Bima Journal of Science and Technology, Vol. 8(1A) Mar, 2024 ISSN: 2536-6041

DOI: 10.56892/bima.v8i1.595

# Effects of Crude Saponins Extract of *Parkia biglobosa* Fruit-Husk on Some Kidney Indices and Serum Electrolytes on Gentamicin-Induced Nephrotoxicity in Male Wistar Rats

Abubakar Ibrahim*, Jalil Idi James, Zainab Aliyu Abubakar and Abubakar Muhammad Hammari

[1]Department of Biochemistry, Gombe State University, PMB127, Gombe, Nigeria

Corresponding Author: ibrahimabubakar@gsu.edu.ng

## ABSTRACT

The effects of crude-saponins extract of Parkia biglobosa fruit husk on gentamicin-induced nephrotoxicity on some kidney function indices in male Wistar rats was studied to determine the nephrocurative potentials of Parkia biglobosa fruit-husk on kidney function. The acute toxicity was conducted on wistar rats fasted overnight providing only water. Each animal was administered with a single oral dose of crude saponins extract up to a dose of 500 mg/kg b.w .Dose up to 500 mg/kg b.w did not cause any mortality or sign of toxicity. Thus the extract is considered safe. Gentamicin administration induced marked nephrotoxicity as evidenced by a significant increase ($p<0.05$) in serum levels of creatinine, urea, uric acid and BUN levels. A significant increase ($p<0.05$) in sodium, potassium, bicarbonates and chloride ions levels whereas significant decrease ($p<0.05$) in calcium ion in the disease control rats. Administration of crude saponins of *Parkia biglobosa* fruit-husk extract and standard drug (furosemide) was found to improve kidney function indices in comparison with the disease control groups.

**Keywords**: Parkia biglobosa, Saponins, Nephrotoxicity, Gentamicin-induced, Kidney indices, Disease control, Nephrocurative.

## INTRODUCTION

Saponins are glycosides that are surface-active and have a distinct foaming feature that develops spontaneously on the surface of surfaces. Although plants account for the vast majority of their creation, bacteria and other lesser marine creatures also contribute to its development. Nephrotoxicity is a situation in which the kidneys have been poisoned by an external agent (Shi *et al*., 2004). Several foreign materials such as drugs, food additives and colorants, cosmetics, radioactive substances as well as other hazardous substances, might negatively influence kidney function. In addition, many medications can have a variety of negative effects on the kidneys, and some medications can have several effects on renal function. The second Thursday of March each year, World Kidney Day is marked to acknowledge the significance of the kidney and related challenges being encountered by kidney patients and to raise awareness of these issues. Approximately seven out of every ten Nigerians is at risk of getting a disease at any time. In the current economic climate, it is hard to offer replacement treatment to all of the patients that require it. In light of the fact that these therapies are necessary to preserve renal function, the next step for nephrologist is to identify viable alternatives that would either slow the course of the illness or allow patients to avoid dialysis (Jaya,2013; Saraladevi,2013).

In accordance with Ameesh and Murugan (2016), traditional medicine, which is mostly comprised of plants, is utilized by around 80% of the world's population, according to the authors. It's a dicotyledonous flowering plant that belongs to the Fabaceae-Mimosoideae family, and it blooms in the spring. The aim of the study is to determine

DOI: 10.56892/bima.v8i1.595

the efficacy of crude saponins extract of Parkia biglobosa fruit husk on some serum biomarkers of kidney damage and serum electrolytes balance in male Wistar rats induced nephrotoxicity by gentamicin.

## MATERIALS AND METHODS

### Collection of Plant Material

The fruit husk of Parkia biglobosa was collected from Gombe town of Gombe state and authenticated with the department of biological sciences, Gombe State University. A voucher specimen no. 37 as Parkia biglobosa was deposited at the department herbarium.

### Chemicals, Reagents and Equipment

All of the chemicals and reagents used in the study were of the analytical grade. In addition, the laboratory equipments used were of analytical grade.

