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EFFECT OF AQUEOUS EXTRACT OF FRESH LEAVES OF *UVARIA CHAMAE* ON SOME ELECTROLYTE LEVELS IN ALBINO RATS.

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ABSTRACT

Various parts of *Uvaria chamae* are used by traditional medicine practitioners in almost all parts of Nigeria especially in the eastern region in management and treatment of several disorders such as heart and kidney related diseases. This research was carried out to investigate the effect of aqueous extract of fresh leaves of *Uvaria chamae* on serum concentration of some electrolytes in albino rats. A total of twenty-five adult male albino rats used in this study were randomly distributed into five groups (A, B, C, D and E). Groups A, B, C and D were administered 100, 400, 600 and 800 mg/kg body weight respectively of the extract for seven consecutive days. Group E was used as control. There was a decrease in physical activities, the rate of feed and water intake and body weight of the animals in the test groups when compared with the control. The recorded concentrations of HCO_3^- , Na^+ and K^+ in the animals given the extract were significantly lower ($P < 0.05$) than those in the control group. This effect was found to be dose dependent. The finding of this research indicates that aqueous extract of fresh leaves *Uvaria chamae* possess the potential to lower serum concentration of some electrolytes. This may be responsible for the application of the leaves of *Uvaria chamae* in the management of kidney related diseases.

Keywords: Aqueous Extract, *Uvaria chamae*, Electrolyte and Albino Rats

INTRODUCTION

The association of human and animals with plants obviously originated with the beginning of life on earth, when plants supplied much of the shelter, oxygen, foods, and medicine needed by higher life forms [1].

With the emergence of societies, man learned to recognize and categorize plant materials suited for use in meeting the necessities of life. According to world health organization (WHO) about 70% of the world's population relies on plants for primary health care[2].In market today of global margin, more than 50 major drugs originated from tropical plants.

Out of the 250,000 species of plants about 17% have been scholarly investigated for medicinal potentials. Most of these species are used for the treatment of malaria and other microbial infection.

Medicinal plants are shrubs, herbs or plants whose parts (leaves, barks, roots, or fruits) are used in the treatment of various disease of man caused by different microbes, either used in the form of concoction or squeezed with hand to take it contents. Among all, plants like *Kalancho epinnata*, *Kajanu skajan*, *Pterocarpus santalinoides*, *Moringa lucida*, *Alstonia boonei*, *Azadirachta indica*, *Khayagranti foliola* and others have been scholarly proved effective in the treatment of malaria and other microbial infection [3].

Uvaria chamae commonly called clustered pear or bush banana (Nne-nwe) is a small tree whose parts (the leaves) are used as concoction for treatment of malaria. A decoction of its roots, mixed with the roots of *Anthocleista djalonesis*, *Salacia nitida* and *Cnestis ferruginea* is used in the treatment of gonorrhea.It belongs to the family *annonaceae* and it is commonly found in the forest zone of West Africa. *Uvaria chamae* is known to have cytotoxic activity [4]. Aqueous extract of this tree leaves have been reported to exhibit *in vitro* activity against the Ki strain of *Plasmodium falciparum* with a median inhibitory

concentration (IC_{50}) of 21.6 μ g/ml [5], and the stem of the tree has antimicrobial activity [6]. The phytochemical screening carried out on the plant fresh leaves and stems revealed the presence of various secondary metabolites like alkaloids, terpenes and flavonoids including others as will be seen below which have been implicated in antimalarial activities in vitro and in vivo [7 and 8].

The bicarbonate ion acts as a buffer in the maintenance of blood pH. It is a polyatomic ion with chemical formula HCO_3^- . Bicarbonate serves a crucial biochemical function in the physiological pH buffering system. The prefix “bi” in bicarbonate comes from an old naming system and is based on the observation that there are two times as much carbonate (CO_3^{2-}) in sodium bicarbonate ($NaHCO_3$) and other bicarbonates as in sodium carbonate (Na_2CO_3) and others [9]. The bicarbonate ion (hydrogen carbonate ion) is an anion with the empirical formula HCO_3^- and molecular mass of 61.01Da, it consists of one central carbon atom surrounded by three oxygen atoms in a trigonal planar arrangement with a hydrogen atom attached to one of the oxygen. It is isoelectric with nitric acid HNO_3 .

