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Time Course of the Effect *Stachytarpheta Jamaicensis* L. (Vahl.) On Plasma Sodium and Potassium Levels of Normal Rabbits

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Abstract: The effect of *Stachytarpheta jamaicensis* tea on the plasma sodium and potassium concentrations of normal rabbits was investigated. The rabbits in the test group were given daily, by intra-gastric gavages, 6.4mg aqueous extract/kg body weight, while those of the control received equivalents of water. The administration of the tea produced significant ($p<0.05$) decreases in plasma sodium concentrations and increases ($p<0.05$) in plasma potassium concentrations. These findings support the use of *Stachytarpheta jamaicensis* tea in the management of edematous conditions and hypertension.

Key words: Edema, hypertension, potassium-sparing diuretic, *Stachytarpheta jamaicensis*.

INTRODUCTION

The ability to induce negative fluid and electrolyte balance has made diuretics useful in the treatment of a variety of conditions, particularly edematous states and hypertension[1,2,3,4]. Among the diuretics, are the potassium-sparing diuretics which inhibit either aldosterone directly, or the Na^+/K^+ exchange mechanisms in the distal tubules and collecting ducts[1,3,4]. This inhibition prevents the reabsorption of sodium in the distal tubules, as well as its exchange for potassium. The consequence of this is the loss of sodium in the urine and the retention of potassium in the blood, which often manifests as a decrease in plasma sodium and increase in plasma potassium levels. At the moment, herbal medicines are widely used in traditional medical practices in the management of a wide variety of illnesses. Herbal medicines are medicinal products that contain as active ingredients, aerial or underground parts of plants, or other materials or combinations thereof whether in the crude state or as plant preparations[5].

Stachytarpheta jamaicensis (family Verbenaceae) commonly called bastard/false vervain or Brazilian tea, is an annual (and sometimes perennial) herbaceous plant that grows 60-120cm tall. It bears small reddish-purple to deep blue flowers and serrated, dark green leaves. Other synonymous Latin binomials for this plant include *Stachytarpheta cayennensis* and *Stachytarpheta indica*[6]. It is used in traditional medicine for its analgesic, antacid, anti-inflammatory, antipyretic, antispasmodic, anti-ulcerogenic, diuretic, gastroprotective, hepatoprotective, hypoglycemic, hypotensive, sedative and tonic properties, and for the management of edema[7,8,9,10,11,6,12,13]. The biochemical basis of most of these ethnomedical uses/claims are yet to be ascertained. In this study, we monitored the effect of aqueous infusion of *Stachytarpheta jamaicensis* on plasma sodium and potassium concentrations of normal rabbits, with a view to ascertaining the effect of this diuretic plant on these parameters: Since abnormalities in sodium and potassium metabolism often characterizes hypertension and edema.

MATERIALS AND METHODS

The tea bags were collected from the Integrated Services Department of Benson Idahosa University, Benin City, Nigeria. The production of the tea bags was supervised by Professor MacDonald Idu of Botany Department, Faculty of Life Sciences, university of Benin, Benin City, Nigeria. The tea bags were used to prepare aqueous infusions by placing a tea bag (containing 1.8g of dried powdered plant (*Stachytarpheta jamaicensis*)), in 250mL of boiled water for 8h. (This is to simulate the traditional procedure for preparing the tea). The resulting aqueous extract was then evaporated to dryness and the residue stored, for subsequent use in reconstituting the administered tea.

3-month old New Zealand white rabbits weighing between 0.7-1.8kg were obtained from a breeder in Benin City, in March, 2007. The animals were housed in clean, disinfectant hutches and acclimatized on guinea growers mash (Bendel Feed and Flour Mills,

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Ltd., Ewu, Nigeria) for a week, after which they were weighed and randomly assigned into two groups of four each. The baseline plasma sodium and potassium concentrations were determined prior to administration of the tea. The test group was given, by i.g. (intra-gastric gavages), 6.4mg aqueous extract/kg body weight, while the control group received appropriate volumes of water by the same route. Mash and water were provided *ad libitum*. The rabbits were weighed weekly to allow for adjustments in the administration of the extract. The treatment lasted for 22days, and blood samples were collected on day 0 (baseline), 1, 8, 15 and 22 for determination of plasma sodium and potassium levels.

