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ELECTROLYTE CONCENTRATION IN ALBINO RATS FED WITH *PIMENTA DIOICA* BERRIES

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ABSTRACT

Background: *pimenta dioica* is used in the eastern region of Nigeria for culinary purposes. This tradition is passed down from generation to generation by the natives of the Niger Delta. Long term effect of *pimenta dioica* on electrolyte level in Niger Delta region of Nigeria is yet to be determined. This study was conducted, to determine electrolyte concentration in albino rats fed with *pimenta dioica* berries. **Materials and Methods**: Twenty albino rats Weighing between 150-180g were grouped into four groups of five rats labeled control, A,B and C. Control group were fed only commercial pellets. Group A received 10g of *pimenta dioica* berries, Group B received 20g *pimenta dioica* berries while group C received 30g of *pimenta dioica* berries daily for 21days. The animals were slaughtered after 7, 14 and 21days and blood samples collected into well labelled heparinized bottle for electrolyte estimation. Electrolyte was estimated using Ion Selective Electrode. **Result**: The result for electrolyte showed that there was no significant elevation in test parameters; sodium ($P > 0.05$), potassium ($P > 0.05$), chloride ($P > 0.05$), bicarbonate ($P > 0.05$) and anion gap ($P > 0.05$) when compared with control. **Conclusion:** The results in this study suggest that *pimenta dioica* berries may not predispose consumers to electrolyte imbalance and metabolic acidiosis. However caution should be taken in consumption of *pimenta dioica* berries in high concentration.

KEYWORDS: *Pimenta dioica*, Electrolyte, Anion gap, Ikum spice.

Abbreviations: Sodium: NA^+; Chloride: Cl^-; Potassium: K^+; Bicarbonate: HCO_3; Anion gap: AG; *Pimenta dioica* : P. *dioica*.

INTRODUCTION

Pimenta dioica also referred to as; Jamaica pepper, Pimento, Malagueta, Pimenta, Piment jamaique, Pimenta Gorda, Dulce, English spice, Tabasca, Toda Especial, Toute Epice, allspices is a tree that is native to the caribbean regions.[1] *Pimenta dioica* belongs to Myrtaceae family, it is a tree that is planted in warm regions of the world as an ornamental plant. *Pimenta dioica* possesses an aromatic flavor and taste resembling a mixture of cinnamon, cloves and nutmeg due to an oil of unknown composition when the leaves are crushed [2].*Pimenta dioica* can be used to remedy poor apetite, chills, diarrhoea, dyspepsia, high blood sugar and rheumatism.[3] *Pimenta dioica* berries are used in the caribbean for culinary and medicinal purposes.[4]

Pimenta dioca berries have been reported to possess Phenylpropanoids.[5] Glycosides[6], Tannins[7] and Essential Oil Constituents.[8]

Pimenta dioica (Allspice) contains a multitude of potential bioactive agents that may contribute to health promotion, including flavonoids, phenolic acids, catechins, and several phenyl-propanoids.[9] Berries contain about 2.5% esential oils that include following bioactive compounds: eugenol (60-75%), eugenol methyl ether, Cineole (eucalyptol), phellandrene and caryophyllenes.[10] Allspice is claimed to possess properties such as; antimicrobial, antioxidant, anti-tumorigenic.[9,10] It is used to combat stress, depression and over come fatique because of it's comforting scent.

Electrolytes are substances that become ions in solution and acquire the capacity to conduct electricity. All life forms require a complex balance of electrolyte inside and outside their body structure. In humans, this balance is regulated by hormones, and disruption of this balance leads to health problems.[11] In physiology, the primary ions of electrolytes are sodium (Na^+), potassium (K^+), calcium (Ca^{2+}), chloride (Cl^-), and bicarbonate (HCO_3^-). The electric charge symbols of plus (+) and minus (-)

indicate that the substance is ionic in nature and has an imbalanced distribution of electrons. This is the result of chemical dissociation.[11]

The maintenance of precise osmotic gradients of electrolytes is important as electrolyte gradients affect and regulate the hydration of the body, blood pH, and are critical for nerve and muscle function[11]. Muscles and neurons are activated by electrolyte activity between the extracellular fluid or interstitial fluid, and intracellular fluid. Electrolytes may enter or leave the cell membrane through specialized protein structures embedded in the plasma membrane called ion channels.[11]

Electrolyte balance is maintained by oral, or (in emergencies) intravenous (IV) intake of electrolyte-containing substances, and it is regulated by hormones. Electrolyte homeostasis is regulated by hormones such as antidiuretic hormone, aldosterone and parathyroid hormone. Serious electrolyte disturbances, such as dehydration and over hydration, may lead to cardiac and neurological complications and medical emergency. Electrolytes disturbances can also cause muscle weakness or severe muscle contractions.[11]

In Nigeria, *pimenta dioica* is used in the eastern region of the country for culinary purposes. It is popularly called "Ikum seed". Berries from pimenta dioica are used in preparation of native soup (a type of soup containing periwinkle and oysters) and in smoking of fish. This tradition is passed down from generation to generation by the natives of the Niger Delta.