### Preparation of Crude Saponins

For extraction of saponins, method described by Obadoni and Ochuko (2001) was adopted, but on the dried fruit husk of *Parkia biglobosa*. A conical flask was added to the ground fruit husk (50 g) and 20% ethanol was added to a 100 $cm^3$ flask. For 4 h, the sample was heated with a constant agitation at 55$^o$ C. The mixture was filtered and 200 ml 20 percent ethanol was added to the residual. In addition, a water bath at 90$^o$ C reduced the mixture to 40 ml. The concentrates was transferred and shaken vigorously into 250 ml funnel and 20 ml diethyl ether. The aqueous layer was recovered while the ether layer has been removed. Repeat and add 60 ml of n-butanol to the cleaning process. Tweaked with 10 mL aqueous sodium chloride, the combined n-butanol extract was washed. In a water bath at 60$^o$ C the rest of the solution was heated. The material was dried at 20$^o$ C to constant weight in an oven following evaporation.

### Experimental Animals

Fourty-two male Wistar rats were obtained from the animal facility centre of the department of physiology, Gombe State University, Gombe. They were housed in polypropylene cages and were given a standard grower diet (vital feeds) and water ad libitum for 7 days before the commencement of the experiment. Throughout the experiment, it was maintained under laboratory conditions of 29±2$^{\circ}$C and 12 h light and dark cycle. The guide for the care and use of laboratory animals was strictly followed. The experimental protocol was approved by the department of veterinary services ethics committee of the Ministry of agriculture, Gombe state with reference number GS/DVS/ECR/VII/53.

### Acute Toxicity Study

The acute oral toxicity testing was performed according to Organization for Economic and Co-operation Development for testing of chemicals (OECD, 2001). Twelve (12) male wistar rats were selected by random sampling. The animals were fasted overnight providing only water. Each animal was administered the crude saponins extract of the fruit husk with a dose of up to 500 mg/kg body weight orally. After the administration, food was withheld for further 3hrs. The animals were observed individually at least once during the first 30 min after dosing and periodically at 8hrs, 14 h, 24 h, and 48 h intervals (with special attention during the first 4hrs) for any post-administration behaviors and even death.

### Experimental Design

Nephrotoxicity was induced following the method described by Paoulomi *et al.* (2012) with slight modifications in male Wistar rats (80±20g) by intraperitoneal administration of

Bima Journal of Science and Technology, Vol. 8(1A) Mar, 2024 ISSN: 2536-6041

DOI: 10.56892/bima.v8i1.595

80 mg/kg b.w of gentamicin for 9 days. Forty-two male wistar rats were divided into six groups of 7 each, as follows: group 1: normal control, group 2: negative control, group 3: standard control, groups 4 and 5 were gentamicin-induced nephrotoxic but treated with 400 mg/kg and 800 mg/kg *p.o* b.w of crude saponins extract respectively. group 6: received normal saline with 1200 mg/kg *p.o* b.w of crude saponins extract only. Administration of extract occurred daily for 12 days.

**Serum Collection and Biochemical Analysis**

After the last dose, 8 h were taken in the rats, chloroform vapour and blood samples were anaesthetized and collected in labeled centrifuge tubes from the animals via heart puncture. The samples were permitted to be cloaked and spun for 5 minutes in a tabletop centrifuge at 3000 rpm. Blood serum was used for estimation of some kidney indices and electrolytes in labeled specimen test tubes.

**Data Analysis**

All values are expressed as Mean± SEM of seven (7) replicates. Mean values with a different superscript in a column were significantly different at $p<0.05$ using one-way analysis of variance (ANOVA) followed by Bonferroni Multiple Comparison Test. Graph Pad Instant Statistical Package Version 5.0 was used for the statistical analysis.

