IJMPR 2022, 6(11), 01-07

International Journal of Modern Pharmaceutical Research
www.ijmpronline.com

ISSN: 2319-5878
IJMPR
Research Article
SJIF Impact Factor: 5.273

EFFECTS OF GREEN TEA *CAMELLIA SINENSIS* ON THE LIPID PROFILE AND ELECTROLYTES OF WISTAR RATS

Ngozi Franca Okoye* and Egburuwhuo Clifford Destiny

*Department of Biochemistry, University of Portharcourt.

Received on: 30/09/2022
Revised on: 19/10/2022
Accepted on: 09/11/2022

***Corresponding Author**
Ngozi Franca Okoye
Department of Biochemistry, University of Portharcourt.

ABSTRACT

This research investigated the effects of green tea *Camellia sinensis* on lipid and electrolyte parameters of Wistar rats for 21 days. A total of 20 Wistar albino rats with mean weight of 130±10 were used for the experiments. The animals were separated into four groups. The first group was the control. The control was given distilled water and allowed access to normal animal feed *ad libitum* but was not administered green tea. The second group was the group to be sacrificed after the first week of experiment. The group was given distilled water, allowed access to normal animal feed *ad libitum* and administered 1ml green tea solution twice daily. The third group was the group to be sacrificed after the second week of experiment. The group had same treatment as the second group above. The fourth group was the group to be sacrificed after the third week which was the final week of experiment. The group had same treatment like the second and third groups. After oral administration of the green tea on rats for 7 days up to 21 days, the results revealed significant reductions on the third week of treatment ($p<0.05$) in triglycerides from 3.36 ± 0.13 to 2.83 ± 0.12 mmol/l; total cholesterol from 4.86 ± 0.88 to 3.54 ± 0.30, low density lipoprotein cholesterol from 7.94 ± 1.30 to 6.02 ± 0.20, very low density lipoprotein cholesterol from 1.45 ± 0.06 to 1.30 ± 0.03mmol/l in the blood of rats. It also revealed a significant decrease on the third week ($p< 0.05$) in calcium electrolyte concentration from 10.63 ± 0.20 to 8.07 ± 0.10 mmol/l. It also revealed significant decrease ($p<0.05$) in the sodium and elevation in potassium electrolytes concentrations from 164.53 ± 0.22 to 130.20 ± 1.21 and 3.81 ± 0.20 to 4.90 ± 0.42 mmol/l respectively. The results suggested that the green tea reduced triglycerides and cholesterol levels in the blood of Wistar albino rats. The results also suggested that green tea reduced calcium and sodium electrolyte levels in the blood but increased potassium levels in the blood of albino Wistar rats based on the 1ml administration for 21 days.

KEYWORDS: Cholesterol, Electrolytes, Green tea, Lipid, Sodium, Potassium, Triglycerides.

INTRODUCTION

Tea is one of the most popular beverages, which is commonly used all over the world. Tea is mostly used in countries such as China and Japan, and green tea accounts for 20% of tea consumption worldwide. Today, green tea is cultivated commercially in Asia, Africa and South America. Green tea is derived from *Camellia sinensis*, an evergreen plant of the *Theaceae* family (Nawab and Farooq, 2015). It is known that black tea, is fermented, however, green tea is produced in a non-fermented procedure. Green tea may be used in the form of a brewed drink or capsular extract. Green tea may be used as dietary supplements. In China, consumption of green tea and the medicinal use of green tea begun more than 4,700 years ago. Presently, there is no proper dose suggested for green tea extract. Researchers examined the possible effects of consistently green tea drinking on cancer prevention, however, evidence has not been sufficiently collaborated (Okoye and Nnadozie, 2021; Ciara, 2021; Nawab and Farooq, 2015; Hazel, *et al.*, 1999). The main active ingredients of green tea include polyphenolic compounds such as epicatechin (EC), epicatechin-3-gallate (ECG), epigallocatechin (EGC) and epigallocatechin-3-gallate (EGCG), all of which may be responsible for the anti-carcinogenic and anti-mutagenic activities of green tea. Other polyphenols in green tea include flavanols and their glycosides and depsides such as chlorogenic acid, quinic acids, carotenoids, trigalloylglucose, lignin, protein, chlorophyll, minerals (aluminum or manganese, depending on the soil content), caffeine and a very small amount of methylxanthines. Tea is the most consumed beverage in the world behind water. However, 78 percent of the tea consumed worldwide is black and only about 20 percent is green (Yang, *et al.*, 1998). All types of tea, except herbal tea, are brewed from the dried leaves of the *Camellia sinensis*

