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Full Length Research Paper

Biochemical effects on the liver and kidney of rats administered aqueous stem bark extract of *Xemenia americana*

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The effects of aqueous extract of *ximenia Americana* stem bark on liver and kidney of albino rats was investigated. Different doses of the crude extract were administered to rats for 30 consecutive days. The levels of serum aspartate aminotransferase (AST) and alanine aminotransferase (ALT) of treated animals significantly ($p<0.05$) increased compared to the control group. High levels of these enzymes observed were found to be dose dependent. The serum level of protein of treated animals showed significant ($p<0.05$) decrease compared to the control group. There was no significant difference in the serum levels of urea and creatinine of the treated animals compared to the control. The data obtained is suggestive of liver damage and unaffected kidney.

Key words: *Ximenia americana*, aspartate aminotransferase, alanine aminotransferase, urea, creatinine.

INTRODUCTION

Traditional medicine as described by world health organization (WHO, 1978) is the total combination of knowledge whether explicable or inexplicable use in diagnosing, preventing or eliminating a physical, mental or social disease which may rely exclusively on past experience handed down from generation to generation. A medicinal plant is any plant used for the extraction of pure substances either for direct medicinal use or for hemisynthesis of medicinal compounds which can be used for the therapeutic purposes or as precursors for the synthesis of useful drugs (Sofowora, 1993). Traditional medicine like orthodox medicine has its own method and techniques of application which aims at healing disease. Treatment and control of disease by the use of medicinal plants continue to play a very significant role in the medical and dental primary health care implementation in Africa and other developing countries of the world. The advantages of traditional medicine include low cost, affordability, availability, acceptability and low toxicity (Sofowora, 1993).

The plant *Ximenia americana* is a short shrub or small tree from Africa, it has been in use for centuries in many countries. It is used for many herbal preparations in Nigeria. The plant is extensively used among the Hausa/Fulani communities as herbal remedies in treating malaria, leproutic ulcers and skin infections of mixed origin (Ogunleye and Ibitoye, 2003). The preparation of branched leaf, bark, and root is used for headaches, toothaches, mumps and conjuncvities in frontal applications (Von May Dell, 1986). In west tropical Africa the root has been used medicinally for febrile headache and venereal diseases, and is said to cause vomiting and purging (Watt and Breyer-Brandwijk, 1962). The extract of the plant was found to be active against test organisms including *Escherichia coli, Pseudomonas aueruginosa* and *Candida albicans* (Arora and Kaur, 1999). Chemical constituents of the plant extract include tannins, flavonoids, saponins, anthraquinones, alkaloids, starch, general glycosides and bitter principles (Ogunleye and Ibitoye, 2003).

Although the scientific evaluation on the efficacy of this plant has been reported (James et al., 2007; Ogunleye and Ibitoye, 2003; Arora and Kaur, 1999), its effects on the liver and kidney are not yet known. This work was therefore designed to evaluate the effect of the aqueous leaf extract of *X. americana* on the liver and kidney of rats.

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Table 1. Serum levels of alanine aminotransferase, aspartate aminotransferase and protein of rats administered aqueous stem bark extract of *Xemenia americana*.

Treatment	AST (U/L)	ALT (U/L)	Protein (g/L)
Normal control	16±0.03	8±0.03	53.25± 2.11
Group 2	19±00.05*	12±0.01*	49.88± 2.25
Group 3	21± 0.03*	17± 0.02*	39.00± 3.01*
Group 4	25±0.048	21± 0.01*	31.88± 3.01*

Values are mean± standard error of mean, n=3.
*Significant ($p<0.05$) compared to control.

MATERIALS AND METHODS

Plant

Stem bark of *X. americana* was collected from within Yola metropolis. The plant was authenticated and a voucher specimen deposited at the Forestry Department of the Federal University of Technology Yola. The stem bark was shade dried and made in to fine powder.

Animal grouping

Twenty Wister rats weighing between 100-130 g were purchased from Veterinary Research Institute, Vom, Jos. They were housed in a well ventilated room and were given commercial diet and water *ad libitum*. The animals were grouped in to four of three rats:

Group 1: Normal control.
Group 2: Treated with 80 mg/kg/day.
Group 3: Treated with 160 mg/kg/day.
Group 4: Treated with 240 mg/kg/day.

Preparation of aqueous extract

Fifty (50 g) grams of the fine powder of the stem bark was suspended in 500 ml of water and stirred magnetically for six hours. The residue was removed by filtration and the extract was evaporated under reduced pressure using rotary evaporator. A stock was constituted from the concentrated crude extract and the animals were administered according to their body weights.

Sample preparation for analysis

At the end of the experiment, rats from the various groups were sacrificed by direct heart puncture and blood was collected into a clean centrifuge tube and allowed to stand for 30 min before being centrifuged at 1800 rpm for 10 min to obtained serum. The levels of alkaline phosphatase was determined by the method of Write et al. (1972). Alanine aminotransferase(ALT) and aspartate aminotransferase(AST) were determined as described by Reitman and Frankel (1957). Similarly, liver and kidney tissues of the rats were homogenized and the supernatant used for the analysis.

Statistical analysis

Results were presented as mean± standard error of mean for all groups. Student t-test was used for test of significance between two groups.

