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RESEARCH PAPER

HISTOLOGICAL EFFECTS OF *XYLOPIA AETHIOPICA* ON THE KIDNEY OF ADULT WISTAR RATS

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ABSTRACT

This study investigates the effect of *Xylopiya aethiopic*a leaves on the histology of the kidney. 24 growing rats were used. They were divided into four groups: A (n = 6) as control and B (n = 6), C (n = 6) and D (n = 6) as tests. Group A received normal feed and distilled water only, while B, C and D, received daily doses of 1.2g, 3.0g, and 6.0g / kg body weight of *Xylopiya aethiopic*a leaves respectively, for 21 days. At the end of the experiment, the animals were sacrificed under light chloroform anesthesia to harvest the kidney for histological studies. The kidney was excised, fixed in 10% formal saline and processed for light microscopy using H&E staining procedures. The histological studies revealed normal cells in the control group (A), while group B presented glomerular degeneration, vacuolation and haemorrhage. Group C showed tubular wall enlargement, exudation, tubular disruption and cellular infiltration, while group D showed parenchymal erosion, tubular cavity obstruction and vacuolation. The observed kidney damages were dosage and duration dependent. The histological observations suggest that *Xylopiya aethiopic*a leaves is toxic to the kidney and may induce a dose dependent renal damage; hence the need for further studies.

Keywords: *Xylopiya aethiopic*a, Kidney, Histology, Plants

INTRODUCTION

For centuries, plant based medications have been man's prime therapeutic weapon and still in the front line for treating a large number of diseases (Iwu, 1993). This also extends to food substances consumed by humans which also have either a therapeutic, nutritional or toxic effects on the body (Sofowara, 1978). These food substances when obtained in their crude form can be of immense help in curing of some ailments. In the past decades, pharmacologists and organic chemists have synthesized a large number of interesting chemical substances from medicinal plants which have been of great help in the practice of medicine (Iwu, 1993). One plant of interest with proven medicinal qualities is *Xylopiya aethiopic*a.

*Xylopiya aethiopic*a commonly known as "African guinea pepper" or "Ethiopian pepper" is wide spread in tropical Africa, Zambia, Mozambique and Angola (Puri and Talata, 1978). In Nigeria, it is found all over the lowland rain forest and most fringe forest in the savannah zones of Nigeria (Sofowara, 1978). It is used as a pepper substitute in Europe and India (Sofowara, 1978) and highly valued in other countries because of its medicinal and pharmacological properties (Okeke *et al.*, 2008). The fruits are used as spices and its aqueous decoctions are used especially after child birth; probably due to its antiseptic properties to arrest bleeding (Burkhill, 1985; Okeke *et al.*, 2008). The seeds contain bitter principles, alkaloids, glycosides, saponins, tannins, sterols, carbohydrate, protein and free fatty acid, mucilage's and acidic compounds (Burkhill, 1985); some of which might be responsible for the reported uses.

On the other hand, the kidney is a paired retroperitoneal organ on the posterior abdominal wall that helps to excrete waste products of protein metabolism from blood, while returning nutrients and chemicals to the blood (Moore and Dalley, 2006). The kidney is a chief regulator of all body fluid and it is primarily responsible for maintaining homeostasis or equilibrium of fluid and electrolytes in the body. It is also an organ with several functions that are essential for animal's survival and also serve as the body's natural filter of blood by removing metabolic by-products and wastes (Guyton and Hall, 2006; Sembuligam and Sembuligam, 2006). Like every other substance, *Xylopiya aethiopicia* is being filtered by the kidney and as such, there is need to evaluate its effect on renal structural/functional integrity.

This study therefore, is designed to investigate the effects of *Xylopiya aethiopicia* on the morphology of the kidney particularly due to the fact that it has over the years, been widely used in traditional medicine.

MATERIALS AND METHODS

Experimental animals: Twenty four (24) adult Albino Wistar rats of comparable sizes and weights ranging from 150 to 300g were procured from the animal farm of Anthonio Services Nigeria, Ekpoma, Edo State, and transferred to the experimental Laboratory of Anthonio Research Center at No. 40 Ujoelen Extension, Ekpoma, where they were allowed two (2) weeks of acclimatization. They were kept in wire mesh cages with tripod that separated the animal from its faeces to prevent contamination. During this period of acclimatization, the rats were fed with growers' mash and water was provided ad libitum. The animals were maintained and utilized in accordance with the standard guide for the care and use of laboratory animals.

