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Assessment of renal and hepatic functions in rats administered methanolic leaf extract of *Jatropha tanjorensis*

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ABSTRACT

Jatropha tanjorensis which has been consumed locally as leafy vegetable and as medicinal plant for a number of years in Nigeria has recently been reported to be toxic to organs in the body. This study investigated the effect of methanolic leaf extract of the plant on liver and kidney functions in albino rats. The extracts was administered to the rats by oral intubation at doses of 0.5g/kg, 1.0g/kg and 2.0g/kg body weight daily for 21 days after which kidney and liver function indicators were measured in the serum. Measurement of organ weight index revealed that methanolic leaf extract of *Jatropha tanjorensis* caused significant increase ($P < 0.05$) in kidney weight in rats. The extract also caused significant elevation of serum alanine aminotransferase (ALT), aspartate aminotransferase (AST) and total bilirubin. There was no significant difference in the levels of alkaline phosphate (ALP) and acid phosphatase (ACP) between the test groups and the control. Significant increase in serum creatinine and urea was also observed in rats administered with the extract. These results suggest that administration of *Jatropha tanjorensis* leaf extract disrupted protein metabolism function of the liver and also interfered negatively with the filtration capacity of the kidney which might result in renal and hepatic dysfunction.

Key words: Renal and hepatic functions, *jatropha tanjorensis*, urea, creatinine, aminotransferases.

INTRODUCTION

Jatropha tanjorensis commonly called “hospital-too-far” or “iyana ipaja” belong to the family Euphorbiaceae and is widely grown in Southern Nigeria (1). The plant has been used locally as a source of edible leafy vegetable and as medicinal plant for a number of years (2). The leaf extract has hypoglycemic and antioxidant properties that makes it a popular remedy for the treatment of diabetic, malaria and hypertension in this region. It was reported that administration of *Jatropha tanjorensis* leaf powder to rabbits resulted in improvement in haematological indices which revealed an enhancement of bone marrow function (3). The antioxidant potential of the leaf

extract has been investigated and was discovered to have anti-oxidative potential against reactive oxygen species produced in protein energy malnutrition (4).

Jatropha tanjorensis, like many members of the family Euphorbiaceae, contain several toxic compounds, including lectin, saponin, carcinogenic phorbol, and a trypsin inhibitor. The plant also exhibits low hemagglutination properties indicating low toxicity on red blood cell. Recent claims have it that the plant is no longer safe for use and that it could be toxic to organs in the body.

Although plant based natural medicines are popularly acclaimed to be safe, scientists advocate for proper toxicological studies in order to ensure safety in their use (5). Liver and Kidney damage are increasingly common conditions with limited treatment options that are causing major financial and emotional burden on the community (6). Population-sampling studies from around the globe indicate an increase in the incidence of end-stage renal and hepatic failure (7). This study intend to investigate the effects of the leaf extract on kidney and liver functions in rats so as to determine its safety or otherwise.

MATERIALS AND METHODS

Preparation of plant extract

Jatropha tanjorensis leaves were collected at Oke Baale area, Osogbo, Nigeria. The leaves were air-dried to constant weight at room temperature after which they were ground into powder using an electric blender. The dry leaf powder was dissolved in 6 volumes 80% methanol for 14 days after which it was filtered through a Whatman filter paper (125mm). Crude extract was collected by removal of the solvent on a water bath. The concentrated extract was allowed to dry at room temperature after which serial dilution of the extract were prepared.

Experimental Animals

Male Wistar strain albino rats weighing between 150-180g were used for the experiment. The animals were obtained from the Animal House, College of Health Sciences, Osun State University, Osogbo and kept in well ventilated and hygienic animal house under constant environmental and nutritional conditions. All the rats were kept in metabolic cages and given food and water *ad libitum*.

Experimental Protocol

Animals were divided into four groups of six rats each. Group A served as control and received distilled water. The experimental groups (Group B, C and D) were administered 0.5g/kg bw, 1.0g/kg bw and 2.0g/kg bw of the plant extract respectively. The administration was carried out for a period of 21 days.

Biochemical Estimation

Rats were sacrificed after 21 days and blood samples collected into a clean dry test tube without an anticoagulant. The blood was allowed to clot for 10 minutes at room temperature after which it was centrifuged at 3000 rpm for 20 minutes. The obtained serum was stored at 4°C for the estimation of biochemical parameters. Estimation of biomarkers for kidney and liver functions were done photometrically according to standard procedures provided along with the kits supplied by Span Diagnostic Ltd., India based on earlier described principles: ALT and AST (8), ALP and ACP (9), urea and creatinine (10), total bilirubin (11).

Statistical Analysis

Data obtained for biochemical estimations were reported as mean $\pm$ SD. Statistical significance was determined by using one way analysis of variance (ANOVA) followed by Dunnet's multiple comparison tests. $P < 0.05$ was used to determine statistical significance.

RESULTS

Results of organ weight index of rats administered *Jatropha tanjorensis* leaf extract for 21 days is shown in Table 1. There was significant increase in kidney weight in rats administered with the extract compared with the control. This is an indication of kidney enlargement.

