Available online on 15.02.2021 at http://ajprd.com

Asian Journal of Pharmaceutical Research and Development

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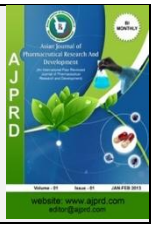

Open Access Research Article

Chrysophyllum Albidum and Its Potential Damage to the Kidney of Wistar Rats

Nweke E lizabeth O,[1] Opara Julia K[2*], Obiesie Ifechukwu J[3]

[1]Department of Anatomy, Faculty of Basic Medical Sciences, Chukwuemeka Odumegwu Ojukwu University, Anambra State, Nigeria.
[2]Department of Anatomy, Faculty of Basic Medical Sciences, Gregory University Uturu, Abia State,Nigeria.
[3]Department of Anatomy, Faculty of Basic Medical Sciences, Nnamdi Azikiwe University Awka, Anambra State, Nigeria

A B S T R A C T

Objective: The study was aimed at determining the effect of graded doses of *Chrysophyllumalbidum* on the kidney.

Materials and Methods: Twenty wistar rats (190-220 grams) were used in this study and they were randomly allocated into four groups of five rats each. Group A received food and distilled water only while groups B, C and D were treated with 100 mg/kg, 200 mg/kg 300 mg/kg of *Chrysophyllumalbidum* leaf extract respectively. The study lasted for three weeks after which the animals where sacrificed and their blood samples and kidney collected for examination.

Results: The result from this study showed a significant decrease ($p<0.05$) in body weight in group of all treated groups. Also, there was a significant increase ($p<0.05$) in kidney weight in group C but a non-significant increase ($p>0.05$) in group B and D when compared to group A. In addition, the serum urea and creatinine level showed a significant decrease ($p<0.05$) in the treated groups when compared with that of group A. Histopathological findings revealed a mild to moderate changes in the cytoarchitecture of the kidney.

Conclusion: This result of this study suggests that ethanolic leaf extract of *Chrysophyllumalbidum* may have the tendency of being toxic to the kidney tissue when consumed at higher doses.

Keywords: Body weight; *Chrysophyllumalbidum*; Creatinine; kidney; Urea; Wistar rats; Histology

A R T I C L E I N F O: Received; 02 Nov. 2020 Review Complete; 19 Jan. 2021 Accepted; 29 Jan. 2021 Available online 15 Feb. 2021

Cite this article as:

Nweke E lizabeth O, Opara Julia K, Obiesie Ifechukwu J, Chrysophyllum Albidum and Its Potential Damage to the Kidney of Wistar Rats, Asian Journal of Pharmaceutical Research and Development. 2021; 9(1):27-32.
DOI: http://dx.doi.org/10.22270/ajprd.v9i1.917

***Address for Correspondence:**

Opara, Julia K,Gregory University, Uturu,Abia State, Nigeria

INTRODUCTION

Medicinal plants have contributed a lot to man in the treatment and management of many diseases due to its richness in medicinal properties; with a greater percentage of the global population relying on botanical preparations as medication[1].This could be due to people's religious beliefs, cost-effectiveness or accessibility. The protective impacts of most medicinal plants have been attributed to the presence of antioxidants that fight against free radicals[2]. An example of one of such medicinal plant is *Chrysophyllumalbidum.*

Chrysophyllumalbidum(family Sapotaceae) is cosmopolitan within the south-eastern part of Nigeria, Cameroun, Uganda, Niger Republic and Ghana[3,4]. In Nigeria, it is known by various names according to tribes such as "agbalumo" in Yoruba, "udara" in Ibo and agwaluma in Hausa[5]. In Benin it is called "Azongogwe" and "Alaso" in Ghana[6]. In addition, it is known as African star apple or cherry in English and is mostly consumed by all age groups. The barks and leaves of *C.albidum*have been reported to have shown efficacy in the treatment of malaria, yellow fever, looseness of the bowels, abdominal ache and

