







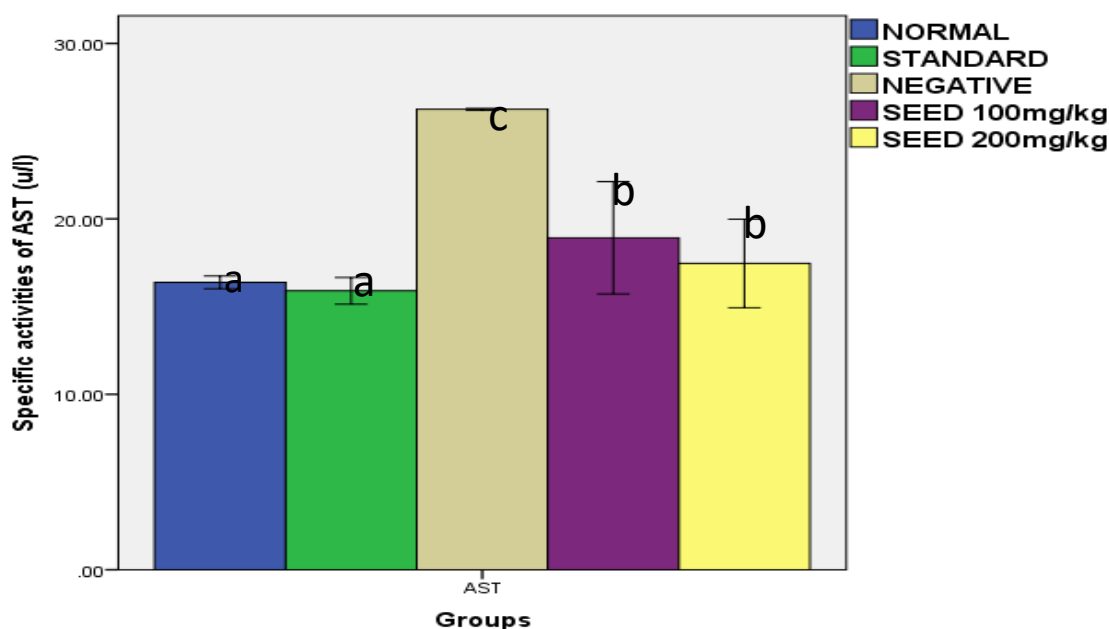




**Effect of methanol extract of *Senna occidentalis* seeds on liver marker enzymes**

**Aspartate transaminase**

The aspartate transaminase (AST) activity of methanol extract of *Senna occidentalis* seeds in normal and CCL<sub>4</sub> induced hepatotoxic rats is shown in Figure 1. There was a significant ( $p < 0.05$ ) increase (26.5u/L) in AST activity in the negative group compared to the other groups. Treatment with the seeds extract at 100mg/kg and 200mg/kg significantly reduced AST activity (18.1u/L and 17.5u/L respectively) with the higher dose of 200mg/kg body weight having a better effect



rats.

Figure 1:

**Alanine transaminase**

Figure 2 shows the effect of serum alanine transaminase (ALT) activity in Normal and CCL<sub>4</sub> induced hepatotoxic rats treated with methanol extract of *Senna occidentalis*. The activity of ALT was significantly ( $p > 0.05$ ) increased in negative group (8.5u/L) compared to the other groups. Administration of seed extracts at (100mg and 200mg/kg) significantly decreased the level of ALT activity. The extract at the dose of 100mg/kg body weight showed a more significant reduction (1.1u/L) than in the group that were administered 200mg/kg (3.6u/L) of seed extract of *Senna occidentalis*.

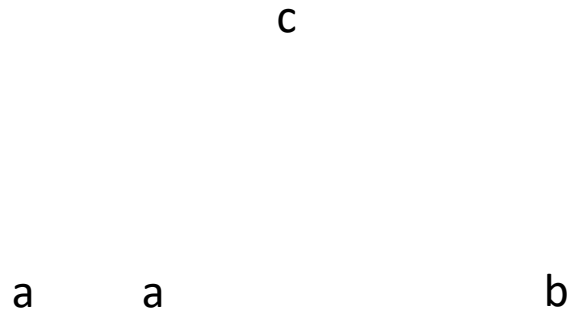


Figure 2: Effect of methanol extract of *Senna occidentalis* seed on serum ALT activity in CCL<sub>4</sub> hepatotoxic rats and other treated rats.

