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Sub-acute Effects of Ethanol Extract of *Sarcocephalus latifolius* Root on Some Physiologically Important Electrolytes in Serum of Normal Wistar Albino Rats

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Abstract: *Sarcocephalus latifolius* (Synonym, *Nauclea latifolia*) is a shrub commonly seen in the South East of Nigeria. It is widely applied as herbal remedy in the treatment of various illnesses. The effect of ethanol extract of the root of the plant on some serum electrolytes was studied. A total of thirty Wistar albino rats were used to determine serum concentrations of K^+, Ca^{2+}, Cl^- and HCO_3^-. The animals were divided into six groups of five rats each. Five groups labeled A, B, C, D and E, were administered orally with graded doses of root extract of *Sarcocephalus latifolius* at concentration of 300, 350, 400, 450 and 500 mg kg^{-1} body weight, respectively. The sixth group (Group F) was used as the control and its animals were simply sustained on normal diet and water. Administration of the extract lasted for twenty-one days after which the animals were sacrificed by cardiac puncture. K^+, Ca^{2+}, Cl^- and HCO_3^- were determined from each sample and the mean concentration was calculated for each dose and the control. Potassium, calcium and chloride determination were done by colorimetric methods while determination of bicarbonate concentration was done by simple titration. Na^+ was separately assayed, by flame photometer, from a set of 18 rats of six animals in each of three groups. For K^+, non dose dependent increases were observed which was non-significant ($p>0.05$), for A, D and E but significant ($p<0.05$) for B and C. Ca^{2+} showed a dose dependent and significant ($p<0.05$) decreases, except for A ($p>0.05$). Decreases ($p< 0.05$) for C, D, E and ($p>0.05$) for A and B were observed for Cl^-. Serum bicarbonate appeared almost completely unaffected by the extract, showing no significant changes. Na^+ levels were depressed for the two test groups, A and B compared with the control (group C), with test group B showing a significant decrease ($p<0.05$). From the analysis, it could be concluded that *Sarcocephalus latifolius* has the capacity to influence various electrolytes to physiologically important degrees. Significant reductions in sodium and calcium levels indicate the usefulness of the plant in treatment of hypertension and pain/fever, respectively. However, significant reductions in chloride may negatively affect the normal balance of fluid in the body. Therefore, more scientific research is needed to establish the best approach to optimizing the numerous medicinal potentials of the plant.

Key words: *Sarcocephalus latifolius*, serum, electrolytes

INTRODUCTION

The use of herbal remedies and indeed natural products for healthcare delivery has been on the increase in recent times. The practice has become obviously popular in Nigeria to the extent that trade fares are periodically organized in different parts of the Country to promote herbal products. Many such products have indeed won certification by the National Agency for Food and Drug Administration and Control (NAFDAC) in Nigeria. Medicinal plants constitute a major source of most modern medicines and this fact is widely accepted (Suffness and Douros, 1982) and further explains the importance of natural products in the pharmaceutical industry (Baker *et al*., 1995). Even the WHO has been cited to encourage the use of traditional medicines from plants and in many advanced countries their use and popularity have increased rapidly (Subbaram, 1997).

Sarcocephalus latifolius (African peach) is one of the numerous plant species believed to have medicinal value. For example, it is among those medicinal plants strongly associated with antimalarial potency and widely used as such (Zirihi *et al*., 2005; Asase and Mensah, 2009). *Sarcocephalus latifolius* is a widely distributed straggling shrub mostly found in the tropical areas of Africa and Asia. The shrub has multiple stems with numerous irregular branches and dense foliage. In Nigeria, the plant is widely distributed in the South-east and South-south regions of the country. *Sarcocephalus latifolius* is reported to have a wide range

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of medicinal properties and its medicinal uses vary from one traditional setting to another; some common traditional uses which have been mentioned in different literatures include fever, pain, dental caries, septic mouth, malaria, hypertension, dysentery, diarrhea and diseases of the central nervous system such as epilepsy (Amos *et al*., 2005; Bum *et al*., 2009; Abbah *et al*., 2010). Anticonvulsant, anxiolytic and sedative properties of *Sarcocephalus latifolius* roots decoction had also been reported (Bum *et al*., 2009).

The present study was conducted in order to determine the possible influence of ethanol root extract of *Sarcocephalus latifolius* on certain electrolytes which have obvious physiological importance. In view of the very high dependence on this plant species as a remedy for diverse ailments (such as malaria endemic in Nigeria) in many localities, this study has become necessary since the balance of electrolytes in humans is essential for normal functioning of cells and organs. Severe electrolyte disturbances can be associated with life threatening consequences such as heart failure, shock and coma, among others.

