Hepatoprotective and Antioxidant Effects of Aqueous Extract of *Rauwolfia vomitoria* (Apocynaceae) Stem Bark in Wistar Rats

D.B. Youmbie Djanche1,*, A. Kada Sanda1, D. Fosting1, D.S. Essama Mbida2

1Department of Biological Sciences, Faculty of Science, University of Bamenda, P.O. Box 39, Bambili, Cameroon.
2Department of Animal Biology and Physiology, Faculty of Science, University of Yaoundé I, P.O. Box 812, Yaoundé, Cameroon.

1. Introduction

The functions of the liver are many and essential for good functioning of body. The dysfunction of liver causes enormous problem of health. Medicinal plants are used to protect liver and treat several hepatitis including, *Crassocephalum crepidioides*, *Epalttes divaricate* and *Sarcostemma brevistigma* respectively to [1-3]. *Rauwolfia vomitoria* (Apocynaceae) generally known in pharmacopoeia as the mainstay in treatment and preservation of human health [4]. In Cameroon, it is known and referred to as “Nteu ta cheu” in Bangou in West Region, “Chanvengo” in Bamenda in North West Region and “Etoe” in Mfoundi in Centre Region of Cameroon. The plant has different species including Indian species named *Rauwolfia serpentina* and the African species named *Rauwolfia vomitoria* (*R. vomitoria*). Okpako [6] research showed that, reserpine is a major element of antihypertensive drugs found in *Rauwolfia vomitoria* in 1952. The children are treated with this plant for cerebral cramps, jaundice and gastrointestinal disorder [7]. In indigenous practice, it is used versus nervous disorders. In Cameroon and Ghana herbalists are used it as an emetic and purgative. In Bangou village-Cameroon, it is used to treat liver diseases. The pharmacuetical derivatives are used mainly as sedative drugs. The sedative property is attributed to its ability to balance body response to stress and anxiety and to increase oxygen delivery to the brain [8]. Constituents like alkaloid, and alstonine, find in the root and leaves of *R. vomitoria* have anticancer properties [9] and antipyrptic effect is known [10]. The roots and leaves of the plant are used for treatment choler a and liver diseases [11]. The stem bark of *Rauwolfia vomitoria* has anti-inflammatory and antioxidative effects and it is non-toxic [12, 13]. The liver is abdominal organ and the largest one. It is a part of the digestive system [14]. It secretes bile and performs vital function such as purification function, synthesis function, and storage function [14]. It is a gland allowing the synthesis of bile as well as that of several carbohydrates and lipids [14]. It also plays an important role in hemostasis. Although various functions of the liver are carried out by the liver cells or hepatocytes unfortunately liver is also prone to many diseases.

Therefore, this study was undertaken to examine the potential hepatoprotective and antioxidant effects of the aqueous extract of the stem bark of *R. vomitoria* on rats using treated CCl4, hepatotoxicity model.

2. Experimental Methods

2.1. Chemicals and Reagents

All chemicals and reagents used in this study were of analytical grade. The enzyme kits were obtained from Fortress Diagnostic, United Kingdom and Inmesco, Germany. Absorances were recorded using Genesys 20 spectrophotometer.

2.2 Plant Collection and Identification

Stem bark of *Rauwolfia vomitoria* was collected in Kepche village, Bangou subdivision of highlands, West region Cameroon (5°14’5” North and 10°23’57” East) in August 2019. The plant was identified at the National Herbarium Yaoundé, Cameroon by comparison with voucher specimen No.16887/HNC.

2.3 Preparation of Aqueous Extract of *Rauwolfia vomitoria*

The fresh stem bark of plant was cut into pieces, air dried away from solar radiation (temperature between 22-25 °C) for two months after which they were pulverized using warm mechanical blender. Two (2) kg of powder obtained was stored in air tight container for further use. Eight hundred (800) g was macerated in 7.5 liters of distilled water for 24 hours and the filtrate obtained was evaporated in an incubator at 45 °C and 72. 78 g of dark brown solid extract was obtained (yield 6.07%). The plant extract was dissolve in distilled water and administrated by oral route to rats. Basing on a preliminary screening test, carrageenan induced inflammation the doses of 100, 200 and 300 mg/kg body weight were selected.

