

Original Research Article

Effects of *Citrus aurantifolia* (Lime) and *Camellia sinensis* (Lipton Tea) Decoction on Some Plasma Electrolytes and Creatinine Concentration in Female Albino Rats

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Abstract: Electrolytes are essential substances in the body required for cell function and cell signalling. The study investigated the effects of *Citrus aurantifolia* (lime) and *Camellia sinensis* (lipton tea) decoction on some plasma electrolytes and creatinine concentration. Twelve (12) female albino rats weighing between 150 -200g were used. The rats were divided into two groups: the control and test groups (n=6). The test group received 2ml/kg body weight of the decoction of lime and lipton tea orally thrice daily for 14days. The rats were sacrificed periodically and blood samples were obtained from the heart. Results obtained showed significant reduction in plasma levels of sodium and significant increases in plasma chloride and creatinine levels (P<0.05). The plasma potassium concentration increased in the test rats but this elevation was not statistically significant. It was thus concluded that the additive effect of decoction of lime and lipton may impair renal handling of electrolytes with consequent hyponatremia and hypercreatininemia. It is therefore suggested that this might be of therapeutic value in conditions associated with hyponatremia in humans.

Keywords: *Citrus aurantifolia* (lime), *Camellia sinensis* (Lipton tea), plasma electrolytes and creatinine.

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INTRODUCTION

Plants play significant role in human lives both as food and drugs. Lime (*Citrus aurantifolia*), is a citrus fruit, which is typically round, green in colour, 3-6 centimetres (1.2-2.4m) diameter, and contains acidic juice vesicles. Fruits are known to be a source of nutrients and it is recommended to consume them daily to get physiological benefits for the body.¹ Limes are rich source of vitamin C, sour and are often used to accent the flavours of foods and beverages. This fruit is well distributed and cultivated in tropical and subtropical countries including Nigeria [2]. It is well known for its rich vitamin content and antioxidant properties.² The active components of lime (polyphenols) are important for a variety of its functions as antimicrobial, anti inflammatory, larvicidal, antidiabetic, anti cancer and some nephro-protective effects [3,4,5, 6].

Lipton tea (*Camellia sinensis*) is a British brand of tea, owned by Unilever. Lipton was also a

supermarket chain in the United Kingdom before it was sold off to Argyll foods, to allow the company to focus solely on tea. The company is named after its founder Thoman Lipton.

Tea is a common beverage and most consumed after water worldwide and can be classified into three types known as green (unfermented), oolong (partially fermented) and black (fermented) teas [7]. Tea is an aromatic beverage commonly prepared by pouring hot or boiling water over cured leaves of the *Camellia sinensis*. The leaf extract had been reported as potential antioxidant and potent remedy for cancers in traditional medicines due to the presence of some metabolites such as flavonoids, alkaloids and terpenoids in the leaf extracts [8, 9]. Its antioxidant, anti-carcinogenic, antibacterial, anti-obesity and anti-diabetic activities has also been reported [8, 10, 11, 12, 13]. In addition, another study demonstrated that green tea extract have a protection against nephrotoxicity and oxidative damage in rat kidney induced by gentamicin [14].

Electrolytes are the smallest of chemicals that are important for the cells in the body for proper functioning. Electrolytes such as sodium, potassium, and others are critical in allowing cells to generate energy, maintain the stability of their walls, and to function in general. They generate electricity, contract muscles, move water and fluids within the body, and participate in myriad of other activities. The homeostatic control of electrolytes and creatinine in the body is controlled by a variety of hormones, most of which are manufactured in the kidney and the adrenal glands. These include rennin (made in the kidney), angiotensin (from the lung, brain and heart), aldosterone (from the adrenal gland), and antidiuretic hormone (from the pituitary). Alterations in the homeostasis lead to abnormalities.

From literature search, studies on the combined effect of lime and lipton tea on plasma electrolytes and creatinine concentration if available are very few especially in our environment. This study thus sought to investigate effects of decoction of lime and lipton tea on plasma electrolytes and creatinine levels in female abino rats. Results from this study may be useful as renal protective agents in humans.

MATERIALS AND METHODS

Animals

Rats (females) of the wistar strain of aged 3 weeks were used. They weighed between 150g and 200g and were fed on pelleted growers mash. These animals were maintained under standard animal house condition and allowed free access to food and water.

Chemicals

Picric acid, 5% Sodium Tung state, tetraoxosulphate vi (sulphuric acid), Sodium hydroxide, creatinine stock standard, creatinine working standard, hydrochloric acid, mercuric nitrate and chloroform were of analytical grade. All reagents were purchased from standard suppliers.

Preparation and Administration of Extracts

Two (2) fresh limes were thoroughly washed with clean water and cut into two (2) apiece. They were then introduced into a 500ml beaker containing 200ml of pure water (distilled water) and a bag of Lipton tea. The mixture was allowed to boil for 20 minutes and then to cool down under room temperature before sieving or filtering with the aid of a sterile cheese cloth. The extract was stored in a clean bottle and kept in the refrigerator at 4 degree Celsius overnight and

subsequently administered to the rats according to the experimental protocol. This procedure was repeatedly done to have a fresh sample routinely. The decoction of lime and Lipton tea was administered to the rats orally using a gavage at 2ml per kilogram (2ml/kg) body weight of rat thrice daily eight (8) hourly.

Ethical Clearance

The entire experimental protocol was performed in accordance with the Institutional Animal Ethical Committee (IAEC), in line with the directions of the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) in Niger Delta University, Wilberforce Island, Bayelsa State, Nigeria.

Blood Collection and Electrolyte Analysis

The rats were anaesthetized using chloroform, then sacrificed and blood was collected from the heart with a 5ml syringe. Blood collected was immediately subjected to centrifugation at 3000 x g for 20 minutes to obtain the plasma. Analysis was carried out immediately after centrifugation.

