



EFFECT OF AQUEOUS EXTRACT OF *Irvengia gabonensis* ON CCL₄ INDUCED HEPATOTOXICITY

Muhammad Ibrahim Usman

Department of Medical Biochemistry, College of Medical Sciences, Yobe State University, P.M.B. 1144, Damaturu, Yobe State Nigeria.

Corresponding Author: ibrahimmuhd@yahoo.com Tel: 08033255654

ABSTRACT

This research evaluated the hepatocurative property of aqueous seed extract of *Irvengia gabonensis* on CCL₄ induced hepatotoxicity. A total of 30 albino rats were grouped into six groups (GI – GVI) of five rats each. GI served as normal control, GII served as CCL₄ control, GIII, GIV and GV were administered with the extract at a dose of 50mg/kg, 100mg/kg and 150mg/kg respectively while GVI rats were administered with standard drug (Livolin) at a dose of 10mg/kg. Liver damage was induced in groups (II-VI) using 120 mg of CCL₄ administered subcutaneously, rats from group I and II were sacrificed 48 hours after CCL₄ administration to confirm inducement of liver damage. Groups III, IV, V and VI were administered with the respective doses for two weeks. A significant decrease ($p < 0.05$) in the mean serum of ALT, AST, ALP, DB, TB, TP and MDA was observed in extract administered groups in a dose dependent pattern compared to group II (CCL₄ control). The hepatocurative effect of the plant could be due to its secondary metabolites contents.

Keywords: *Irvengia gabonensis*; CCL₄; hepatocurative and liver function indices

INTRODUCTION

African mango (*Irvengia gabonensis*) belongs to the Irvingiaceae family of plants. The plant bears a fruit that is yellow when ripe with an edible sweet, smooth and brittle pulp which is slightly slimy with a turpentine flavour. It can be eaten fresh or used in preparation of wine, jam, juice and jelly (Tchoundjeu and Atangana, 2007). The seed ranks as an oil seed used as a popular soup and stew thickener in Nigeria. In Nupe it is called "Pekpear" "Ogbono/Ogiri" in Igbo, "Goro biri" in Hausa and "Oro" (tree) "Aapon" (kernel) in Yoruba. The kernels are also made into a cake called 'Dika bread' or 'Odika bread' for year-round preservation and easy use (Tchoundjeu and Atangana, 2007). Edible oil extracted from the seed is used in cooking and as a substitute for cocoa butter. Matos *et al* (2009) reported that the margarine based on *I. gabonensis* oil is an alternative to the trans-fatty acids obtained during hydrogenation and other reactions used in margarine production. It is also used in manufacture of pharmaceuticals and cosmetics.

Liver is an important body organ and actively involved in different metabolic functions. Hepatic damage caused by chemicals or infectious agents is associated with distortion of these metabolic functions and may lead to progressive liver fibrosis

and ultimately cirrhosis and liver failure (Meyer and Kulkarni, 2001). Carbontetrachloride (CCL₄) is widely used for experimental induction of liver damage and a number of investigators have utilized this chemical to produce liver cirrhosis in experimental animals. However, the principal causes of CCL₄ induced hepatic damage are increased lipid peroxidation and decreased activities of antioxidant enzymes and generation of free radicals. Rajesh and Latha, (2004) showed that various herbal extracts could protect organs against CCL₄ induced oxidative stress by altering the levels of increased lipid peroxidation and enhancing the decreased activities of antioxidant enzymes. This study was therefore designed to determine the curative effect of aqueous seeds extract of *Irvengia gabonensis* on liver function indices (AST, ALT, ALP, MDA, Bilirubin, Total Protein and Albumin) on CCL₄ induced liver damage in order to give an insight on the possible hepatocurative effect.

MATERIALS AND METHODS

Study Animals

Albino rats (both male and female) weighing 120 g were obtained from Department of Biological Sciences, Bayero University, Kano.

Special Conference Edition, November, 2019

The animals were housed in colony cages at an ambient temperature and relative humidity. The animals had free access to standard palletized grower feed and drinking water. The principles of laboratory animal care and guidelines were followed.

Collection and Extraction of Plant Material

Irvengia gabonensis seeds were bought from Yanlemo fruit market Zaria road Kano, they were shade dried in shade and ground into powder form out of which 100 g of the powder was weighed and soaked in 500 cm³ of distilled water for 24 hours. Thereafter, the solution was filtered and 10 ml of the filtrate was evaporated to dryness in an oven at 40 °C to produce a dark brown residue. The residue was weighed and the concentration of the filtrate was found to be 200 mg/ml. This was administered to the animals according to the required dose using the relation (Muhammad *et al.*, 2017).

Volume to be administered (cm³) = $\frac{\text{Weight of rats (kg)} \times \text{dose (mg/kg)}}{\text{Concentration of the extract (mg/ml)}}$

Concentration of the extract (mg/ml)

Experimental Design

Induction of liver damage

Liver damage was induced using CCL₄ by the method of Alhassan *et al.* (2009). A stock solution of CCL₄ was prepared in 1:1 by dissolving 25 cm³ of CCL₄ in 25 cm³ pure olive oil. The liver damage was induced by single intraperitoneal injection of CCL₄ (120mg/kg) to the rats in groups II, III, IV, V and VI.