dermatological infection[5-7]. Findings have shown*Chrysophyllumalbidum*to possess anti-inflammatory, antinociceptive and antioxidant properties which have been attributed to the presence of eleagnine in the seed[8,9]. The pulp of the fruit is understood to be rich in ascorbic acid and phytochemicals like tannins, saponins, flavonoids, terpenoids etc.[10]. Furthermore, the pulps have been reported to have antimicrobial activity[11]. The seeds and roots extracts of *C. albidium* are oftenapplied to wounds to stopbleeding as well asto stimulate the healing process in wounds[12]. Further studies by Onyeka et al.[9] on the bark of *C. albidum* showed that it could have anti-fertility properties as the extract caused a reduction in sperm count, morphology and motility.

Despite the pharmacological properties of *C. albidum*, there have been non-rigorous scientific researches to assess the efficacy and safety of the consumption of *Chrysophyllumalbidum*on some organs like the kidney.This study therefore was geared towards investigating the biochemical and histological effect of *Chrysophyllumalbidum* on the kidney of wistar rats.

MATERIALS AND METHODS

Collection of Plant

The plant was plucked from the tree in a farm in Uturu, Abia State which was later identified and authenticatedby a Botanist in the Department of Botany, Abia State University Uturu.

Preparation of *Chrysophyllumalbidum* extract

The leaves were plucked from the stem, washed in a basin of water to remove debris and air dried under room temperature for a week. The leaves were later milled into coarse powder using a laboratory grinder. 250 g of the coarse powder was macerated in 1000 ml of 95% ethanol for 48hours, and then filtered using Whatman No 1 filter paper. The filtrate was further dried using a laboratory oven at 45^{o}C into a gel-like form. 2 g of the extract was dissolved in 20 ml of distilled water to obtain a Stock Solution of 100 mg/ml.

Animals

Adult male wistar rats (190 – 220 g) were procured from the Animal House of the Department of Anatomy, Abia State University, Uturu. They were housed in wire gauze cages and kept in a well-ventilated and infection free environment. The rats were allowed to acclimatize for a period of fourteen (14) days under normal temperature of 27 – 30^{o}C before their weights were taken and distributed into groups. The animals were fed with normal rat chow and clean drinking water *ad libitum*. The study was carried out with the consent of the local ethics committee on animal handling of Abia State University, which was in accordance with the National Institute ofHealth's guidelines for the care and use of Laboratoryanimals [13].

Experimental design

Twenty (20) male wistar rats were weighed before treatment and allocated randomly into four groups of five animals each (n = 5). The animals were distributed as thus;

Group A - normal control (received 2 ml/kg of distilled water)

Group B - administered 100 mg/kg of ethanolicextract of *Chrysophyllumalbidum*

Group C - administered 200 mg/kg of ethanolicextract of *Chrysophyllumalbidum*

Group D - administered 300 mg/kg of ethanolicextract of *Chrysophyllumalbidum*

Administration was done orallyand lasted for a period of three weeks (21 days). At the end of the treatment, therats were anaesthetized with mild chloroform in a desiccator.The rats were cut open and blood was collected from the inferior vena cava in plain blood sample tubes.The serum was retrieved from the blood sampleby centrifugation at 3000rmp for 10 minutesand the kidney biomarkers urea and creatinine were assessed. The kidney was then harvested for histopathological examination.

Morphological parameters

Measurement of body and kidney weights

The body weights of the animals were measured by placing them on a weighing balance and their weights recorded. The weights were recorded 24 hours before the first treatment and 24 hours after the last treatment; the difference between the weights were calculated and analyzed. The harvested kidneys were rinsed thoroughly in saline solution and then weighed using a weighing balance.

Determination of the kidney function test

Determination of creatinine level was carried out according to the method described by Larsen[14] while that of urea was done using the method of Urease-Berthelot[15].

