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THE MEDICINAL EFFECTS OF *GARCINIA KOLA* STEM BARK EXTRACT ON RENAL TISSUES IN ALLOXAN INDUCED DIABETIC RATS (AIDRS)

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ABSTRACT

Background: The search for alternative means of managing illness or disease conditions is as old as man. Plant and its parts (e.g. seeds, stems, leaves, roots and bark, etc.) have continuously been explored as food and medicine. The prevalence of some of these diseases is becoming alarmingly high so much that it is becoming a world problem and indeed a public health concern. It has become expedient that drastic measures be taken to curb the outrageous growth of these medical conditions. Some of these medical conditions are a result of what we eat as food especially diabetes mellitus. ***Aim****:* The study was aimed at investigating the effects of *Garcinia kola* stem bark (GKSB) extract on the histology of the kidney in Alloxan induced diabetic rats (AIDRs). ***Significance of the Study****:* The result of this study will be very relevant in proffering alternative therapies in the management of diabetes. ***Materials and Methods:*** 72 male wistar rats grouped into six comprising 12 animals per group. Each group is further split into 4 weekly subgroups consisting of 3 animals per group. The six major groups were the Normal Control Animals, non diabetic animals, which did not receive any treatment of the extract. The 2nd was diabetic, and not treated throughout the experimental period. The 3rd was non diabetic but administered the plant extract at 35.8mg/kg b. w. dose. ***Results and Discussion***: The study revealed that at the first week of inducing diabetes using Alloxan, the kidney tissues showed an obliterated Bowman's capsular space. This response is considered a generalized tubulonephropathies ranging from tubulonephritis to edematous swellings. The study indicated that at the third week of the administration of *Garcinia Kola* stem bark extract; the damages on the renal tissues were

amended showing intact glomeruli and renal tubules. This suggests that the *Garcinia Kola* stem bark extract had curative effect on the kidney. ***Conclusion***: The study has shown that *Garcinia Kola* stem bark extract has medicinal effect on diabetic renal tissues. This further means that the extract has active ingredients that could be useful in the management of diabetic conditions.

KEYWORDS: Kidney, Garcinia, Kola, Stem, Alloxan.

INTRODUCTION

The search for alternative means of managing illness or disease conditions is as old as man. Plant and its parts (e.g. seeds, stems, leaves, roots and bark, etc.) have continuously been explored as food and medicine. The prevalence of some of these diseases is becoming alarmingly high so much that it is becoming a world problem and indeed a public health concern. It has become expedient that drastic measures be taken to curb the outrageous growth of these medical conditions. Some of these medical conditions are a result of what we eat as food especially diabetes mellitus.

Amongst the basic food nutrients quite available to man, carbohydrate meal seems more common. In most African countries particularly in Nigeria, almost all meals are carbohydrate based and diabetes is therefore predominant in our communities. The ailment is believed to be a carbohydrate metabolic disease caused as a result of insufficient insulin production. Insulin which causes conversion of surplus glucose to glycogen for storage in the liver is manufactured by pancreatic islets cells under regulation by the pituitary gland. In 2006, the WHO reported about 180million cases of the ailment. In 2010, it was projected that approximately 285million people globally were diabetic with type 2 contributing 90% of the cases.

It is believed that from the creation of man in the Garden of Eden according to the Biblical report that everything that is needed for the healing of man has been provided in the garden. The fruits, leaves, stem and roots of the trees were all medicinal. This is the bedrock of the numerous scientific investigations on plants that have medicinal values and some have paid off very well with little modification on its constituent. Garcinia kola stem bark has been speculated to have medicinal components although have not been investigated scientifically. Although, the leaves have shown evidence of hypoglycemic effects and thus have been implicated as a possible means of managing the disease.

The drug Alloxan, a toxic sugar is well known for damaging the pancreatic cells and inducing diabetes mellitus owing to the deficiency of the insulin producing cells.

There have been previous works on diabetes and Garcinia Kola reported by well known authors.[1-4,6-16,18-25]

Aim

The study was aimed at investigating the effects of *Garcinia kola* stem bark (GKSB) extract on the histology of the kidney in Alloxan induced diabetic rats (AIDRs).