Effect of aqueous extract of *Irvengia gabonensis* on CCL₄ induced hepatotoxicity

A total of 30 albino rats were grouped into six groups of five rats each.

Group I: Normal control

Group II: positive control

Group III: a dose of 50mg/kg of aqueous seed extract of *I. gabonensis* was administered orally

Group IV: a dose of 100mg/kg of aqueous seed extract of *I. gabonensis* was administered orally

Group V: a dose of 150mg/kg of aqueous seed extract of *I. gabonensis* was administered orally

Group VI: standard drug (Livolin, 10mg/kg) was administered orally

The rats from group I and II were euthanized 48 hours after CCL₄ administration and blood samples were analysed for liver function indices to confirm inducement of lipid peroxidation and liver damage. Group III, IV and V are treated with the respective

doses of aqueous seed extract of *I. gabonensis* and group VI with Livolin for two weeks.

Statistical Analysis

Results were expressed as mean ± standard deviation and analyzed using ANOVA, with p value <0.05 considered significant, a component of GraphPad InStat3 Software version 3.05 by GraphPadInc.

RESULTS AND DISCUSSION

Table 1 showed liver function indices of rats 48 hours after CCL₄ administration. The result showed a significant increase (p<0.05) in the mean serum level of liver enzymes, Direct and total bilirubin, total protein and malondealdehyde with a significant decrease (p<0.05) in the level of albumin in CCL₄ induced rats (Group II) compared to the normal control (Group I). Table 2 showed the liver function indices after 2 weeks of oral administration of the ASEIG. A significant decrease (p< 0.05) in the mean serum level of liver enzymes, Direct and total bilirubin, total protein and malondealdehyde was observed in extract administered groups in a dose dependent pattern compared with CCL₄ control group. (Group II).

Table 1: Liver Function Indices of Rats after 48 Hours of CCl₄ Administration

Group	AST(U/L)	ALT(U/L)	ALP(U/L)	ALB(g/dl)	DB(mg/dl)	TB(mg/dl)	TP(g/dl)	MDA(nMol/ml)
I	34.33±2.88 ^a	27.67±2.31 ^b	57.21±3.36 ^c	6.42±0.37 ^d	0.30±0.05 ^e	1.64±0.12 ^f	9.64± 0.27 ^g	0.21±0.26 ^h
II	50.76±3.00 ^a	55.67±3.22 ^b	310.13±1.02 ^c	3.50±0.77 ^d	1.36±0.20 ^e	4.50±0.67 ^f	16.28±0.39 ^g	0.59±0.15 ^h

Values are presented as mean ± SD, n = 5. Values bearing the same superscripts in the same column are significantly different (p<0.05). Key: AST: aspartate aminotransferase, ALT: alanine aminotransferase, ALP: alkaline phosphatase, ALB: albumin, DB: direct bilirubin, TB: total bilirubin, TP: total protein and MDA: malondialdehyde

Table 2: Liver function indices of rats (AST, ALT, ALP, ALB, DB, TB, TP and MDA) administered with aqueous seed extract of *Irvingia gabonensis* for two weeks after CCl₄ administration.

Group	AST(U/L)	ALT(U/L)	ALP(U/L)	ALB(g/dl)	DB(mg/dl)	TB(mg/dl)	TP(g/dl)	MDA(nMol/ml)
I	34.33±2.88 ^a	27.67±2.31 ^d	57.21±3.36 ⁿ	6.42±0.37 ^m	0.30±0.05 ^q	1.64±0.12 ^v	9.64± 0.27 ^t	0.21±0.26 ^x
II	50.76±3.00 ^{a,b,c}	55.67±3.22 ^{d,e,f,g}	310.13±1.02 ^{h,i,j,k,l}	3.50±0.77 ^{m,n,o,p}	1.36±0.20 ^{q,r,s,t}	4.50±0.67 ^{v,w,x,y,z}	16.28±0.39 ^{t,u,v,x,y}	0.59±0.15 ^{x,y,z,a}
III	40.43±3.137	34.7±0.625 ^d	152.23±1.79 ⁱ	3.72±0.06	0.52±0.22 ^r	3.30±0.75 ^w	11.96±1.35 ^u	0.52±0.15 ^x
IV	40.6±1.244	30.45±0.493 ^e	143.96±3.564 ^j	4.33±0.06 ⁿ	0.49±0.15 ^s	2.64±0.12 ^x	10.15±0.61 ^v	0.30±0.10 ^y
V	33.53±2.053 ^b	29.13±0.4041 ^f	135.6±2.430 ^k	4.76±0.98 ^o	0.32±0.15 ^t	1.79±0.06 ^y	9.46±0.39 ^x	0.19±0.10 ^z
VI	35.1±0.351 ^c	30.96±0.7024 ^g	72.30±8.72 ^l	4.27±0.12 ^p	0.30±0.02 ^u	1.62±0.28 ^z	7.86±0.32 ^y	0.22±0.53 ^a