2.4 Experimental Animals

Female Wistar rats weighting 110-130 g were used for all experiments. They were housed in plastic cages (60 cm × 40 cm with the high of 30cm) with natural cycle at ambient temperature (24 ± 2 °C). The animals were fed with standard food and water *ad libitum* and fasted for 11 hours with free access to water before hepatotoxicity test.

The animals used in this study were handled, according to ethical guidelines of Cameroon National Veterinary Laboratory as referenced by the approval and heal control No 001/17 CCRS/MINEPA/DR-NW/DD-ME/SSV.
2.4.1 Animal Treatment

Randomly, rats were separated into eight groups of five as following:

Group I was used as control (Control I) and was given distilled water (10 mL/kg). Group II considered as vehicle control and was given olive oil (5 mL/kg). Group III served as pharmacological group and was given aqueous extract at the dose of 300 mg/kg. For in vivo hepatotoxicity induction, rats of groups IV, V, VI, VII and VIII were orally administrated 1 mL/kg of CCl₄ (1 mL/kg + 20% CCl₄ in olive oil) two times per week (Monday and Thursday) for a period of four weeks.

After intoxication of rats by CCl₄, Group IV served as the control and was orally administered silymarin (50 mg/kg) four days a week (Tuesday, Wednesday, Friday and Saturday) for four weeks. Groups VI, VII and VIII were orally administrated aqueous extract of R. vomitoria at the doses of 100, 200 and 300 mg/kg respectively.

At the end of the experiment, animals under ether anesthesia were sacrificed, on the twenty-ninth day. Blood samples were collected, centrifuged at 3000 rpm for 15 minutes to obtain clear serum. Serum was used for liver functional parameters analysis. The animals were dissected and liver tissues were removed, one part to assess oxidative stress parameters and another part was trimmed down for histological analysis.

2.5 Biochemical Analysis

Freshly serum was used for evaluation of hepatic biomarkers. Following the manufacturer protocol, appropriate kits were used for biochemical evaluations. The determinations of the activities of aspartate aminotransferase (AST) and alanine aminotransferase (ALT) and total cholesterol were measured using Innesco (Germany) kit. The level of alkaline phosphatase (ALP), triglyceride (TG), HDL-cholesterol, LDL-cholesterol and total bilirubin (T-BIL) were measured using Fortress diagnostic (United Kingdom) kit. The level of total proteins was estimated using the method described by Gornall et al. [15].

2.6 Evaluation of Lipid Peroxidation and Antioxidant Biomarkers

Hepatic tissues collected from each rat were cleaned from any materials and periphered with cold saline. The tissues were homogenised in cold phosphate buffer saline (0.1 M pH 7.4). Then, the homogenate was filtered and centrifuged at 3000 rpm for 15 min. The supernatant was used for lipid peroxidation and antioxidant biomarkers as follow: Lipid peroxidation was evaluated colorimetrically by measuring malondialdehyde (MDA) content in the tissues by the method described by Ohkawa [16, 17]. The procedure to estimate the reduced glutathione (GSH) levels was done according to the method described by Ellman [16, 18]. The activity of catalase (CAT) in the tissues was determined by the method of Sinha [16, 19]. Superoxide dismutase (SOD) activity was measured in supernatant of homogenate by the method of Misra and Fridovich [16, 20]. The presence of nitrite, a stable oxidized product of Nitric oxide (NO), was determined by the method described by Kim [16, 21]. The protein content in the homogenate was determined by the method of Gornall [15; 16].