Significance of the Study

The result of this study will be very relevant in proffering alternative therapies in the management of diabetes.

Scope of the Study

This study was limited to the Histological Effects of GKSB Extracts investigated on the Kidney AIDRs using routine histological tissue processing methods.

MATERIALS AND METHODS

Research Design: The study was experimental.

Sample Size and Sampling Technique: This research involved 72 male wistar rats grouped into six comprising 12 animals per group and they were randomly selected for the study.

***Criteria for Subject Selection*:** Normal male wistar rats without any known deformities with relatively equal body weights.

***Ethical Clearance*:** Ethical clearance was obtained from the Research Ethics Committee of the University of Port Harcourt, Nigeria.

***Data Collection*:** 72 male wistar rats grouped into six comprising 12 animals per group. Each group is further split into 4 weekly subgroups consisting of 3 animals per group. The six major groups were the Normal Control Animals, non diabetic animals, which did not receive any treatment of the extract. The 2nd was diabetic, and not treated throughout the experimental period. The 3rd was non diabetic but administered the plant extract at 35.8mg/kg b. w. dose. The fourth group was diabetic, treated with a known control drug, glibenclamide. The 5th and 6th groups were diabetic, treated with 35.8, 17.9mg/kg b. w. of the extract. All

diabetic animals were previously induced with Diabetic mellitus by a single intraperitoneal injection of alloxanmonohydrate at 150mg/kg body weight. Diabetes induction is verified by blood glucose analysis using blood from the tail vein estimated by a glucometer to be more than 300mg/dL. After each period of experiment, the Liver, Kidney and Pancreas were excised and processed for histological assay following the standard procedure for tissue processing for histological investigation. The duration of the study was 10 weeks (October 8 – December 31, 2018).

RESULTS

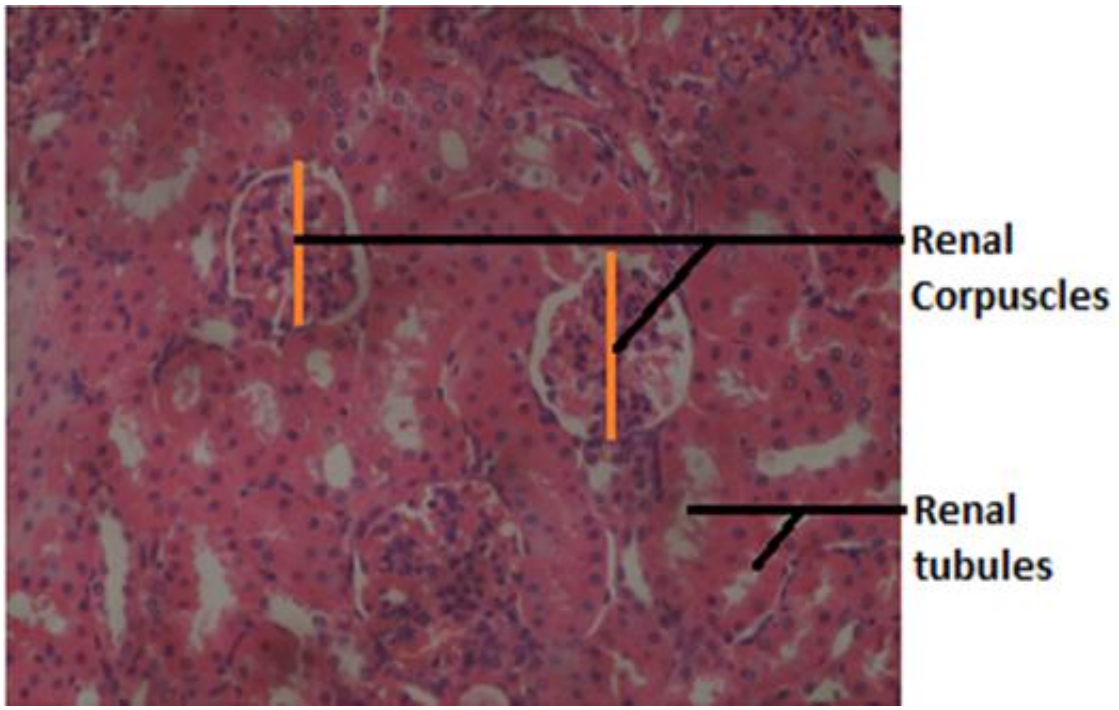

Plate 1: Control Kidney Tissue.