Values are presented as mean ± SD, n = 5. Values bearing the same superscripts in the same column are significantly different (p<0.05). Key: AST: aspartate aminotransferase, ALT: alanine aminotransferase, ALP: alkaline phosphatase, ALB: albumin, DB: direct bilirubin, TB: total bilirubin, TP: total protein and MDA: malondialdehyde

DISCUSSION

Administration of CCl₄ to rat significantly increases serum liver enzymes activities (AST, ALT and ALP), bilirubin, total protein and MDA concentrations with a concomitant decrease in albumin compared to the normal control, confirming an induction of liver damage. This is in accordance with the findings of various researchers (Muhammad *et al.*, 2015; Alhassan *et al.*, 2009). The mechanism of CCl₄-induced liver damage is considered to be due to the enzymatic activation (Cyt P₄₅₀) of CCl₄ into trichloromethyl free radical (CCl₃^{*}) within the membrane of the endoplasmic reticulum. This is followed by chloromethylation, saturation, peroxidation and progressive destruction of the unsaturated fatty acid of the endoplasmic reticulum membrane phospholipids known as lipids peroxidation leading to its functional and structural disruption (Recknageh, 1983).

Administration of aqueous seed extract of *Irvingia gabonensis* for two weeks at doses of 50, 100 and 150 mg/kg body weight lead to a significant decrease in the mean serum levels of AST, ALT, ALP, total protein, MDA, and bilirubin, with an increase in the mean serum concentration of albumin in a dose dependent pattern compared with the test control. Thus, indicating a possible hepatocurative effect of the extract. This findings agrees with the research of Ngondi *et al*

(2009) who reported that crude extract and some isolated compounds from *Irvingia gabonensis* exhibit hepatoprotective and antioxidant activities useful for the prevention of toxic-induced and free radical-mediated liver diseases, suggesting that antioxidant compounds may be used as prophylactic agents.

A possible mechanism for the hepatocuration may be due to their antioxidant properties, which could counteract the toxic effect of CCl₄. The bark was said to contain flavonoids, phenolic and triterpenoids which may bind to the trichloro methyl-free radical, preventing its covalent binding to microsomal lipid and protein and thereby preventing lipid peroxidation which is thought to be the cause of liver damage by CCl₄ (Dai and Cederbaum,1995).

CONCLUSION It may be concluded that aqueous seed extract of *Irvingia gabonensis* can confer hepatocurative effect against CCl₄ hepatotoxicity. The pharmacological activity of the extract may be mediated through its antioxidant properties.

REFERENCES

- Alhassan, A.J., Sule, M.S., Hassan, J.A., Baba, B.A. and Aliyu, M.D. (2009). Ideal hepatotoxicity model using CCl₄. *BAJOPAS*. **2(2)**: 185-187.
- Dai, Y. and Cederbaum, A.I. (1995). Inactivation and degradation of human cytochrome P450E1 by CCl₄ in a transfected HepG2 cell line. *J Pharmacol Exp Ther* **275**: 1614-1622
- Matos, L., Nzikou, J.M., Matouba, E.V., Pandzou-Yembe N., Linder, T.M. and Desobry, S. (2009). Studies of *Irvingia gabonensis* Seed Kernels: Oil Technological Applications *Pak Jour Nutr*. **8 (2)**: 151-57
- Meyer, S. and Kulkarni, A. (2001). Introduction to biochemical toxicology, New York: John Wiley and Sons. 3rd edn. Pp.487.
- Muhammad, I.U., Alhassan, A.J., Wudil, A.M. and Jarumi, I.K. (2015). Toxicological and Protective Effect of Aqueous Stem Bark Extract of *Khaya senegalensis* (ASBEKS) on Liver of Experimental Rat. *BJAST* **9(6)**: 600-605.
- Muhammad, I.U., Jazuli, F.U., Faruq, F.W., Imam, A. A., Alhassan, A.J. and Yaradua, A.I. (2017). Phytochemical Screening, Acute (LD₅₀) and Sub-Chronic Toxicity Studies of Aqueous Stem Bark Extract of *Cinnamomum Verum*. *SJMPS*. **3(11)**: 1253-1258.
- Ngondi, J.L., Etoundi, B.C., Nyangono, C.B., Mbofung, C.M. and Oben, J.E. (2009). A novel seed extract of the West African plant *Irvingia gabonensis* significantly reduces body weight and improves metabolic parameters in overweight humans in a randomized double-blind placebo controlled investigation. *IGOB* **131 (8)**: 77-81.
- Rajesh, M. and Latha, M. (2004). Preliminary evaluation of the antihepatotoxic activity of Kamilari, a poly herbal formulation. *J. Ethnopharmacol.* **91**: 99-104.
- Recknagel, R.O. (1983). A new direction in the study of carbon tetrachloride hepatotoxicity. *Life sciences*. **33**: 401-408.
- Tchoundjeu, Z and Atangana, A.R. (2007). *Irvingia gabonensis* (Aubry-Lecomte ex O'Rorke) Baill. In: van der Vossen, H.A.M. & Mkamilo, G.S. (Editors). *PROTA* **14**:131-138.