Histopathological Examination

The kidney tissues were processed for microscopic examination using standard procedure described by Arthur and John[16].The tissues were fixed in 10% formalin before undergoing the normal histological processes. The specimens were later sectioned using a microtome and then stained with haematoxylin and eosin (H&E) dye. The stained samples were placed under a microscope for examination.

Statistical Analysis

Data were analyzed using One-way analysis of variance (ANOVA), followed by Least Significant Difference (LSD) post hoc test for kidney parameters while data for body weight was analyzed using Student dependent t-test. The p-value, $P<0.05$ (95% confidence interval) was considered to be significant and results werepresented as mean ± SEM.

RESULTS

Body weight

Table 1: The effect of ethanolic extract of *Chrysophyllumalbidum* leaf on body weight

		MEAN	±SEM	WD	P-VALUE	T-VALUE
Group A (Control)	**Initial weight (g)**	152.00	±2.00	48.00	0.000*	-24.00
	Final weight (g)	183.33	±0.00			
Group B (100 mg/kg of *C. albidum*)	**Initial weight (g)**	233.33	±16.67	-70.00	0.044*	4.55
	Final weight (g)	163.33	±3.33			
Group C (200 mg/kg of *C. albidum*)	**Initial weight (g)**	250.00	±0.00	-110.00	0.011*	9.52
	Final weight (g)	140.00	±11.54			
Group D (300 mg/kg of *C. albidum*)	**Initial weight (g)**	250.00	±0.00	-103.33	0.004*	15.50
	Final weight (g)	146.67	±6.67			

Values are mean ±SEM, n = 5,WD = Weight Difference, * significant at P < 0.05

The effects of ethanolic extract of Chrysophyllumalbidum on the body weight of the rats are shown inTable 1. The weights of the rats were shown to haveincreased significantly($p<0.05$) in the control group (group A). However a significant decrease ($p<0.05$) in body weight was observed in the treated groups (groups B, C and D).

Kidney weight

Table 2: The effect of ethanoic leaf extract of *Chrysophyllumalbidum* on Kidney weight

		MEAN	±SEM	P-VALUE	F-VALUE
Relative Kidney weight (g)	**Group A (Control)**	0.38	±0.00		
	Group B (100 mg/kg of *C. albidum*)	0.39	±0.03	0.901	8.97
	Group C (200 mg/kg of *C. albidum*)	0.51	±0.01	0.002*	
	Group D (300 mg/kg of *C. albidum*)	0.41	±0.01	0.464	

Values are mean ±SEM, n = 5,* significant at P < 0.05

Treatment with *C. albidum* showed a significant increase ($p<0.05$) in the kidney weight of animals in group C when compared to group A, and a non-significant increase ($p>0.05$) in group B and D when compared to group A. This is shown in Table 2.

Kidney enzyme biomarkers

Table 3: Effect of ethanolic leaf extract of *Chrysophyllumalbidum* on Urea and Creatinine levels

		MEAN	±SEM	P-VALUE	F-VALUE
Urea Concentration (mg/dL)	**Group A (Control)**	60.46	±0.26		
	Group B (100 mg/kg of *C. albidum*)	54.90	±1.68	0.005*	
	Group C (200 mg/kg of *C. albidum*)	55.81	±1.04	0.012*	8.52
	Group D (300 mg/kg of *C. albidum*)	53.71	±0.35	0.002*	
Creatinine Concentration (mg/dL)	**Group A (Control)**	0.39	±0.01		
	Group B (100 mg/kg of *C. albidum*)	0.22	±0.01	0.000*	99.93
	Group C (200 mg/kg of *C. albidum*)	0.31	±0.01	0.000*	
	Group D (300 mg/kg of *C. albidum*)	0.26	±0.01	0.000*	

Values are mean ±SEM, n = 5,* significant at P < 0.05

The effect of C. albidum on the kidney markers such as urea and creatinine are shown in Table 3.These markers were significantly lower($p<0.05$) in the groups treated with C. albidum when compared to the control for both urea and creatinine.