Picture shows a number of normalrenal corpuscles (glomerulus) and tubules with clearly defined lumen and subcapsular space.

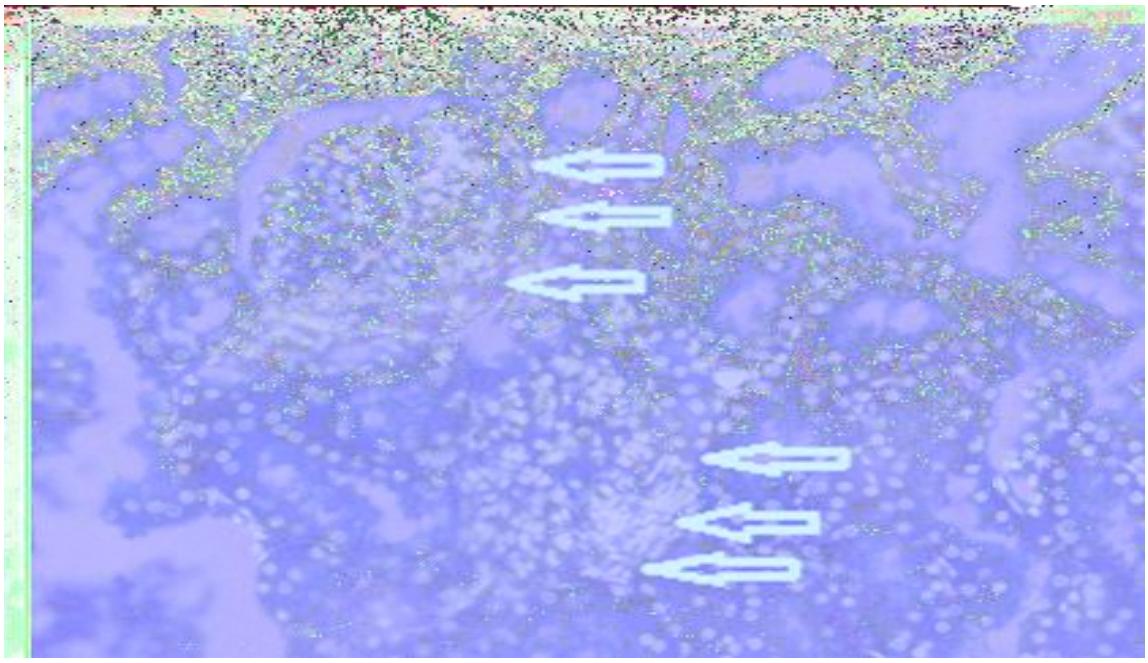

Plate 2: Diabetic Kidney Tissue.

Picture shows obliterated Bowman's capsular space (arrowed). There is generalized tubulonephropathies ranging from tubulonephritis to edematous swellings at week 1. H&E. M x400.

