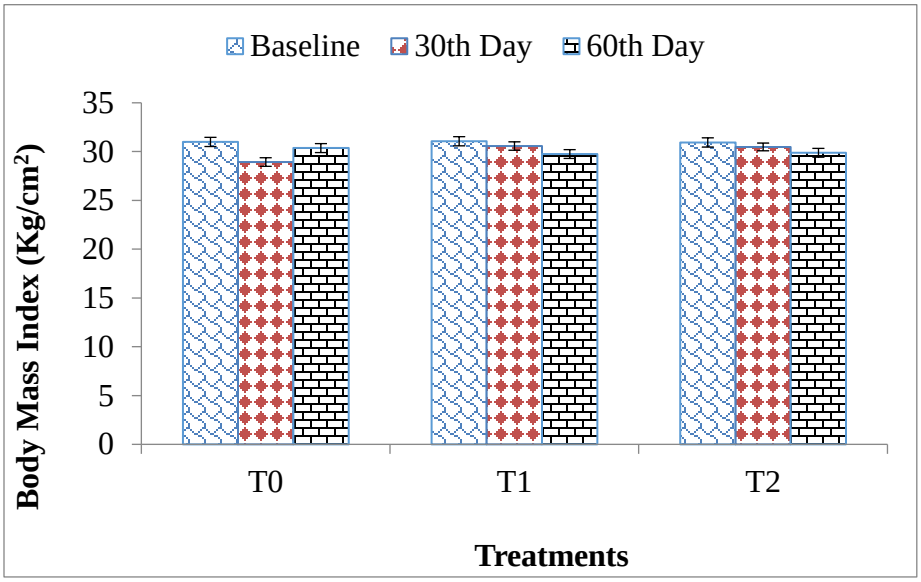

Figure 2: Comparison of the local and branded green tea for its effects on cardiovascular patients based on mean body mass index (Kg/cm2SE)

Serum Glucose (mg/dL)

Table 5 shows the findings of a study comparing the efficacy of local and branded green tea on cardiovascular patients by using an analysis of variance. The interaction between treatments and days, as well as the interaction between treatments and days, was determined to be significant (P0.01). The Duncan Multiple Range Test (DMR) was used to examine the mean values. When comparing serum glucose levels in different treatments and days, it was discovered that T2 branded green tea had a substantially higher baseline of 171.04±2.60 and a significantly lower 60th day of 127.95±1.95 than all other treatments and days. Overall, local green tea (151.55±2.45), branded (148.96±4.13), and placebo (141.19±1.57) had considerably higher mean serum glucose levels than the other treatments. In contrast, the total mean of serum glucose in days increased significantly from baseline (157.46±3.05) to the 30th day (150.28±1.56) and then died in the 60th day (133.96±1.49). (Table 6). The graphical representation of the fluctuation trend in the efficacy of local and branded green tea on cardiovascular patients is shown in Figure 3.

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Source of Variation	Degree of Freedom	Sum of Squares	Means Squares	F-Value
Treatments	2	1220.427	610.214	17.249**
Days	2	6089.761	3044.880	86.073**
Treatments x Days	4	2719.799	679.950	19.221**
Error	54	1910.290	35.376	
Total	62	11940.277		

Table 5: Comparison of the local and branded green tea for its effects on cardiovascular patients using analysis of variance of blood glucose, **Significant at P<0.01

Treatments	Baseline	30th Day	60th Day	Overall Mean
T_0	141.29±2.15de	146.86±2.23cd	135.43±2.06ef	141.19±1.57B
T_1	160.05±2.43b	156.09±2.37bc	138.51±2.11de	151.55±2.45A
T_2	171.04±2.60a	147.88±2.25cd	127.95±1.95f	148.96±4.13A
Overall Mean	157.46±3.05A	150.28±1.56B	133.96±1.49C	147.23±1.75

Table 6: Comparison of the local and branded green tea for its effects on cardiovascular patients in terms of mean serum glucose (mg/dLSE)

Sharing similar letters in a row or column has no statistical significance (P>0.05). The comparison between interaction means is represented by small letters, while the overall mean is represented by capital letters.T_0 = Placebo, T_1 = Local green tea, T_2 = Branded green tea