#### **Alkaline Phosphatase**

The result of serum alkaline phosphatase activity of CCL<sub>4</sub> induced hepatotoxic rats treated with methanol extract of *Senna occidentalis* shown in Figure 3. Induction with CCl<sub>4</sub> significantly increased the concentration of ALP in the serum to a value of 220.5u/L. However, treatment with seed extracts at 100mg and 200mg/kg significantly reduced ( $p>0.05$ ) the level of ALP activity to 140.2u/L and 175.0u/L respectively.

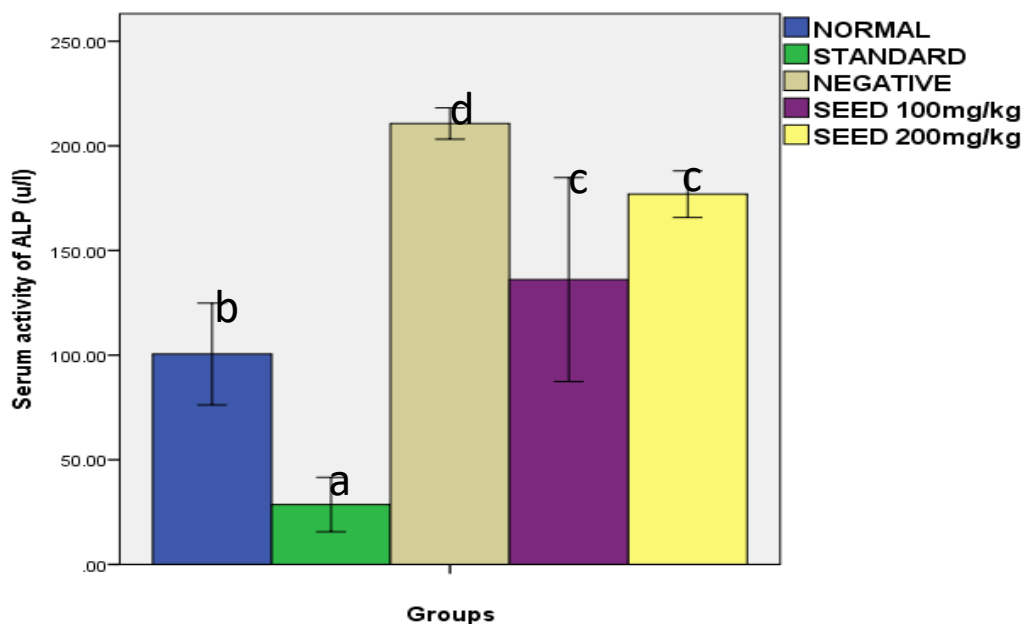


Figure 3: Effect of methanol extract of *Senna occidentalis* seeds on serum ALP activity in CCL<sub>4</sub> hepatotoxic rats and other treated rats.

### Total protein

The effect of methanol extract of *senna occidentalis* on the total protein concentrations in normal and CCl<sub>4</sub> induced hepatotoxic rats is showed in Figure 4 There was significant( $p>0.05$ ) reduction in total protein concentration upon induction with CCL<sub>4</sub>. However, administration of the seeds extract at 100 mg/kg and 200 mg/kg significantly increased total protein concentration.