Animal grouping: The experimental animals were separated into four groups (A – D) of six rats each (n = 6) using 4 big cages to house the animals. Group A served as the control, while groups B - D served as the test groups. Group B – D received graded doses of the *Xylopiya aethiopicia* leaves. Group A received only the normal feed (grower's mash) and water with no administration of the *Xylopiya aethiopicia* leaves.

Substance Preparation: Adequate amount of fresh leaves of *Xylopiya aethiopicia* was collected from a natural habitat at Eke Village of Udi local Government Area of Enugu State. The fresh leaves were allowed to air-dry on a dry table in a well ventilated room, with total absence of direct sunlight as described by Fleischer *et al.*, (2008). The dried leaves were blended into fine powder using an electric blender. The fine powder was measured using Electric Balance (Denver Company, USA, 200398. IREV.CXP-3000) and packaged in small plastic envelopes and then stored pending usage. The substance preparation process was performed with maximum care in order to avoid any form of contamination to ensure accurate results.

For the purpose of this study, pastes were prepared by adding measured quantities of *Xylopiya aethiopicia* powder to feed (grower mesh) and mixed with sprinkles of water to add up to 50grams as described by Nwaopara *et al.*, (2011).

Experimental Protocol: Experimental animals were divided into four groups of six rats each. Group A served as control and received normal feed plus distilled water. The experimental (test) groups (Group B, C and D) received 1.2g/kg body weight, 3.0g/kg body weight and 6.0g/kg body weight of the leaves respectively. The administration of the substance lasted for a period of 21 days. At the end of the study, the rats were sacrificed under light chloroform anesthesia. The abdomen of each rat was carefully dissected to harvest the kidneys that were then fixed in 10% formol saline for histological studies.

Data presentation: The histological results were presented in tissue micrographs and compared with the histo-architecture of the control group.

RESULTS

Kidney sections from the control group (A) presented normal histological features. The Bowman's capsule and the glomeruli appeared to be prominent and normal (Figure 1). Kidney sections from group B showed glomerular degeneration, vacuolation, and haemorrhage (Figure 2). Kidney sections from group C presented tubular wall enlargement, exudation, tubular wall disruption and cellular infiltration (Figure 3). Also, sections from group D presented parenchymal erosion, tubular cavity obstruction and vacuolation (Figure 4).

