

Abstract

The study examined how well the alkaloid content of *Vitex doniana* affected the liver function in albino rats. The liver damage in albino rats was induced using a CCl₄ solution in paraffin (1:1). The liver function tests were performed by administering several groups of albino rats oral dosages (200, 400, and 600 mg/kg) of the bulk alkaloid over the course of 14 days. After the rats were sacrificed, the liver was examined hepatopathologically to determine the serum levels of albumin, total protein, cholesterol, triglycerides, low-density lipoproteins (LDLs), and high-density lipoproteins (HDLs). When compared to the control, the alkaloid fraction of *V. doniana* significantly ($p < 0.05$) enhanced the levels of total protein, serum albumin, and HDLs. The findings also demonstrated that rats given with alkaloid fraction had significantly ($p < 0.05$) lower serum levels of CHOL, TAG, LDLs, and BUN as compared to untreated rats. The alkaloids repaired the normal cellular architecture of the liver that had been damaged by the standard hepatotoxin. The use of *V. doniana* in treating disorders linked to the liver is supported by the fact that its alkaloids repair CCl₄-induced hepatocellular damage.

Introduction

Involved in the body's detoxification process are crucial organs including the kidney and liver. The kidney in particular keeps the body's water composition and level stable as well as the levels of vital minerals. On the other side, the liver is in charge of protein synthesis, detoxification, regulation, and homeostasis maintenance. *Vitex doniana* (Family *Verbenaceae*) is widely used in folk medicine in tropical Africa. The leaf extract is taken as a therapy for liver problems. The leaves are used as vegetables in foods and as sauce. The plant exhibited strong antioxidant activity, according to the authors' earlier investigation on the *in-vitro* antioxidant and hepatoprotective activities of *V. doniana*. The study also discovered numerous possible and promising alkaloids from its active fractions, which are thought to significantly lower blood phosphatase and aminotransferase activity levels in rats fed with the *V. doniana* fraction after being intoxicated with tetrachloromethane (CCl₄). In order to better understand how the bulk alkaloids function in the regulation of oxidative stress, it was necessary to isolate them. The effects of the bulk alkaloid of *V. doniana* leaves on the histopathological and biochemical parameters of CCl₄-induced rats were assessed as part of the ongoing search for hepatocurative alkaloids from *V. doniana*.

Methods

- Fresh leafy vegetables were collected, washed, dried, ground into fine powder and extracted.
- Extraction of bulk alkaloids by dissolving 50 g of the dried methanol extract in 10 %v/v MeOH, then partitioned in an equal volume of dichloromethane and acidic water (0.1 M HCl) in a separatory funnel.
- Hepatocurative assay was done using six groups (A-F) of male albino rats (weight 100. 71 ± 27. 13 g) kept in cages (five rats per each).
- A solution of CCl₄ in paraffin (1:1) was used to induce liver damage in rats on the 1st and 8th day.
- Treatments with doses of alkaloid fractions and the standard drug lasted for 14 days.
- An assay of biochemical parameters was performed within 12 h of preparation of sera.
- Statistical analyses were carried out with SPSS version 25.0 Windows while GraphPad Prism 8 was used for plotting the graphs.
- All the values were expressed as mean ± standard deviation (SD) and analyzed using one-way ANOVA and post-hoc Turkey test. The difference between treatment groups was significant at $p < 0.05$ levels.

Results

✓ Effect of Alkaloid fraction on serum protein

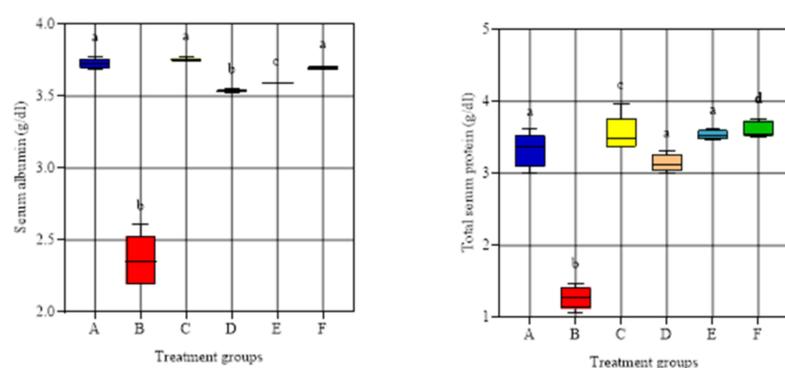


Figure 1. Serum albumin and total protein concentrations (g/dl) of CCl₄-intoxicated rats treated with alkaloid fractions of *V. doniana* leaves. Values are means ± SD, $n = 5$. Boxplots with different superscripts with group B are significant at $p < 0.05$. A = control; B = untreated; C = BHT; D = 200 mg/kg; E = 400 mg/kg; F = 600 mg/kg.

Rats given 200 mg/kg of the bulk alkaloids showed no significant difference ($p > 0.05$) in serum albumin levels compared to the control group. The serum albumin of rats treated with 400 and 600 mg/kg of alkaloids and total protein of rats treated with 200–600 mg/kg of alkaloids, however, significantly increased ($p > 0.05$) when compared to the untreated rats..

➤ Effect of Alkaloid fraction on lipid profile

All the treatment doses of alkaloids caused a significant change ($p < 0.05$) in the CHOL, TAG, HDLs, and LDLs of rats compared with the untreated.

