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Original Research Article

The effect of ethanolic extract of premature *Musa Paradisiaca* (plantain) pulp on the histology of the liver and kidneys of female Wistar rats

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ABSTRACT

Background: Premature plantain is a major component in herbal remedies used for the treatment of different ailment such as reducing blood sugar, and peptic ulcer disease. The aim of the study was to determine the effect of ethanolic extract of premature *Musa paradisiaca* on histology of the liver and kidneys of female Wistar rats.
Methods: Twenty female Wistar rats weighing between 180-200 g were divided into four groups. Group 1 was administered distilled water only, while groups 2, 3 and 4 were administered the ethanolic extract of premature *Musa paradisiaca* in low, medium, and high dose respectively for 14 days.
Results: Twenty-four hours after the last administration, all animals were sacrificed, tissues were harvested. The histological reports showed varying level of damage to the cytoarchitecture of the liver and kidney tissues of the treatment groups when compared to the control.
Conclusions: This plant may likely induce nephrotoxic and hepatotoxic changes.

Keywords: Kidney, Liver, *Musa paradisiaca*

INTRODUCTION

Plants have long been directly connected to scientific discoveries and numerous studies as a source of medicine. Medicinal plants constitute one of the main sources of new pharmaceutical and healthcare products; there has been an increase in the demand for phytopharmaceuticals all over the world due to the side effects of allopathic drugs.

The WHO referred to herbal medicine as "herbs, herbal materials, herbal preparations and finished herbal products that contain as active ingredients parts of a plant and other plant materials or combinations". According to studies, more than 60% of consumers use herbal remedies because they have a strong faith in its efficacy and safety and do not seek medical advice before doing so.[1]

Some authors also opined that ingestion of herbs and roots (45.5%) is a major cause of liver diseases, with primary liver cancer and liver cirrhosis accounting for 44.3% and 20.4% respectively.[2]

Some studies have reported that components of herbal medicine cause renal tubular lesions such as inflammatory cell infiltration, degeneration, and necrosis of renal tubular epithelial cells.[3] In another study where rats were exposed to plant extracts, histopathologic changes in the kidney were that of acute tubular necrosis with diffused interstitial

and glomerular haemorrhage This suggests that irreversible cellular injury affecting the epithelial parenchyma and endothelial cells occurred.[4]

Musa paradisiaca commonly known as 'plantain' is the accepted name of the hybrid between *Musa acuminata* and *Musa balbisiana*. Premature plantain is heavily consumed in Nigeria in many ways. While it may be a useful herbal remedy in treating different ailments, hyperglycaemia in diabetes and peptic ulcer disease.[5,6] It may also be associated with adverse reactions and there is not enough reliable information on its effect on the liver and kidney. Hence the need for this study.

METHODS

Fruit of premature *Musa paradisiaca* was identified by Department of Plants Science and Biotechnology, Rivers State University. A voucher specimen number of RSUPb 042/ *Musa paradisiaca* fruit was assigned.

Preparation of extracts

Plantain fruit was peeled, sliced into tiny pieces, air-dried in an air oven, and grounded into powdered form. The powdered form was extracted with ethanol in a soxhlet apparatus at 45ºC for 48 hours. The extract was preserved in an airtight glass jar and placed on a shelf in a cool dry place.

Procedure for phytochemical screening

To determine the presence of various phytoconstituents, a preliminary phytochemical study with the extracts was carried out to identify the following markers: alkaloids, saponins, tannis, flavonoid, terpenes, simple sugars, anthraquinones, sterols, terpenoids. Phytochemical screening was performed according to standard methods.[7-9]

Type of study

This study was an experimental study.

Duration of the study

The study duration was August 2021 to March 2022.

Experimental protocol

Twenty healthy adult albino female Wistar rats, Rattus novegicus (150-200 g body weight) were purchased from the University of Port-Harcourt, Rivers State, Nigeria and housed according to laboratory animal housing standards at the animal house, Faculty of Basic Medical Sciences, Rivers State University, Nigeria.