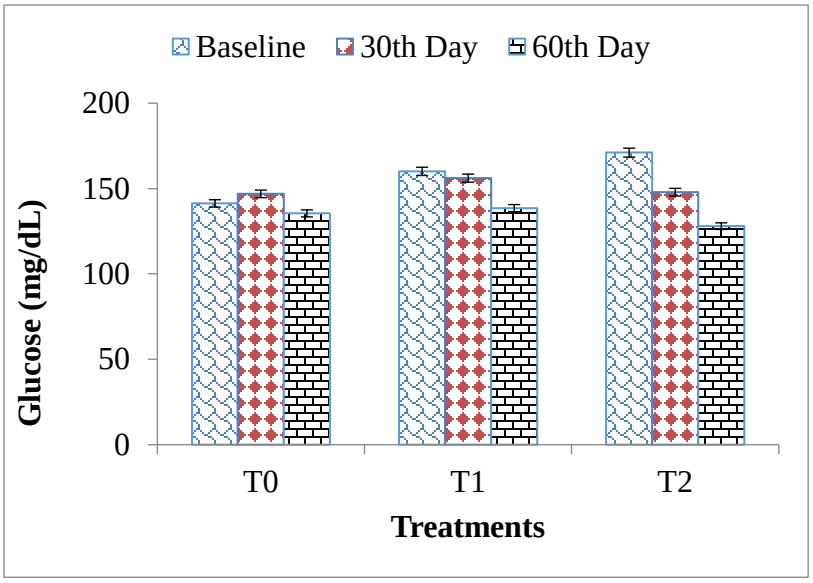

Figure 3: Comparison of the local and branded green tea for its effects on cardiovascular patients in terms of mean serum glucose (mg/dLSE)

DISCUSSION

The results of the current study's comparative efficacy of green tea showed that body weight grew non-significantly after two months in the no-intake group and reduced after two months in the green tea-intake group. Because two types of teas were employed, the two-month consumption of Lipton green tea resulted in a more substantial decline when compared to the no-intake group and local green tea. These findings are consistent with Zheng et al., 2004 findings [9]. They experimented on mice and found that drinking green tea powder reduced body weight significantly (p<0.05) due to caffeine and theanine, but not catechins. Bogdanski et al., (2012) looked at overweight CVD patients and found that they lost weight significantly [13]. Similarly, Basu et al., (2010) found that uninterrupted green tea drinking in adults resulted in a considerable reduction in body weight and BMI [14].

Rudelle et al., (2007) discovered that drinking a drink containing green tea catechins, caffeine, and calcium increases 24-hour energy expenditure by 4.6 percent, although the involvement of the individual components could not be determined [15]. It was suggested that such changes might suffice in preventing weight gain. When Klaus et al., (2005) nourished

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EGCG refined from green tea to mice, they too assessed reduced diet-encouraged heaviness in mice by declining energy immersion plus elevating fat corrosion [16].

Thielecke and Boschmann (2009) reported anti-obesity effects of green tea on overweight human participants in another randomized, double-blind, cross-over pilot trial. These findings suggest that EGCG alone has the ability to increase fat corrosion in humans, perhaps contributing to green tea's obesity-fighting properties [17]. Nagao et al., (2007) conducted human studies and discovered that continuous green tea drinking rich in catechins resulted in a decrease in body mass index, suggesting green tea as an effective anti-obesity strategy [18].

The efficacy of local and Lipton green tea on hyperglycemia was examined in this study, and it was discovered that glucose was non-significantly elevated after one and two months of no-intake and lowered after two months of green tea intake. Because two types of teas were employed, the two-month consumption of Lipton green tea resulted in a more substantial decline when compared to the no-intake group and local green tea. The results followed the findings of Wu et al., (2004) they revealed that green tea and green tea alter glucose metabolism constructively in investigational simulations of type II diabetes mellitus [19]. Bogdanski et al., (2012) also noticed significant decrease in glucose level of diabetic CVD patients by constant green tea intake for three months [13].

Lambert et al., (2003) experimented on mice [20] and Ullmann et al., (2003) investigated on humans, and concluded that ingestion of EGCG at a dose of approximately 75 mg/Kg resulted in hypoglycemic effects [21]. According to Nagaya et al., (2004) green tea showed noteworthy outcome on plasma lipid without eating and glucose absorption of healthy smokers. These consequences recommend that intake of green tea reduces CVD hazards in cigarette smoker also [22].

CONCLUSIONS

It is concluded that Green tea has the ability to lower the level of blood glucose and lipid profile including serum triglycerides, serum cholesterol, LDL, total lipids, and cholesterol: HDL while increasing the level of HDL effectively. It is also effective in lowering weight. Green tea should be used in moderation because higher doses can cause toxicity in the body. So it can act as an anti-diabetic, hypo-lipidomic, and weight-lowering agent and it improves cardiovascular function.

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