Histopathological studies

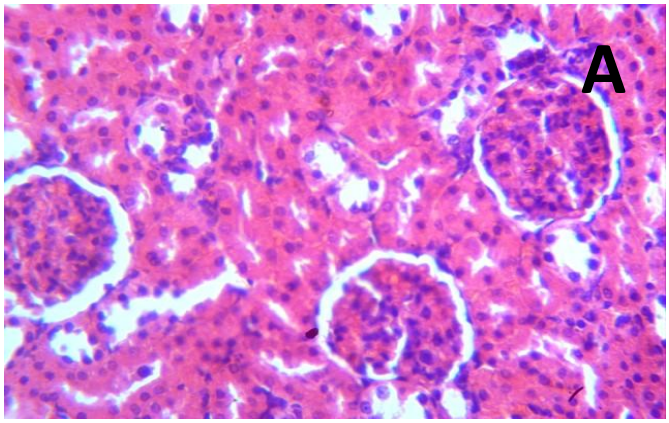

Figure 1: Photomicrograph of the kidney of rats treated with 2 ml/kg distilled water showing normal renal architecture with glomeruli, bowman space, renal tubules and tubular cell.

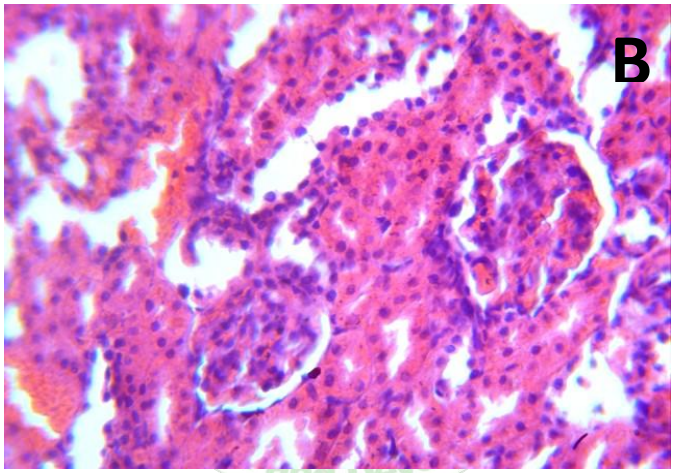

Figure 2: Photomicrograph of the kidney of rats treated with 100 mg/kg of *C. albidum* showing moderate tissue damage with necropsied glomeruli, mild congestion of blood vessel and mild aggregate of inflammatory cell**.**

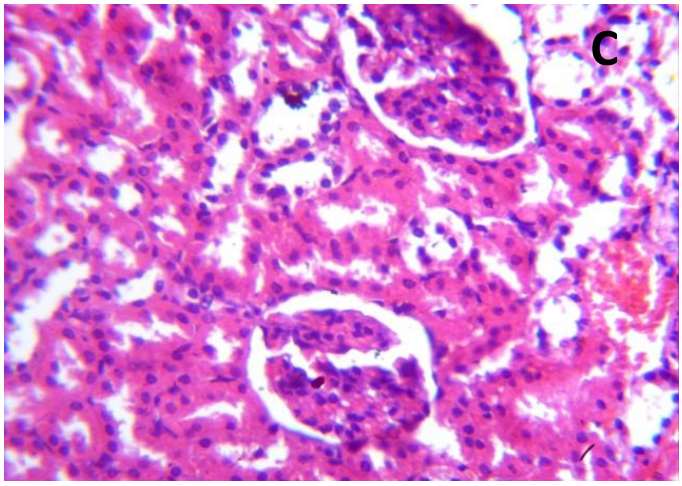

Figure 3: Photomicrograph of the kidney of rats treated with 200 mg/kg of *C. albidum* showing mild congestion of blood vessel, mild fatty change and mild aggregate of inflammatory cell.