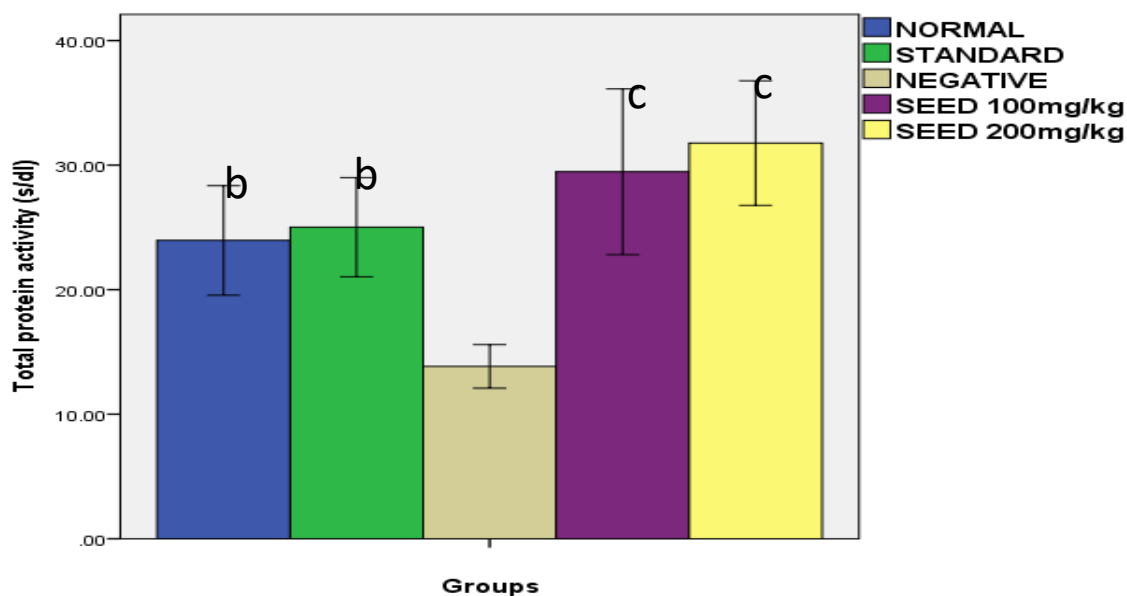


Figure 4: Effect of methanol extract of *Senna occidentalis* seeds on total protein level in CCl<sub>4</sub> hepatotoxic rats and other treated rats.

### Effect of Methanol Extract of *Senna occidentalis* seeds on Antioxidant Enzyme

#### Superoxide dismutase

Figure 5 shows the Superoxide dismutase activity of methanol extract of *Senna occidentalis* seeds in treated and CCl<sub>4</sub> induced hepatotoxic rats (negative group). Significant reduction (0.58u/L) in superoxide dismutase activity was observed in negative group administered with CCl<sub>4</sub>. Treatment with 100mg and 200mg of the seeds extract increases the superoxide dismutase activity with the 200mg/kg body weight exhibiting a higher increment (0.85u/L) in activity than the 100mg/kg groups (0.82u/L).

#### Catalase

The effect of seed extract of *Senna occidentalis* on catalase activity of CCl<sub>4</sub> induced rats is shown in Figure 6. The catalase activity was significantly ( $p < 0.05$ ) decreased in hepatotoxic rats (3.3u/L) compared to other treated groups. However, treatment at 100mg increased the activity (5.7u/L) and at 200 mg/kg body increased catalase activity (76.0u/L) significantly when compared with the CCl<sub>4</sub> induced group.



### Lipid peroxidation

Figure 7 shows the level of production of Malondialdehyde (MDA) as an index of lipid peroxidation in the CCl<sub>4</sub> induced group and the other treated group. There was observed significant ( $p < 0.05$ ) increase ( $13.1 \times 10^{-5} \text{u/mol}$ ) in the level of MDA in CCL4group when compared with other experimental treated groups. Treatment with methanol extracts of *Senna occidentalis* seeds significantly decreased the level generation of MDA at 100mg ( $4.1 \times 10^{-5} \text{u/mol}$ ) and 200mg ( $4.3 \times 10^{-5} \text{u/mol}$ ) in the treated groups.

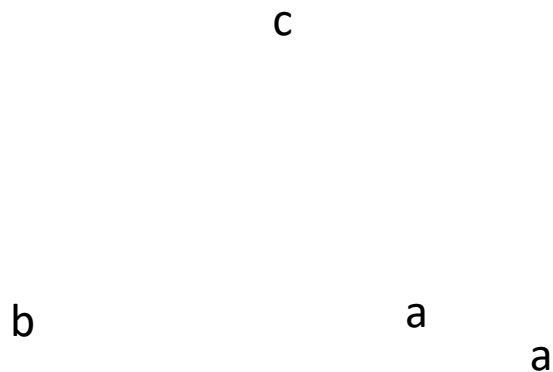


Figure 7: Effect of MDA in hepatotoxic rat treated with methanol extract of *Senna occidentalis* seeds in CCL<sub>4</sub> hepatotoxic rats and other treated rats.

### Discussion

The liver has various significant functions that are fundamental to life, including protein synthesis or production, glucose homeostasis, and detoxification. Albeit the liver has a solid regenerative capacity, it can still get damaged and harmed because of its exposure to natural poisons and toxins, resulting in organ dysfunctions and metabolic abnormalities [32].

The underlying molecular mechanism of acute liver has been discovered to be related with oxidative stress, apoptosis, and inflammation [33]. CCl<sub>4</sub> treatment is known to invigorate lipid peroxidation, reactive oxygen species generation, and centrilobular necrosis and steatosis; it has been widely used to induce acute hepatic damage in a mouse model of hepatotoxicity [34].