MATERIALS AND METHODS

Collection and processing of plant specimen: *Sarcocephalus latifolius* was identified by P.O. Ugwuozor, a taxonomist in the Department of Botany, Nnamdi Azikiwe University, Awka, in the South East of Nigeria. Roots were harvested fresh and washed in clean water. They were then cut into smaller pieces and dried under shade within the Biochemistry Department of Nnamdi Azikiwe University. The dried pieces were then pulverized to very fine texture.

Preparation of extract: The pulverized root material, weighing 1 kg, was soaked in ethanol for 48 h. The liquid was then thoroughly filtered using whatman filter paper. Concentration of the sample was done by evaporation in a rotary evaporator RE 52-2 (Searchtech Instruments). The concentrate (extract) was stored in the refrigerator and later used for administration to the experimental animals.

Experimental animals: Wistar albino rats were obtained from the Veterinary department of the University of Nigeria, Nsukka. The animals were housed in cages kept in an adequate animal house environment and were acclimatized for three days. They were adequately fed with appropriate feed formula.

Administration of extract: A total of thirty Wistar albino rats, divided into six groups of five rats each, were used for the determination of potassium, calcium, chloride and bicarbonate. Five groups labeled A, B, C, D and E were administered orally with graded (increasing) doses of root extract of *Sarcocephalus latifolius* at concentrations of 300, 350, 400, 450 and 500 mg kg^{-1} body weight, respectively. The sixth group (Group F) was used as the control and its animals were simply sustained on normal feed diet and water. The extract was orally administered daily for twenty-one days.

Serum sodium was determined from a separate set of eighteen rats, divided into three groups of six animals each and labeled A, B and C. Groups A and B served as test animals whereas animals in group C were used as control. Animals in groups A and B were administered with a daily oral dose of 500 and 800 mg kg^{-1}, body weight, respectively, of the ethanol extract of *Sarcocephalus latifolius*. Administration lasted for twenty-one days. Animals in group C were kept as control and were not administered with the extract.

Preparation of serum sample: In 24 h after the last administration, all the animals were sacrificed, group by group. The blood from each animal was collected by cardiac puncture with sterile syringes and emptied into pre-labeled centrifuge tubes for serum separation. They were left standing at room temperature for 30 min before centrifuging at 4000 rpm for 5 min in an 80-1 electric centrifuge (B-Bram Scientific and Instrument Co., England). Potassium, calcium and chloride determination were done by colorimetric methods using Biorex reagent kits (UK)-BXCO141A for potassium, BXCO291A for calcium and BXCO281A for chloride, carefully following the specifications of the Manufacturer. Determination of bicarbonate concentration was done by simple titration (Scribner and Caillouette, 1954).

Serum sodium ion concentration was determined using flame photometer (IL 943).

Statistical analyses: Data were analysed using one-way analysis of Variance (ANOVA) at 0.05 level of significance, using the statistical package for social sciences (SPSS), version 17.0 for windows software package.

RESULTS

The mean serum potassium concentrations determined for normal wistar albino rats administered with extracts of *Sarcocephalus latifolius* at doses ranging between 300 and 500 mg kg^{-1} body weight, showed nonsignificant increases by the extract. The mean potassium concentrations (mmol L^{-1}) for the test groups

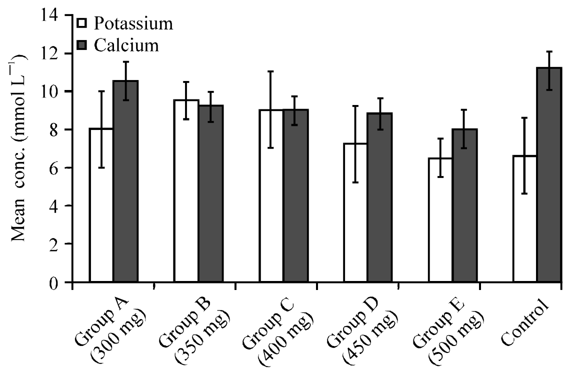

Fig. 1: Mean concentrations of potassium and calcium (Data represented as Mean±SEM). Increased K^+ ($p>0.05$) for A, D and E and ($p<0.05$) for B and C. Decreased Ca^{2+} ($p>0.05$) for A, but ($p<0.05$) for B to E

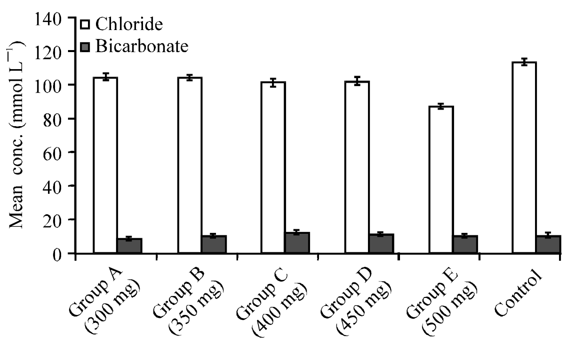

Fig. 2: Mean concentrations of chloride and bicarbonate (Data represented as Mean±SEM). For A and B, Cl^- decreased ($p>0.05$); for C, D and E, Cl^- decreased ($p< 0.05$). Bicarbonate is apparently unaffected