## RESULTS AND DISCUSSION

The oral administration of crude saponins extract of Parkia biglobosa fruit husk up to dose of 5000 mg/kg b.w did not show any sign of toxicity in the animals. The animals showed no change in behavioral response and symptoms even at the first 30 minutes and subsequently at 4 h, 8 h, 14 h, 24 h, up to 48 h. Since the extract did not produce any sign of toxicity at dose of 5000 mg/kg b.w, it is considered safe. The results of the effects of crude saponins extract administration on kidney function parameters in gentamicin-induced nephrotoxicity in male wistar rats is presented in Table 1.

The result showed that there was significant increase ($p<0.05$) in creatinine, uric acid, blood urea nitrogen and urea in the disease control rats(Group 2) when compared with normal control rats (Group 1). Administration of crude saponins of *Parkia biglobosa* fruit-husk extract and standard drug (Group 3) decreases ($p< 0.05$) the level of creatinine, uric acid, blood urea nitrogen and urea when compared with the disease control rats. However, creatinine and urea are considered biomarkers of renal function efficiency (Abdel-Raheem *et al*.,2010). Since, the results showed that there was a significant increase ($p<0.05$) in creatinine, uric acid, blood urea nitrogen and urea in the disease control rats (group 2) can be considered as an indication of renal damage (Karahan *et al*.,2005) when compared with normal control rats. Administration of crude saponins of Parkia biglobosa fruit husk extract and standard drug decreases ($p< 0.05$) the level of creatinine, uric acid, blood urea nitrogen and urea when compared with the disease control rats and serves as an indication of metastable dialyzing power of the extract (Chao-Hsun *et al.*,2010).

**Table 1:** Effects of Crude Saponins Extract Administration on Kidney Function Parameters in Gentamicin-induced Nephrotoxicity in Male Wistar Rats

| Groups | CREAT (mg/dl) | UA (mg/dl) | BUN (mg/dl) | UREA (mg/dl) |
|---|---|---|---|---|
| **Group 1** | 2.3±0.18$^{a}$ | 2.1±0.21$^{a}$ | 25.1±0.71$^{a}$ | 39.8±0.91$^{a}$ |
| **Group 2** | 3.5±0.06$^{b}$ | 4.3±0.19$^{b}$ | 33.4±1.00$^{b}$ | 81.6±1.31$^{b}$ |
| **Group 3** | 1.3±0.01$^{c}$ | 3.3±0.07$^{ab}$ | 26.0±0.72$^{a}$ | 53.1±1.08$^{ab}$ |
| **Group 4** | 2.3±0.21$^{a}$ | 2.8±0.16$^{c}$ | 22.4±0.31$^{ab}$ | 45.0±1.33$^{c}$ |
| **Group 5** | 1.6±0.23$^{c}$ | 2.5±0.08$^{c}$ | 24.1±0.26$^{a}$ | 47.4±1.78$^{c}$ |

DOI: 10.56892/bima.v8i1.595

| | | | | |
|---|---|---|---|---|
| **Group 6** | 1.3±0.07$^{c}$ | 2.2±0.04$^{a}$ | 21.2±0.82$^{ab}$ | 37.4±1.23$^{a}$ |

Data are expressed as mean ± SEM of seven (7) replicates. Mean values with different superscript in a column are significantly different ($p< 0.05$)

The results of the effects of crude saponins extract of *Parkia biglobosa* fruit-husk administration on electrolytes in gentamicin-induced nephrotoxicity in male wistar rats is presented in Table 2. The result shows that there was significant increase ($p<0.05$) in $Na^+$ (173.3±7.70 mmol/L), $K^+$ (5.9±0.42 mmol/L), $HCO_3^-$ (41.4±1.80 mmol/L) , $Cl^-$ (121.4±3.91 mmol/L) in disease control rats(Group 2) when compared with the normal control rats (Goup1). Administration of crude saponins (Group 4,5 and 6) of *Parkia biglobosa* fruit-husk extract and standard drug (Group3) significantly decreases ($p<0.05$) the level of $Na^+$, $K^+$, $HCO^{3-}$ and $Cl^-$ as compared with the disease control rats. There was significant decrease ($p<0.05$) in $Ca^{2+}$ (1.5±0.24 mmol/L) in disease control rats as compared with the normal control rats. Administration of Crude saponins of *Parkia biglobosa* fruit-husk extract and standard drug significantly increases ($p <0.05$) the level of $Ca^{2+}$ (2.4±0.19 mmol/L and 3.5±1.37 mol/L) when compared with the normal control rats respectively.