bush. The level of oxidation of the leaves determines the type of tea. Green tea is made from unoxidized leaves and is one of the less processed types of tea. It therefore contains the most antioxidants and beneficial polyphenols. Green tea was used in traditional Chinese and Indian medicine to control bleeding and heal wounds, aid digestion, improve heart and mental health, and regulate body temperature, improvement of weight loss and inflammation (Lacey, 2021; Okoye and Nnadozie, 2021; Ciara, 2021). Studies have shown that green tea extract also possesses anti-inflammatory activity due to their polyphenolic constituents present. Due to the popularity of recent findings, green tea has almost become synonymous with weight loss and diet. The addition of green tea into diet pills and weight loss supplements is perhaps spurred by reports of harmful side-effects of other drugs like ephedra. For 4000 years, green tea diet has been used all throughout Asia as a beneficial health and medicinal drink (Lacey, 2021; Williams, *et al.*, 2004; Wu and Zhu, 2003). Green tea diet is different from all other tea diets because its liquid is extracted by steaming the leaves of the *Camellia sinensis* plant as opposed to full oxidation. In this way, green tea diet manages to preserve a lot more antioxidants and keep them intact for the body to use. Green tea diet is an excellent source of polycatechin polyphenols, a group of antioxidants that act on free radicals. These free radicals have harmful effects on the body since they are the major causes of diseases and ageing. With green tea diet's polycatechin polyphenols, a person has a better chance of avoiding ailments and keeping healthy for a much longer period of time. (Dryden, *et al.*, 2006). The term lipids are applied to those fatty, oily and waxy substances of animals or vegetable origin that are practically insoluble in water but dissolve freely in non-polar solvent such as chloroform, ether, hexane and benzene (Simons and Gibson, 1980). Lipid profile or lipid panel is a panel of blood tests that serves as an initial screening tool for abnormalities in lipids, such as cholesterol and triglycerides. The results of this test can identify certain genetic diseases and can determine approximate risks for cardiovascular disease, certain forms of pancreatitis, and other diseases. The implication of cholesterol in the development of hypercholesterolemia and lipid related diseases have stimulated enormous and growing literature. In simplest terms, it appears there is a statistically significant correlation between high serum cholesterol level and the incidence of lipid related disease. This suggests that it would be desirable to maintain normal level of cholesterol in the blood plasma (Zubay, 1998; Ellefson and Caraway, 1976).

Electrolytes are minerals that carry an electric charge when they are dissolved in a liquid such as blood. The blood electrolytes such as sodium, potassium, chloride, calcium and bicarbonate help regulate nerve, skeletal, muscle function and maintain acid base balance and water balance (Levey, *et al*., 2009; Levey, *et al*., 2007). Electrolytes, particularly sodium, help the body maintain normal fluid levels in the fluid compartments because the amount of fluid a compartment contains depends on the amount or concentration of electrolytes in it. If the electrolyte concentration is high, fluid moves into that compartment. Likewise, if the electrolyte concentration is low, fluid moves out of that compartment. To adjust fluid levels, the body can actively move electrolytes in or out of cells. Thus, having electrolytes in the right concentrations is important in maintaining fluid balance among the compartments. The kidneys help maintain electrolyte concentrations by filtering electrolytes and water from blood, returning some to the blood, and excreting any excess into the urine. Thus, the kidneys help maintain a balance between daily consumption and excretion of electrolytes and water (Inker, *et al*., 2012).

If the balance of electrolytes is disturbed, disorders can develop. For example, an electrolyte imbalance can result from the following such as becoming dehydrated or overhydrated, taking certain drugs, having certain heart, kidney or liver disorders, being given intravenous fluids or feeding in inappropriate amounts.

MATERIALS AND METHOD

EXPERIMENTAL ANIMAL
Wistar Albino Rats.

TREATMENT/ DIET
Green tea and normal animal feeds.

TREATMENT COLLECTION
The Green tea was bought from a supermarket in Port Harcourt, Rivers State.

TREATMENT PREPARATION
The treatment solution was prepared by brewing a bag of green tea with 500 ml of distilled water. A sterile syringe was used to measure 1ml of the brewed solution for treatment.