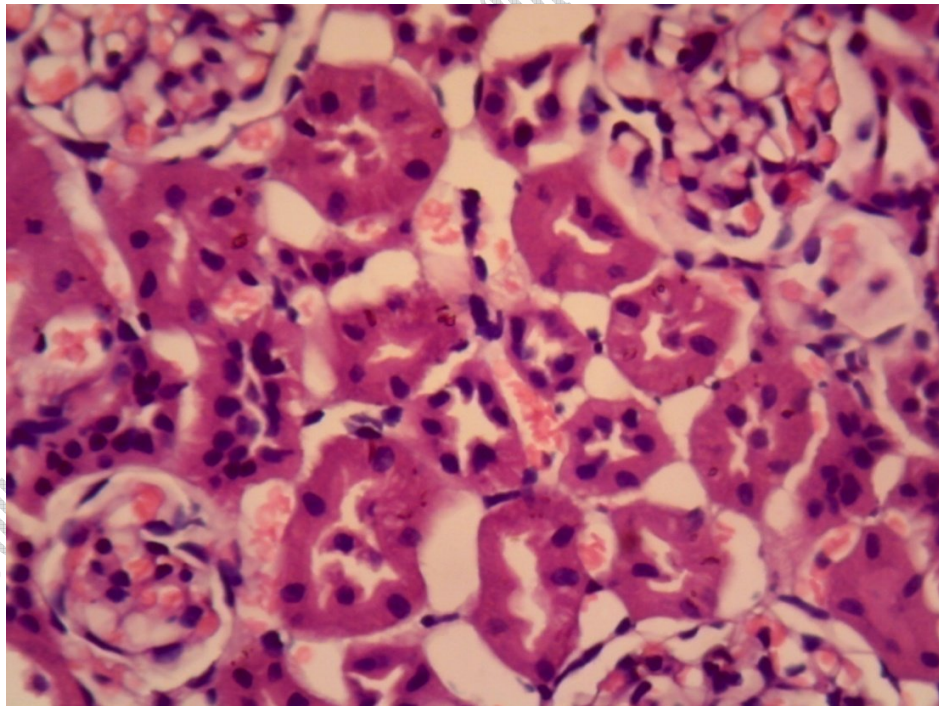


Figure 1: Control Group A (Kidney; H&E X400): Histological representations of control rat kidney showing normal histological features.

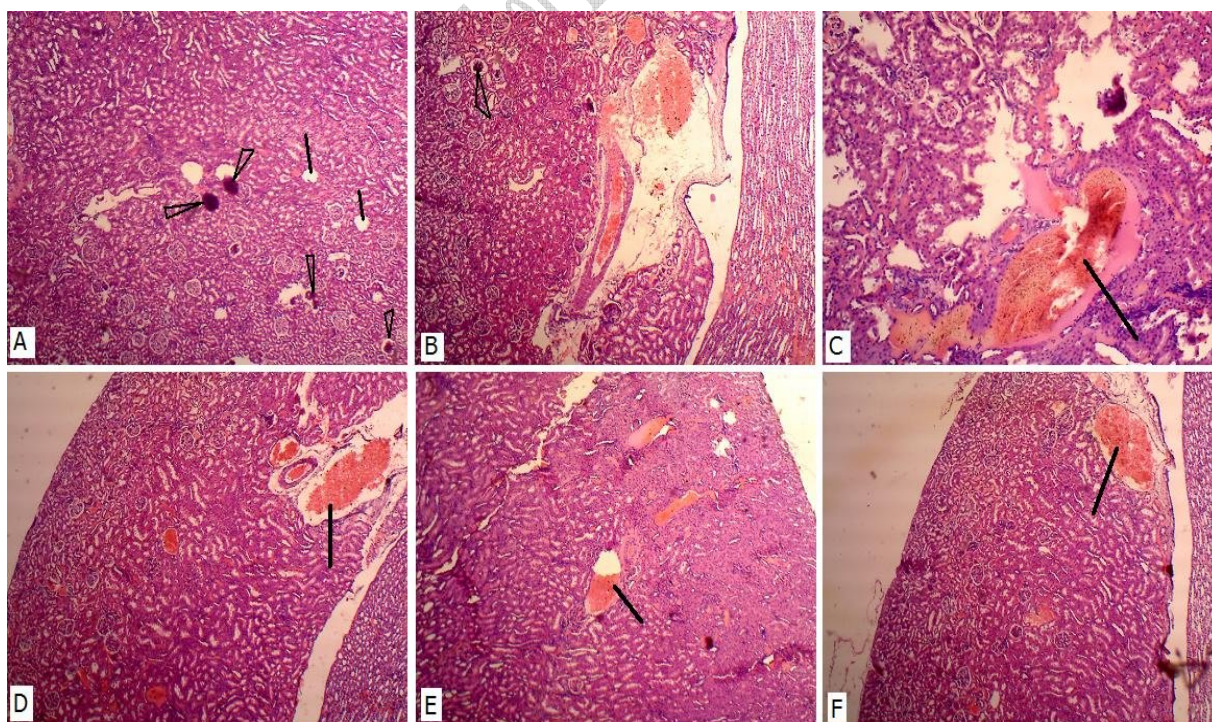


Figure 2: Test group B (Kidney; H&E X100): Histological representation of rat kidney fed with 1.2grams/kg/day of *Xylopiya aethiopica* leaves for 21 days (see plate A showing vacuolation; plates A and B showing glomerular degeneration; and plates C, D, E and F showing haemorrhage).

