Nephrocurative Effect of Flavonoid-rich Fraction of *Irvingia gabonensis* Seed Extract against Acetaminophen-induced Kidney Damage in Mice.

Madinat Hassan[1], Sunday Zeal Bala[2], Jemila Saleh[1]and Muhibat Bolanle Komolafe[1]

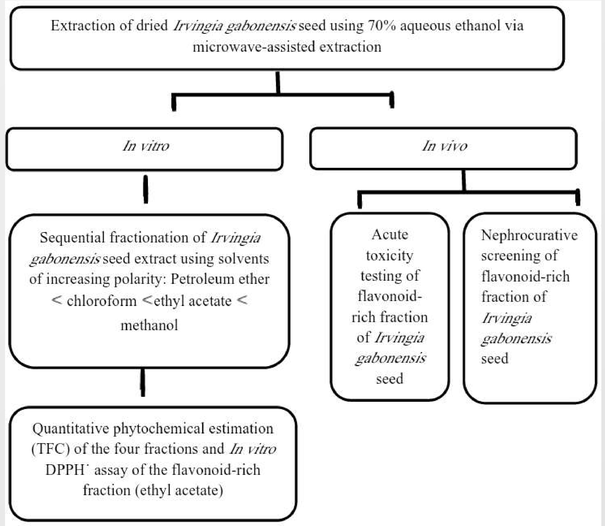
[1] Biology Department, Faculty of Science, Airforce institute of Technology, Kaduna, Nigeria

[2] Biochemistry Department, Faculty of Basic Medical Science, Bayero University Kano, Nigeria

INTRODUCTION

- Phytomedicine is a prominent form of traditional medicine, which has been in practice since time immemorial across the globe as a therapeutic approach to manage specific pathological conditions
- Acute kidney damage is an abrupt or rapid decline in renal filtration function.
- This alteration result in the retention of urea and other nitrogenous waste products and dysregulation of extracellular volume and electrolytes.
- One of the experimental models for inducing kidney damage is acetaminophen, this chemical agent produces acute kidney damage when an excess therapeutic dose is taken
- *Irvingia gabonensis* called Ogbono in Igbo language have been explored for its nephrocurative effect and the seed remains one of the medicinal plant used to ameliorate kidney damage in Nigeria.

METHODS



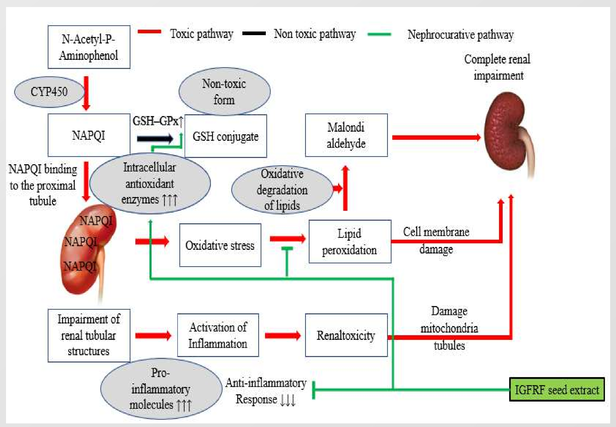


Figure 1: Hypothetical mechanism of action of flavonoids-rich fraction of *Irvingia gabonensis* (IG) seed extract against acetaminophen-induced kidney damage. It is believed that the flavonoids-rich fraction enhances the activity of GSH-GPx, increase intracellular antioxidant enzymes activity, inhibit the oxidative toxicity pathway and further down regulate the pro-inflammatory cascade of reaction involved in acetaminophen-induced kidney damage. Thus, these evidently deduced that the flavonoids-rich fraction of IG reduced the exacerbation of kidney damage and therefore, could be a potential nephron-curative agent.

RESULTS

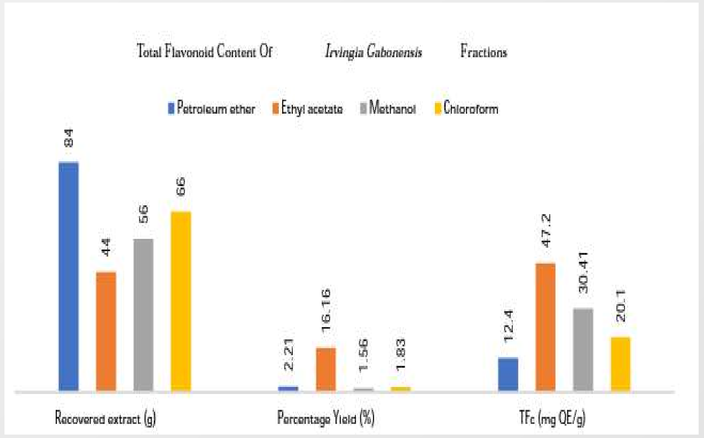


Figure 2: Total recovery of *Irvingia gabonensis seed extracts in grams, Percentage yield and total flavonoid content (TFC) of the different solvent fraction of the plant seed extract*

