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Magnesium ion, Potassium ion and Chloride Levels in Albino Rats Administered with Aqueous Fresh Leaf Extract of *Acalypha wilkesiana*

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Abstract: Medicinal application of *Acalypha wilkesiana* includes management and treatment of anxiety and gastrointestinal track disorders, many of these applications are still being investigated. The present study evaluated the effect of aqueous fresh leaf extract of *Acalypha wilkesiana* on electrolyte balance in albino rats. The research was conducted with 20 albino rats which were divided into five groups of four rats each, doses of 200, 350, 500 and 650mg/kg body weight of the extracts were orally administered to groups A, B, C and D respectively, while group E acted as the control. After administration, physical activities and rate of feed and water intake decreased in the test groups while no significant changes was noticed in the control. Similarly, the average body weight of the test groups reduced while the control gained weight. The average concentration of potassium ion, chloride ion and magnesium ion were insignificantly higher ($P>0.05$) in the treated animals than the control group E. The reductions were observed to be dose dependent. From the results of this research, aqueous leaf extract of *Acalypha wilkesiana* may be used in management and treatment of disorders of electrolyte imbalance.

Key words: *Acalypha wilkesiana* · Electrolytes · Anxiety and gastrointestinal disorders

INTRODUCTION

Medicinal plants have been identified and used throughout human history. Plants have the ability to synthesize a wide variety of chemical compounds that are used to perform important biological functions, long before the discovery and development of modern scientific medicine such as the use of pharmaceutical drugs and doctor's surgery, traditional healing methods had been in use and are still being used today in every culture [1].

Typically such folklore has been handed down from generation to generation often for hundreds if not thousands of years. Each new generation learns at first hand the look and feel of a particular symptoms and illness and the best methods for collecting, preserving and administering them. These traditions known as folk medicine traditions are entirely dependent upon repeated experience and observation [2].

In Nigeria, tradition medicines are sought after where modern healthcare facilities are not available and accessible. In Haiti, herbal cures are an important part of health care regimes. The world's Health organization estimate that 80% of the world's inhabitants rely mainly on traditional medicines for their heaths care, plant products plant an important role in the health care of the remaining 20% of the population who manly reside on development countries [3].

Acalypha wilkesiana also known as copper leaf is one of such plants whose leaves and seeds are used as medicinal herbs in various part of the continent in the treatment of skin problems, common cold, headache rheumanoid arthritis, swelling, breast tumors, inflammation as well as reducing fever. It is growing in the deep well drained soils and requires sunlight in maintaining the production and good health of the bright red pigments [4].

Magnesium is the key mineral in human metabolism and found in small to medium amount magnesium ion is known as the best supporting actor of the mineral kingdom, human body contains about 760mg of magnesium at birth [5]. Magnesium function as a co-factors of many enzymes involved in energy metabolism, protein synthesis, RNA and DNA synthesis and maintenance of the electrical potential of nervous tissues.

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A diet low in magnesium (mg^{2+}) has been linked to unwanted increase in the inflammatory process while some amount of inflammation is necessary to support normal immune function and tissue repair after injury they are several factors affect the levels of magnesium ion in the body, low intake of food rich in mg^{2+}, poor intestinal absorption of minerals and excessive excretion of minerals [6].

Potassium is the principal intracellular cation, it is equally important in the extracellular fluid for specific functions. Potassium is gotten from dietary sources which includes banana, orange, pineapple and beans. The absorption of K^+ from the gastrointestinal tract is very efficient and very little is lost through faces. However, in subjects with diarrhea a good proportion of K^+ is lost in the feces. The plasma concentration of potassium is 3.4-5.0 Meq/L. The whole blood contains much higher level of K^+ since it is predominantly an intracellular cation.

Chlorine or chloride ion is a constituent of sodium chloride. Hence the metabolism of chlorine and sodium are intimately related. Chloride ion can function biochemically by regulation of acid- base equilibrium, fluid balance and osmotic pressure [7]. Adequate intake of sodium will satisfy the chloride requirement of the body. The common source of chloride ion includes salt as cooking medium, whole grain, leafy vegetables egg and milk.