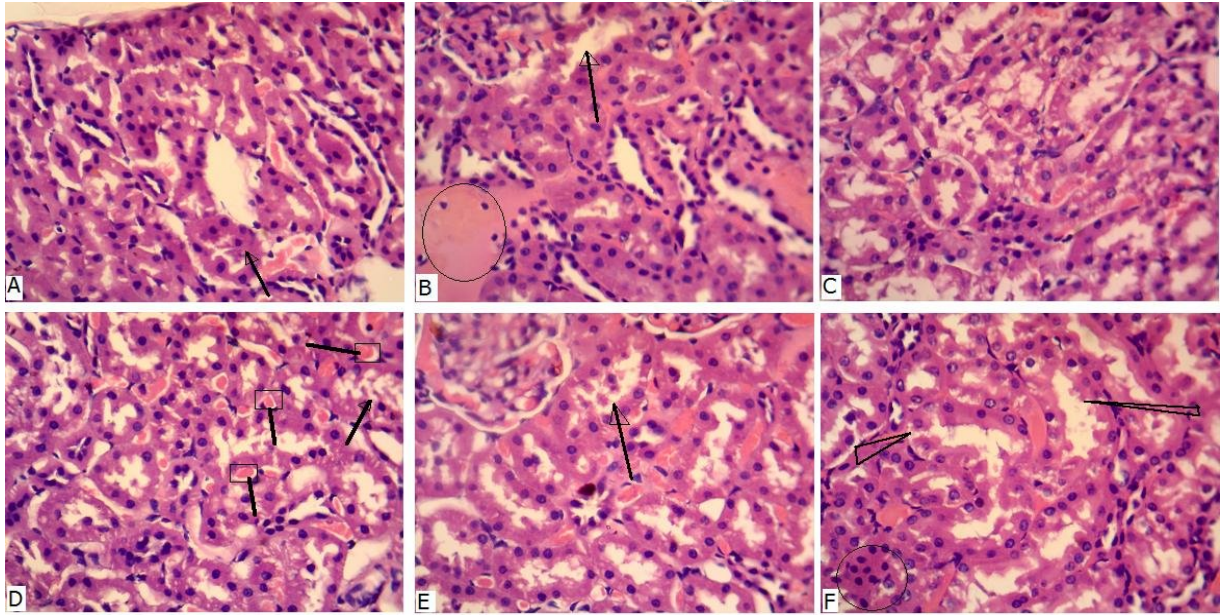


Figure 3: Test group C (Kidney; H&E X400): A histological representation of rat kidney fed with 3.0grams/kg/day of *Xylopiya aethiopic*a leaves for 3 weeks (See plate A showing tubular wall enlargement; plate B showing exudation; plate C, D, E and F showing tubular disruptions; and plate F showing cellular infiltration)