2.7 Histopathological Study

To study the liver sections under microscope, the tissue passed via many proceedings of fixation, dehydration, clearing, infiltration, embedding, sectioning and stain. In fixation, liver samples of all experimental groups were kept in 10 % neutral formalin. After fixation, tissues have been dehydrated in different percentages of alcohol (75%, 95% and 100% absolute) embedded in paraffin block and serially sectioned (5 µm size) using a microtome. Liver sections were stained with Mayer hematoxylin and eosin. CCl₄ induced liver damage was observed using microscope (Zeiss, Hallbermoos, Germany).

2.8 Statistical Analysis

All data were presented as mean ± S.E.M of five (5) rats. Difference between means was assessed by two ways Analysis of Variance (ANOVA), followed by Bonferroni post-test using Graph pad prism 5.03. Statistical significance was considered at p<0.05.

3. Results and Discussion

3.1 Hepatoprotective Effects of R. vomitoria Aqueous Extract

Protein content significantly increased [p<0.05] in control I (normal rats) in tissue and serum when compared to control II (rats treated with CCl₄ and distilled water). Oral route administration of the extract at the dose of 300 mg/kg significantly reduced protein level in tissue and serum by 43.61% and 47.42% respectively when compared to control II (Fig. 1).

Table 1: Effect of stem bark aqueous extract of R. vomitoria on AST, ALT, ALP and T Bil in the serum of rats intoxicated by carbon tetrachloride

<table>
<thead>
<tr>
<th>Experimental groups</th>
<th>AST Units/L</th>
<th>ALT Units/L</th>
<th>T Bil (mg/dL)</th>
<th>ALP (Units/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control I (distilled water, 10 mL/kg)</td>
<td>87.95 ± 4.54</td>
<td>56.54 ± 6.23</td>
<td>1.11 ± 0.02</td>
<td>24.03 ± 1.23***</td>
</tr>
<tr>
<td>Vehicle, olive oil (5 mL/kg)</td>
<td>92.58 ± 4.09***</td>
<td>61.51 ± 4.07***</td>
<td>1.17 ± 0.05***</td>
<td>22.20 ± 1.37***</td>
</tr>
<tr>
<td>Control II (CCl4 1 mL/kg + distilled water (10 mL/kg)</td>
<td>213.15 ± 4.54***</td>
<td>155.57 ± 4.54***</td>
<td>2.01 ± 0.05***</td>
<td>34.92 ± 1.45***</td>
</tr>
<tr>
<td>CCl₄ (1 mL/kg) + R. vomitoria (100 mg/kg)</td>
<td>202.68 ± 4.78***</td>
<td>145.10 ± 4.78***</td>
<td>1.87 ± 0.02***</td>
<td>31.21 ± 1.04***</td>
</tr>
<tr>
<td>CCl₄ (1 mL/kg) + R. vomitoria (200 mg/kg)</td>
<td>150.07 ± 5.49***</td>
<td>112.55 ± 5.21***</td>
<td>1.66 ± 0.02***</td>
<td>28.52 ± 1.54***</td>
</tr>
<tr>
<td>CCl₄ (1 mL/kg) + R. vomitoria (300 mg/kg)</td>
<td>97.54 ± 6.75**</td>
<td>78.35 ± 4.07***</td>
<td>1.26 ± 0.05***</td>
<td>22.95 ± 1.38***</td>
</tr>
<tr>
<td>CCl₄ (1 mL/kg) + SL (40 mg/kg)</td>
<td>90.47 ± 3.71***</td>
<td>69.54 ± 4.75***</td>
<td>1.11 ± 0.03***</td>
<td>24.91 ± 1.53***</td>
</tr>
<tr>
<td>Pharmacological group, R. vomitoria (300 mg/kg)</td>
<td>69.05 ± 6.12***</td>
<td>60.05 ± 6.07***</td>
<td>1.21 ± 0.04***</td>
<td>24.59 ± 1.48***</td>
</tr>
</tbody>
</table>

Results are expressed as mean ± S.E.M; n=5; p<0.05; p<0.01 and p<0.001, significantly different compared to Control I (Normal rats); p<0.01 and p<0.001; statistically significant compared to control II (Intoxicated rats, treated with distilled water); E: Extract; SL: Silymarin; CCl₄: Carbon tetrachloride; dist wat: Distilled water.

