World Journal of Pharmaceutical Sciences
ISSN (Print): 2321-3310; ISSN (Online): 2321-3086
Published by Atom and Cell Publishers
Available online at: http://www.wjpsonline.org/
Original Article

Effect of aqueous leaf extract of *Jatrophacurcas* on serum lipid profiles in albino rats

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Received: 05-02-2015 / Revised: 27-02-2015 / Accepted: 02-03-2015

ABSTRACT

The contribution of a research work evaluating the pharmacological effects of a common plant cannot be over emphasis. This study investigated the effect of aqueous leaf extract of *Jatropha curcas* (ALEOJC) on serum lipid profile in CCl_4 induced hepatotoxicity rats. The rats (50) were grouped into four (I, II, III and IV) of which GIII and IV were administered with different concentration of the extract. The histology and lipids profile were evaluated using standard methods. Two weeks after daily oral administration of ALEOJC at a dose of 1000mg/kg to GIV shows significant ($P<0.05$) reduction in serum total cholesterol and LDL compared to GII. Administration of the extract for 4 weeks showed a significant difference ($P<0.05$) in serum triglycerides and LDL- cholesterol in G III and IV compared to GII. Administration of ALEOJC showed significant and dose dependent hepatocurative activity which was compared to the positive control group and negative control. The histopathological findings were in support of the biochemical changes recorded during the study**,** sections of the liver in G I, III and IV shows fine vascular sinusoids with no pathological changes while G II shows areas of liver damage (plates 1-4). It might be inferred that the ALEOJC extract have either hepatocurative effects and/or promoting anti-dyslipidaemic effect.

Key words: Anti-dyslipidaemic, CCl_4, Hepatocurative, Hepatocytes, *Jatropha curcas*

INTRODUCTION

Traditional medicine is considered as the total sum of knowledge, skills and practices based on the theories, beliefs and experiences indigenous to different cultures that are used to maintain health, as well as to prevent, diagnose, improve or treat physical and mental illnesses [1]. Natural medicinal products are increasingly gaining popularity and use worldwide as complementary alternative therapies [2], based on the fact that the raw materials are available naturally and in abundance with potentially beneficial substances [3]. *Jatropha i*s a genus of approximately 175 succulent plants, shrubs and trees (some are deciduous, like *Jatropha curcas L.*), from the family Euphorbiaceae. *Jatropha curcascu* is the most widely available species [4]. All parts of *J. curcas*have been used in traditional human medicine and for veterinary purposes [5]. *Jatropha* species are a significant source of many phytochemicals. Some *Jatropha* species are being sold as raw drugs and aqueous or alcoholic extracts or as tinctures for various applications [4]. In the last few decades several studies on phytochemistry have made the identification and isolation of numerous compounds from plants that have been the basis for the development of new lead chemicals for pharmaceuticals. The genus *Jatropha i*s one of the important sources for phytochemicals with varying biological activities [4].

Lipids play an important role in the body; they serve as hormones or hormone precursors, aid in digestion, provide energy, storage and metabolic fuels, act as functional and structural components in biomembranes and form insulation to allow nerve conduction and prevent heat loss. In clinical chemistry, over the last decade however, lipids have become associated with lipoprotein metabolism and atherosclerosis [6]. Cholesterol is insoluble in the blood as such it is transported throughout the body in complexes known as lipoproteins [7]. Cholesterol is an essential component of cell membranes; it also plays a major role in digestion and functions as a precursor for steroid hormones. This research work is aimed at investigating the effect of *Jatropha curcas* aqueous leaf extract on serum lipid profile in CCl_4 induced hepatotoxic albino rats.

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The research work will specifically focus on:

- Determiningserum cholesterol, triglyceride, HDL and LDL in CCl_4 induced hepatotoxicity albino rats administered with/without aqueous leaf extract of *Jatropha curcas a*nd apparently normal rats.
- Histopathological examination of the liver of the CCl_4 induced hepatotoxicity in albino rats treated with/without aqueous leaf extract of *jatropha curcas and* apparently normal rats.

MATERIALS AND METHODS

Extract Preparation: Fresh leaf of *J. curcas* was collected from Bayero University, Kano-State, Nigeria in the month of July, 2011. Leaf was air dried under shade and powdered. The powder was weighed and soaked in distilled water for 48 hours. The mixture was filtered using whatman No.1 filter paper; the residue was dried and reweighed. The concentration of aqueous leaf extract (filtrate) was determined as the difference in weight/final volume of the solution.