EXPERIMENTAL DESIGN
The experimental design was made of 20 Wistar albino rats purchased from the Animal House Department of Biochemistry University of Port Harcourt. The mean weight was 130±10g. The experimental animals were separated into 4 groups. And each group had its experimental animals of 5. The rats were allowed access to normal animal feeds *ad libitum* and distilled water. The sacrificing of experimental animals was carried out every 1 week (7days). The experiment lasted for 3 weeks (21 days). The first group was the control. The control was given distilled water and allowed access to normal animal feed *ad libitum* but was not administered green tea. The second group was the group to be sacrificed after the first week of experiment. That is, 7 days. This group was given distilled water, allowed access to normal animal feed *ad libitum* and 1ml green tea twice daily. The third group was the group to be sacrificed after the second week of experiment. That is, 14 days. The group had same treatment as the second group

above. The fourth group was the group to be sacrificed after the third week which was the final week of experiment. The group had same treat as the second and third above but was sacrificed after 21 days (3weeks).

GROUP 1: The group served as the control. The group had access to standard animal feeds *ad libitum* and distilled water but was not administered 1ml green tea for the days the experiment lasted before sacrifice.
GROUP 2**:** The group served as the experimental animals to be sacrificed after 1 week. The group had access to normal animal feeds *ad libitum* and distilled water while experiment lasted. The group was also administered 1ml green tea morning and evening from day 1 of experiment to day 7 the experiment lasted before sacrifice.
GROUP 3**:** The group served as the experimental animals to be sacrificed after 2 weeks. The group had access to normal animal feeds *ad libitum* and distilled water while experiment lasted. The group had the same administration as group 2 above. However, the administration lasted for 14 days before sacrifice.
GROUP 4**:** The group served as the experimental animals to be sacrificed after 21 days the experiment lasted. The group also had access to normal animal feeds *ad libitum* and distilled water and same administration as groups 2 and 3. However, the administration lasted for 21 days before sacrifice.

SACRIFICE OF THE EXPERIMENTAL ANIMALS
The administration of the green tea was between 10am-11am in morning and 3pm -4pm in the evening. Twenty four hours after the last administration, the animals were anaesthetized under chloroform vapour. Sacrifice was made after the experimental animals have been completely anaesthetized. The experimental animals were dissected and blood was collected through cardiac puncture and stored in sterile lithium heparin bottles for accurate laboratory analysis.

ESTIMATION OF LIPID PROFILE PARAMETERS.
The plasma levels of all the Lipids were determined using Mindray test kits.

PLASMA HDL ESTIMATION
METHOD
The method of Tietz (1995) was used to determine the level of high density lipoprotein – cholesterol in the samples.
Reaction Principle.
(1) LDL,VLDL, Chylomicrons ↔ Cholestenone + H_2O_2
$2H_2O_2 \leftrightarrow 2H_2O + O_2$
(2) HDL ↔Cholestenone + H_2O_2
H_2O_2 + HDAOS + 4-aminoantipyrin ↔ Quinonimine.

The System monitors the change in absorbance at 600 nm. This change in absorbance is directly proportional to the concentration of cholesterol in the sample and is used by the System to calculate and express the HDL-cholesterol concentration.

Procedure
Two test tubes labelled T1 (reagent blank) and T2 (test sample) were set up. T1 contained 900 µl of reagent (R1) and 12 µl of distilled water, while T2 contained 900 µl of reagent (R1) and 12 µl of test sample. The contents of each tube were mixed and incubated at 37℃ for 5 min. After incubating, 300 µl of the second reagent (R2) was added to both test tubes. The contents of each tube was incubated again for 5 minutes at 37^0C, the absorbance was read immediately.

Calculation
ΔA = [ΔA sample] - [ΔA blank].
Conc. of HDL = [change in absorbance of sample] – [change in absorbance of blank].
The result is expressed in mmol/L.
PLASMA TOTAL CHOLESTEROL ESTIMATION.
Cholesterol oxidase- peroxidase (CHOD-POD) method according to
Tietz (1995) was used to determine the level of total cholesterol in the samples.
Rea ction Principle
Ch olesterol ester + H_2O ↔ Cholesterol + Fatty acid
C holesterol + O_2 ↔ Δ4-Cholestenone + H_2O_2
2 H_2O_2 + 4-Aminoantipyrine + Phenol ↔ Quinoneimine + $4H_2O$
By the catalysis of cholesterrol esterase and cholesterol oxidase, Cholesterol ester is catalyzed to yield H_2O_2, which oxidizes 4- aminoantipyrine with phenol to form a colored dye of quinoneimine. The absorbance increase is directly proportional to the concentration of cholesterol.
Procedure
Two test tubes labelled T1 (reagent blank) and T2 (test sample) were set up. T1 contained 1000 µl of reagent (R1) and 10 µl of distilled water, while T2 contained 1000 µl of reagent (R1) and 10 µl of test sample. The contents of each tube were mixed thoroughly at 37℃. The absorbance was read 10 min. later.
Calculation
ΔA = [ΔA sample] - [ΔA blank]
Conc. of cholesterol = [change in absorbance of sample] – [change in absorbance of blank].
The result is expressed in mmol/L.
PLASMA TRIGLYCERIDES (TG) ESTIMATION.
Glycerokinase Peroxidase- Peroxidase method according to Tietz (1995) colorimetric method was used to determine the level of Triglyceride in the samples.
Reaction Principle
Triglycerides + $3H_2O$ ↔ Glycerol + fatty acid
Glycerol + ATP ↔ Glycerol-3-phosphate + ADP
Glycerol-3-phosphate + O_2 ↔ Dihydroxyacetone Phosphate + H_2O_2
H_2O_2 + 4-Aminoantipyrine + 4-Chlorophenol ↔ Quinoneimine + HCl + H_2O
Through a sequence of enzymatic catalysis steps by lipase, glycerol kinase and Dihydroxyacetone phosphate dehydrogenase, triglycerides is catalyzed to yield H_2O_2,