A-E, are 8.0±0.00, 9.5±0.96, 9.0±2.00, 7.2±0.20 and 6.5±0.50, respectively, with the control value of 6.6±0.24. Serum calcium was depressed non significantly under the same conditions for all the doses. Mean calcium concentrations (mmol L^{-1}) for test groups A-E were 10.5±0.50, 9.25±0.85, 9.0±0.00, 8.8±0.20 and 8.0±0.00, respectively while mean calcium concentration for the control is 11.2±0.80 (Fig. 1).

Under the same dose schedules and experimental conditions, serum chloride concentration was significantly decreased at higher doses whereas serum bicarbonate was apparently unaffected (Fig. 2). The mean chloride concentrations (mmol L^{-1}) for test groups A-E are 104±8.00, 104.5±2.87, 101±9.00, 102.4±2.23 and 87±3.00, respectively while the mean chloride concentration for the control is 113.2±2.87. The mean bicarbonate concentrations (mmol L^{-1}) for the test groups

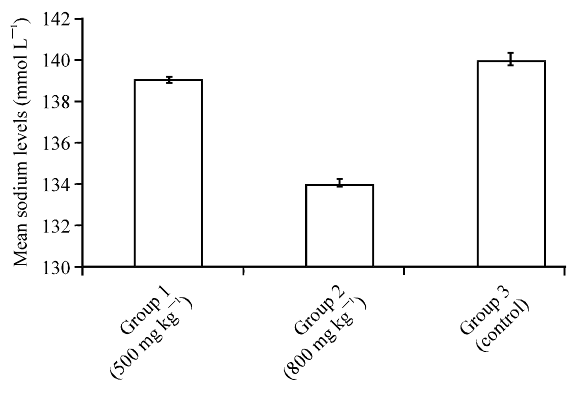

Fig. 3: Mean Sodium levels (data represented as Mean±SEM). Groups 1 and 2 decreased Na^+ ($p>0.05$) for group 1 but for group 2 ($p<0.05$)

are 9.0±0.00, 10.5±0.50, 13.3±1.67, 11.3±1.67 and 10.5±1.50, respectively whereas the mean bicarbonate concentration for the control is 10.88±0.59.

The effect of the extract on serum sodium is significantly dose dependent. At a dose of 500 mg kg^{-1} body weight, the decrease in sodium was nonsignificant ($p>0.05$), whereas at a dose of 800 mg kg^{-1} body weight, a significant decrease ($p<0.05$) in serum sodium concentration was recorded (Fig. 3). The mean sodium levels (mmol L^{-1}) for the test groups are 139.2±1.02 and 134.5±1.50, respectively, whereas the mean sodium concentration for the control is 140.66±1.12. Evidently, the extract has the capacity to depress sodium ion concentration.

DISCUSSION

Certain conventional drugs and some natural plant products have the potential to cause varying degrees of elevation or depression in plasma electrolytes and this has fundamental clinical consequences. Increases or decreases in sodium concentration may contribute to fluctuations of blood pressure. Different studies have indeed revealed that plant extracts can strongly influence the blood concentrations of sodium. This study has demonstrated the ability of root extract of *Sarcocephalus latifolius* to decrease serum sodium levels in experimental animals. Root extract of *Sarcocephalus latifolius* reportedly reduced the systolic, diastolic and mean arterial pressures in both non-hypertensive and hypertensive rats (Nworgu *et al*., 2008). Another independent study reported that leaf extract of *Sarcocephalus latifolius* had no significant effect on serum sodium but significantly elevated serum potassium (Akpanabiatu *et al*., 2005).