Experimental Design: The experimental animals (50 rats) were divided into four groups of which group I and II has 15 rats each while, group III and IV have 10 rats each. Liver toxicity was induced in group II – IV using CCl_4 according to Alhassan*et al.,* 2009.
Group I: negative control/normal rats.
Group II: No extract Administered.
Group III: treated with aqueous leaf extract of *Jatropha curcas* at doses of 10mg/Kg
Group IV: treated with aqueous leaf extract of *Jatropha curcas a*t doses of 1000mg/Kg
Five animals were removed from G I and II 48 hours after CCl_4 treatment and sacrifice for blood sample to confirm inducement of lipid peroxidation and liver damage. Group III and IV are treated with the respective doses of aqueous leaf extract of *Jatropha curcas* for four weeks and five are removed from each group at interval of two weeks.

Methods

- Serum cholesterol was determined using the method of Lothar*et al*(1998) [6],
- serum triglyceride, HDL and LDL by the method of Jacobs *et al* (1990) [9]
- Histopathological examination of rat liver by the method of Avwioro, 2010[10] and Mitchell *et al*(2011) [11].

Statistical Analysis: The data was statistically analyzed using One-way Analysis of Variance (ANOVA) with P value <0.05 considered extremely significant, a component of GraphPad Instat3 Software (2000) version 3.05 by GraphPad Inc.

RESULTS

Histopathology Result

Plate 1 shows photomicrographs of cross section of liver of normal rats (negative control). Plates 2 shows the liver for a rat treated with 150mg/Kg body weight of CCl_4. Plates 3 and 4 shows photomicrographs of cross section of liver of group of rats treated with varying doses of ALEOJC for four weeks.

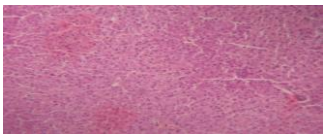

Plate 1: Stained cross section of liver for control group (untreated) of rats showing the portal tract area, with no pathological changes (Hand E Stain (×100)

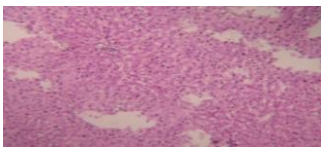

Plate 2: Stained cross section of liver for control group (treated with CCl_4) of rats showing the portal tract area, with pathological changes (Hand E Stain (×100)

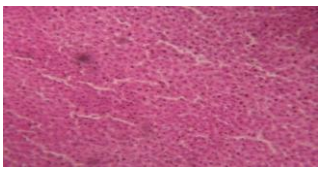

Plate 3: Stained cross section of liver of CCl_4 hepatotoxicity rats administered with daily dose of 10mg/Kg ALEOJC for four weeks showingthe portal tract area, with no pathological changes (Hand E Stain (×100)

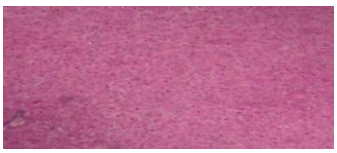

Plate 4: Stained cross section of liver of CCl_4 hepatotoxicity rats administered with daily dose of 1000mg/Kg ALEOJC for four weeks showingthe portal tract area, with no pathological changes (H and E Stain (×100).

Table 1: **Serum Lipid Profile for Groups of Rats Two Weeks after Treatment with Different Concentration of ALEOJC.**

GROUP	T.CHOL mg/dl	TRIG. mg/dl	HDL mg/dl	LDL mg/dl
I	120.32^{a} ±1.10	150.56^{c} ±2.07	17.16±0.46	73.05^{d}±1.74
II	$160.65^{a,b}$ ±13.71	165.88±3.04	13.97±0.38	$113.50^{d,e}$±13.55
III	141.16±6.99	179.87±2.45	13.97±0.38	85.22±6.47
IV	124.70^{b} ±7.89	183.12^{c}±1.65	12.62±0.10	75.46^{e} ±7.89

Values are presented as mean ± SD, n= 5 **Values bearing superscripts in the same column are significantly different.**

Key: Group I: Normal Control, Group II: CCL4 (Untreated), Group III: CCL4 + 10mg/kg of ALEOJC, Group IV: CCL_4 + 1000mg/kg 0f ALEOJC, ALEOJC: Aqueous Leaf Extract of *Jatropha Curcas* T.CHOL: Total Cholesterol, TRIG: Triglyceride, HDL: High Density Lipoprotein, LDL: Low Density Lipoprotein.