Table 1: Effect of flavonoid-rich fraction (ethyl acetate fraction) of *Irvingia gabonensis* (IG) scavenging activity on 1,1-Diphenyl-2-Picryl-Hydrazyl (DPPH) radical compared with Vitamin C

Concentration (µg/ml)	IG Absorbance (Mean±SD)	Vit.C Absorbance (Mean±SD)	IG% radical scavenging activity (%)	Vit.C% radical scavenging activity (%)
20	1.09±0.45 a	1.98±0.45 a	44±12.7 b	26±12.7 bc
40	1.26±0.11 ab	1.48±0.11 b	60±10.6 b	45±10.6 c
60	0.50±0.55 b	1.60±0.55 b	74±6.4 ab	65±6.4 b
80	0.22±0.84 c	1.89±0.84 a	90±14.1 a	70±14.1 b
100	1.09±0.16 a	2.41±1.16 a	95±3.5 a	90±3.5 a

Values are measure of triplicate estimation Means in the same column followed by different letters are significant at $P \leq 0.05$,

$IC_{50}(IG) = 25.76\ (\mu g/ml)$, $IC_{50}(Vit.C) = 47.97\ (\mu g/ml)$.

Table 2: Serum kidney function indices of acetaminophen-induced kidney damaged mice after two weeks and four weeks oral administration of flavonoid-rich fraction of *Irvingia gabonensis*

Groups	Na^+ (mmol/L)	K^+ (mmol/L)	Creatinine (mmol/L)	HCO_3^- (mmol/L)	Cl^- (mmol/L)	Urea (mmol/L)
Group I	147.93±8.56 a	5.65±0.52 a	27.29±2.96 a	31.33±4.04 a	91.83±4.34 b	12.87±2.42 d
Group II	168.27±3.59 b	8.49±1.42 a	51.50±7.76 b	35.57±4.94 a	117.29±13.18 a	25.93±2.10 a
Group III	129.43±9.68 a	4.21±0.88 a	34.28±3.00 a	32.96±1.76 a	75.87±7.50 c	18.58±0.90 b
Test group After two weeks administration						
Group IV	152.00±6.24 b	6.53±1.27 a	41.66±5.25 b	34.62±6.46 a	98.27±11.62 b	22.18±2.76 b
Group V	147.67±3.06 a	6.99±1.74 a	39.02±5.76 a	34.02±5.76 a	95.53±6.46 b	19.67±3.23 b
Group VI	143.67±3.79 a	6.73±1.99 a	35.39±8.14 a	33.06±4.10 a	91.04±8.49 b	19.17±2.11 c
After four weeks administration						
Group VII	136.80±2.08 a	5.93±2.05 a	36.46±6.61 a	32.69±2.00 a	93.22±4.19 b	18.57±3.16 c
Group VIII	132.80±3.65 a	5.37±1.96 a	31.92±9.98 a	31.92±9.98 a	84.36±7.48 b	14.68±0.90 cd
Group IX	127.33±8.74 a	4.97±1.70 a	29.27±2.36 a	30.89±2.79 a	79.70±11.59 b	11.03±1.53 d

Values are measure of triplicate estimation Means in the same column followed by different letters are significant at $P \leq 0.05$, IG = *Irvingia gabonensis*.

The figures below shows the gradual alteration in the level of the kidney serum biomarkers after the administration of *Irvingia gabonensis* flavonoid-rich extract for two-weeks (Group 4 – Group 6) and four-weeks (Group 7 – Group 9).