**Table 2:** Effects of Crude Saponins Extract Administration on Electrolytes in Gentamicin-induced Nephrotoxicity in Male Wistar Albino Rats

| Groups | $Na^+$ (mmol/L) | $K^+$(mmol/L) | $Ca^{2+}$(mmol/L) | $HCO_3^-$ (mmol/L) | $Cl^-$(mmol/L) |
|---|---|---|---|---|---|
| **Group 1** | 136.9±4.90$^{a}$ | 5.9±0.42$^{a}$ | 2.7±1.22$^{a}$ | 28.6±2.60$^{a}$ | 82.4±1.58$^{a}$ |
| **Group 2** | 173.3±7.70$^{b}$ | 9.2±0.89$^{b}$ | 1.5±0.24$^{b}$ | 41.4±1.80$^{b}$ | 121.4±3.91$^{b}$ |
| **Group 3** | 148.6±3.02$^{c}$ | 5.2±0.17$^{a}$ | 3.5±1.37$^{ab}$ | 31.4±2.61$^{a}$ | 99.5±2.23$^{ab}$ |
| **Group 4** | 157.3±9.12$^{ab}$ | 7.4±0.26$^{ab}$ | 2.0±0.16$^{c}$ | 31.0±2.02$^{a}$ | 108.6±2.61$^{c}$ |
| **Group 5** | 152.9±2.22$^{ab}$ | 7.2±0.29$^{ab}$ | 2.4±0.19$^{a}$ | 30.0±2.44$^{a}$ | 87.6±5.57$^{d}$ |
| **Group 6** | 139.9±5.76$^{a}$ | 6.7±0.75$^{d}$ | 5.8±0.78$^{d}$ | 32.1±1.47$^{a}$ | 81.4±2.50$^{d}$ |

Data are expressed as mean ± SEM of seven (7) replicates. Mean values with different superscript in a column are significantly different ($p< 0.05$)

## DISCUSSION

From this study, the acute toxicity test was found to be above 5000 mg/kg b/w as the administration of a dose up to 5000 mg/kg b.w did results to any death (mortality) among the animals. This implies that the extract is safe and agrees with reports of previous work of Modupe *et al*. (2012) who reported that oral administration of stem extract of *Parkia biglobosa* up to 5000 mg/kg doses of the extract to rats did not show signs of conventional toxicity. The effects of crude saponins extract of *Parkia biglobosa* were found to be effective against nephrotoxic effects of gentamicin rats.

The elevated levels of serum creatinine, urea, blood urea nitrogen and Uric acid in disease control rats when compared to the normal rats is an indication of renal damage. These results are in agreement with reports by Adeneye and Benebo (2008) which demonstrated the evidence of renal damage in rats. Furthermore serum electrolyte; sodium, potassium, chlorides and bicarbonate which are found to be on the rise in the disease control rats(Group 2) when compared with normal control rats (Group 1) demonstrates the nephrotoxic efficacy of gentamicin, this is also in line with studies conducted by Pelani *et al*. (2009) that serum electrolytes levels are bound to be elevated in damages caused to the kidneys.

The low levels of calcium in disease control rats (Group 2) calcium may be attributed to

DOI: 10.56892/bima.v8i1.595

imbalance between calcium and phosphorous trying to check each other. This implies that phosphorous level is high which results in low calcium level in disease control group. The counterbalance of these electrolytes in groups 4, 5 and 6 that were administered 400 mg/kg b.w, 800 mg/kg b.w and 1200 mg.kg b.w respectively of crude saponins extract showed a significant reduction in the levels of these biochemical markers when compared to the disease control rats, while low level calcium ions in the disease control rats was increase in the treated groups to normal. Thus, indicating the curative potentials of *Parkia biglobosa* fruit-husk crude saponins extract against nephrotoxicity induced by gentamicin. These results tallied with works of Balakumar *et al*.(2010); Olagunju *et al*. (2009) that proved the effects of saponins, triterpenoids and alkaloids in protective or curative action in nephrotoxicity.