Long term effect of *pimenta dioica* on electrolyte level in Niger Delta region of Nigeria is yet to be determined. This is as a result of paucity of data. Hence the need for this study. This study therefore sought to determine electrolyte concentration in albino rats fed with *pimenta dioica* berries.

MATERIALS AND METHOD

Plant material and experimental animal

The plant part used for this study is the berry of *pimenta dioica*. It was bought from creek road market in Port-Harcourt metropolis Rivers State Nigeria. It was identified in pharmacy department of River State college of Health Science and Technology. Twenty five male and female albino rats weighing between 150-180 g were used in the study. They were bred in the animal house of university of Port-Harcourt, River State, Nigeria.

Treatment of Pimenta dioica berries

The berries of *Pimenta dioica* were dried for 2-3days and pounded in the mortar into powder form. The powdered form was kept in clean, dried bottle until it was ready for use.

Treatment of animal

The animals were kept in clean metallic cages that were placed in a well ventilated house with optimum condition. The floors of the cages were filled with saw dusts while the cleaning of the cages were done on daily basis. The albino rats were allowed to acclimatize to the environment for one week and maintained at room temperature of 35 ± 2^{o}C and kept in a constant 12hours light/dark cycle. The rats were fed with standard commercial rat pellets and had free access to drinking water ad libitum.

Experimental design

Twenty (20) rats of both sexes (male and female), were grouped into four (4) groups labeled; control, group A, group B and group C. each containing 5 rats per group. The initial weights of all the rats were weighed. The control group received 40g of commercial rat pellets and had access to drinking water from the tap. Graded dose of 10g, 20g and 30g of the dried powdered berries were mixed respectively with 40g of the animal feed and fed to the rats in groups A,B,C respectively. Blood samples were collected by cardiac puncture weekly for 3 weeks (21 days) for the estimation of electrolyte concentration.

Collection of blood and preparation of sample

At the end of each week (7 days), one rat from each group was anaesthetized using chloroform in an enclosed chamber. Blood was collected by cardiac puncture into a well labeled anticoagulated bottles (lithium heparin). Each sample were centrifuged at 1500rpm for 5minutes and plasma separated into a plain bottle using a pasture pipett. Seperated plasma were analyzed immediately in the laboratory.

Determination of electrolyte concentration

The electrolyte concentration was determined using the Ion Selective Electrode (ISE) analyser.[12]

Principle

An ideal Ion Selective Electrode consist of a thin membrane which only the intended ion can be transported. The transport of ions from a high concentration to a low one through a selective binding with some sites within the membrane creates a potiential difference.

Procedure

- The on bottom at the back of the Ion selective electrode analyzer was pressed
- The analyzer was allowed to boot
- The test mode botton was pressed, the sample test number (Get PAT) was entered.
- The 'yes' botton was pressed.
- The plasma was taken to the probe.
- The 'run' botton was pressed.
- The screen displayed test in progress until the result was ready and displayed on the screen and was all printed out.
- The sample was removed after the "sample off beep".
- The result was entered in the result book.

- The probe was flushed with distilled water after each run.

STATISTICAL ANALYSIS

Statistical analysis were performed using excel, and Graphpad prism. Group comparism were done using analysis of variance (Anova) and the student t test, P values of < 0.05 were considered statistically significant.

RESULT

The result of electrolyte (sodium, potassium, chloride, bicarbonate and anion gap) concentration in albino rats fed with *pimenta dioica* berries after 21days are summaried in the tables 1-3 respectively.

The study was conducted to evaluate the concentration of electrolyte (sodium potassium, chloride, bicarbonate, and anion gap) in albino rats fed with different doses of *pimenta dioica* berries and albino rats that were not fed with *pimento dioica* berries (which were used as control). The data are presented in the tables below.

Table 1: Electrolyte concentration in albino rats fed with 10g (Group A) of *pimenta dioica* berries after 21days and control.

Parameter	Albino rats fed with 10g of P. dioica berries	Control	P. value
Sodium(mmol/l)	139.67±2.89	136.00±1.00	0.1062
Potassium(mmol/l)	5.63±0.96	6.23±0.72	0.4353
Chloride(mmol/l)	108.33±1.53	105.33±5.03	0.3789
bicarbonate(mmol/l)	20.00±5.57	25.00±6.08	0.3529
Anion gap(mmol/l)	10.67±5.03	10.00±1.73	0.8380

Table 2: Electrolyte concentration in albino rats fed with 20g (Group B) of *pimenta dioica* berries after 21days and control.