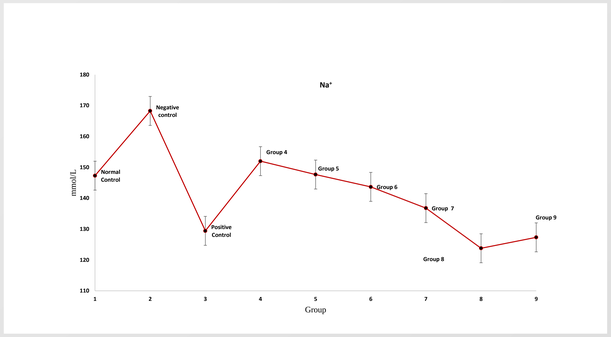


Figure 3

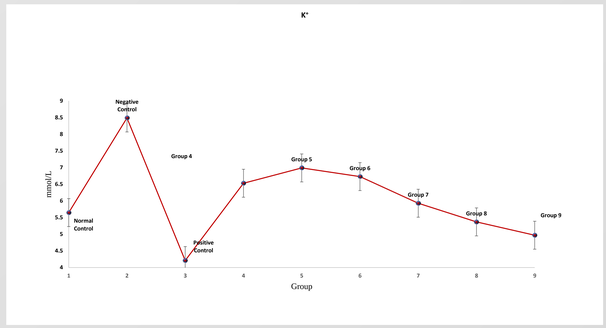


Figure 4

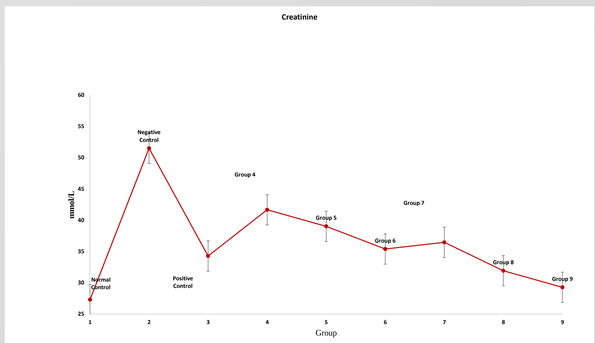


Figure 5

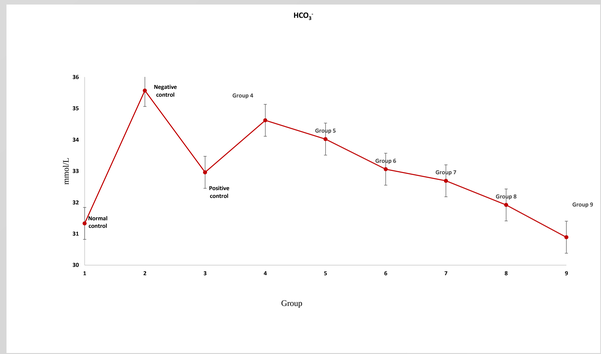


Figure 6

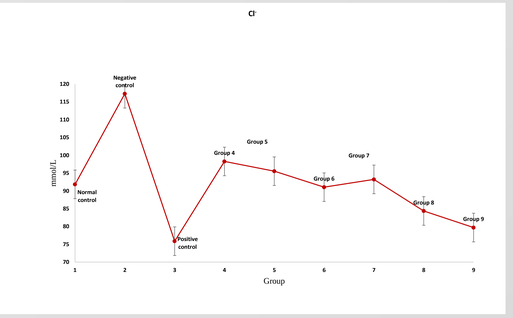


Figure 7

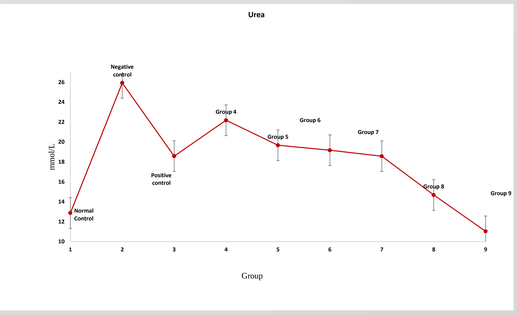


Figure 8

Table 3:Acute Lethal Dose (LD_{50}) analysis on experimental mice in phase I and II of Acute Toxicity Study

Experimental Groups	Treatment	No. of deaths after 24 hours
Phase I		
1	10mg/kg bw IG extract	0/3
2	100mg/kg bw IG extract	0/3
3	1000mg/kg bw IG extract	0/3
Control	0	0/3
Phase II		
1	1000mg/kg bw IG extract	0/1
2	2000mg/kg bw IG extract	0/1
3	30000mg/kg bw IG extract	0/1

Mg/kg bw = milligram/kilogram body weight, IG = *Irvingia gabonensis*
LD_{50}<=30000mg/k

CONCLUSION

The results obtained from this study have given an insight on the nephrocurative potentials of flavonoids-rich fraction of *Irvingia gabonensis seed extract*. This reveals that *Irvingia gabonensis* seed is a promising source of alternative raw material for the pharmaceutical industries, especially in drugs formulation for kidney damage. Thus, based on the result obtained from this study, the flavonoids rich fraction of *Irvingia gabonensis* seed extract can be said to have a curative medicinal effect on kidney diseases.

REFERENCES

Etta HE, Olisaeke CC, Iboh CI. Effect of *Irvingia gabonensis* (Aubry-Lecomte ex O'Rorke) Seeds on the Liver and Gonads of the Male Albino Rats. J Bio, Agric and Healthcare. 2014; 4(1): 10-15

Ewere GE, Okolie NP, Avan ED, Umoh PE. Comparative effects of ethanol leaf stem back extracts of *Irvingia gabonensis* (Bush Mango) on sodium arsenite-induced lipid profile perturbations in wistar rats. *Springer,* Clin Pytoscience. 2021; (7):3doi: 10.1186/s40816-020-00241-5

Karthivashan G., Kura AU, Arulselvan P, Isa N, FakuraziS.The modulatory effect of Moringa oleifera leaf extract on endogenous antioxidant systems and inflammatory markers in an acetaminophen-induced nephrotoxic mice model. PeerJ. 2016; (4)2127