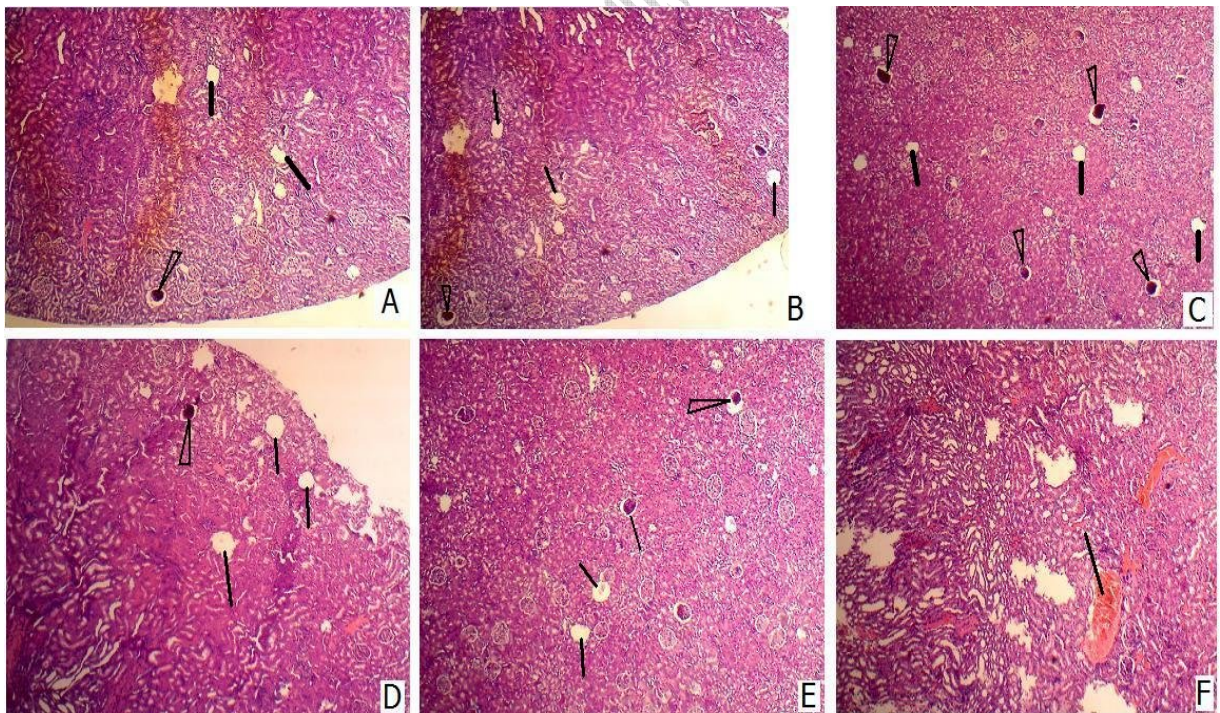


Figure 4: Test group D (Kidney; H&E X100): A histological representation of rat kidney fed with 6.0grams/kg/day of *Xylopiya aethiopic*a leaves for 3 weeks (see plates A, B, C, D and E, showing glomerular degeneration and vacuulations; and plate F showing parenchymal erosion).

DISCUSSION

The presence of histological cellular alterations in this study, indicate that *Xylopiya aethiopicia* has nephrotoxic potentials as the kidneys are especially liable to injury based on their vulnerability to toxic insults delivered into the blood stream from the gastro intestinal tract (GIT) and in turn, transported to the kidney. More so, the kidneys are exposed to a variety of waste products produced by metabolic activities in the body (Guyton and Hall, 2006; Sembulingam and Sembulingam, 2006). Breener *et al.*, (1972) noted that most waste products are poorly reabsorbed by the renal tubules and the effect of the extract will therefore be important for effective removal of waste products from the kidney, while Spinelli *et al.*, (1972) explained that the glomerular capillaries forms a complex network of channels anastomose freely in mammals. In fact, the total area available for filtration in this complex network is a function of the length, diameter and number of capillary branched (Brenner *et al.*, 1972). Moreover, the specific morphology of the capillary network including the capillary dimensions and the branching pattern as well as the properties of the blood determines the distribution of blood flow and as such, the area used for filtration.

On the hand, the observed haemorrhagic changes may probably be due to the effect of saponin found in the leaf of *Xylopiya aethiopicia* (Irvine, 1961) as it is known to be toxic to body system (Watt and Breyer-Brandwijk, 1962). Available literature shows that renal function is impaired by any acute condition causing severe reduction in glomerular filtration. This usually occurs during circulatory failure following severe trauma and haemorrhage. Such impairment of renal blood flow and glomerular filtration also occurs in most cases of acute diffuse proliferative glomerulonephritis (Muir, 1980).

The results of this study however, disagree with the study of Woode *et al.* (2011) whereby *Xylopiya aethiopicia* was been shown to be non nephrotoxic to several hepatotoxins. Even documented findings from acute and sub-acute studies on the toxic effects of *Alstinia congensis engler* bark and *Xylopiya aethiopicia* fruit mixtures, does show their capacity to induce mild increase in creatinine levels of wistar rats (Ogbonnia *et al.*, 2008). This could explain the possible renal cytoarchitectural alterations observed in this study. Hence, dosage differences might explain the comparative differences in the observations made from other studies on *Xylopiya aethiopicia*.

Therefore, the active ingredients in *Xylopiya aethiopicia* leaves are likely implicated in the various deleterious distortions observed on the kidney sections, and suggests that the excessive consumption of *Xylopiya aethiopicia* leaves be avoided.

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AUTHORS' CONTRIBUTIONS

The experiment was conducted by Obhakhon J.O. and Obodo B.N. with supervision, assistance and financial support from Ozor M.O. All authors were involved in the preparation of the final draft of this manuscript.