Table 2. Serum levels of urea and creatinine of rats administered aqueous stem bark extract of *Xemenia americana*.

Treatment	Urea (mmol/L	Creatinine (mmol/L)
Normal control	4.20±0.11	2.37±0.09
Group 2	4.16±0.12	2.31±0.09
Group 3	4.17±0.10	2.44±0.08
Group 4	4.15±0.18	2.35±0.07

Values are mean± standard error of mean, n=3.

RESULTS AND DISCUSSION

Serum alanine aminotransferase (ALT) and aspartate aminotransferase (AST) of treated animals significantly ($p<0.05$) increased compared to the control (Table 1). Increase in the levels of these enzymes was found to be dose dependent. Serum proteins of the treated animals decreased significantly ($p<0.05$) compared to the control group. However, serum urea and creatinine of treated animals did not show any significant difference compared to the control group (Table 2). All the animals gained some weight after they were administered the crude extract as shown in Table 3.

The present study was designed to evaluate the effects of aqueous extract of *X. americana* stem bark on the liver and kidney of rats. Liver and kidney are two important organs that perform vital function for the healthy survival of the body. The liver primarily detoxifies harmful substances, secretes bile in to intestine, synthesizes and stores important molecules, among other things. The kidney helps in maintaining homeostasis of the body by reabsorbing important materials and excreting waste products.

The serum levels of both ALT and AST showed significant ($p<0.05$) increase compared to the control group. This result is in line with the work reported by Brown et al. (2007), where chronic kava beverage consumption was associated with elevated GGT and ALP. The rise in the level of ALT is usually accompanied by elevation in the levels of AST which plays a role in the conversion of amino acids to keto acids. Primary and secondary hepatic tumors cause an elevation of both enzymes with AST higher than ALT. Both AST and ALT are excellent markers of liver damage caused by expo-

Table 3. Percentage weight gain of the experimental rats administered aqueous stem bark extract of *Xemenia americana*.

Group	Mean weight before administration (g)	Mean weight after administration (g)	Mean percentage weight gain
Normal control	116.6	158.6	26.48
Group 2	112.1	145.3	22.85
Group 3	129.9	199.4	34.85
Group 4	117.0	190.7	38.65

sure to toxic substances (Ranjna, 1999). AST is not specific for the liver only but is also located in other organs like the heart, brain, kidney and skeletal muscle. ALT is the more liver specific enzyme for diagnostic use when the integrity of the hepatocellular membrane is compromised, there is extrusion of the enzyme in to the plasma (Moss and Henderson, 1999). The significant increase in serum ALT activity that was observed in all the treated groups could be an evidence of hepatotoxicity caused by the extract.

The gross pathology presentations of the animals sacrificed at the end of the four weeks revealed apparently damaged liver in all the treated groups.

Even though there are quite some number of medicinal plants used in treating liver diseases, reports are accumulating about liver injury after intake of herbals including those advertised for the treatment of liver diseases (Sickle and Schuppon, 2007). For instance, acute and/or chronic liver damage occurred after ingestion of some Chinese herbs. Herbs that contain pyrrolizidine alkaloids, kava, atractylis gummifera, senna alkaloids, cause liver damage (Sickle and Schuppon, 2007) like many synthetic drugs undergoing metabolic activation to form reactive metabolites which are often associated with drug toxicity. It is recognized that some herbal components may also be converted to toxic or even mutagenetic and carcinogenic metabolites by cytochrome p450 and less frequently by phase 2 conjugating enzymes (Zhou et al., 2007).

The serum proteins of the treated animals showed significant ($p<0.05$) decrease compared to the control. The major components of serum proteins include albumin and globulins and liver is the organ, mainly responsible for formation of plasma albumin and at least 30% serum globulins. Decreased levels of serum proteins are found in renal disease, malnutrition, albuminuria and terminal liver failure. Although the concentration of the serum albumin is reduced in severe liver diseases, that of the globulins is usually increased so that the total protein concentration is rarely low. Reduction in serum proteins observed in the present work may be due to liver damage caused by the extract or binding of the plasma proteins to the extract.

There was no significant difference in the serum levels of urea and creatinine of the treated animals. Urea is the main end product of protein catabolism. Amino acid deamination takes place in the liver, which is also the site of urea cycle, where ammonia released is converted into urea and is excreted through urine. It represents 90% of the total urinary nitrogen excretion. Urea varies directly with protein intake and inversely with the rate of excretion. Some of the urea is bound to hemoglobin, so its concentration in the red cells is greater than that in the plasma. Renal diseases which diminish the glomerular filtration lead to urea retention and decrease in urea is seen in severe liver disease with destruction of cells leading to impairment of the urea cycle (Ranjna, 1999). Insignificant difference in serum urea observed here is suggestive of normal functional kidney and the liver damage may not be severe. Creatinine is a waste product formed in muscle by creatine metabolism. Creatine is synthesized in the liver, passes into the circulation and is taken up almost entirely by skeletal muscles. Its retention in the blood is evidence of kidney impairment.

It can be concluded that aqueous stem bark crude extract of *X. americana* may be hepatotoxic and could not have any toxic effect on the kidney.

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