Table 2: Effect of stem bark aqueous extract of R. vomitoria on total cholesterol, triglyceride, HDL-cholesterol and LDL-cholesterol in the serum of rats intoxicated by carbon tetrachloride

<table>
<thead>
<tr>
<th>Experimental groups</th>
<th>Total cholesterol (mg/dL)</th>
<th>Triglyceride (mg/dL)</th>
<th>LDL-cholesterol (mg/dL)</th>
<th>HDL-cholesterol (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control I (distilled water, 10 mL/kg)</td>
<td>70.68 ± 1.02</td>
<td>61.02 ± 1.77</td>
<td>21.12 ± 0.41</td>
<td>37.35 ± 1.05</td>
</tr>
<tr>
<td>Vehicle, olive oil (5 mL/kg)</td>
<td>71.07 ± 3.02</td>
<td>62.27 ± 2.68</td>
<td>21.79 ± 0.63</td>
<td>36.82 ± 1.98</td>
</tr>
<tr>
<td>Control (CCl₄ 1 mL/kg) + distilled water (10 mL/kg)</td>
<td>92.07 ± 1.15</td>
<td>104.24 ± 1.69***</td>
<td>17.01 ± 0.15</td>
<td>57.21 ± 1.82***</td>
</tr>
<tr>
<td>CCl₄ (1 mL/kg) + R. vomitoria (100 mg/kg)</td>
<td>80.05 ± 2.16***</td>
<td>94.30 ± 2.18***</td>
<td>14.15 ± 0.57</td>
<td>54.71 ± 1.94***</td>
</tr>
<tr>
<td>CCl₄ (1 mL/kg) + R. vomitoria (200 mg/kg)</td>
<td>81.07 ± 2.83***</td>
<td>80.53 ± 2.36***</td>
<td>12.56 ± 0.56</td>
<td>52.40 ± 1.99***</td>
</tr>
<tr>
<td>CCl₄ (1 mL/kg) + R. vomitoria (300 mg/kg)</td>
<td>75.57 ± 2.67*</td>
<td>76.42 ± 3.48***</td>
<td>17.62 ± 0.62</td>
<td>42.66 ± 1.64***</td>
</tr>
<tr>
<td>CCl₄ (1 mL/kg) + SL (50 mg/kg)</td>
<td>78.05 ± 2.47***</td>
<td>79.31 ± 2.57***</td>
<td>16.55 ± 1.13</td>
<td>42.64 ± 1.39***</td>
</tr>
<tr>
<td>Pharmacological group, R. vomitoria (300 mg/kg)</td>
<td>67.15 ± 1.81***</td>
<td>58.69 ± 3.23*</td>
<td>23.60 ± 0.53</td>
<td>31.81 ± 1.07***</td>
</tr>
</tbody>
</table>

Results are expressed as mean ± S.E.M; n=5; p<0.05; p<0.01 and p<0.001 significantly different compared to Control I (Normal rats); p<0.01 and p<0.001; statistically significant different compared to control II (Intoxicated rats, treated with distilled water); AST: Aspartate aminotransferase; ALT: Alanine aminotransferase; ALP: Alkaline phosphatase; T Bil: Total bilirubin.

Table 3 Effect of stem bark of aqueous extract of *R. vomitoria* on reduced GSH, MDA, SOD, CAT and nitrite in the tissue of rats intoxicated by carbon tetrachloride

