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Toxic Effect of *Ipomoea carnea* Leaves on Wistar Rats

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ABSTRACT

Ipomoea carnea is known as an ornamental hedge plant in Sudan. The leaves of *ipomoea carnea* were fed to male wistar rats at 2 and 10% of standard diet for 21 days. Locomotor disturbance, loss of hair and reflexes and interohepatonephropathy were observed in the rats fed a diet containing 10% *I. carnea* leaves, these changes were accompanied by leukocytosis, anemia and increases in serum aspartate Amino Transferase (AST) activity and urea concentration and by decreased albumin level. The effect on rats fed a diet containing 2% *I. carnea* leaves is less marked.

Key words: *Ipomoea carnea*, interohepatonephropathy, leukocytosis, disturbance

INTRODUCTION

Large number of medicinal plant constituents such as flavonoid, anthraquinones, tannins, triterpenes, sterols, alkaloids and volatile oil have been shown to be associated with antimicrobial, antifungal, anthelmintic, insecticidal, molluscicidal and other activity (Bakhiet and Adam, 1995). Because that many families of plant such as Apocynaceae, Asteraceae, Cucurbitaceae, Rutaceae and Umbelliferae are consider as traditional herbalremedies which are able to remedy many disease like skin infection,diarrhea, gastrointestinal disturbances, eczema, haemorrhoids and others, However, many cases of poisoning by plants occur from over dosage because of absence of standardized dosage system in herbal medicine for example *Rutagraveolen* L. (Rutaceae) locally known as Sadab, is widely distributed in various regions of Sudan and other countries and is used in traditional medicine as a remedy for a variety of disorders from cramps to hysteria, helminthoses, skin conditions and diseases of womb (Al-Agraa,1992). The plant aerial parts contain rutin, furocoumarins and lemonin as major compounds (Srivastava *et al*., 1998). The toxicity of *R. graveoiens* was investigated in Nubian goats which received the leaves of plant at 5 g kg^{-1} b.wt. day^{-1} and manifested, tremor, dyspnoea, frequent urination, incoorination of movement, ataxia and recumbency with death after 1-7 days (Al-Agraa *et al*., 2002). *Ipomoea carnea* locally known as Awier, occurs in tropical areas of the world such as North America, South America, Africa, Asia and Australia (Austin, 1988; McDonald and Mabry, 1992). And there are many species of *Ipomoea* such as *I. aquatica* Forsk. Also known as *I. repens*, occurs in canals, mouldy stream banks, fresh water ponds and lakes, is commonly used as a vegetable crop in Asian immigrants to USA and Mexico (McDonald,1991). Because it is rich in iron and S. methyl methionine (Vitamin U) and is used

traditionally to treat gastric and intestinal disorders and diabetes mellitus probably because of its anti hyperglycemic activity. Other species of *Ipomoea carnea* have antifungal activity against Alternaria alternate and *Curvularia lunata* was confirmed by Guleria and Kumar (2006) that due to present of swainsonine,2-epilentiginosine, calystegines B1, B2, B3 and C1 and N-methyl-Trans 4 hydroxy-L-proline (Ikeda *et al*., 2003). And it's cause the toxicity by sequential changes in the liver of goats, sheep and calves (Adam *et al*., 1973) and produce normocytic normochomic anaemia (Tartour *et al*., 1974). In Mozambique, De Balogh *et al*. (1999) found the toxicity of *I. carnea* appear as changes in the brain and spinal cord that include widespread cytoplasmic vacuolation of neurons and glial cells. In Brazil, Armien *et al*. (2007) mentioned that *I. carnea* intoxication in goats is characterized by cytoplasmic vaculation in neurons of C.N.S. and autonomic nervous system. Hueza *et al*. (2003) proved that the toxic principle of *I. carnea* (swainsonine) could pass through the placenta and endanger the lives of rate pups because of the decreased body weight, thymus atrophy and spleen enlargement of pups.

MATERIALS AND METHODS

Plant material: *Ipomoea carnea* leaves were collected from Shambat, Khartoum North (February, 2007). The plant leaves were cleaned, shade-dried.

Experimental design: Eighteen 60-day-old male Wistar rats were housed within the premises of the Medicinal and Aromatic Plants Research Institute, National Centre For Research, Khartoum, with feed and water provided *ad libitum*. The rats were allotted at random to three groups, each of 6 rats. Group 1 continued to be fed the normal diet and served as control. Group 2 and 3 received diets consisting of 2% (w/w) and 10% (w/w) of *Ipomoea carnea* leaves, respectively. All rats were fed their designated experimental diets for 3 weeks.