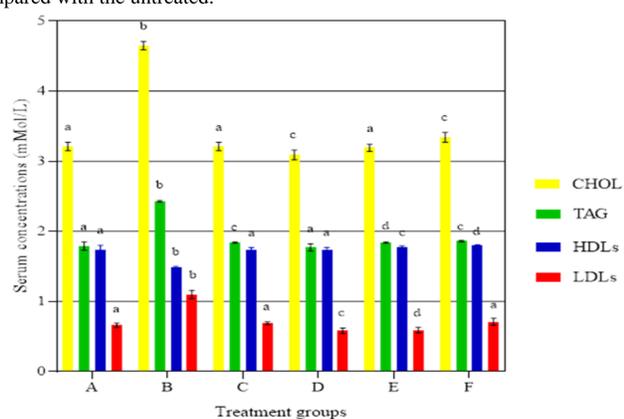


Figure 2. Effects of *V. doniana* alkaloids on lipid profiles of CCl₄intoxicated rats. Values are means ± SD, $n = 5$. Bars with different superscripts with group B are significant at $p < 0.05$. A = control; B = untreated; C = BHT; D = 200 mg/kg; E = 400 mg/kg; F = 600 mg/kg.

✓ Effect of Alkaloids on renal function parameters

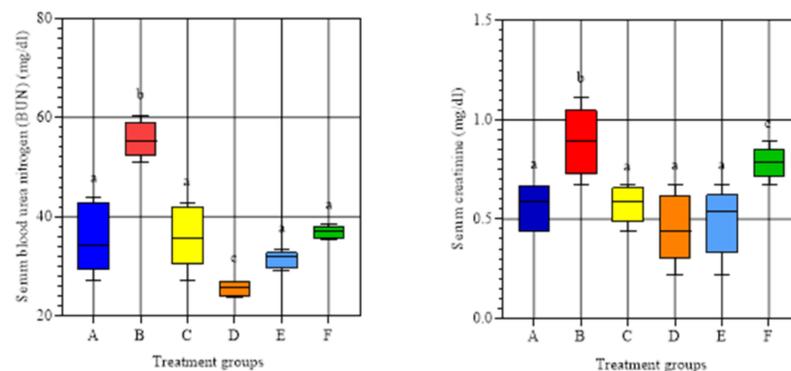


Figure 3. Effect of *V. doniana* alkaloids on some kidney function parameters of the rat. Values are mean ± SD ($n = 5$). Treatment groups with a different alphabet for each group are statistically significant ($p < 0.05$). A = control; B = untreated; C = BHT; D = 200 mg/kg; E = 400 mg/kg; F = 600 mg/kg.

All renal function measures decreased in a concentration-dependent manner, with the dose of 200 mg/kg causing the greatest reduction and the dose of 600 mg/kg the least. When compared to untreated rats, the treatment of CCl₄-intoxicated rats with 200–600 mg/kg of alkaloids considerably ($p < 0.05$) reduced the level of BUN and serum creatinine.

➤ Effect of *V. doniana* alkaloid on liver histology

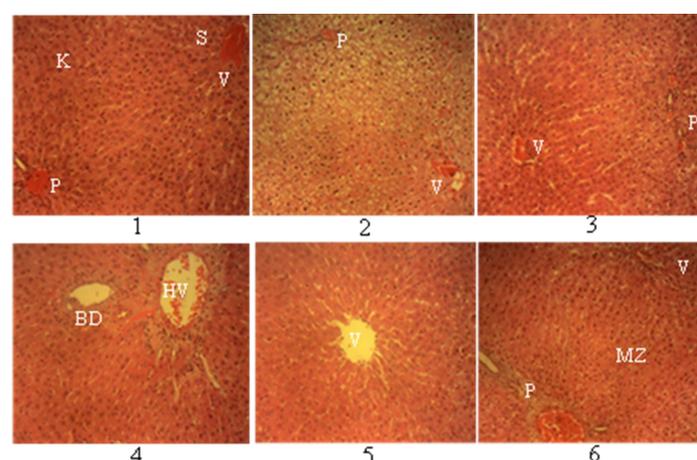


Figure 4. Liver sections of the rats administered with *V. doniana* alkaloids. Slide 1 (H & E x200) for group A, Slides 2-6 (H & E x160) for groups B to F; V = central veins; K = Kupffer cells; S = Sinusoid; HV = Hepatic vein; BD = Bile duct; MZ = Mid-zonal; P = Periportal.

The central veins (V) contain normal hepatocytes. The normal histo-architecture of the liver was visible in liver sections from CCl₄-intoxicated rats treated with 200 and 400 mg/kg of alkaloid fraction (slides 4 and 5). However, hepatocytes in the periportal (P) and mid-zonal (MZ) regions of the hepatic lobules of CCl₄-intoxicated rats treated with 600 mg/kg of alkaloid fraction exhibited a slight cellular enlargement. Hepatocytes in the region of the central veins (V) are normal.

Conclusion

- The research has shown that the alkaloids of *V. doniana* can reduce the toxicity caused by tetrachloromethane in the kidney and liver of albino rats.
- Evidence suggests that the *V. doniana* alkaloids significantly reduced CCl₄-induced hepatotoxicity, which may be related to the plant's high antioxidant activity..
- The results also showed significant restoration of the liver architecture, which is evidence of its hepatocurative effects.
- The mechanisms by which these bioactive alkaloids carry out their biological functions should be the subject of further study. There should be research done to identify and isolate these bioactive alkaloids.
- The results of this additional study will shed light on the processes that give rise to the distinct bioactivities of these alkaloids. The identification of the precise *V. doniana* alkaloids that are responsible for the effects being seen is still being studied.