which oxidize 4-aminoantipyrinel to yield a colored dye of quinoneimine. The absorbance increase is directly proportional to the concentration of triglycerides.

Procedure
Two test tubes labelled T1 (reagent blank) and T2 (test sample) were set up. T1 contained 1000 µl of reagent (R1) and 10 µl of distilled water, while T2 contained 1000 µl of reagent (R1) and 10 µL of test sample. The contents of each tube were mixed thoroughly at 37℃. The absorbance was read at a wavelength of 546 nm10 min. later.

Calculation
ΔA = [ΔA sample]- [ΔA blank]
Conc. of triglyceride = [change in absorbance of sample] – [change in absorbance of blank].
The result is expressed in mmol/L.

ELECTROLYTE TEST
Sodium levels were determined by colorimetric test. The magnesium-uranyl acetate method. The Principle of this method is that after the precipitation of sodium magnesium uranyl acetate, in the supernatant form with uranyl ions in solution with thioglycolic acid a yellow-brown coloured complex is formed. The optical density difference between the reagent blank (without precipitation of sodium) and the result of the analysis is proportional to the sodium concentration (Trinder, 1951). Reagent A kit contained uranyl acetate (19mM) and magnesium acetate (140mM) while reagent B kit contained ammonium thioglycolate (550mM), ammonia (550mM) and the standard aqeous solution of sodium equivalent150mmol. 2.00ml of reagent A was mixed with 0.02 ml of the sample. For the standard, 2.00 ml of reagent A and 0.02 ml of the standard were mixed. The mixtures were let to stand for 5 minutes, they were then shaken thoroughly for 30 seconds. The mixtures were allowed to stand for 30 minutes. They were centrifuged at 2,000rpm for 5 minutes. The supernatant was then separated. 0.05ml of the clear supernatant was mixed with 2.00ml of reagent B. For the blank, 0.05 ml of reagent A and 2.00 ml of reagent B were mixed, while the standard tube contained 0.05 ml of supernatant and 2.00ml of reagent B. The absorbance of the mixtures was read after 10 minutes at 405nm with spectronic – 20 spectrophotometer.

Calculations: $\frac{\text{Blank O.D – Sample O.D}}{\text{Blank O.D – Standard O.D}} \times 150 = \text{mmol/L}$

Calculations Normal values 135-150 mmol/l.
Potassium levels were determined by colorimetric endpoint method.

The Principle of this method is that the amount of potassium is determined by using sodium tetraphenyl boron (2.1mmol/l) in a specifically prepared mixture to produce a potassium concentration in the range of 2 – 7 mEq/L (Tietz 1995). 1.0ml of reagent was mixed with 0.1ml of sample except for the controls, which had no samples. The blank tube contained 1.0ml of reagent while the standard tube contained 1.0ml of reagent and 0.1ml of standard. The mixtures were incubated at 25^{o}C for 3mins. The absorbance was read against reagent blank at 500nm with Spectronic -20 spectrophotometer.

Calculations: $\frac{\Delta A \text{ unknown}}{\Delta A \text{ standard}} \times C \text{ standard} = \text{potassium concentration mEq/L}$

3. CALCIUM
The method of Tietz (1995) was used. The collection of blood sample was carried out after cardiac puncture. The blood was collected by a sterile syringe into a sterile lithium heparin bottle. The spinning of the blood sample was by a centrifuge in order to separate the plasma from the blood cells. The selected three clean dry test tubes were labelled as blank (B), standard(S) and test (T). Buffer reagent (L1) 0.5ml was measured into B, into S and T, respectively. Colour reagent (L2) 0.5ml was measured into B, S, and T, respectively. Distilled water 0.02ml was measured into B only. For Calcium standard, the measurement was only 0.02ml into S. Into the sample, the measurement was 0.02ml into T only. The tubes were well mixed and incubated at room temperature for 5 minutes. Measurement of the absorbance at 570nm for the standard and test sample against the blank was within 60 minutes.