Lots of 3 rats from each group were killed by decapitation at 10 days and the remaining rats were similarly killed at 21 days after commencement of feeding. Blood sample were collected from the killed rats for hematology and serum analysis.

Blood analysis: Serum samples were analyzed for the activity of Aspartate Aminotransferase (AST) and Alanine Aminotransferase (ALT) and for concentrations of total protein, albumin, globulin and urea.

Hemoglobin (Hb) concentration, Red Blood Cell (RBC) counts, Packed Cell Volume (PCV), Mean Corpuscular Volume (MCV), Mean Corpuscular Hemoglobin (MCH), Mean Corpuscular Hemoglobin Concentration (MCHC) and White Blood Cell (WBC) counts were determined by standard methods (Schalm *et al*., 1975).

Statistical analysis: The significance of differences between means was compared at each time point using Duncan's multiple range test after ANOVA for one-way classified data (Snedecor and Cochran, 1989).

RESULTS

The effect on the body weight and body weight gain of rats receiving diets containing 2% (group 2) and 10% (group 3) of *Ipomoea carnea* leaves for 21 day is presented in Table 1, was nearly not affected and no death.

Table 1: Growth changes in wistar rats fed *Ipomoea carnea* for 21 days

Treatment groups	Body weight (g) (10 days)	Weight gain (g) (10 days)	Weight gain (g) (21days)
Control (normal diet)	70.0±1.4	15.0±1.2	8.3±4.4
(2% *Ipomoea carnea*)	63.3±4.4^{NS}	6.7±4.4^{NS}	15.0±2.9^{NS}
(10% *Ipomoea carnea*)	65.0±3.7^{NS}	10.0±2.9^{NS}	11.7±3.3^{NS}

Values are expressed as Mean±S.E; NS = Not significant; *Significant = ($p<0.05$)

Table 2: Haematological changes of wistar rats fed *Ipomoea carnea* for 21 days

		Duration			
		10 day		21 days	
Parameters	Control (normal diet)	*I. carnea* (2%)	*I. carnea* (10%)	*I. carnea* (2%)	*I. carnea* (10%)
Hb (g dL^{-1})	14.3±1.2	11.8±0.2^{NS}	12.9±0.4^{NS}	12.1±0.4^{NS}	11.6±0.4^{NS}
RBC ($\times10^6 mm^3$)	7.9±0.4	6.3±0.4*	6.5±0.3*	6.5±0.2^{NS}	6.2±0.2*
PCV (%)	50.7±2.3	37.0±2.3*	39.9±1.4*	40.6±0.4^{NS}	38.1±0.9*
MCV (m^3)	64.3±1.7	58.8±0.6^{NS}	62.0±0.7^{NS}	63.1±1.2^{NS}	61.3±1.4^{NS}
MCH (pg)	18.1±0.5	18.7±0.1^{NS}	20.0±0.3^{NS}	18.8±0.0^{NS}	18.7±0.1^{NS}
MCHC (%)	28.2±0.3	31.8±0.2^{NS}	32.2±0.2^{NS}	29.5±0.6^{NS}	30.6±0.2^{NS}
WBC ($\times10^3$ mm^3)	3.9±0.3	4.6±0.2^{NS}	7.2±0.6*	6.8±0.6*	6.1±0.4*
Lymphocytes (%)	95.0±1.7	87.5±2.9^{NS}	89.2±2.3*	90.6±1.7^{NS}	80.2±1.3*
Granulocytes (%)	5.0±1.7	10.9±2.4^{NS}	10.8±2.3*	9.4±1.7^{NS}	19.8±1.3*

Values are expressed as Mean±SE; NS = Not significant; *Significant = ($p<0.05$)

Table 3: Serobiochemical changes of Wistar rats fed *Ipomoea carnea* for 21 days

		Duration			
		10 days		21 days	
Parameters	Control (normal diet)	*I. carnea* (2%)	*I. carnea* (10%)	*I. carnea* (2%)	*I. carnea* (10%)
AST (iu)	24.4±1.2	82.40±21.1^{NS}	66.4±11.2^{NS}	61.2±4.1*	75.9±2.8*
ALT (iu)	37.0±1.2	29.63±2.84^{NS}	38.6±2.3^{NS}	8.5±1.9*	14.8±3.4*
Total protein (g dL^{-1})	7.4±0.6	6.9±0.1^{NS}	5.9±0.5*	6.8±0.8^{NS}	6.5±0.2^{NS}
Albumin (g dL^{-1})	2.9±0.1	2.4±0.1^{NS}	2.1±0.5^{NS}	1.7±0.4^{NS}	1.0±0.1*
Globulin (g dL^{-1})	4.5±0.5	4.3±0.1^{NS}	3.7±0.2^{NS}	5.2±0.3^{NS}	4.2±0.2^{NS}
Urea (mg dL^{-1})	23.8±1.7	27.3±0.6^{NS}	38.7±4.8^{NS}	46.0±2.7*	47.7±2.7*