The aim of this research was to investigate the effect of *Acalypha wilkesiana* on electrolyte levels of albino rats.

MATERIALS AND METHODS

Collection of Albino Rats: Twenty albino rats weighing approximately 203-235g were obtained from Department of Zoology University of Nigeria, Nsukka and transported down to the Department of Biochemistry Ebonyi State University, Abakaliki.

Collection of Plant Leaves: Fresh leaves of *Acalypha wilkesiana* was collected from Abakaliki Local Government Area of Ebonyi State and was authenticated by Dr. Nwali C.N of Applied Biology Department, Ebonyi State University, Abakaliki.

Preparation of Plant Extract: The fresh leaves of *Acalypha wilkesiana* weighing 160g were sliced into small pieces and ground with mortar and pestle to obtain paste. The paste was soaked in 200ml of distilled water and allowed to stand for 30minus and then filtered using muslin cloth or handkerchief. It was evaporated using a rotor evaporator to obtain a gel-like extract. Solution of the extract was made with distilled water. The handkerchief was weighed to be 9.4g using a beam balance. The mortar was filtered properly using a clean white handkerchief. The residue (Chaff) and the handkerchief weighed 90g and the extract weight of the residue (Chaff) was 80.6g. The volume of the extract (juice) was measured to be 350ml using the beaker. The extract was kept in a clean air tight container and stored in a cool dry place at room temperature of 25°C.

Animal Handling and Treatment: The albino rats were grouped into five groups in steel cages, labeled A-E, each containing four albino rats. The rats were acclimatized for seven days before treatment commenced.

Measurement of Weight: The weight of the rats was measured daily, using weighting balance and was used to determine the actual volume of plant extract to be administered.

Animal Treatment: The rats were allowed free food and water during the period of treatment. Different doses of the extract 200, 350, 500 and 650mg/kg body weight were administered to the animals in group A to D respectively, while the control group E was given distilled water.

Collection of Sample from Animal: Blood samples were collected from the albino rats after oral administration of the appropriate dosages for seven consecutive days. The animals were starved for one day before decapitation and the blood samples collected in sample bottle. The animals (albino rats) were sacrificed under mild anaesthesia using chloroform through a cardiac puncture, the blood sample were collected from each animal.

Preparation of Serum: Blood sample collected from the albino rats, were allowed to coagulate and then centrifuge at 3000xg for 10 minutes to get serum, (the resulting supernatant). The serum was collected using micropipette.

Determination of Magnesium: This method utilizes an arsenazo dye which binds preferentially with magnesium. The absorbance of the arsenazo-magnesium complex is measured at 572 nm and is proportional to the concentration of magnesium.

Determination of Chloride: 0.1 ml of serum was mixed with 10 ml of diluting fluid in a beaker. 2-3 drops of the indicator solution was added. The machine was switched.

The concentration of chlorides in mmol/L indicated when the digital display stops. Repeat the same procedure with 0.1 ml of standard to confirm the accuracy of the result.

Potasium Determination: Potasium concentration was determined using Sofowora, (2000) [8] methods.

RESULTS

Physical Observation: There was a decrease in food and water in the treated animals compared to the control (group E) that showed an increase in food and water consumption. Hence, there was a decrease in the weight and physical activities, e.g: Movement in the treated animals in respect to the control changes in body weight (g) of animals during seven (7) days of treatment with plant extract (*Acalypha wilkesiana*). The changes in body weight of the animals during seven (7) days of treatment as summarized in table 1. A linear decrease occurred in the test group (A-D), while the control group (E) gained weight. This reduction in the weight of the treated animals also varied among the groups. That is, the weight decrease was dose dependent.

The average level of potassium ion in groups A, B, C and D (3. 92mmo/L, 6.37mmo/L, 7.4mmol/L and 19.52mmo/L) were found to be higher than the average level of potassium in group E (3.63 mmol/L) after seven days of treatment with aqueous fresh leaf extract of *Acalypha wilkesiana*.

The average level of chloride ion in groups A, B, C and D (102. 27mmo/L, 84.74mmol/L, 75.44±0.22 mmo/L and 72.20mmol/L) were found to be lower than the average levels of chloride ion in group E (115 34mmol/L).