Carbonic dehydratase catalyzes its reaction with water to form carbonic acid (H_2CO_3), which when dissociate forms H^+ and HCO_3^- much of H^+ buffered by Hb and the HCO_3^- diffuses out into the extracellular fluid along a concentration gradient.

Under normal circumstances the higher PCO_2 in the blood living tissue stimulates erythrocytes HCO_3^- production, consequently the arterio-venous difference in the ratio of $[HCO_3^-]$ to $[CO_2]$ and therefore the pH is kept relatively constant. Extracellular and intracellular buffers other than HCO_3^- and hemoglobin (Hb) do not contribute significantly to blood buffering.

Potassium levels influences multiple physiological processes including; Resting cellular membrane potentials and propagation of action potential in neuronal muscular and cardiac tissues. Due to the electrostatic and chemical properties of potassium. Potassium ion (K^+)

are larger than sodium ion(Na^+) and the ion channels and pumps in cell membranes can differentiate between the two ions, actively pumping and passively passing one of the two ions while blocking the other.

Plasma potassium level is normally kept at 3.5 to 5.0mMol/L. Any level outside this ranges are associated with an increasing rate of death from multiple causes and some cardiac, kidney and lungs disease progresses more rapidly if serum potassium levels are not maintained within the normal range. Potassium ion is also important in preventing muscle contraction and the sending of all nerve impulses in animals through action potentials. By nature of their electrostatic and chemical properties of potassium ion (K^+) are larger than the sodium ion. Storage of potassium in the body fluids may cause a potentially fatal condition known as hypokalemia (high serum potassium), typically resulting to vomiting, diarrhea and /or increase diuresis. Deficiency symptoms includes; muscle weakness, paralytic ileus ECG abnormalities, decrease reflex response and in severe cases respiratory paralysis, alkalosis and cardiac arrhythmia [10].

Individuals suffering from kidney diseases may suffer from adverse health effects from consuming large quantity of dietary potassium. End stage renal failure patients undergoing therapy by renal dialysis must observe strict dietary limits on potassium intake, as kidney control potassium excretion and building up of blood concentration of potassium (hyperkalemia) may result to fatal cardiac arrhythmia [11].

Hyperkalemia (low serum potassium level) is associated with body potassium deficiency, excessive potassium loss due to prolonged diarrhea, or prolonged period of vomiting and increase secretion of mineralocorticosteroids.

Sodium ion is the major cation of the extracellular fluid (ECF) and principally regulates its volume thus, sodium ion plays a cardinal role in the blood pressure regulation. Sodium transmission in and out of the cells plays a critical role in the body function. Many

processes in the body especially in the brain, nervous system and muscle operate through electrical signals generated by electrolytes.

Therefore, extremes in the blood levels could cause the cell to malfunction and may be fatal. Sodium was first isolated by Humphry Davy in 1807 by the use of electrolysis of sodium hydroxide. Sodium like other member of group one element possess similar description like its proximate elements like potassium in the same column in the periodic table. It is a chemical element with symbol Na far from its first (initial) and second letter, with atomic number 11 and mass number of 22.989u. Like other six element in the group, it has a single electron on the outer shell that it readily donate creating a positively charged atom (a cation). Its only stable isotope is ^{23}Na . the free metal does not occur in nature but must be prepared from the compounds. Sodium is the sixth most abundant element in the earth crust and exist in numerous mineral such as feldspars, sodalite, and rock salt (NaCl). Many salts of sodium are highly water soluble. Intracellular medium sodium is identified by the D spectral line: though it has a high vaporization temperature, its abundant allowed it to be detected by mariner 10 in mercury's atmosphere [12].