Values are expressed as Mean±SE; NS = Not significant; *Significant = ($p<0.05$)

Haematological changes for rats receiving diets containing 2% (group 2) and 10% (group 3) of *I. carnea* leaves for 21 day is presented in Table 2. There was no significant changes in WBC, lymphocyte, granulocytes, Hb, MCV and MCH in rats on 2% (group 2) for 10 days, although the values of RBC and PCV were lower ($p<0.05$) than control (group 1) and those of MCHC did not change. In rats fed 2% (w/w) (group 2) *I. carnea* leaves for 21 day, no significant changes in erythrocyte series were observed but the values of WBC were increased ($p<0.05$). In rats fed 10%(w/w) (group 3) *I. carnea* leaves for 10 and 21 days, the values of RBC, PCV, MCHC and lymphocytes were lower ($p<0.05$) than control (group 1) and those granulocytes were higher ($p<0.05$) than control (group 1).

Serobiochemical changes of for rats receiving diets containing 2% (group 2) and 10% (group 3) of *I. carnea* leaves for 21 day is presented in Table 3. In rats fed 2% (w/w) (group 2) *I. carnea*

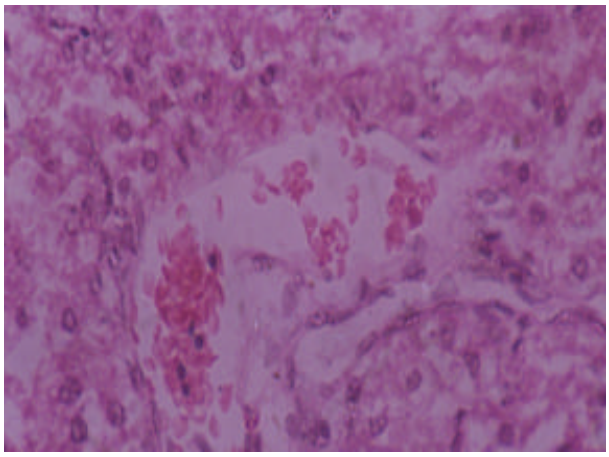

Fig. 1: Liver of rat receiving daily *Ipomoea carnea* leaves at 10% for 21 days showing fatty cytoplasmic vaculation of the centirlobular hepatocytes and isolated cell necrosis H and E. X250

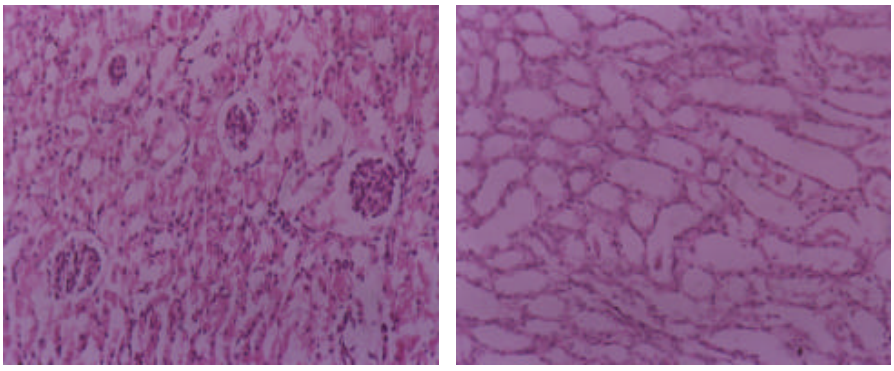

Fig. 2: Kidney of rat receiving daily *Ipomoea carnea* leaves at 10% for 21 days showing (a) segmentation and packing of the glomerular tubules H and E. X 125 (b) dilatation and necrosis of the renal tubules H and E. X250

leaves, there were no changes either in the activity of serum AST and ALT or in the concentrations of total protein, albumin, globulin and urea. Rats on 10% (w/w) (group 3) *I. carnea* leaves for 10 days showed almost similar data values to these of group 2 but total protein concentration was lower ($p<0.05$) than control (group 1) and group 2. In rats in group 2 and group 3 the activity AST and concentration of urea were higher ($p<0.05$) and the activity of ALT was lower ($p<0.05$) than control. In group 3, the concentration of albumin was lower ($p<0.05$) than group 2 and control (group 1).