In this present study, it was observed that there was statistically significant increase ( $p < 0.05$ ) in the serum AST, ALT and ALP in the group that was administered CCl<sub>4</sub> alone when compared to control. AST, ALT and AST that exist in the hepatocytes can certainly leak into the peripheral blood as soon as the hepatocytes are injured. Increase in these enzymes may be due to generation of free radical, CCl<sub>3</sub>• that alkylates cellular proteins and lipids in the presence of oxygen causing lipid peroxidation, leading to liver damage which result in leakage of hepatic enzymes [35]. This is an indication that CCl<sub>4</sub> could damage the plasma membrane of liver cells (hepatocytes). However, subsequent administration of the methanol extract of *Senna occidentalis* seeds in this study was able to significantly reduce ( $p < 0.05$ ) the effect of CCl<sub>4</sub> towards normalization comparable to the control group in rats as observed by reduced concentration of these hepatic

enzymes found in the bloodstream. The hepatoprotective effect of methanol extract of *Senna occidentalis* seeds could be due to the presence of alkaloids, phenol, flavonoids, tannin, and saponins which enhance antioxidant activity and reduce free radical generation from CCl<sub>4</sub>, which is the basic triggering factor for hepatotoxicity [36]. The findings in this study with respect to the significant (p<0.05) changes recorded in the extract treated group corroborate with finding of the reports of [37] which showed CCl<sub>4</sub> induced hepatotoxicity administered with *Solanum xanthocarpum* leaf extract and ethanol leaf extract of *Spilanthes filicaulis* respectively.

Also, the total protein (TP) level was reduced in the CCl<sub>4</sub> rats showing the pulverization in the quantity of hepatic cells, which may result in a diminished hepatic ability to synthesize proteins [38, 39, 40]. Decreased concentration of liver protein may indicate impaired or damaged liver. Whereas the administration of methanol extract of *Senna occidentalis* seeds significantly and advantageously improved serum levels of protein approaching them to the normal group levels. This may be due to the fact that phytochemicals present in *Senna occidentalis* seeds extract act as agonist for the genes that are responsible for protein synthesis.

Antioxidants such as SOD, CAT, and GPx are known to neutralize excess free radicals and hence protect against their toxic effects [41]. It was observed that CCl<sub>4</sub> had significant effects on the activities of liver SOD by reducing its activity. This decrease in SOD activities may be due to the overwhelming reaction between the antioxidant molecule and the generated trichloromethyl radicals [42]. This effect was ameliorated by the oral administration of methanol extract of *Senna occidentalis* at the dose of 100mg/kg and 200mg/kg. The SOD usually catalyzes superoxide radical into oxygen and hydrogen peroxide [43]. SOD is the first line of defense against oxygen-derived free radicals and can be rapidly induced in some conditions when exposed to the oxidative stress. Also, in this study, the level of antioxidant enzyme, CAT activity was significantly decreased in rats administered CCl<sub>4</sub> only compared to rats in the treated groups. This can be attributed to free radicals and oxidative stress formation in CCl<sub>4</sub> intoxicated rats. The overall antioxidant effect exhibited by *Senna occidentalis* could be attributed to the presence of phenolic compounds in it [44]. This high scavenging property or activity can be attributed mainly to hydroxyl groups existing in the chemical structure of phenolic compounds that can provide the necessary components as a radical scavenger [45]. This finding support earlier reports that metabolites and phytoconstituents of *Senna occidentalis* like phenol, tannins and flavonoids possess antioxidant properties [46].

The decreased MDA level following *Senna occidentalis* administration can be attributed to the in vivo elevated levels of antioxidants and decreased formation of free radicals. The findings in this study are similar to previous results which elucidated similar liver toxicants and medicinal leaf protection [47,48]. The study showed that CCl<sub>4</sub> was able to significantly induce lipid peroxidation in the liver of the intoxicated test animals, however the role of medicinal plants in ameliorating this effect was observed. There was reduction in lipid peroxidation vis a vis CCl<sub>4</sub> induced hepatotoxicity as a result of the ability of the medicinal plants to raise the activities of antioxidant enzymes that helps to mop up the MDA already generated.

It can be concluded from this study that *Senna occidentalis* seed extracts significantly reverse the effect of oxidative stress induced by CCl<sub>4</sub> by enhancing activities of SOD and CAT, decreasing lipid peroxidation and protecting the integrity of the liver cells.

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