Also, the average level of magnesium in group A – D (4.15mmol/L, 3.70mmol/L, 14.85mmol/l and 5.12mmol/L) were found to be higher than that in group E (1.94mmol/L) which served as control.

DISCUSSION

The extraction of fresh leaves of *Acalypha wilkesiana* with distilled water as solvent yielded 9.4%. This low percentage yield suggested that most of the chemicals constituent of the leaves are not soluble in water. This may explain why alcohol (ethanol) extract is frequently used by traditional medicine practitioners.

Throughout the days of administration of the aqueous extract of fresh leaves of *Acalypha wilkesiana* to the albino rats, there were decrease in their physical activities, feed and water intake, the changes in body weight of animals during seven days of treatment was linearly decreased in the test groups (A, B, C and D) why the control group E gained weight. The reason behind these changes in physical activities can be due to the effect of aqueous extract of fresh leaves of *Acalypha wilkesiana* on the general metabolism of the animals although the actual mechanism involved is not cearly under stood.

Table 1: Changes in Body Weights (g) of Animals During 7 Days of Treatment with Plant Extract (*Acalypha wilkesiana*) Average Wight of Animals

Days	Group a	Group B	Group C	Group D	Group e
1.	93.05±5.18	117.00±5.93	211.00±5.90	215.00±6.12	205.05±5.83
2.	87.04±4.73	100.02±4.64	197.00±5.00	198.04±5.60	200.00±5.79
3.	85.04±4.67	90.00±4.32	194.01±4.83	186.93±4.90	194.01±4.33
4.	85.03±4.63	86.02±3.48	190.00±4.72	184.44±4.36	192.00±4.18
5.	84.05±4.57	82.05±3.38	190.00±4.70	182.50±4.29	190.00±2.88
6.	92.02±3.38	80.06±2.48	188.02±4.49	180.15±4.21	190.00±1.88
7.	77.02±2.37	79.00±2.223	180.00±4.40	180.09±4.11	190.00±1.18

Values are mean ± standard deviation, N= 4.

Table 2: Average Concentration of Potassium, Chloride and Magnesium Levels in the Serum of Albino Rats Treated with *Acalyphia wilkesiana* after 7days of Administration

Groups	Potassium (MMOL/L)	Chloride (MMOL/L)	Magnesium (MMOL/L)
Group A	3.92±0.5	102.27±1.41	4.15±0.38
Group B	6.39±0.47	84.75±2.07	3.70±1.82
Group C	7.41±0.17	75.44±0.22	4.85±0.38
Group D	9.52± 0.20	72.20±4.95	5.12±0.64
Group E	3.63±0.52	65.34±2.85	1.94±0.22

Values are mean ± standard deviation

There was a significant increase (P<0.05) in the average body weight of the treated animals than in the control groups. The changes in the average weight of the animals during the course of the administration were minimal. The action of the aqueous extract of fresh leaves of *Acalypha wilkesiana* on the body system of the animals may play a role in the changes observed in the average body weight. The actual mechanism involved is not yet known.

The average potassium level in the control group was insignificantly lower (P>0.05) than the test groups. The average potassium in groups A and B was significantly higher (P<0.05) than groups C and D. The observations indicated that the chemical constituents of the extract may not have any effect on the potassium level.

The average chloride level in the control group was insignificantly higher (P>0.05) than the treated groups. The average concentration was found to be significantly higher (P<0.05) in groups A and B than in groups C and D. The chemical components of the extract may not play a role in the chloride ion.

The average level of magnesium ion in the treated groups was non-significantly higher (P>0.05) than the control group. Also average levels of magnesium ion significantly increased (P<0.05) in groups A and B than in groups C and D. This extract may be used in the treatment of electrolyte disorders.

CONCLUSION

From the observations made in this research that the aqueous leaf extract of *Acalypha wilkesiana* may be used in the management and treatment of disorders of electrolyte imbalances. However, this observation cannot be substantiated since crude extract was used and the active compounds responsible for these effects are yet unknown.

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