Pathological changes: There were no lesions in the spleen, heart and other vital organs of control rats. The spleen, heart, brain and peripheral nerve of rats in groups 2 and 3 had no lesions. In rats in group 3, there were fatty cytoplasmic vaculation of the centirlobular hepatocytes and isolated cell necrosis (Fig. 1) segmentation and packing of the glomerular tubules (Fig. 2a) dilatation and necrosis of the renal tubules (Fig. 2b),vaculation or desquamation of the intestinal epithelium (Fig. 3) and lymphocytic accumulation. These changes were less intense in group 2.

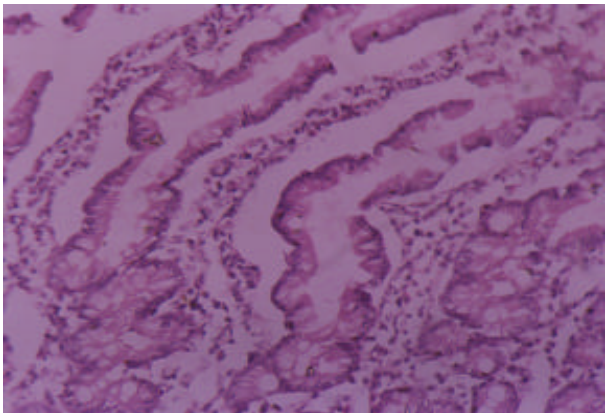

Fig. 3: Intestine of rat receiving daily *Ipomoea carnea* leaves at 10% for 21 days showing vacuolation or desquamation of the intestinal epithelium H and E. X250

DISCUSSION

The incorporation of *I. carnea* leaves in diets at 2 or 10% was chosen for several reasons. In rats these dietary levels represent non toxic concentrations of some plants and are exemplified by *Thymus valgaris* leaves. On the other hand 2 or 10% dietary *Rhazya strica* and *Cuminum cyminum* was toxic to rats (Adam, 1999; Haroun *et al*., 2002). The susceptibility of animals fed plants materials seems dependent of the types of active principles in the plant, the concentration added to the diet and the rate of their metabolic conversion in the liver to metabolites and their consequent excretion. No research has been done to investigate the safety of *I. carnea* leaves fed to Wister rats. The present study suggests the seriousness of the feeding the leaves of *I. carnea* at 10% may be related to the concentration and characteristics of the compounds in *I. carnea* leaves compared with those fed at 2% of the plant leaves. Phytochemical investigations have demonstrated the presence of swainsonine, 2-epi-Ientiginosine, calystegines B1, B2, B3 and C1 and N-methyl-Trans 4 hydroxy-L-praline in *I. carnea* leaves (Ikeda *et al*., 2003). Rats fed 10% *I. carnea* leaves had damage to intestines, liver and kidneys which probably contributed to the increase serum AST activity and concentration of urea and to decrease in albumin concentration. The organ damage from 2% *I. carnea* leaves was less intense. The development of locomotor disturbances in Wister rats on 10% *I. carnea* for 21 days might be due to hepatotoxicity because of the absence of significant changes in the brain. De Balogh *et al*. (1999). Investigated *I. carnea* toxicosis in goats and found that cytoplasmic storage vacuoles in the neurons that were membrane bound and consistent with lysosomes and that in chronically poisoned goats there were fatty vacuolation in neurons of CNS and autonomic nervous system, pancreatic cells hepatocytes, kupffer cells, thyroid follicles and macrophages in lymphatic tissues. Hueza *et al*. (2003) suggested that the toxic constituent of *I. carnea* is swainsonine and could pass through the placenta and edger the livers of rats pups. The decrease in RBC and PCV with no change in MCV or MCHC indicated normocytic normochromic anaemia. Leukocytosis, notable in the rats fed diets containing 10 and 2% *I. carnea* leaves was associated with granulocytosis. Lymphocyes infiltrated in the vital organs of *I. carnea* fed rats.

CONCLUSION

It is concluded that this study demonstrated a significant toxicity difference for male Wistar Rats from *I. carnea* leaves fed at 2 and 10% for 21 days. Feeding *I. carnea* leaves at 10% of the diet,

was more toxic and caused locomotor disturbance, loss of hair and reflexes and enterohepatonephrotoxicity, while feeding rats at 2% of the plant leaves were less toxic.

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