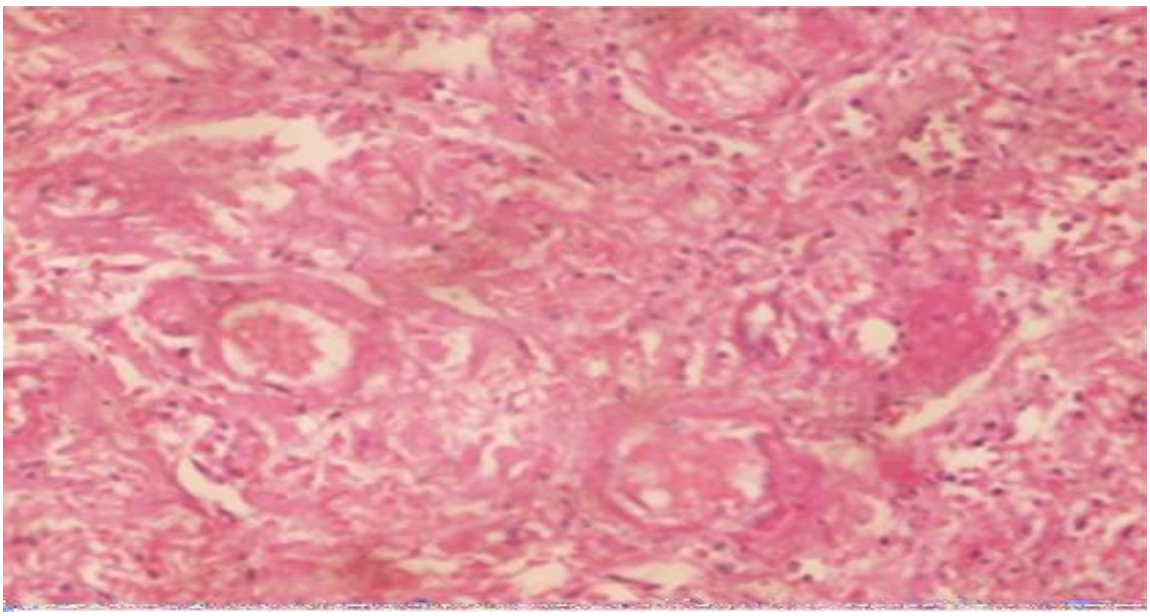

Plate 3: Diabetic renal tissue.

Photomicrograph shows completely distorted renal tissue. There is hyalinization of the glomerulus and complete tubulonephritis. Nodular necrosis is seen at week three (3). H&E. M x400.

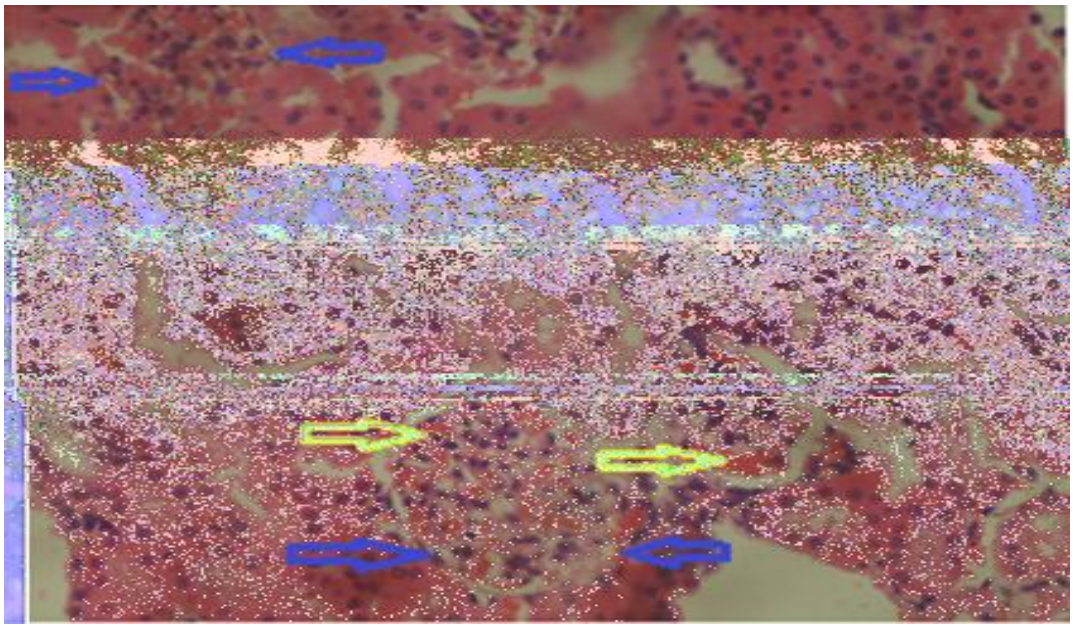

Plate 4: *Garcinia kola* stem bark treated diabetic renal tissue.

Photomicrograph shows distorted kidney tissue characterized by obliteration of Bowman's capsular space arrowed (Blue), glomerular tuft hyalinization and mesangial expansion (Yellow) at week 1 of administration. H&E. M x400.