Herbal extracts, as with certain conventional drugs (Crook, 2006a), can cause hypokalaemia or hyperkalaemia. Hyperkalaemia predisposes to cardiac arrest and thus any extract that significantly elevates potassium in blood or tissues is a potential risk and must be taken with caution. Thus, the potentials for root of *Sarcocephalus latifolius* to increase potassium levels should be a consideration while attempting to exploit its numerous medicinal potentials. Decreased blood potassium (hypokalaemia) on the other hand can lead to muscular weakness, hypotonia and cardiac arrhythmias, among other clinical features (Crook, 2006b). In the same vein, various drugs can alter the concentrations of calcium in blood or tissues. Elevations of calcium (hypercalcaemia) can be caused by certain drugs such as thiazides, while calcium depression (hypocalcaemia) can be caused by other drugs, such as furosemide (Crook, 2006a). Hypercalcaemia predisposes to renal damage, polyuria and renal calculi. Elevations also predispose to muscle paralysis, coma and death, CNS effects, bone and joint pain, complicity in hypertension, among other effects (Crook, 2006b). It has been reported that the root of *Sarcocephalus latifolius* is widely used in Cameroon for treating pain and fever (Taiwe *et al*., 2011). Thus, reductions in calcium levels may contribute to the mechanisms for ameliorating pain by the root extract of *Sarcocephalus latifolius*. This study has demonstrated that the root of the plant *Sarcocephalus latifolius* contains active pharmacological components with the potentials to influence electrolyte status. This is of immense clinical significance since fluctuations in some of these can lead to major adjustment in the overall wellbeing of an individual. Severe electrolyte disturbances can be associated with life threatening consequences such as heart failure, shock and coma, among others. Thus, while Sarcocephalus latifolius, like many other herbs, has found use over so many diseases of humans, its use in crude form should be done with caution to avoid unpleasant clinical developments. The species indeed could be a source of chemical leads for development of newer and very useful drugs and scientific research is all that is needed to exploit the full potentials.

REFERENCES

Abbah, J., S. Amos, B. Chindo, I. Ngazal and H.O. Vongtau *et al*., 2010. Pharmacological evidence favouring the use of *Nauclea latifolia* in malaria ethnopharmacy: Effects against nociception, inflammation and pyrexia in rats and mice. J. Ethnopharmacol., 127: 85-90.

Akpanabiatu, M.I., I.B. Umoh, E.O. Udosen, A.E. Udoh and E.E. Edet, 2005. Rat serum electrolytes, lipid profile and cardiovascular activity on *Nauclea latifolia* leaf extract administration. Ind. J. Clin. Biochem., 20: 29-34.

Amos, S., J. Abbah, B. Chindo, I. Edmond and L. Binda *et al*., 2005. Neuropharmacological effects of the aqueous extract of *Nauclea latifolia* root bark in rats and mice. J. Ethnopharmacol., 97: 53-57.

Asase, A. and G.O. Mensah, 2009. Traditional antimalaria phytotherapy remedies in herbal markets in Southern Ghana. J. Ethnopharmacol., 126: 492-499.

Baker, J.T., R.P. Borris, B. Carte, G.A. Cordell and D.D. Soejarto *et al*., 1995. Natural product drug discovery and development. J. Nat. Prod., 58: 1325-1357.

Bum, E.N., G.S. Taiwe, F.C.O. Moto, G.T. Ngoupaye and G.C.N. Nkantchoua *et al*., 2009. Anticonvulsant, anxiolytic and sedative properties of the roots of *Nauclea latifolia* Smith in mice. Epilepsy Behav., 15: 434-440.

Crook, M.A., 2006a. Abnormalities of Plasma Potassium. In: Clinical Chemistry and Metabolic Medicine, Crook, M.A., (Ed.). 7th Edn., Hodder Arnold Publishers, UK., pp: 85-93.

Crook, M.A., 2006b. Disorders of Calcium Metabolism. In: Clinical Chemistry and Metabolic Medicine, Crook, M.A., (Ed.). 7th Edn., Hodder Arnold Publishers, UK., pp: 98-105.

Nworgu, Z.A.M., D.N. Onwukaeme, A.J. Afolayan, F.C. Ameachina and B.A. Ayinde, 2008. Preliminary studies of blood pressure lowering effect of *Nauclea latifolia* in rats. Afr. J. Pharm. Pharmacol., 2: 37-41.

Scribner, B.H. and J.C. Caillouette, 1954. An improved method for the bedside determination of bicarbonate in serum. J. Am. Med. Assoc., 155: 644-648.

Subbaram, N.R., 1997. Medicinal plants and intellectual property rights. Proceedings of the International Workshop on Medicinal Plants, their Bioactivity, Screening and Evaluation, December 2-5, 1997, Lucknow, India.

Suffness, M. and J. Douros, 1982. Current status of the NCI plant and animal product program. J. Nat. Prod., 45: 1-14.

Taiwe, G.S., E.N. Bum, E. Talla, T. Dimo and N. Weiss *et al*., 2011. Antipyretic and antinociceptive effects of *Nauclea latifolia* root decoction and possible mechanisms of action. Pharm. Biol., 49: 15-25.

Zirihi, G.N., L. Mambu, F. Guede-Guina, B. Bodo and P. Grellier, 2005. *In vitro* antiplasmodial activity and cytotoxicity of 33 West African plants used for treatment of malaria. J. Ethnopharmacol., 98: 281-285.