Parameter	Albino rats fed with 20g of P. dioica berries	Control	P. value
Sodium(mmol/l)	136.33±1.53	136.00±1.00	0.7701
Potassium(mmol/l)	6.40±1.37	6.23±0.72	0.8584
Chloride(mmol/l)	108.33±2.52	105.33±5.03	0.4080
bicarbonate(mmol/l)	18.00±2.65	25.00±6.08	0.1415
Anion gap(mmol/l)	10.00±2.65	10.00±1.73	1.0000

Table 3: Electrolyte concentration in albino rats fed with 30g (Group C) of *pimenta dioica* berries after 21days and control.

Parameter	Albino rats fed with 30g of P. dioica berries	Control	P. value
Sodium(mmol/l)	139.00±2.65	136.00±1.00	0.1405
Potassium(mmol/l)	5.67±0.32	6.23±0.72	0.2857
Chloride(mmol/l)	106.33±2.52	105.33±5.03	0.7735
bicarbonate(mmol/l)	22.67±7.57	25.00±6.08	0.6990
Anion gap(mmol/l)	10.67±9.02	10.00±1.73	0.9055

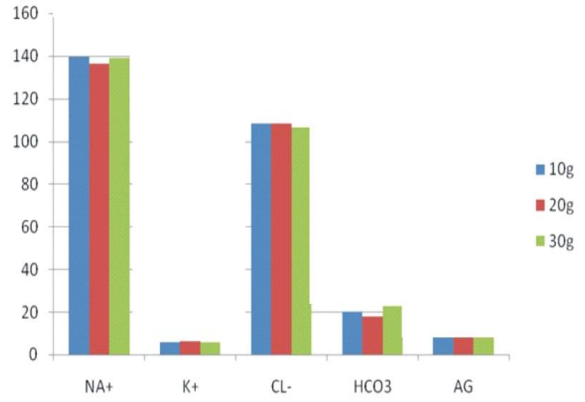

Figure 1 Electrolyte concentration in rats fed with 10g, 20g, and 30g of *pimenta dioica* berries after 21 days.

DISCUSSION

This study showed that electrolyte (sodium, potassium, chloride and bicarbonate) concentration is not significantly affected by consumption of *pimenta dioica* berries. *Pimenta dioica* berries has been known to have antimicrobial, antioxidant and anti inflammatory properties [9,10].However, there was no significant difference in electrolyte concentration in rats fed with *Pimenta dioica* berries. This indicates that osmotic gradients is not affected by *Pimenta dioica* berries. Electrolytes leave and enter the cell membranes through ion channels and are important for muscle contraction. Electrolyte balance is maintained by oral intake of electrolyte containing substances. The insignificant difference may be attributed to electrolytes contained in *Pimenta dioica* berries which help in maintenance of

electrolyte balance. In humans electrolyte homeostasis may be controlled by hormones such as antidiuretic hormone aldosterone and parathyroid hormones. This is reflected in the work of researchers [9,10]. who suggested that *pimenta dioica* berries possess antioxidant and antitumorigenic properties.

Chloride concentration in albino rats fed with *pimenta dioica* berries was within the normal range of 98-108mmol/l. Chloride plays a role in helping the body maintain a normal balance of fluid. The insignificant change in chloride may be attributed to the *pimenta dioica* berries helping to maintain normal balance of fluid in the body.

Potassium was more increased in the group that was given 20g of *Pimenta dioica*. This is because the spice is enriched with good amount of minerals like potassium, manganese and selenium.

Bicarbonate concentration in albino rats fed with *Pimenta dioica* berries increased as concentration of berries consumed increased.. *Pimenta dioica* berries contains eugenol which contributes to anti-imflammatory functtion and stimulate digestive enyzmes.[13] *Pimenta dioica* berries is also known for antioxidant activities.[14] It contains Eugenol.[15], Quercetin[16], Gallic acid and Glloycosides.[6] Phenolic Glycesides have been extracted from *Pimenta dioica* berries1.[17]

Anion gap was more increased in albino rats fed with *Pimenta dioica* than in control. Studies by researchers[18] in albino rats indicated a dose dependent decrease in blood pressure. Anionic gap in this study was not increased. It was not significantly different in control and test. This indicates that *Pimenta dioica* berries does not affect metabolic acidiosis and electrical charge of body fluids.

CONCLUSION

This study shows that pimenta dioica berries used by women in eastern region of Nigeria for culinary purposes does not predispose to electrolyte imbalance and metabolic acidiosis.However, caution should be taken over long term use.

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