In human, sodium is an essential mineral that regulate blood volume, blood pressure, osmotic equilibrium and pH. The minimum physiological requirement for sodium is 500mg per day. Sodium chloride (NaCl) is the principal source of sodium in the diet and it is used as seasoning and preservatives in such commodities as pickled preserves in jerky for Americans. Most sodium chloride comes from processed foods. The UL standard for sodium intake is 2.3g per day and exceeding the threshold can lead to hypertension, but the average person in the United State consumes 3.4g per day. Hypertension causes 7.6million premature death worldwide each year [13].

The renin-angiotensin system regulates the amount of fluids and sodium concentration in the body. Reduction in the blood pressure and sodium concentration in the kidney results in the production of renin which in turn produces aldosterone and angiotensin, retaining

sodium in the urine. When the concentration of sodium increases, the production of renin decreases and the sodium concentration returns to normal.

AIM

The aim of this research work was to assess the effect of aqueous extract of fresh leaves of *Uvaria chamae* on the kidney of albino rats, by measuring the levels of some electrolytes (Bicarbonate ion, Potassium ion and Sodium ion) in the blood of albino rats treated with the aqueous extract of fresh leaves of *Uvaria chamae*.

MATERIALS AND METHODS

METHODS

Collection of Samples

Twenty-five (25) adult male albino rats weighing between 80g to 200g were purchased from the animal house unit, of the department animal science, faculty of Agriculture university of Nigeria Nsukka Enugu state (UNN) and were housed in the animal house units of Biochemistry department Ebonyi state university Abakaliki in a ventilated cage under good laboratory conditions.

Collection of Medicinal Plants

Fresh leaves of *Uvaria chamae* (Nne-enwe) were collected from Ohatekwe Amagu in Ikwo Local Government Area of Ebonyi State and was identified by Dr. Nwani, C. D. of the Department of Applied Biology, Ebonyi State University Abakaliki.

Preparation of Plant Extract

The fresh leaves of the *Uvaria chamae* were washed and air-dried, and 800g was ground into paste (using pestle and mortar). It was soaked into deionized water (300ml) in a beaker and allow to stand for one hour. The extract was obtained by decantation.

Animal Handling

The animals were acclimatised for seven days, and they were allow free access to water and grower mash feed. The animals were divided into five (5) groups; A, B, C, D, and E in each steel cage containing a total of five rats.

Administration of Plant Extract

Aqueous extract of the plant was administered by oral intubation throughout the experiment, groups A, B, C and D were fed with an oral administration of the extract with the volume of extract calculated using specific doses, 100, 400, 600 and 800 mg/kg given respectively. The animals were allowed free access to feeds and water. Group E was administered with distilled water throughout the research period

Collection of Blood Sample

After seven days of extract administration to the experimental animals (albino rats), the rats were starved overnight. Under mild anesthesia using chloroform, blood sample were collected from the rats via cardiac punctures, the collected blood sample were poured into a sterile bottle.

Preparation of Serum

The collected blood sample were centrifuged to obtain the serum via decantation used for the measurement of the serum levels of the electrolytes

Measurement of Parameters

The serum concentrations of sodium and potassium ions were determined using flame emission spectrometry (FES) method of [14], as applied by [15]. Whereas the bicarbonate ion concentration was determined using titration method of [16], as described and used by [15].

RESULTS

PHYSICAL OBSERVATIONS

Administration of aqueous extract of *Uvaria chamae* fresh leaves to the albino rats produced a decrease in physical activities relative to the untreated group (control). There was also a reduction in feed and water consumption by the rats in the treated groups, while the control did not show any easily noticeable changes.

CHANGES IN AVERAGE BODY WEIGHT OF THE RATS DURING SEVEN DAYS OF EXTRACT ADMINISTRATION

The change in the average body weight of the animals is presented in table 1 below.