Plasma sodium and potassium and chloride were analysed by the flame photometry method (410 flame photometer, (Chirion diagnostics), following manufacturers guidelines [15]. Plasma creatinine was determined using standard assay kits following modified Jaffe method. The adopted normal reference intervals used for the electrolytes are; Sodium=135 - 145mmol/L, Potassium=3.3- 5.0mmol/L, Chloride= 95- 110mmol/L and Creatinine= 60- 120µmol/L or 0.68- 1.36mg/dl [16].

Statistical Analysis

Data was expressed as mean ± standard deviation. The significant difference between the test and control were analysed using unpaired t-test. Data were analysed using the SPSS software (SPSS Inc. Chicago, USA). $P \leq 0.05$ was set at the level of significance.

RESULTS

The results showed a significant decrease in plasma sodium level in the test group after administration of combined tea and lime as compared to the control rats ($p \leq 0.05$). There was a non-significant elevation of potassium level in the test rats and the plasma levels of chloride and creatinine showed significant increase in the test rats when compared to the controls ($p \leq 0.05$) see table below.

Table-1: Electrolytes and creatinine levels in normal female albino rats administered extracts of decoction of *Citrus aurantifolia* (lime) and *Camellia sinensis* (Lipton tea).

Day	Sodium (mmol/L)	Potassium (mmol/L)	Chloride (mmol/L)	Creatinine (mg/dl)
C	52.26±0.12a	203.44±5.86a	74.13±0.19a	0.72±0.01a
T	52.26±0.12a	197.94±0.47a	74.01±0.12a	0.71±0.00a
C	52.41±0.00a	257.53±8.35a	74.99±0.42a	1.33±0.01a
T	52.12±0.38a	267.81±11.35a	75.15±0.76a	1.33±0.01a
C	51.92±0.54b	233.69±3.79a	74.94±0.76b	1.37±0.03b
T	27.26±0.33a	233.49±4.05a	83.47±0.23a	1.60±0.02a
C	51.08±0.06b	240.25±10.95a	73.53±0.87b	1.40±0.01b
T	12.53±0.06a	244.74±0.42a	86.31±2.87a	2.00±0.01a

C= Control; T= Test. Values are presented as mean± SD of triplicate determinations. Values with different superscript alphabets are significant statistically (P<0.05).

DISCUSSION

This study aimed at investigating the effects of *Citrus aurantifolia* (lime) and *Camellia sinensis* (lipton tea) decoction on some plasma electrolytes and creatinine concentration in female wistar rats as indices of renal function. This appears to be the first study to investigate and document changes in plasma electrolytes and creatinine levels in our environment.

The result from this study demonstrated that combined decoction of lime and Lipton tea induced electrolyte imbalance in the experimental animals. This is similar with findings of previous studies, who reported high levels of potassium, sodium and chloride [17, 18]. Sodium is the most abundant extracellular ion, and it plays an important role in muscle contraction. Similarly, potassium, an abundant intracellular ion, plays a vital role in muscle contraction. The electrolyte derangement resulting from the reduced serum level of sodium, elevated potassium and chloride levels seen in this study thus provides evidence that the use of decoction of lipton tea and lime could present a risk for arrhythmias, abdominal pain and cramping, and muscle weakness overtime.

It is a well known fact that high plasma concentrations of creatinine and urea could be used as indicators of nephrotoxicity [19]. High concentration of creatinine and or urea may signify low renal clearance, which indicates a diminished or impaired ability of the kidneys to filter these waste products from the blood and excrete them in urine. As their clearance values decrease, their blood levels increase. Hence, an abnormally elevated blood creatinine may be suggestive of impaired renal function [19]. This study revealed that decoction of lipton tea and lime induced a significant rise in plasma creatinine which is in consonance with the study by Saka *et al* [20] that reported impaired renal handling of plasma electrolytes and creatinine with consequent hyponatremia and hypercreatinemia. The mechanism of electrolyte imbalance by these extracts is not clear. However, it was suggested that these extracts may contain secondary metabolites or phyto-chemicals capable of interfering with the proper functioning of the

kidneys as reported by Erika *et al.* ²¹ Further studies are required in this area to contribute substantially to knowledge and to possibly unravel the cause and cure of these electrolyte abnormalities by these extracts. There are however a few contrary studies that showed nephro-protection by extracts of *Citrus aurantifolia* against gentamycin-induced nephro-toxicity and oxidative damage in rats [14]. Others include nephro-protection by green tea extract during *Plasmodium berghei* infection, lead acetate-induced and cyclosporine A induced nephro-toxicity in rats respectively [22, 23, 24].

It is pertinent to note in this study, that there were arbitrarily reported values of electrolytes as in very low values of sodium, potassium and chloride in both the test and control groups compared to the normal reference values used [16]. This may imply that both groups of rats researched upon were not healthy as originally intended in the study. These findings however do not negate the fact that there were significant electrolyte abnormalities with the decoction of the combined extracts (test group) as against the controls reported in this study.

It is noteworthy that although hyponatremia is a major challenge associated with the combined decoction as seen in this study, however, if given with close serial monitoring, it may be beneficial in treatment of conditions associated with hypernatremia.

CONCLUSION

This study showed that oral administration of decoction of *Camellia sinensis* and *Citrus aurantifolia* is associated with electrolyte imbalance, leading to hyponatremia and hypercreatinemia. However, this might be beneficial in treatment of conditions associated with hypernatremia. Further analyses are required to unravel the mode of action of the phytochemical constituents of these extracts that cause these electrolyte abnormalities as this will contribute substantially to knowledge and aid treatment of several diseases.

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