CALCULATION = $\frac{\text{Absorbance of the test x 10}}{\text{Absorbance of standard}}$

STATISTICAL ANALYSIS
Data analysis was performed using the Statistical package for Social Sciences Software (SPSS, version 11.0). The statistical method of one way analysis of variance ANOVA was used to compare the mean values obtained among different groups. Differences were considered significant where P value was $p \leq 0.05$.

RESULTS

The data were expressed as the Mean ± SD and represent the average values for the animals in the same group. Each analysis was repeated three times and the average was used to compare between the groups.

Table 1: Effect of 7 to 21 days oral administration of green tea on Sodium, Potassium and Calcium electrolytes of Wistar rats.

Sample	Na^{+} (mmol/l)	K^{+} (mmol/l)	Ca^{2+} (mmol/l)
Control/ Group1	164.53 ± 0.22	3.81 ± 0.20	10.63 ± 0.20
Group2	153.20 ± 1.31^{a}	3.99 ± 1.50^{a}	9.89 ± 1.30^{a}
Group3	142.57 ± 1.14^{b}	4.57 ± 0.31^{b}	9.10 ± 0.07^{b}
Group4	130.20 ± 1.21^{c}	4.90 ± 0.42^{c}	8.07± 0.10^{c}

Results are expressed as Mean ± Standard Deviation, n=3, values with different superscript are statistically different at ($P < 0.05$).

Table 2: Effect of 7 to 21 days oral administration of green tea on Triglycerides and Total cholesterol levels of albino wistar rats.

Samples	Triglyceride (mmol/l)	Total Cholesterol (mmol/l)
Control/ Group 1	3.36 ±0.13	4.86 ± 0.88
Group 2	3.07 ± 0.54^{a}	4.62 ± 1.18^{a}
Group 3	2.98 ± 0.17^{b}	3.88 ± 1.40^{b}
Group 4	2.83 ± 0.12^{c}	3.54 ± 0.30^{c}

Results are expressed as Mean ± Standard Deviation, n=3, values with different superscript are statistically different at ($P < 0.05$).

Table 3: Effect of 7 to 21 days oral administration of green tea on High density lipoprotein (HDL), very low density lipoprotein (VLDL) and low density lipoprotein (LDL).

Sample	HDL (mmol/l)	VLDL (mmol/l)	LDL (mmol/l)
Control/Group 1	2.50 ± 0.40	1.45 ± 0.06	7.94 ± 1.30
Group 2	2.45 ± 0.20^{a}	1.40 ± 0.15^{a}	7.76 ± 1.30^{a}
Group 3	2.55 ± 0.13^{b}	1.38 ± 0.06^{b}	7.10 ± 1.50^{b}
Group 4	2.60 ± 0.10^{c}	1.30 ± 0.03^{c}	6.02 ± 0.20^{c}

Results are expressed as Mean ± Standard Deviation, n=3, values with different superscript are statistically different at ($P < 0.05$).