The estimation of plasma sodium and potassium concentration was done by flame photometry, at the Biochemistry Department, Central Hospital Benin, Benin City, Nigeria.

All results are given as mean ± S.E.M. Statistical evaluation was performed by student's t test.

RESULTS AND DISCUSSION

Results: All through the treatment period, the plasma sodium concentrations of the treated animals were significantly lower ($p<0.05$) than that of the control, as well as their corresponding baseline values (Table 1). As for the time course of the effect of the tea on plasma sodium levels, the various levels of significance for the measurements are as follows: $p<0.005$ on days 1, 15 and 22, and $p<0.01$ on day 8, when compared to controls; and $p<0.05$ on day 1, $p<0.025$ on day 8, and $p<0.005$ on days 15 and 22, when compared to baseline values. The plasma potassium concentration of the treated animals, after the administration of the tea, were significantly higher ($p<0.05$) than those of the control and their corresponding baseline values (Table 1). The time course of the effect of the tea on plasma potassium levels is as follows: $p<0.005$ on all days compared to control; and $p<0.05$ on day 1, $p<0.01$ on day 8 and $p<0.005$ on days 15 and 22, compared to baseline values.

Discussion: In this study, the tea reduced plasma sodium levels and increased plasma potassium levels. This means that it is a potassium-sparing diuretic and may have acted by inhibiting aldosterone directly or the Na^+/K^+ exchange mechanisms in the distal tubules. In fact, according to Dmitrieva and Doris[14], renal sodium excretion is facilitated by inhibition of Na^+/K^+-ATPases in the kidney.

In the hypertensive, there is the prevalence of high serum sodium concentrations[15,16] and low serum potassium concentrations[15]. No wonder Coruzzi *et al*.[17], wrote that potassium depletion plays a critical role in the pathogenesis of essential hypertension, with sodium retention being pivotal to the mediation of this effect. Our results suggests that *Stachytarpheta jamaicensis* tea can be a handy tool for reversing the aforementioned conditions; as the hyponatremic and potassium-sparing effect observed herein, stands as a sure testimony to this; provided a rabbit-to-man extrapolation is allowed. It therefore behooves on us all, to harness this findings for the management of the abnormal sodium and potassium metabolism that accompany hypertension.

Conclusion: A critical look at our results on the course of the effect of the tea, reveal that the extract elicits long-term diuretic tolerance in the animals: that is, the effect increased with every administration/measurement. According to Brater[2], long-term tolerance refers to an increase in the response to a diuretic after the first dose has been administered. The implication of this is that for any patient, an effective dose of a diuretic has to be determined, and thereafter, administration is made as often as needed to maintain the response, taking cognizance of the patient's ability to restrict sodium intake and the duration of action of the drug. This is quite imperative especially given the fact that this tea is often administered by most herbal practitioners, for the management of high blood pressure, in which case it is administered over a long period, at the same dose.

Table 1: Time course of the effect of *Stachytarpheta jamaicensis* on plasma sodium and potassium concentrations of normal rabbits

	Concentration (mmol/L)			
Time	Sodium		Potassium	
	Control	Test	Control	Test
Baseline	123.75±0.48	123.00±1.08	3.75±0.21	3.73±0.11
Day 1	127.50±1.19	117.75±2.66*$^+$	3.68±0.19	4.00±0.18*$^+$
Day 8	128.00±0.71	111.25±4.89*$^+$	3.50±0.21	4.20±0.18*$^+$
Day 15	130.25±1.11	101.75±5.10*$^+$	3.38±0.17	4.48±0.21*$^+$
Day 22	132.25±1.80	98.00±4.55*$^+$	3.23±0.11	4.50±0.09*$^+$

Sodium concentrations are expressed as mean ± SEM.
*$p<0.05$ compared to control, n=4, per group.
$^+p<0.05$ compared to baseline, n=4.

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