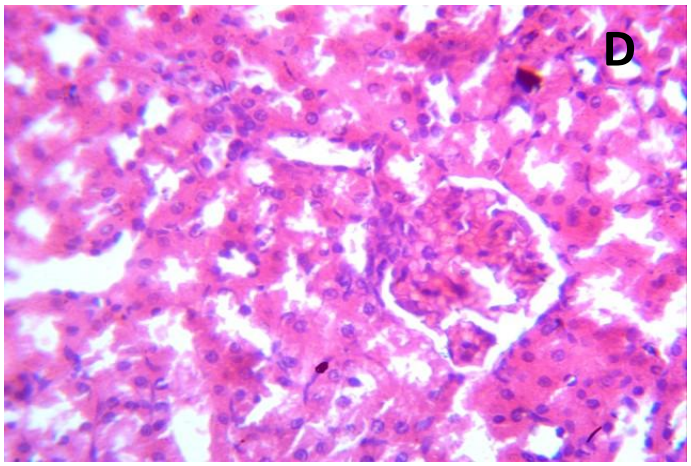

Figure 4: Photomicrograph of the kidney of rats treated with 300 mg/kg of *C. albidum* showing mild tissue damage with mild fatty change and dilation of the renal tubules

DISCUSSION

The kidneys are paired organs responsible for the urine production, excretion of toxins and waste products, regulation of extracellular fluid (ECF) volume, electrolyte concentrations, and hormone production[17]. In managing patients with kidney damage or disease, assessment the renal function is paramount. With medicinal plants gaining much significance in the treatment and management of various ailments, there seem to be an increase in its demand. This increase in demand for medicinal plants could be as a result of some side effects of orthodox drugs or the relatively high cost of some of them. These medicinal plants have been reported to contain numerous phytochemicals like tannins, alkaloids, saponin, glycosides, phenolic acids, flavonoids, and steroids, which possess antioxidant properties[18].

The findings from this study showed significant decrease in the body weight of animals in the treated groups. This decrease in body weight could be attributed to loss of appetite by the treated animals maybe due to some contents present in the extract. Loss of appetite sometimes can result to muscle and adipose tissue loss. This study contradicts the findings of Adebayo et al.[3] and Akin-Osanaiyeet al.[19] who reported non-significant difference in body weight and a significant increase in body weight respectively. However, it corresponds with the findings of Azoret al.[20] who reported a significant decrease in body weight.

The increase in the relative organ-bodyweight could be due to inflammation caused by the extract. However, the non-significant effect shows a non-adverse effect of the extract on the organ weight. This study is in line with that of Akin-Osanaiyeet al.[19] who reported an increase in kidney weight. The level of creatinine and urea concentration reduced significantly in the groups treated with *Chrysophyllumalbidum* when compared to the control. Creatinine and urea are waste products generated from the breakdown of creatine and protein respectively and thus removed from the body by the kidneys and serve as indicators of kidney disease[21]. The significant decrease in the serum kidney markers suggests that the extract of *C. albidum* is non-toxic to the kidney. This study corroborates with that of Adebayo et al.[3] who reported a significant decrease in the level of creatinine but contradicts the report of the urea level.

Histopathological findings from this study revealed mild to moderate changes in the architecture of the kidney such as mild fatty change, dilation of renal tubule and aggregation of inflammatory cells. This contradicts the report of Akin-Osanaiyeet al.[19]who found no changes in the microscopic anatomy of the vital organs.

CONCLUSION

The ethanolic leaf extract of *Chrysophyllumalbidum* showed mild toxic effect to the kidney tissue. Findings from this study suggestthat extract of *C. albidum* could potentially cause damage to the kidney when consumed at higher doses. It is there fores recommended that the extract of *C. albidum* should be consumed at moderate doses to avoid tissue damage.

Acknowledgment

None

Conflict of interest

All authors declare no conflict of interest

Funding

This research was not funded

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