Rats were fed with standard rat feeds, the rats had access to unlimited and unrestricted water before and during the experiment. They were also acclimatized for 14 days (12 h light/dark cycle) before the commencement of the experiment. The rats were randomized into four groups, and each consisted of five rats, which based on their weights were administered the extract orally in low, medium, and high dose except the control which was given only distilled water. The rats were identified by defining marks placed on their head, tail, and back

Animal sacrifice

On the 15th day, the body weight of the rats was obtained using a digital weighing balance; the animals were anaesthetized using chloroform and humanely sacrificed. The liver and kidneys were harvested and weighed before transfer into universal bottles containing buffer formalin. The paraffin embedded tissues were cut at 5mm thickness and stained with haematoxylin-eosin solution. The sections were examined microscopically for histological observation.

RESULTS

Histological figures showing the effect of premature Musa paradisiaca on the kidney

Animals fed with a high dose of premature plantain showed mild expansion and glomerular urinary space glomerular degeneration (DGL) in tissue sections of the kidney. Also, tissue sections showed myxoid degeneration in the distal tubules while proximal tubules showed cellular hyperplasia (PT). Tissue sections showed normal glomerulus (GLO) with normal urinary space (NUS) and epithelial lining. The PT and DT showed normal cytoarchitecture. H and E at 400X were observed.

Tissue section showed normal cellular organization, GLO, proximal and distal tubules under H and E at 400X were observed. The tissue section showed mild expansion and glomerular urinary space DGL. The DT showed myxoid degeneration while proximal tubules showed PT. H and E at 400X were observed.

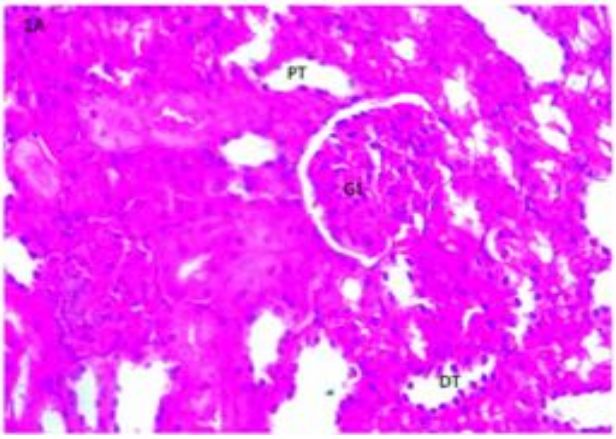

Figure 1: Photomicrograph section of Wistar rat kidney tissue from control group given only distilled water.

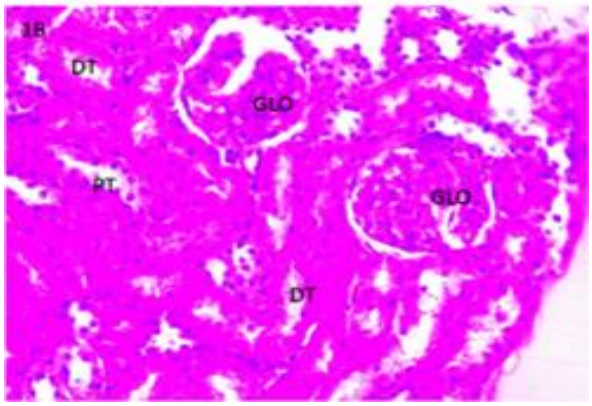

Figure 2: Photomicrograph section of Wistar rat kidney tissue from low dose.

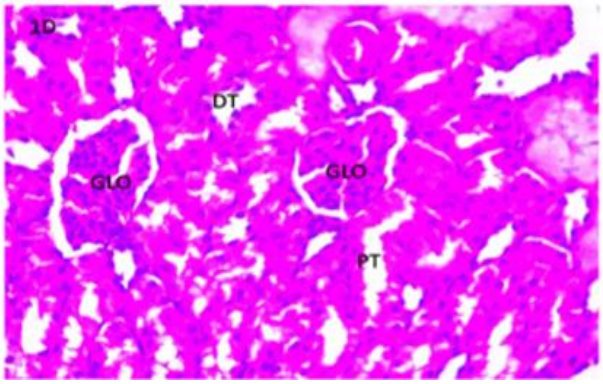

Figure 3: Photomicrograph section of Wistar rat kidney tissue from medium dose.

