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Full Length Research Paper

Oral administration of *Rauwolfia vomitoria* extract has no untoward effect on kidney and liver functions in rats

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The effect of ethanolic extract of leaf and root of *Rauwolfia vomitoria* on kidney and liver functions in rats was investigated. Rats were given daily oral administration of ethanolic extracts of either root or leaf of *R. vomitoria* at two different concentrations (1.0 and 2.0 g/kg body weight) for a period of 14 days. Some biochemical parameters in the serum, liver and kidney of the rats were measured and compared with control. There were no significant difference (P<0.05) in serum alkaline phosphatase (ALP), aspartate aminotransferase (AST), alanine aminotransferase (ALT), urea, creatinine, Na^+ and K^+ in rats treated with the extracts compared with the control. The levels of the enzymes in the liver and kidney of rats that received the extracts were not also significantly different (P<0.05) from the control group. Measurement of organ, body weight ratio did not show any indication of kidney or liver enlargement. These results showed that the extract did not cause derangement of cellular activities in the tissues of the animals. We therefore suggest that administration of ethanolic extract of root and leaf of *R. vomitoria* has no untoward effect on liver and kidney functions in rats.

Key words: *Rauwolfia vomitoria,* ethanolic extract, liver function, kidney function.

INTRODUCTION

Drugs of plants origin have served through the ages as the mainstay in the treatment of variety of diseases and preservation of human health. However, their general acceptability has been limited by lack of dose regiment and adequate toxicity data to evaluate their safety (Pousset, 1988). It is therefore necessary to investigate the toxicity of local medicinal plants usually employed by herbalists in the treatment of diseases, especially now that there are proposals on the integration of traditional medicine in health care programme in most countries of the World.

Rauwolfia vomitoria is a medicinal plant which grows in the humid tropical secondary forests of Africa and used traditionally to treat a variety of ailments (Sofowora, 1993). Extensive studies carried out on its chemical properties showed that the plant contains more than 50 active indole alkaloids, each possessing remarkable pharmacological activities (Iwu and Court, 1982; Pousset and Poisson, 1965). A bioactive β-carboline alkaloid, alstonine, present in the root and leaf were previously shown to have anti-cancer activity (Pettit et al., 1994; Demis et al., 2006) while the antipyretic effect of the leaf extract has also been demonstrated (Amole and Onabanjo, 1999). The pharmaceutical derivatives are used mainly as antihypertensives and sedatives. Its sedative property is attributed to its ability to balance body response to stress and anxiety, and to increase oxygen delivery to the brain (Oliver-Bever, 1982). Folk medicinal uses of the roots are extensive, particularly for their aphrodisiac, emetic, purgative, dysenteric, abortive and insecticidal properties (Principe, 1989). Decoctions of the leaves of *R. vomitoria* have a powerful emetic effect and chopped leaves stewed with animal fat are applied to swellings (Burkill, 1994). The root is also brewed as tea and used in humans to treat snakebite and cholera (Waterman, 1986).

Traditional medicine practitioners believe that the herb is non-toxic but there are no adequate documented toxicity data to support this claims. As this herb continues to receive attention and more of its medicinal values discovered day by day, there is need to investigate the effects of its consumption on liver and kidney functions using animal model.

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Table 1. Some biochemical parameters in the serum of rats administered with *Rauwolfia vomitoria* extracts for 14 days.

Parameters	Control	Root extract (1.0 g/kg)	Root extract (2.0 g/kg)	Leaf extract (1.0 g/kg)	Leaf extract (2.0g/kg)
ALP (IU/L)	48.8±4.6	51.1±3.9	49.9±4.3	50.2±4.4	49.2±2.9
ALT (IU/L)	29.9±4.0	30.2±3.7	31.1±2.8	30.5±3.2	28.8±4.2
AST (IU/L)	69.2±5.6	71.6±4.8	67.5±6.0	70.1±4.4	69.8±5.0
Na^+ (mmol/L)	127.0±17.6	131.2±18.1	128.6±16.6	128.5±17.0	129.4±15.7
K^+ (mmol/L)	3.86±0.48	3.25±0.96	3.54±0.62	4.04±0.22	4.12±0.15
Urea (mmol/L)	4.44±0.43	4.35±0.50	4.58±0.32	3.98±0.83	4.02±0.78
Creatinine (mmol/L)	32.6±3.3	31.5±4.0	32.3±3.1	31.8±3.9	32.0±3.6

Values are Mean ± SD, n=5.
All values along each row are not significantly different at $p<0.05$.