DISCUSSION

This study investigated the effects of green tea on the lipid profile and electrolytes such as sodium, potassium and calcium of albino Wistar rats for 21 days. After oral administration of the product, the results revealed significant reductions in treatment ($p<0.05$) in triglycerides from 3.36 ± 0.13 to 2.83 ± 0.12 mmol/l in the third week of treatment. The total cholesterol decreased from 4.86 ± 0.88 to 3.54 ± 0.30 mmol/l, low density lipoprotein cholesterol from 7.94 ± 1.30 to 6.02 ± 0.20 mmol/l, very low density lipoprotein cholesterol from 1.45 ± 0.06 to 1.30 ± 0.03 in the third week of treatment. This study further revealed a significant decrease ($p< 0.05$) in calcium electrolyte concentration from 10.63 ± 0.20 to 8.07 ± 0.10 mmol/l. The work also showed significant decrease ($p<0.05$) in the sodium electrolyte concentrations from 164.53 ± 0.22 to 130.20 ± 1.21. However, plasma potassium showed significant increase of 3.81 ± 0.20 to 4.90 ± 0.42 mmol/l. Biochemical markers play an important role in accurate diagnosis and also for assessing risk and adopting therapy that improves clinical outcome. Over decades research and utilization of biomarkers has evolved substantially. A Biomarker is a characteristic that is objectively measured and evaluated as an indicator of normal biological, pathologic processes, or pharmacologic responses to a therapeutic intervention. As markers of lipid profile and electrolyte balance, cholesterol, triglycerides, sodium, potassium and calcium are used for routine analysis (Vasan, 2006). From the results, electrolyte biomarkers of kidney function showed significant increase ($p<0.05$) in potassium and decrease in sodium in all the groups treated with green tea when compared with the untreated normal group. Hyperlipidemia disease has afflicted humankind since antiquity. In 2002, coronary heart Epidemiological evidence strongly supported the positive correlation between blood lipids, hyperlipidemia and its complications, mainly coronary heart disease (Gordon and Rifkind, 1989). This relationship has been shown between and within cultures (Smelt, 2010)). The hyperlipidemia is traditionally defined as conditions in which the concentration of cholesterol or triglyceride-carrying lipoproteins in plasma exceeds an arbitrary normal limit (Sundaram and Yao, 2010). These lipoproteins deposit in the interstitial space of arteries, restricting the blood supply to the heart and this phenomenon is known as atherosclerosis. Higher deposition of lipoproteins can completely block the blood supply to the heart, and thus myocardial infarction (MI) occurs, which is commonly known as heart attack (Sundaram and Yao, 2010). From the results, the Green tea showed significant ($P < 0.05$) decrease in serum triglyceride, low density lipoprotein and total cholesterol levels and significant increase in the high density lipoprotein concentration. Green tea can be used to control hyperlipidemic effects caused by high fat diet. There is considerable discussion about elevated cholesterol and its link to cardiovascular diseases because there is a direct relationship between elevated levels of cholesterol in the plasma and incidence of heart disease. Experts generally agreed that people with levels of total cholesterol in plasma above 6.2mmol/l for many years are at the risk of having a heart attack compared with people whose plasma cholesterol level is below 5.2mmol/l. It is also generally recommended that adults endeavour to achieve levels of both free cholesterol and cholesteryl ester in plasma of 5.2mmol/l or less. Consumption of high cholesterol diet can increase the chances of an organism developing the metabolic disorder. However, it has been shown that consumption of some natural plant products such as green tea as