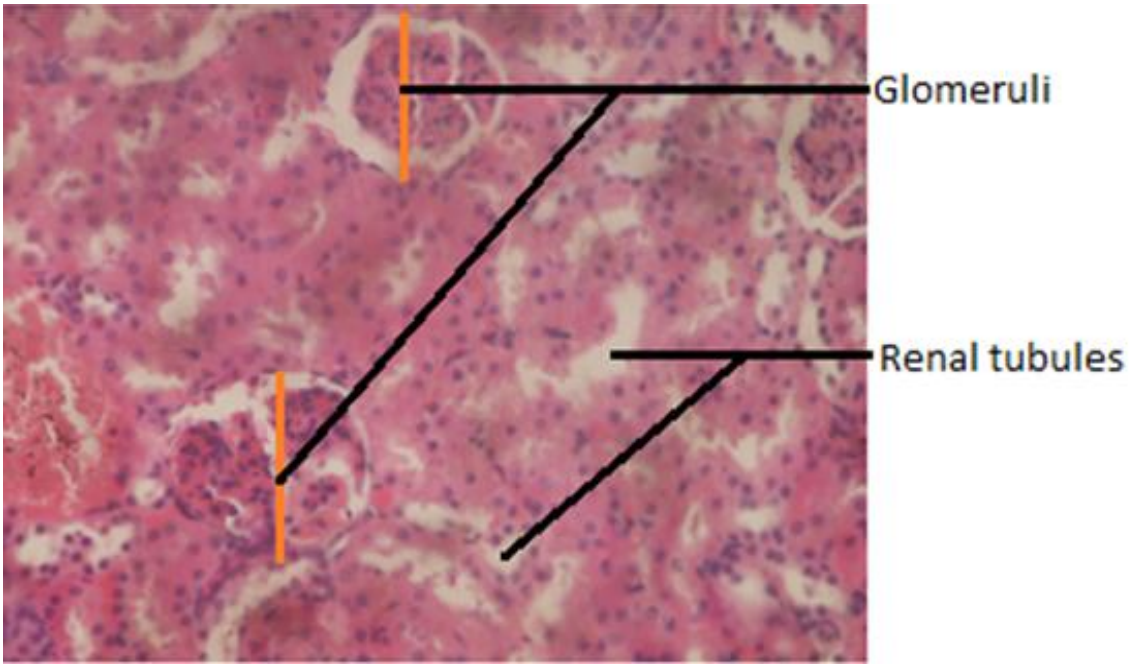

Plate 5: *Garcinia kola* stem bark extract administered kidney tissue.

Photomicrograph of the kidney showing intact glomeruli and renal tubules at week three (3) of administration. H&E. M x400