MATERIALS AND METHODS

R. vomitoria was obtained from Goderich area, Freetown Sierra Leone. The roots and leaves were thoroughly washed, cut into pieces, dried and then ground into powder. All chemicals used for the study were of analytical grade (ANALAR) and were obtained from British Drug House, Poole England.

Preparation of leaves and roots extract

Ethanolic extracts of the leaves and roots were prepared by putting 10 g of ground dry sample in 250 ml of 95% ethanol in 500 ml capacity volumetric flask. The flask was plunged with cotton wool wrapped with aluminum foil, shaken vigorously and allowed to stand in the refrigerator for 24 h. The extract obtained were evaporated to dryness using a rotatory evaporator and stored in the refrigerator in reagent bottles. Preparations that will deliver the crude extracts to rats at doses of 1.0 and 2.0 g/kg body weight were then made using distilled water. These concentrations are related to doses of *R. vomitoria* normally prescribed by traditional healers for the treatment of different ailments.

Animal handling

Twenty five (25) male Fischer strain albino rats with average weight of 160 g were used for the study. They were obtained from the Department of Pharmacology, College of Medicine and Allied Health Sciences, University of Sierra Leone, Freetown. The rats were kept in well-ventilated house conditions (temperature: 28-31°C; photoperiod: 12 h natural light and 12 h dark; humidity: 50-55% and given normal rat feed and water *ad libitum*. They were randomly divided into five experimental groups (A, B, C, D and E). Group A served as the control, and groups B and C were administered *R. vomitoria* root extract orally at doses of 1.0 and 2.0 g/kg body weight, respectively. Groups D and E received the leaf extract at doses of 1.0 and 2.0 g/kg body weight, respectively. The extracts were administered daily for a period of 14 days.

Preparation of serum and tissue homogenate

The rats were sacrificed at the end of the experimental period and their venous blood collected into clean sample bottles. This was allowed to clot and then centrifuged at 3000 rpm for 5 min after which the serum was separated and stored frozen until needed for analysis. After bleeding, the animals were quickly dissected and their tissues (liver and kidneys) removed and homogenized in ice-cold 0.25 M sucrose solution (1:5, w/v). The homogenate was kept frozen overnight to ensure maximum release of the enzymes.

Enzymes assay and measurement of serum metabolites

The method of Wright et al. (1972) was employed for the assay of alkaline phosphatase (EC. 3.1.3.1). Aspartate aminotransferase (EC. 2.6.1.1) and alanine aminotransferase (EC. 2.6.1.2) were assayed as described by Mohun and Coole (1957). Serum urea concentration was determined by the method of Veniamin and Vakirtzi (1970). Serum creatinine was determined using the Jaffe reaction (Tietz et al., 1994) while serum sodium and potassium ions were determined by flame photometry using the Jenway Clinical PFP7 Flame Photometer. All measurements were done using Spectronic 21 digital Spectrophotometer.

Statistical analysis

Data were analyzed using Duncan multiple range test following one-way analysis of variance (ANOVA). Differences at $P<0.05$ were considered significant.

RESULTS AND DISCUSSION

There were no significant difference ($P<0.05$) in the serum and tissues levels of ALP, ALT and AST in the test groups compared with the control as shown in Tables 1 and 2. These results indicated that the extract did not bring about pronounced cellular damage in the liver and kidney of the rats during the experimental period. Enzyme activities in the serum and tissues are often used as 'marker' to ascertain early toxic effects of administered foreign compounds to experimental animals (Coodley, 1970). ALP is a membrane bound enzyme (Wright and Plummer, 1974) while ALT and AST are cytosolic enzymes (Christen and Metzler, 1985). These enzymes are highly concentrated in the liver and kidney and are only found in serum in significant quantities when the cell membrane becomes leaky and even completely ruptured (Cotran et al., 1989: Ngaha, 1981). A rise in serum level or decrease in tissue level of these intracellular enzymes is an index of damage to liver and kidney cells (Moss and Rosalki, 1996).