## CONCLUSION

*Parkia biglobosa* fruit-husk crude saponins extract produce some nephrocurative potentials in the rats as the oral administration in gentamicin-induced nephrotoxic rats resulted in a significant reduction and restoration of some kidney function biomakers caused by gentamicin. Therefore, *Parkia biglobosa* fruit-husk crude saponins can be better used for the development of new therapeutics to manage kidney disease.

**Acknowledgements**

The authors thank all the laboratory staff of the Department of Biochemistry, Faculty of science, Gombe State University.

## REFERENCES

Abdel-Raheem I.T., El-Sherbiny G.A., Taye A.(2010). Green tea ameliorates renal oxidative damage induced by gentamicin in rats. Pakistan J. Pharm Sci. 62(2):183-190

Adeneye, A.A. and Benebo, A.S.(2008).Protective effects of aqueous leaf and seed extract of *Phyllantus amarus* on gentamicin and acetaminophen-induced nephrotoxic rats. J Ethnopharm,118:318-323

Ameesh M. and Murugan S(2016). Protective Role of Ethanolic extract of tridaxprocumbens in Experimental Hepatocellular Carcinoma in Rats. IOSR J Dental Med Sci. 15(4): 32-38

Balakumar, P., Rohilla, A., Thangathirupathi, A. (2010).Gentamicin-induced nephrotoxicity; Do we have a promising therapeutic approach to blunt it? Pharmacology Res.62:179-186

Jaya P.P (2013). Nephroprotective Potential of Herbal Medicines: A Review; Asian J Pharmacol Tech. 3 (3):115-118

Karahan I., Attessahin A., Yilmaz S., Ceribasi A.O., Sakin F(2005). Protective effects of lycopene on gentamicin-induced oxidative stress and nephrotoxicity in rats. Toxicology. 215(3):196-204

Modupe B.I., Isichie C.O., Aguiyi J.C (2012).Toxicity Studies of the Extracts of *Parkia biglobosa* Stem Bark in Rats. British J. of Pharm Res. 3(1):1-16

Obadoni B.O, Ochuko P.O(2001). Phytochemical studies and comparative efficacy of the crude extract of some homeostatic plants in Edo and Delta states of Nigeria. Global J Pure Appl Sci. 8: 203- 208.

OECD (2001). OECD guidelines for testing chemicals, organization for economic co-operation and development, acute up and down procedure no. 425: 1-2

Olagunju, J.A., Adeneye, A.A., Fagbohunka, B.S., Bisuga, N.A.,Ketiku, A.O et al.(2009). Nephroprotective activities of the aqueous seed extract of Carica papaya (L) in $CCL_4$ induced renal

DOI: 10.56892/bima.v8i1.595

injured wistar rats : A dose and time-dependent study. Bio Med 1;11-19

Paoulomi, C., Aniruddha, M., Subhangkar, N (2012). Protective effects of the aqueous leaf extract of Aloe barbadensis on gentamicin and cisplatin-induced nephrotoxicity rats. Asian Pacific J Topical Biomedicine: S1754-S1763

Pelani, S., Kumar, R.P., Kumar, B.S (2009).Effects of ethanolic extract of Indigofera barberi (L) in acute acetaminophen induced nephrotoxic rats. New Biotechnol 25:14-24

Saraladevi, N. (2013). End-stage renal disease in Sub-Saharan Africa. Kidney Int. Suppl. 2013: 3: 161–163

Shi J., Arunasalam K., Yeung D., Kakuda Y., Mittal G., Jiang Y. Guelph (2004). Saponins from edible legumes: chemistry, processing, and health benefits. J Med Food. 7(1):67-78.