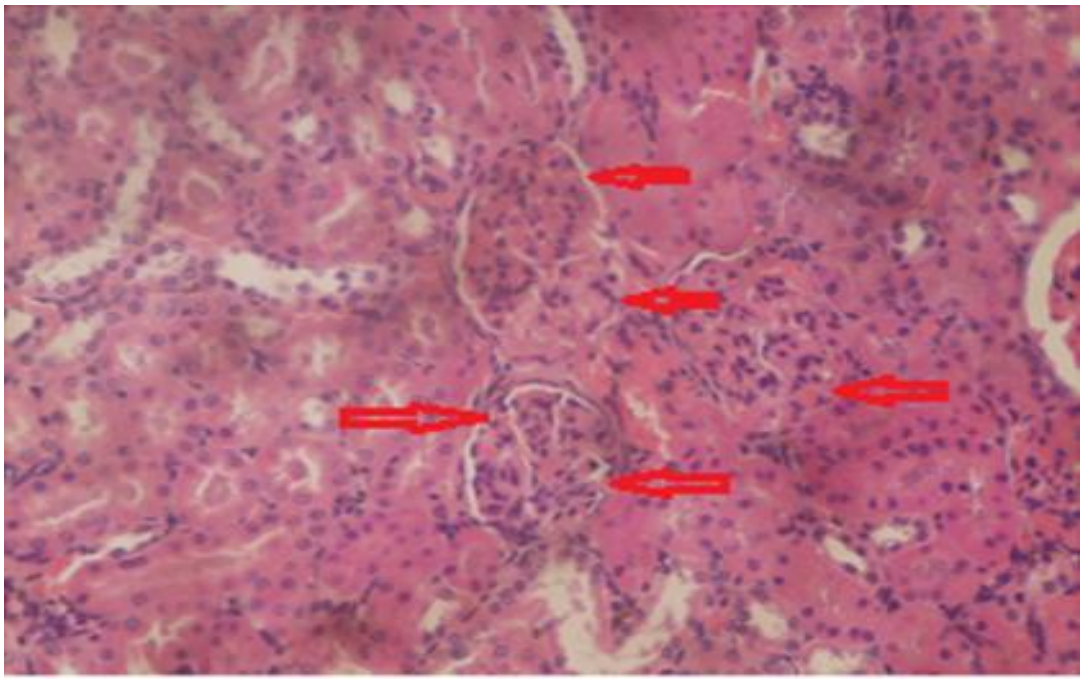

Plate 6: Glibenclamide treated diabetic kidney tissue.

Bowman's capsular space obliterated arrowed (Red) at week three (3). H&E. M x400.

DISCUSSIONS

The result of the study showed that the histological parameters of the kidney were intact in the control specimen. It clearly marked the renal corpuscles (glomerus) and tubules with well defined lumen and sub-capsular space as depicted in plate 1. The cortical region was replete with numerous glomeruli and convoluted tubules with no tissue damage. The medullary region has tubular structures forming the medullary rays with normal tubulointerstitium.

The study further revealed that at the first week of inducing diabetes using Alloxan, the kidney tissues showed an obliterated Bowman's capsular space. This response is considered a generalized tubulonephropathies ranging from tubulonephritis to edematous swellings. At the third week of continued administration of Alloxan, there was massive distortion of renal tissues with hyalinization of the glomerulus, Bowman's capsule and complete tubulonephritis. Nodular necrosis and distortion/thickening of the basement membrane; the convoluted tubules appeared edematous with cellular hypertrophy and mesangial expansion. There was a generalized histological alteration in the tubulointestitium. This is similar to observed characteristic appearance of diabetic tissues as described by other authors.[6,7] Previous researchers have attributed these observed lesions to the effects of free radicals and the involvement of oxidative stress caused by administered diabetic agents.[7,8,9]

The study indicated that at the third week of the administration of *Garcinia Kola* stem bark extract; the damages on the renal tissues were amended showing intact glomeruli and renal tubules. This suggests that the *Garcinia Kola* stem bark extract had curative effect on the kidney. This further means that the extract has active ingredients that could be medicinal in the management of diabetic conditions.

The result of the investigation showed that the glibenclamide treated diabetic group, showed significant improvement in the histological structure of the kidneys. Lymphocytic infiltration at the early stage of treatment was indicative of immune response. The improvement in the microvascular changes in the renal tissue is considered an effect of the antioxidants property of the plant extract. The administration of the drug and plant extract tends to counteract the oxidative stress caused by alloxan by direct effect on the kidney tissue. The integrity of the kidney to perform its role in serving as a perfect filter for blood and maintaining homeostasis was compromised in diabetic situations as reflected in the serum biochemical results. These effects are reversed in the GKSB extract treated groups. This puts the save use of the plant extract in a therapeutic light and agrees with the works of Osifo *et al*,[10] who worked on the seeds of *Garcinia kola.*

CONCLUSION

The study has shown that *Garcinia Kola* stem bark extract has medicinal effect on diabetic renal tissues. From the result seen in this study, it is obvious that this extract could be used as an alternative therapy or substitute to the conventional drugs used in the management of a diabetic condition.

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Conflict of Interest

We write to state that there is no conflict of interest.

Source of Funding-Self-funding.

Author's Contribution

We write to state that both authors have contributed significantly, and that all authors are in agreement with the contents of the manuscript. 'Author A' (Josiah S. Hart) designed the

study and protocol, 'reviewed the design, protocol and examined the intellectual content and 'Author B' (John Nwolim Paul) wrote the first draft of the manuscript, managed the literature search and managed the analyses of the study. All authors read and approved the final manuscript.

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