Table 1 shows the results of serum concentrations of urea and creatinine in rats at the end of the experimental period. Serum levels of these metabolites in the test

Table 2. Enzyme activities in the liver and kidney of rats administered with *Rauwolfia vomitoria* extracts for 14 days.

Enzymes	Control	Root extract (1.0 g/kg)	Root extract (2.0 g/kg)	Leaf extract (1.0 g/kg)	Leaf extract (2.0g/kg)
KIDNEY					
ALP	155.2±19.6	162.4±15.1	150.0±22.8	161.6±18.1	159.3±14.4
ALT	398.5±26.2	400.3±19.0	395.4±24.4	405.6±20.5	402.1±18.3
AST	988.8±50.5	1012.2±39.4	1004.5±43.3	995.2±51.8	1002.5±44.2
LIVER					
ALP	102.7±20.2	95.8±26.3	100.2±22.7	98.0±31.4	96.9±34.3
ALT	476.3±29.2	472.7±18.4	478.3±15.5	489.8±14.3	482.4±21.1
AST	870.4±41.0	862.2±51.3	873.6±37.4	880.5±40.2	875.4±28.4

Values are Mean ± SD (IU/L), n=5.
All values along each row are not significantly different at $p<0.05$.

Table 3. Organ : body weight ratio of rats administered with *Rauwolfia vomitoria* extracts for 14 days.

Organ	Control	Root extract (1.0 g/kg)	Root extract (2.0 g/kg)	Leaf extract (1.0 g/kg)	Leaf extract (2.0g/kg)
Kidney	0.019±0.002	0.019±0.003	0.018±0.003	0.020±0.001	0.017±0.005
Liver	0.025±0.003	0.027±0.002	0.026±0.004	0.024±0.004	0.028±0.002

Values are Mean ± SD, n=5.
All values along each row are not significantly different at $p<0.05$.

groups were not significantly different from the control which showed that the extracts did not cause de-rangement in cellular activities in the rat's tissues. Urea and creatinine are waste products which are passed into the blood stream to be removed by the kidney. Elevation of these waste products in the blood (serum) is an indication of renal function impairment (Orth and Ritz, 1998; Cameron and Greger, 1998).

Serum concentration of Na^+ and K^+ in the test groups and that of the control as shown in Table 1 indicated no significant difference between the four groups. The fact that these electrolytes were not elevated in the serum showed that the osmotic regulatory function of the kidney was not affected upon administration of the extract. One of the principal functions of the kidney is to maintain osmotic balance of the blood and this is done by reabsorption of ions among which are Na^+ and K^+. These electrolytes are elevated in the blood (serum) in nephrotic syndrome and renal tubular abnormalities (Gennari, 1998; Tanne, 1998). Their serum levels may also increase in states characterized by excess destruction of cells (Rose, 2001).

There was no significant difference in organ, body weight ratio in the test groups compared with the control as can be seen in Table 3. This result indicated that the extract did not cause kidney or liver enlargement in the rats. Results obtained in Tables 1, 2 and 3 also clearly showed that all biochemical parameters investigated were not significantly affected with increase in concentration of the extracts which also confirmed that the extract is not toxic.

Conclusion

Leaf and root extract of *R. vomitoria* administered to rats orally at doses compared to that used for therapeutic purposes for a period of 14 days did not cause kidney or liver enlargement. The extracts also maintain cellular integrity in the rat's system, as it did not alter kidney and liver function indicators. We therefore conclude that administration of leaf and root extract of *R. vomitoria* to rats does not have any untoward effect on kidney and liver functions in rats which implied that the use of the extract is safe.

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