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Effect of Aqueous Extract of *Tridax procumbens* Linn on Plasma Electrolytes of Salt-Loaded Rats

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Abstract: The effect of aqueous extract of *Tridax procumbens* Linn on the weight, packed cell volume and plasma electrolyte profiles of salt-loaded rats were investigated. The test and test-control groups received a diet consisting 8% salt and 92% commercial feed, while the control group received a diet consisting 100% of the commercial feed. The test group also received daily by intra-gastric gavages, 50 mg/100 g body weight of the extract, while the test-control and control groups received appropriate volumes of water by the same route. The mean daily weight gain and Packed Cell Volume (PCV) of the test rats were significantly higher ($p<0.05$) than those of the test-control and control. The treated animals had significantly lower ($p<0.05$) plasma sodium and chloride levels, compared to the test-control. There was no difference in the plasma calcium and potassium levels of the test and test-control animals. This result suggests that the antihypertensive action of *T. procumbens* may be mediated via reduction of weight and alteration of plasma sodium and potassium levels and in addition suggest its use in the management of obesity and diabetes mellitus.

Key words: *Tridax procumbens*, hypertension, plasma electrolytes, salt-loading

INTRODUCTION

The observation that high salt intake is associated with hypertension is not new (Blaustein *et al*., 2006). In addition to raising the blood pressure, dietary salt is responsible for several other harmful effects, some of which though independent of the arterial pressure, also harm the cardiovascular system. It increases the mass of the left ventricle, thickens and stiffens conduit arteries and thickens and narrows resistance arteries, including the coronary and renal arteries. It also increases the number of strokes, the severity of cardiac failure and the tendency for platelets to aggregate (De Wardener and MacGregor, 2002; Meneton *et al*., 2005). In renal disease, a high salt intake accelerates the rate of renal functional deterioration (Bakris and Smith, 1996). Apart from its effect on the cardiovascular system it also affects calcium and bone metabolism, which underlies the finding that in postmenopausal women salt intake controls bone density of the upper femur and pelvis. It controls the incidence of carcinoma of the stomach and is associated with the severity of asthma in male asthmatic subjects (Carey *et al*., 1993; De Wardener and MacGregor, 2002).

In normotensive as well as hypertensive subjects, blood pressure can be judged to be "salt-sensitive" when observed to vary directly and substantially with the net intake of sodium chloride. From both a clinical and public health perspective, the phenomenon of normotensive salt sensitivity may be important. Not only is normotensive salt sensitivity a likely and possibly common precursor of hypertension, but the phenomenon might be susceptible to dietary suppression, which could prevent or delay its progression to hypertension (*vide infra*) (Morris *et al*., 1999; O'Shaughnessy and Karet, 2004).

Tridax procumbens Linn belongs to the family Compositae (alt Asteraceae). Native to Central America and tropical South America, it has spread throughout the tropical and subtropical parts of the world. Its common names are coat buttons, tridax daisy, erva-de-touro, cadillo chisaca, tridax (http://www.lucidcentral.org/keys/FNW/FNW seeds/html/fact sheets/*Tridax procumbens*.htm; http://www.ars-grin.gov/cgi-bin/npgs/html/family.pl). The Ibo people of South Eastern Nigeria call it "mbuli". Traditionally, it is used for the treatment of bronchial catarrh, dysentery, malaria, stomachache, diarrhoea, high blood pressure and to check haemorrhage from cuts, bruises and wounds and to prevent falling of hair. It possesses antiseptic, insecticidal, parasiticidal and hepatoprotective properties and has marked depressant action on respiration (Salahdeen *et al*., 2004; Edeoga *et al*., 2005; Ravikumar *et al*., 2005; Saxena and Albert, 2005; Hemalatha, 2008). In the present study, we investigated the effect of aqueous extract of *T. procumbens* Linn on the weight, Packed Cell Volume (PCV) and plasma electrolytes of salt-loaded rats, with a view to finding any clue to the mechanism of its antihypertensive property and/or any protective role of the plant against the pathogenesis of salt sensitive hypertension.

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MATERIALS AND METHODS

Collection of animals and preparation of the leaf extract: Albino rats were collected from the animal house of the Department of Biochemistry, University of Port Harcourt, Port Harcourt, Nigeria. The plants were collected from behind the Ofrima Hall Complex of University of Port Harcourt, Port Harcourt, Nigeria. After due identification at the Herbarium of the Department of Plant Science and Biotechnology, Faculty of Science, University of Port Harcourt, Nigeria, their leaves were collected, rid of dirt, oven dried at 55°C and ground into powder. The resultant powder was soaked in boiled distilled water for 12 h, after which the resultant mixture was filtered. A known volume of the resultant filtrate was evaporated to dryness and the weight of the residue used to determine the concentration of the filtrate, which was in turn used to determine the dose of administration of the extract to the test animals.