<table>
<thead>
<tr>
<th>Experimental groups</th>
<th>GSH (µmol/mg protein)</th>
<th>MDA (µmol/mg protein)</th>
<th>SOD (µmol/mg protein)/nm/mg protein)</th>
<th>CAT (µmol of H$_2$O$_2$/10 min/mg protein)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control I (distilled water, 10 mL/kg)</td>
<td>8.94 ± 0.51</td>
<td>1.15 ± 0.03</td>
<td>7.43 ± 0.05</td>
<td>3.68 ± 0.05</td>
</tr>
<tr>
<td>Vehicle, olive oil (5 mL/kg)</td>
<td>8.82 ± 0.44**</td>
<td>1.20 ± 0.04**</td>
<td>7.40 ± 0.66**</td>
<td>3.53 ± 0.09**</td>
</tr>
<tr>
<td>Control II (CCl$_4$, 1 mL/kg + distilled water (10 mL/kg)</td>
<td>3.29 ± 0.36**</td>
<td>2.38 ± 0.05**</td>
<td>3.09 ± 0.45**</td>
<td>1.62 ± 0.33**</td>
</tr>
<tr>
<td>CCl$_4$ (1 mL/kg) + R. vomitoria (100 mg/kg)</td>
<td>4.35 ± 0.43**</td>
<td>2.18 ± 0.03**</td>
<td>4.54 ± 0.30**</td>
<td>2.07 ± 0.05**</td>
</tr>
<tr>
<td>CCl$_4$ (1 mL/kg) + R. vomitoria (200 mg/kg)</td>
<td>6.09 ± 0.40***</td>
<td>1.75 ± 0.03**</td>
<td>4.55 ± 0.23**</td>
<td>2.52 ± 0.04**</td>
</tr>
<tr>
<td>CCl$_4$ (1 mL/kg) + R. vomitoria (300 mg/kg)</td>
<td>4.00 ± 0.50**</td>
<td>1.34 ± 0.05**</td>
<td>5.16 ± 0.26**</td>
<td>3.10 ± 0.03**</td>
</tr>
<tr>
<td>CCl$_4$ (1 mL/kg) + SL (50 mg/kg)</td>
<td>8.52 ± 0.44**</td>
<td>1.20 ± 0.02**</td>
<td>6.82 ± 0.29**</td>
<td>3.22 ± 0.04**</td>
</tr>
<tr>
<td>Pharmacological group, R. vomitoria (300 mg/kg)</td>
<td>8.48 ± 0.32**</td>
<td>1.23 ± 0.04**</td>
<td>6.08 ± 0.35**</td>
<td>3.60 ± 0.03**</td>
</tr>
</tbody>
</table>

Results are expressed as mean ± S.E.M; n=5; *p*<0.05, **p*<0.01 and ***p*<0.001 significantly different compared to Control I (Normal rats). *p*<0.05, *p*<0.01 and ***p*<0.001 significantly different compared to Control II (Intoxicated rats, treated with distilled water). CCl$_4$: Carbon tetrachloride; SL: Silymarin; GSH: Reduced glutathione; MDA: Malondialdehyde; SOD: Superoxide dismutase; CAT: Catalase.

3.2 Antioxidant Effects of Aqueous Extract of *R. vomitoria*

MDA levels in control II or rats treated with CCl$_4$ and distilled water (2.38 ± 0.02 µmol/mg protein) were significantly higher than in control I (1.15 ± 0.03 µmol/mg protein; *p*<0.001). Furthermore, nitrite levels in control II (0.20 ± 0.01 µmol/mg protein) were also higher than in control I (0.12 ± 0.02 µmol/mg protein; *p*<0.05). Administration of the aqueous extract decreased significantly CCl$_4$ induced hepatic peroxidation. MDA and nitrite levels significantly reduced by 43.80% and 44.54%, respectively in the group that received the aqueous extract at the dose of 300 mg/kg compared to control II (*p*<0.05). Silymarin also prevented the elevation of MDA and nitrite levels after administration of CCl$_4$ (Table 3). In control II, CCl$_4$ significantly (*p*<0.01) decreased the reduced GSH level in liver as compared to control I. In contrast, rats treated with aqueous extract at doses of 200 and 300 mg/kg showed significantly increased reduced GSH levels by 43.42% and 45.26%, respectively compared to control II. Similar results were also found with the dose of 50 mg/kg of silymarin (Table 3). Significant decreasing (*p*<0.01) of the activities of MDA and CAT were observed in control II as compared to control I. There were significant increases in SOD and CAT activities in the aqueous extract treated groups compared to control II. The group treated with the aqueous extract of *R*.* vomitoria* at the dose of 300 mg/kg showed a significantly increased of the activity of SOD (*p*<0.05 by 20.00%) and CAT (*p*<0.05 by 24.30%) when compared to control II (Table 3).