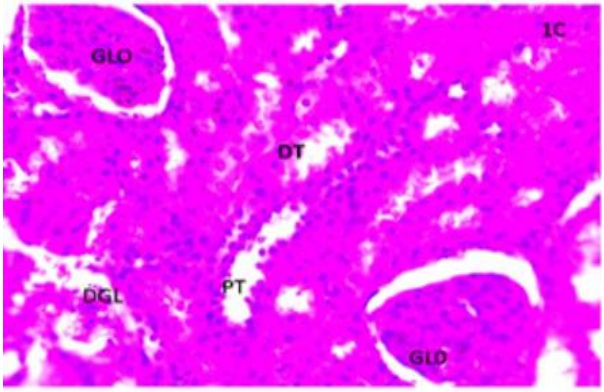

Figure 4: Photomicrograph section of Wistar rat kidney tissue from a high dose.

Histological figures showing the effect of premature Musa paradisiaca on the liver

Animals fed with a high dose of premature plantain showed expanded sinusoidal space (SSE) and few nuclear pyknosis (NP) in tissue section of the liver. Sections of the liver also showed portal (PV) and congested bile (BD). Section showed liver hepatocytes (HPC), sinusoidal space (SS) and central vein (CV). H and E at 400X were observed. Section showed central vein (CV), liver hepatocytes (HPC), and sinusoidal space (SS) with lymphocytes infiltration (LI). Section showed hepatocytes vacuolation (VC), NP and sinusoidal space expansion (SSC). Section showed some connective tissue leison (CTL), expanded SSE and few NP. Section showed PV and congested bile BD.

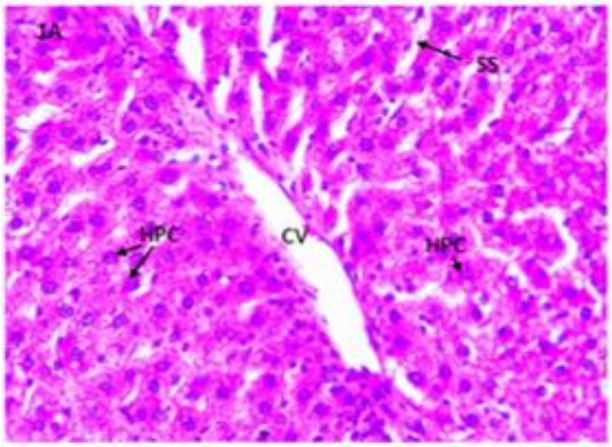

Figure 5: Photomicrograph section of Wistar rat liver from control group given only distilled water. Section showed liver HPC, SS and CV. H and E at 400X.

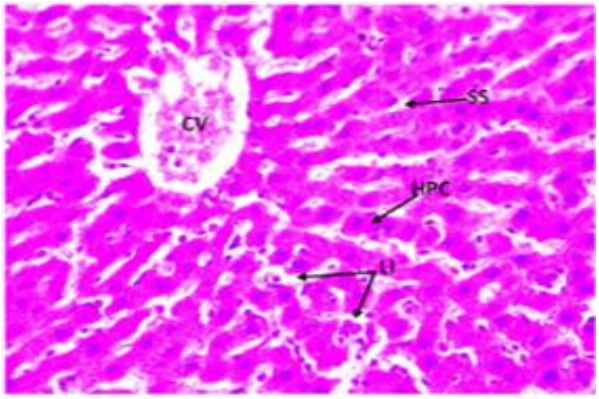

Figure 6: Photomicrograph section of Wistar rat liver from low dose.