Experimental design and composition of diet: The rats were randomly sorted into three groups of five animals each, so that the average weight difference was ±1.8 g. The animals were individually housed in plastic cages. After a one-week acclimatization period on guinea growers mash (Bendel Feed and Flour Mills Ltd., Ewu, Nigeria), the treatment commenced and lasted for a week. The control group received a diet consisting 100% of the commercial feed, while the test-control and test received a diet consisting 8% salt and 92% commercial feed. The 8% dietary salt-loading was adapted from Obiefuna *et al.* (1991). The test received daily by intra-gastric gavages, 50 mg/100 g body weight of the extract while the test-control and control group received appropriate volumes of water by the same route. The animals were allowed food and water *ad libitum*. At the end of the treatment period the rats were weighed and anaesthetized by intra-peritoneal injection of 5 mg/kg body weight of 25% Urethane saline solution. While under anesthesia, blood was collected from each rat via heart puncture and transferred into heparin sample bottles after which they were painlessly sacrificed.

Determination of PCV and plasma electrolyte profile: PCV was measured with micro haematocrit, with 75 x 16 mm capillary tubes filled with blood and centrifuged at 3000 rpm for 5 min. The electrolytes were analyzed with an auto-analyzer. Sodium and potassium were determined by using a flame photometer (Model, 405, Corning, UK) using NaCl and KCl to prepare the standards. All other metals were determined by Atomic Absorption Spectrophotometer (Perkin-Elmer Model 403, Norwalk CT, USA).

Statistical analysis of data: All values are quoted as the mean ± SD. The values of the various parameters for the test, test-control and control groups were analyzed for statistical significant differences using the student's t-test. $P<0.05$ was assumed to be significant.

RESULTS AND DISCUSSION

The effect of the extract on the PCV and mean daily weight gain of salt-loaded rats is shown in Table 1. The PCV of the test rats was significantly higher ($p<0.05$) than those of the test-control and control. This means that the extract had positive effect on the haemopoietic system of the test rats and could protect the animals against the salt-loading induced lowering of PCV. The raised haematocrit is an indication of haemoconcentration which may be due to increased RBC mass. The mean daily weight gain of the test group is significantly lower than those of the test-control and control. Weight loss helps improve and control coronary risk incidence, diabetes mellitus, dyslipidemia, hypertension, obesity and physical functioning (Reisin *et al.*, 1978; Shah, 1991; Trussell *et al.*, 2005; Bantle *et al.*, 2006; Krauss *et al.*, 2000, 2006) and is one of the strategies for increasing low HDL-C levels (Assmann and Gotto, 2004), as well as improving the insulin resistance (Krauss *et al.*, 2006). Therefore, the implication of the significantly low mean daily weight gain produced by the extract in test animals is that it may be useful in the management of hypertension, obesity and dyslipidemia. This corroborates the use of the plant in traditional medicine for the management of hypertension.

Table 1: Effect of aqueous extract of *Tridax procumbens* on the weight and PCV of salt-loaded rats

Parameter	Control	Test-control	Test
Mean daily weight gain (g/day)	4.048±0.673[a]	3.238±1.019[b]	2.524±1.258[c]
PCV (%)	35.926±5.762[a]	31.111±1.571[b]	40.476±3.367[c]

Values are means±SD, n = 5 per group. Entries with different superscripts are significantly different at $p<0.05$

Table 2: Effect of aqueous extract of *Tridax procumbens* on plasma electrolyte concentrations of salt-loaded rats

	Concentration (mmol/L)		
Parameter	Control	Test-control	Test
Sodium	40.667±5.133[a]	42.367±5.187[b]	41.000±2.646[a]
Potassium	0.747±0.098[a]	0.807±0.202[a]	0.807±0.264[a]
Calcium	4.250±0.250[a]	3.250±0.250[b]	3.250±0.000[b]
Chloride	25.067±1.793[a]	26.600±2.163[b]	25.800±1.058[c]

Values are means±SD, n = 5 per group. Entries with different superscripts are significantly different at $p<0.05$

The effect of the extract on plasma electrolytes of salt-loaded rats is shown in Table 2. The treated animals had significantly lower ($p<0.05$) plasma sodium and chloride levels, compared to the test-control. Reduction in plasma sodium and chloride concentrations is one of the mechanisms of action of antihypertensive drugs,

especially the diuretics (Burton and Theodore, 2007). According to them, diuretics act by diminishing sodium chloride reabsorption at different sites in the nephrons, thereby increasing urinary sodium chloride and water losses, consequently leading to decreased plasma levels of these electrolytes. This again corroborates the use of this plant as an antihypertensive, in traditional medicine practice. There was no difference in the plasma calcium and potassium levels of the test and test-control animals. This probably means that the plant has no effect on calcium and potassium metabolism.

Conclusion: In conclusion, our result suggests that the antihypertensive action of *T. procumbens* may be mediated via reduction of weight and alteration of plasma sodium and potassium levels.

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