shown in this research and also apple cider vinegar with the "mother" can lead to decrease in cholesterol levels (Okoye and Porolo 2019; Nelson, 2013; Shishehbor, *et al*.,; 2008). There is new evidence emerging that shows that green tea can help dieters. Researchers found that green tea extract helped people to burn more calories. Green tea diet helps increase the body's metabolic rates. With its thermogenic properties, it is only natural that green tea diet can also promote faster metabolism of fats and sugars. Excess glucose found in the body is turned into fats by the hormone insulin (Shafii, 2020; Okoye and Porolo 2019; Nelson, 2013; Sinija and Mishra, 2008; Shishehbor, *et al*.,; 2008). Because green tea diet has an inhibiting effect on insulin, green tea diet therefore helps keep sugar from being stored as fats and, instead, sends them directly into the muscles for immediate use. There are other benefits of green tea such as the fact that it can even help prevent tooth decay. It is also known that it's bacteria-destroying abilities can help prevent food poisoning, it can also kill the bacteria that cause dental plaque. Meanwhile, skin preparations containing green tea from deodorants to creams are starting to appear on the market. There is also epidemiological evidence that drinking green tea may help prevent diabetes (Takatoshi *et al.,* 2006). Researchers at the University of Chicago stipulated that polyphenols help inhibit the growth of bacteria that cause bad breath (Wu and Zhu, 2003). Furthermore, green tea could be relevant for management of iron overload and oxidative stress. Green tea may also help to reduce inflammation associated with Crohn's disease and ulcerative colitis (Dryden *et al.,* 2006). According to the National Cancer Institute, the polyphenols in tea have been shown to decrease tumour growth in laboratory and animal studies and may protect against damage caused by ultraviolet UVB radiation (Li, *et al.,* 2014). In countries where green tea consumption is high, cancer rates tend to be lower, but it is impossible to know for sure whether it is the green tea that prevents cancer in these particular populations or other lifestyle factors. Some studies have also shown the positive impacts of green tea on the following types of cancers: breast, bladder, ovarian, colorectal, esophageal, lung, prostate, skin and stomach (Yang, *et al.,* 1998). Researchers believe that it is the high level of polyphenols in tea that helps kill cancerous cells and stop them from growing. However, the exact mechanisms by which tea interacts with cancerous cells is unknown. The cancer-protective effects of green tea have been reported in several population-based studies. For example, cancer rates tend to be low in countries such as Japan where green tea is regularly consumed. It is not possible to determine from these population-based studies whether green tea actually prevents cancer in people. Furthermore, EGCG was shown to reduce specific binding of both the 12-Otetradecanoylphorbol-1-3-acetate (TPA) type and the okadaic acid-type tumour promoters (the two major classes of tumour-promoting agents) to their receptors. This 'sealing' effect of EGCG is achieved by its interaction with the phospholipid bilayer of the cell membrane (Fujiki *et al.,* 2000). When non-Hodgkin's lymphoma cells were transplanted into mice, green tea prevented 50% of the tumours from taking hold and significantly inhibited growth of the tumours (Bertolini *et al.,* 2000). Many laboratory studies have shown that topical treatment or oral consumption of green tea polyphenols inhibits chemical carcinogen- or ultraviolet radiation-induced skin tumour genesis in different animal models (Katiyar and Elmets., 2001). Tannins present in green tea like catechin, epicatechin etc. bind with non heme iron in the body. This interferes with iron absorption, which can lead to iron deficiency anaemia. (Nawab and Farooq, 2015). Iron deficiency anaemia can cause feelings of weakness, shortness of breath, irritability, headaches and irregular heartbeat. So anaemic patient should use it cautiously, if taken in high amount. Epigallocatechin-3-gallate (EGCG) has anti-folate activity so to prevent folate deficiency it should not used in excessive quantity. Since green tea is a diuretic and it can cause excessive urination which may lead to dehydration and electrolyte imbalances. If severe dehydration occurs, it may cause headaches, lethargy, altered heart rate and shock. Green tea contains poly phenols; the researchers showed that it may stain the teeth. Nausea, vomiting, loss of appetite, abdominal bloating/pain, dyspepsia, flatulence and diarrhoea are other side effects reported that are caused by the use of green tea. Excessive consumption of caffeine from green tea may also cause central nervous system stimulation such as vertigo, insomnia, tremors, impatience, distraction, agitation and psychomotor agitation. Those with severe caffeine sensitivities could experience insomnia, anxiety, irritability, nausea, or upset stomach (Nawab and Farooq, 2015). Those taking blood thinners (anticoagulant drugs) such as Coumadin/warfarin should drink green tea with caution due to its vitamin K content. It is also recommended to avoid green tea and aspirin, because they both reduce the clotting effectiveness of platelets. Furthermore if taken with stimulant drugs, green tea could increase blood pressure and heart rate. (Nawab and Farooq, 2015; Emily, 2013).

CONCLUSION

This research showed that the use of natural plant products such as green tea can reduce cholesterol and triglycerides levels in the blood of Wistar albino rats. The research also showed that the use of green tea reduced sodium levels while elevating potassium levels. This study suggests that taking green tea in moderation has some health benefits.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

ETHICAL APPROVAL

This research work was carried out with the approval of the University of Port Harcourt research ethics committee.