Table 2: **Serum Activity of Lipid Profile for Groups of Rats Four Weeks after Treatment with Different Concentration of ALEOJC.**

GROUP	T.CHOL mg/dl	TRIG. mg/dl	HDL mg/dl	LDL mg/dl
I	121.38^{a} ±1.18	130.00^{c}±1.81	18.05 ±0.68	77.318^{f}±1.24
II	$189.23^{a,b}$±2.32	$295.22^{c,d}$±4.07	6.51 ±0.17	$123.68^{f,g}$±1.74
III	119.47^{b}±1.93	$151.67^{c,d,e}$±2.49	12.18 ±1.01	76.83^{g}±1.42
IV	115.41^{b}±4.17	$122.78^{d,e}$±3.53	16.59±0.31	74.26^{g}±1.61

Values are presented as mean ± SD, n= 5. **Values bearing superscripts in the same column are significantly different.**

Key: Group I: Normal Control, Group II: CCL4 (Untreated), Group III: CCL4 + 10mg/kg of ALEOJC, Group IV: CCL_4 + 1000mg/kg 0f ALEOJC, ALEOJC: Aqueous Leaf Extract of *Jatropha Curcas* T.CHOL: Total Cholesterol, TRIG: Triglyceride, HDL: High Density Lipoprotein, LDL: Low Density Lipoprotein

DISCUSSION

The alterations on hepatocytes induced by CCl_4 were confirmed by histopathological examination of the liver, which revealed degenerative and necrotic changes. Four weeks after administration of ALEOJC, cross sections of the liver of G I, III and IV shows normal liver hepatocytes arranged as thin plates separated by fine vascular sinusoids and no pathological changes was observed, while G II shows areas of liver damage (plates 1-4). The recorded degenerative changes (massive necrosis) in CCl_4 intoxicated rats were in agreement with the results of [12] who reported that, CCl_4 may cause fatty liver due to disturbance in normal lipid homeostasis by an increase in the esterification of free fatty acids to triglycerides, phospholipids and other fatty acid esters with increase in cholesterol synthesis. $CC1_4$ can also cause inhibition in fatty acids β-oxidation and decreases cellular lipid secretion [13]. $CC1_4$ metabolites affects Golgi apparatus, thus leads to inhibition in the secretion of very low density lipoprotein [14], [15] and disruption of the mechanism of coupling triglycerides with appropriate lipoprotein carrier molecules [12]. Suppression of lysosomal acid triglyceride lipase activity also leads to accumulation of triglycerides in hepatocytes of $CC1_4$ rats [16]. The damaging effect of CCl_4 on hepatocytes could be due to effects on mitochondrial function with loss of Ca^{++} from mitochondria and endoplasmic reticulum. The elevated serum calciumroles in destruction of cytoskeletal structures and increase in the activation of a number of hydrolytic and catabolic enzymes like proteases, endonucleases and phospholipases, which in turn contributed to and enhance cellular necrosis or apoptosis[17].

In contrast to the low level of HDL, serum level of total cholesterol, triglycerides and LDL were significantly increased with CCl_4 induced toxicity in this study. These effects were significantly reversed by oral administration of ALEOJC

towards the normal level indicating the ameliorating effects of ALEOJC which were more pronounced at a daily dose of 1000mg/Kg than at a daily dose of 10mg/Kg four weeks after treatment. The decreased serum cholesterol in the plant extract administrated rat might be due to increased activity of enzyme LCAT (lecithin cholesterol acyltransferase) involved in esterification of cholesterol in the plasma. The significant decrease in serum triglycerides (TG) in the *J. Curcas* extract administrated animals might be due to decreased accumulation of lipoprotein. This might be due to increased activity of lipoprotein lipase, which is involved in the uptake of TG rich lipoprotein by extra hepatic tissue. The observed elevation in serum LDL, triglycerides and cholesterol induces by CCl_4 reported by [18] is in agreement with findings of this work. Elevation of serum cholesterol in patients with liver diseases was associated with the failure of liver to remove cholesterol from the blood [19];[20]. It can be assumed that hypercholesterolemia in $CC1_4$ treated rats has resulted in damage of hepatic parenchymal cells that led to disturbance of total lipid metabolism in liver which is considered as the main site for lipoprotein synthesis and the major determinant of lipoprotein catabolism [21], [22]. It might be inferred that the ALEOJC extract have either hepatocurative effects and/or promoting anti-dyslipidaemic effect.

ETHICAL CLEARANCE: All experiments were carried out with strict compliance to the "principle of laboratory animal care" (NIH Publication No. 85-23) [23] and ethical guidelines for investigation of experimental pain in conscious animals [24].

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