The liver toxicity induced by carbon tetrachloride (CCl$_4$) in many experimental studies causes systemic effects throughout the body. This inducing stress causes oxidative damage to several organs including the liver [22], kidney [23] and spleen [24]. It was also established that, CCl$_4$ could induce the production of inducible NO synthase for the production of nitric oxide [25]. Nitrite is a stable product of NO, and NO is an inflammation mediator that induces the synthesis of prostaglandins, cytokines and reactive oxygen species (ROS) which justify the toxicologic effects.

Administration of CCl$_4$ has caused a significant decrease the reduced glutathione (GSH). and catalase (CAT) and superoxide dismutase (SOD) activities in control II (rats treated with CCl$_4$ and distilled water) compared to control I (normal rats). CAT and SOD are enzymes that protect body against free radicals. They are mediated by superoxide anion (O$_2^−$) and hydrogen peroxide (H$_2$O$_2$) [26]. The decrease in CAT and SOD in animals treated with CCl$_4$ in this study would be due to membrane damage and impaired dynamic permeability of membranes caused by lipid peroxidation. This lipid peroxidation was confirmed in this study by increasing in the level of Malondialdehyde (MDA) in control II compared to control I. The aqueous extract has significantly increased the levels of GSH, CAT and SOD activities compared to control II. This activity of the extract to restore the level of GSH and the activities of enzymes (CAT and SOD) would be due to the ability of the bioactive metabolites contained in the extract to inhibit the synthesis of NO and to limit the synthesis of ROS to reduce oxidative stress and pro-inflammatory mediators. The administration of CCl$_4$ has caused a significant increasing of the level of MDA, nitrites and serum proteins in control II compared to control I. The aqueous extract significantly decreased the levels of MDA, protein and nitrite in this model of liver toxicity. The decreasing in MDA level could result from an inhibitory action of lipid peroxidation by the metabolites contained in our plant extract. Phytochemical analysis revealed that the extract contains tannins, terpenoids, triterpenes and vitamin C. The work of Padatty et al. [27] has shown that vitamin C is an antioxidant substance.
which directly or indirectly lowers lipid peroxidation by regeneration of vitamin E. Vitamins and scavengers from Rauwolfia vomitoria species (ROS) by fast transfer of electrons during the inhibition of lipid peroxidation [28] to act indirectly as an antioxidant. In the present study, histological observations (Fig. 2) have shown that, oral administration of CCl4 induced hepatic degeneration of control II when compared to control I. These results indicate that during intoxication CCl4 could cause hepatic degeneration [29] which could explain liver abnormalities observed in this study. At a dose of 300 mg/kg, the aqueous extract repairs damaged hepatocytes, suggesting that the extract would contain substances capable to regenerate hepatocytes.

Administration of CCl4 has caused a significant increase of aspartate aminotransferase (ALT), alanine aminotransferase (ALAT), bilirubin, and alkaline phosphatase (PAL) in control II (rats treated with CCl4 and distilled water compared to control I (normal rats). It is known that CCl4 activates peroxidase and phosphate which lead to oxidation of hepatic membrane, inducing an increase of the levels of ALT, ASAT, PAL and bilirubin [25]. The activity of enzymes by CCl4 blocks the bile ducts to provoke hyperbilirubinemia and hypercholesterolemia [30] and therefore increase ALT, ASAT, PAL and bilirubin. When liver cell plasma membrane is damaged, a variety of enzymes normally located in the cytosol are released into the blood stream with higher concentration in serum. Therefore, measurements of the activities of serum marker like ALT, ASAT have provided a powerful tool for the assessment of liver function [31].