There was a significant ($P < 0.05$) decrease in average body weight of the albino rats in the groups given the extract, while the increase in the control group was not significant ($P > 0.05$). This change in the body weight of the test groups varied linearly with the dose.

Table 1: Weight (g) of albino rats

DAYS	GROUP A	GROUP B	GROUP C	GROUP D	GROUP E
1	164.41±4.47	150.51±4.67	160.03±4.67	158.05±4.07	168.41±5.67
2	156.52±4.86	140.41±3.89	138.05±3.89	140.05±5.48	170.01±5.83
3	150.25±4.41	134.65±3.72	130.25±8.99	134.55±3.66	174.65±5.58
4	148.45±4.40	132.35±3.53	130.45±4.67	132.25±4.39	178.55±5.54
5	140.55±7.06	130.45±7.05	128.21±4.61	130.35±4.10	180.65±5.62
6	138.51±4.52	128.65±3.18	128.25±4.69	128.65±4.43	182.05±5.67
7	130.15±4.41	120.55±4.06	126.05±4.67	124.25±4.25	182.85±5.64

Values in mean body weight ± standard mean deviation; N = 5

BICARBONATE ION (HCO_3^-), POTASSIUM ION (K^+) AND SODIUM ION (Na^+) IN ALBINO RATS AFTER SEVEN (7) DAYS OF EXTRACT ADMINISTRATION

The results obtained on the electrolytes are shown in table 2 below. The concentration of (HCO_3^-), (K^+) and (Na^+) in the serum of the albino rats administered the extract were significantly lower ($P < 0.05$) than in the control group. The decrease in the concentration of the electrolytes was found to be dose dependent.

Table 2: Average Levels of some electrolytes.

GROUPS	HCO₃⁻ (mg/mol)	K⁺(mg/mol)	Na⁺ (mg/mol)
GROUP A	10.18 ± 0.76	2.45 ± 0.51	89.90 ± 1.45p
GROUP B	8.69 ± 3.51	2.46 ± 0.67	80.54 ± 1.59
GROUP C	6.62 ± 0.80	1.15 ± 0.35	66.82 ± 2.09
GROUP D	4.08 ± 3.02	0.53 ± 0.37	51.71 ± 1.91
GROUP E	12.54 ± 2.66	3.71 ± 0.60	112.43 ± 3.05

Values are mean ± SD; N=5.

DISCUSSION AND CONCLUSION

DISCUSSION

The decrease in the physical activities as a result of extract administration is not well understood at this stage of the research. However, it may be as a result of the chemical constituent of the extract. Some phytochemicals have been reported to affect the physical activities in the test animals, for example alkaloids are central nervous system stimulant which are capable of inducing calmness in test animals [17].

Medicinal plant extracts have been reported to cause decrease in physical activities when administered to albino rats. Further investigations are required to fully explain the actual biochemical mechanism responsible for the decrease in feed and water intake by the animal administered with the extract [18]. This agrees with the work of [19]. However, a metabolic upset caused by chemical constituent of the extract may be responsible. Plant extract contain chemical compounds that have been reported to lower appetite, this observation is consistent with findings of [19].

The significance decrease in the concentrations of the electrolytes suggests that the extract may show a protective property on the kidney. The kidney regulates the concentration of electrolytes in blood. Clinically electrolytes such as Potassium ion (K^+), Sodium ion (Na^+) and bicarbonate ion (HCO_3^-) are among the parameters that are useful in the determination of kidney function. Elevation of their levels indicates kidney damage[19].

CONCLUSION

The aqueous fresh leaves extract of *Uvaria chamae* administered to the test groups resulted in decrease on some serum electrolytes levels. This may be an indication that *Uvaria chamae* aqueous leaf extract possess a protective function on the kidney and helps to maintain electrolytes balance as well in the treatment of some kidney diseases.

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