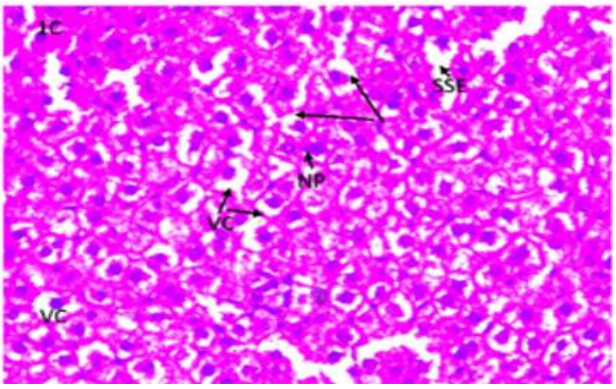

Figure 7: Photomicrograph section of Wistar rat liver from middle dose group.

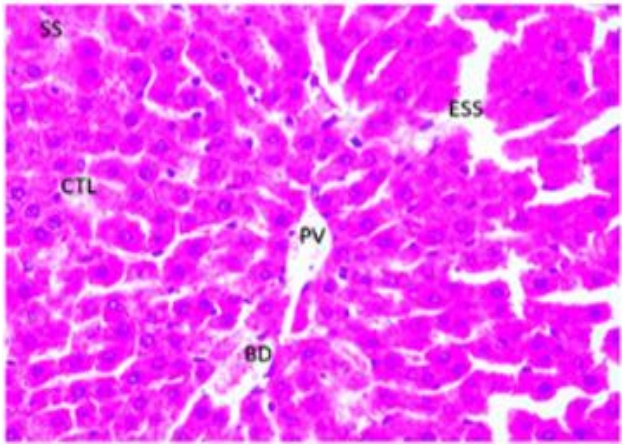

Figure 8: Photomicrograph section of liver tissue from high dose group.

DISCUSSION

The components of herbal medicine have been reported to cause renal tubular lesions such as inflammatory cell infiltration, degeneration, and necrosis of renal tubular epithelial cells.[3] In Figure 4, histopathological changes of the kidney in the high dose treatment group revealed myxoid degeneration, cellular hyperplasia, and glomerular degeneration. The lesions seen could be because of the presence of phenol containing compounds (flavonoids and tannin). This result agrees with.[10,11] They reported that degenerative renal histological changes were observed in rats after exposure to compounds containing phenol. This also agrees with Yang et al they reported flavonoids to be a known cause of kidney toxicity due to disruption of metabolic processes.[12]

Ingestion of herbs and roots is a major risk factor of liver diseases.[2] Sinusoidal space expansion also known as dilatation was seen in the liver of all treatment groups. Hepatic sinusoidal dilatations (enlargement of hepatic capillaries) indicate the presence of hepatic venous obstruction, resulting in vascular stasis and congested parenchyma.[13]

The morphological changes such as hepatocytes VC, NP and sinusoidal space expansion as seen in Figure 7 and congested bile as seen in Figure 8 were observed in tissue sections of animals treated with the plant extract. These changes in seen can be attributed to presence of liver injuries. This agrees with they reported that liver injury leads to distinct morphological abnormalities such as loss of sinusoidal fenestrations.[14] These histological changes seen, can also be attributed to phytochemical constituent of premature *Musa paradisiaca*. This is in agreement with who reported following the administration of a plant extract, that the changes in histological architecture of the liver, was indicative of toxicity, and attributed it to phytochemicals present in the extract.[15] Lymphocyte infiltration was observed in animals treated with lose dose as seen in Figure 6. This implies that premature *Musa paradisiaca* is likely to contain some compounds capable of causing drug induced liver injury. This was in accordance with who reported that lymphocytes play a key role in inflammatory processes and hepatic inflammation during drug induced liver toxicity.[16]

Also, observed in treatment groups was nuclear pyknosis, and degenerative changes of the hepatocytes. This emphasizes further, that premature *Musa paradisiaca* is likely to contain hepatotoxic compounds. This agrees with they also reported degenerative changes in rat liver with vacuolation of hepatocyte cytoplasm, nuclear pyknosis and necrotic changes as indications of hepatocellular damage and attributed these effects to undetermined phytochemicals in the plant extract.[17]

CONCLUSION

In conclusion, premature *Musa paradisiaca* extract, may likely induce nephrotoxic and hepatotoxic changes in female Wistar rats.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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