Administration of the aqueous extract has improved the levels of ASAT, ALT, bilirubin and PAL, suggesting that the extract would contain substances capable to inhibit peroxidase, phosphatase and cholestasis. The flavonoids present in the extract [12] may also explain the important observed of liver function restoration. The flavonoids directly protect the mitochondria, by inhibiting the cytochromes P 450 which are the main responsible for the bioactivation of CCl4 [32]. Our results indicate that CCl4 administered at a dose of 1 mL/kg has caused a significant increase of total cholesterol, triglycerides and LDL-cholesterol of control II (rats treated with distilled water) compared to control I (Normal rats). Hypercholesterolemia and hypertriglyceridemia are independent risk factors that alone or together could accelerate the development of coronary heart disease and the progression of atherosclerotic lesions [33]. Indeed, CCl4 reduces the activity of the enzymes lipoprotein lipase and triglyceride lipase and decreases the oxidation of fats, thus provoking the accumulation of triglycerides in the serum and reduces the bioavailability of free fatty acids (glycerophosphates) [33].

The increasing of total cholesterol level is due to an increasing of the activity of enzyme β-hydroxymethylglutaryl-CoA (HMGGCoA), which leads to an increase in the synthesis of cholesterol and its release in the blood stream [33]. Administration of the aqueous extract of Rauwolfia vomitoria has improved the lipids profile of the animals. These results suggest that the extract contains bioactive compounds with lipid-lowering properties. These bioactive compounds could inhibit the intestinal absorption of dietary cholesterol or the synthesis of cholesterol by the liver and stimulate the biliary secretion of cholesterol and then its excretion in the poo to reduce the level of total cholesterol [34]. The lipid-lowering properties of the extract could also be due to the inhibition exerted by bioactive components such as tannins [12] on the activity of certain enzymes, in particular lipoprotein lipase, triglyceride lipase and/or β-hydroxymethylglutaryl-CoA [27].

Analyses of histological sections of the liver of rats treated with CCl4 and with the extract at doses of 100 and 200 mg/kg indicate architectural modifications of the liver causing infiltration of inflammatory cells, dilution of sinusoid capillaries and the presence of Kupffer cells compared to control I. The work of Brattin et al. [35] showed that the metabolic biotransformation of CCl4 into trioxymethyl (CCl3) by covalent bond to DNA, RNA and protein group of liver enzymes of hepatocytes induces cell death and an increasing of transaminases. The metabolic biotransformation of CCl4 to dioxytrichlomethyl (CCl2=O) causes cellular abnormalities such as DNA damage, necrosis, hepatocyte degeneration and liver fibrosis [36].

Administration of the extract (300 mg/kg) to rats receiving CCl4 has improved these structural alterations, suggesting that the extract would contain substances capable to protect cell membranes, reducing the toxic effects of CCl4, regenerating and / or repairing destroyed hepatocytes. These results can be explained by accepting like Monday et al. [37] who worked with the ethanolic extract of the roots of R. vomitoria combined with vitamin E that protect the mitochondrial structures and destructive enzymes. The phytoconstituents, namely polyphenols, alkaloids and vitamin C identified [12, 16] in this extract which have contributed to repair and / or regenerate hepatocytes destroyed by CCl4.

4. Conclusion

The findings of the present investigation prove that aqueous extract of Rauwolfia vomitoria stem bark was efficient for the treatment of CCl4 induced hepatic damage in rats. The results exhibit that hepatoprotective effect of aqueous extract, probably due to both an increasing in the activity of the antioxidant-defense system and an inhibition of lipid peroxidation.

Acknowledgements

This research was partially funded by Pr. Maurice Aurélien SSSO, Rector of the University of Yaoundé 1-Cameroon for encouragement. Indeed, the authors wish to thank him for valuable financial assistance. The authors wish to thank also Mr. Takala Jean Claude, technician laboratory in faculty of medicine and biomedical science of University of Yaoundé 1 for his implication in histological realisation. The authors wish to thank also Dr. Keungui Brice Armand for his support to structure this manuscript.

References