Table 1: Results of organ weight index of rats administered *Jatropha tanjorensis* leaf extract for 21 days

Parameters	Group A (Control)	Group B	Group C	Group D
Kidney weight index	0.021 $\pm$ 0.002	0.033 $\pm$ 0.004*	0.036 $\pm$ 0.004*	0.039 $\pm$ 0.003*
Liver weight index	0.034 $\pm$ 0.004	0.036 $\pm$ 0.002	0.031 $\pm$ 0.003	0.033 $\pm$ 0.002

The results are mean of six rats in each group $\pm$ SD

* Significantly different from the control at $P < 0.05$

Table 2 shows the results of kidney and liver function indicators in the serum of rats administered with the extract and the control. This table shows that the extract caused significant increase in serum creatinine, urea, ALT, AST and total bilirubin compared with the control. The levels of serum ALP and ACP were not significantly different from the control.

Table 2: Kidney and liver biomarkers in serum of rats administered *Jatropha tanjorensis* leaf extract for 21 days

Parameters	Group A (Control)	Group B	Group C	Group D
Creatinine (mg/dl)	52.32 $\pm$ 3.42	68.67 $\pm$ 3.33*	72.74 $\pm$ 1.61*	75.40 $\pm$ 2.20*
Urea (mg/dl)	63.55 $\pm$ 2.04	76.51 $\pm$ 3.80*	80.62 $\pm$ 2.13*	82.46 $\pm$ 1.91*
ALT (IU/L)	56.48 $\pm$ 2.54	69.70 $\pm$ 3.35*	71.23 $\pm$ 4.42*	73.50 $\pm$ 5.21*
AST (IU/L)	91.41 $\pm$ 3.29	123.41 $\pm$ 6.29*	131.27 $\pm$ 5.86*	139.39 $\pm$ 6.64*
ALP (IU/L)	123.4 $\pm$ 3.34	118.4 $\pm$ 4.34	129.8 $\pm$ 3.49	132.4 $\pm$ 2.98
ACP (IU/L)	6.39 $\pm$ 0.31	6.54 $\pm$ 0.27	6.81 $\pm$ 0.22	6.88 $\pm$ 0.30
Total Bilirubin (mg/dL)	0.47 $\pm$ 0.03	0.62 $\pm$ 0.01*	0.63 $\pm$ 0.02*	0.68 $\pm$ 0.02*

The results are mean of six rats in each group $\pm$ SD

*Significantly different from the control at $P < 0.05$

DISCUSSION

The significant elevation in the serum level of creatinine and urea is a pointer to renal dysfunction in rats administered with the extract. Creatinine is a break-down product of creatine phosphate in muscle. It is usually produced at a fairly constant rate by the body and filtered out of the blood by the kidneys. If the filtering capacity of the kidney is deficient, creatinine blood levels rise (12). Measurement of serum creatinine is the most commonly used indicator of renal function. A rise in blood creatinine level is observed only with marked damage to functioning nephrons (13).

Urea is the major end product of protein catabolism in animals and is the primary vehicle for removal of toxic ammonia from the body. It is primarily produced in the liver and secreted by the kidneys. Urea determination is very useful for clinicians in assessing kidney function of patients. In general, increased urea levels are associated with nephritis, renal ischemia and urinary tract obstruction (14).

The observed elevation of serum ALT and AST in the serum of rats administered *Jantrophia tanjorensis* leaf extract are indications of their leakage into the bloodstream due to liver damage (15). Measurement of the activities of various enzyme in body fluids play a significant role in disease investigation and diagnosis and detection of tissue damage (16). Marker enzymes located in some cells can leak into the serum or other parts of the living system as a result of injury to the cell where they are located (17).

Low levels of AST is normally found in the blood, however, when the liver or heart is damaged additional AST is released into the bloodstream. It rises within 6 to 10 hours and remains high for 4 days. ALT is produced within the cells of the liver and is the most sensitive marker for liver cell damage (18). Any form of hepatic cell damage can result in leaking of ALT into the bloodstream leading to a rise in the serum levels.

Total bilirubin was also elevated in the serum of rats administered with the extract which is an indication of liver function disruption. Bilirubin is a conventional indicator of liver diseases and its elevation in the serum has been associated with hepatocellular damage and hepatic biliary tract obstruction (19, 20).

There was no significant difference in the serum levels of ALP and ACP between the test group and the control. ALP and ACP are also found in the liver and their serum levels often indicate the condition of the liver. The hepatotoxic potential of the extract observed in this study agree with previous study where it was reported that acute and sub acute dose of *Jantrophia tanjorensis* leaf extract caused a mild significant toxic effects on lungs and liver of rats (21).

Results obtained in this study showed that oral administration of *Jantrophia tanjorensis* leaf extract to rats disrupted renal and hepatic functions in rats. Serum biomarkers of renal and hepatic functions in rats given the extract were significantly altered compared with the control at the end of the short term studies. Although the leaf extract has been discovered to contain useful medicinal ingredients which makes it a popular remedy for the treatment of different ailment, the hepatotoxic and nephrotoxic potential of the plant need to be carefully considered before administering it to patients.

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