REFERENCES

1. Bertolini, F., Fusetti, L., Rabascio, C., Cinieri, S., Martinelli, G., and Pruneri, G. (2000). Inhibition of angiogenesis andinduction of endothelial and tumor cell apoptosis by green tea in animal models of human high-grade non-Hodgkin's lymphoma. *Leukem*, 14(8): 1477–82.
2. Ciara, C. (2021). 10 Green Tea Benefits and the Best Way to Drink It. Lifehack.
3. Dryden, G., Song, M., and McClain, C. (2006). Polyphenols and gastrointestinal diseases. *Curr Opin Gastroenterol*, 22(2): 165–170.
4. Ellefson, R. D., and Caraway, W. T. (1976). Fundamentals of Clinical Chemistry, 2nd Edition. Heineman Books, London, 457.
5. Emily, C. Negative Benefits of Green Tea for Dieting Last Updated, 2013; 16: 17.
6. Fujiki, H., Suganuma, M, and Okabe, S. (2000). A New concept of tumor promotion by tumor necrosis factor-alpha, and cancer preventive agents (-)-epigallocatechin gallate and green tea—a review. *Cancer Detect Prevent*, 24(1): 91–99.
7. Gordon, D.J., and Rifkind, B.M. (1989). Treating high blood cholesterol in older patient. *Am J Cardiol*, 63(16): 48-52.
8. Hazel, B. M., George, W. L., & Kenneth, D. F. (1999). Medicinal herbs in the United States: research needs. Environmental health perspectives, 107(10): 773-778.
9. Inker, L.A, Astor, B.C., and Fox, C.H. (2014). KDOQI US commentary on the 2012 KDIGO clinical practice guideline for the evaluation and management of CKD. *Am J Kidney Dis*, 63(5): 713-735.
10. Lacey, B. (2021). 10 Benefits of Green Tea | Why You Should Drink it Every Day. Health & Wellness.
11. Levey, A.S, and Stevens, L.A., and Schmidet, C.H. (2009). A new equation to estimate glomerular filtration rate. *Ann Intern Med*, 150(9): 604-12.
12. Levey, A.S, Coresh, J., and Greene, T. (2007). Expressing the modification of diet in renal disease study equation for estimating glomerular filtration rate with standardized serum creatinine values. *Clin Chem*, 53(4): 766-72.
13. Katiyar, S.K., and Elmets, C.A. (2001). Green tea polyphenolic antioxidants and skin photo protection (review). *Int J Oncol*, 18(6): 1307–13.
14. Li, N., Deng, L., Xiang, L., and Liang, Y. (2014). Photoprotective Effect of Tea and its Extracts against Ultraviolet Radiation-Induced Skin Disorders. *Tropi J of Pharm Res*, 13(3): 475-483.
15. Nawab, A. and Farooq N. (2015). Review on green tea constituents and its negative effects. *The Pharma Innovation Journal*, 4(1): 21-24.
16. Nelson, R.H. (2013). Hyperlipidemia as a Risk Factor for Cardiovascular Disease. *Prim Care*, 40(1): 195 -211.
17. Okoye, N. F and Nnadozie, C. C.(2021). Effect of green tea and black coffee on kidney profile of Wistar rats. *Int J of Moder Pharma Res*, 5(5): 197–207.
18. Okoye, N. F. and Porolo, S. B. (2019). The effect of apple cider vinegar on the lipid profile and electrolyte of Wistar rats. *J of Advan in Biol and Biotech*, 21(3): 1–11.
19. Shafii, R. 2020. Fat Wars by Combination of Green Tea Extract and Caffeine, Burning more Calories and Effect on Fat Oxidation in Humans. *Int J Nutr Sci* and Food Tech, 6:3, 28–32.
20. Shishehbor, F.; Mansoori, A.; Sarkaki, A. R.; Jalali, M. T., and Latifi, S. M. (2008). Apple Cider Vinegar Attenuates Lipid Profile in Normal and Diabetic Rats. *Pakistan J of Biol Sci*, 11(23): 2634-2638.
21. Simons, L. A., and Gibson, J. C. (1980). Lipid: Clinicians Guide. 1st Edition. MTP Press Limited, England, 81.
22. Sinija, V.R., and Mishra, H. N., (2008). Green tea: Health benefits. *J of Nutr & Environ Med*; 17(4): 232–242
23. Smelt, A.H.M., (2010). Triglycerides and gallstone formation. *Clin Chim Acta*, 411(21 -22): 1625-31
24. Sundaram, M., and Yao, Z. (2010). Recent progress in understanding protein and lipid factors affecting hepatic VLDL assembly and secretion. *Nutr Metab*, 7: 35.
25. Takatoshi, M., Satoshi. H., Akira, S., Ichiro, T., Tadashi, H. (2006). Green tea extract improves running endurance in mice by stimulating lipid utilization during exercise. *Am J Physiol Regulat Integrat Comparat Physiol*, 290(6): R1550–6.
26. Tietz, NW. (1995). Clinical Guide to Laboratory Tests, 3rd Edition (US, Philadelphia:W.B. Saunders).
27. Trinder, P. (1951). A rapid method for the determination of sodium in serum. *Analy*, 76(907): 596.
28. Vasan, S. (2006). Biomarkers of cardiovascular diseases. Molecular basis and practical considerations. *Circul*a, 113(19): 2335–2362
29. Williams, R. J., Spencer, J. P. E., Rice-Evans, C. (2004). "Flavonoids: Antioxidants or signalling molecules". *Free Radi Biol and Med*, 36(7): 838-849.
30. Wu, C., Zhu, M. (2003). Compounds in tea stop bad breath-Halitosis-polyphenols prevent growth of bacteria. Brief Article in USA Today. (American association of advancement in science).
31. Yang, C.S., Chen, L., Lee, M.J., Balentine, D., Kuo, M.C., and Schantz, S.P. (1998). Blood and urine levels of tea catechins after ingestion of different amounts of green tea by human volunteers. *Cancer Epidemiol Biomarkers Prev*, 7(4): 351-354.
32. Zubay, G.L. (1998). A Text on Biochemistry, 4th Editon. Wm. C., Brown Publisher, Columbia University. P 543-550.