

## Dose-Dependent Effects of Aqueous Leaf Extract of *Desmodium adscendens* on Liver Functions

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### Abstract

*Desmodium adscendens* is one of many plant species and their derivatives that are used in different parts of the world for the treatment of diseases. It is a rainforest herb which has been traditionally used for a wide variety of medical conditions including: muscle cramp, tendon, spinal pain, bronchitis, epilepsy and some central nervous system disorders. This study is aimed at determining its effect on the function and histology of the liver as it's being used in the treatment of these disease conditions. Forty-eight (48) male Wistar rats used for the research were assigned into four (4) groups, n = 12. Group A (control) received normal rat feeds and water. Group B received rat feeds and low dose of the extract (300 mg/kg body weight). Group C received rat feeds and median dose of the extract (450 mg/kg body weight). Group D was treated with high dose of the extract (600 mg/kg body weight) and was also fed with rat feeds. The administration was done orally and once daily for four (4) weeks. Blood samples were obtained for analysis via cardiac puncture after rats were put under chloroform anaesthesia. The extract was found to cause dose-dependent decrease in the concentration of serum liver enzymes; Alkaline Phosphatase (ALP), Alanine Aminotransferase (ALT) and Aspartate Aminotransferase (AST). Extract also caused similar effect on the concentration of total bilirubin; conjugated and unconjugated bilirubin. *Desmodium adscendens* protects and improves the state of health of the liver.

**Keywords:** Liver Enzymes; Bilirubin; Antimicrobial Effects; Phytochemical Constituents

### Introduction

Traditional Medicine has been brought into focus for meeting the goals of a wider coverage of primary health care delivery, not only in Nigeria and Africa, but also, to various extents, in all countries of the world. It is therefore not a surprise that a number of drugs in use were developed from plant products [1].

In many countries of Africa, this traditional use of plants has been the mainstay of health maintenance. The effect of these plants or their extracts are known for a multitude of beneficial effects, which include antibacterial, antiviral, anti-diabetic, or antioxidant, and have been the focus of numerous studies [2].

World Health Organization (WHO) estimates that up to 80 per cent of people still rely mainly on traditional remedies such as herbs for their medicines [3]. In Nigeria, majority of the population in the rural settlements settles for herbal medicine because they have little or no access to Western or orthodox medicine whereas the medicinal plants are easily accessible. In areas where the people have access to Western medicine, herbal medicine is sometimes chosen over orthodox in management of diseases for other reasons such as affordability

of cost of treatment with these drugs compared to orthodox drugs. The herbal medicines are found in abundance at virtually no cost [4]. Due to these reasons, herbs will continue to be the source of medical care for the majority of the world's poor particularly those in the tropical areas [5].

It is estimated that between 35,000 and 70,000 different species of plants have been used as medicines by various peoples of the world, and at least some 7,000 plant-derived medicinal compounds have been introduced into Western pharmacopoeia. Out of these, only about 120 plant-based drugs coming from 95 plant species are prescribed for use worldwide, leaving a huge number yet to be explored [3,5].

Considering the increasing dependence on traditional medicine in human and animal healthcare, researches into the efficacy of some of the herbs used in the treatment of some illness have become inevitable. It is equally very important to determine what side effects these traditional medicines have on the body in the course of their use as therapy in treating these diseases.

*Desmodium adscendens* in the family of *Fabaceae* is among these notable medicinal plants.

It is a rainforest herb which has been traditionally used by the natives for a wide variety of medical conditions including: muscle cramp, tendon, spinal pain, bronchitis, epilepsy and some central nervous system disorders. Other uses include rheumatism, jaundice, hepatitis, protection of liver from cirrhosis, asthma (owing to its bronchial-dilating effects), allergic symptoms and eczema. It is also a very potent natural antispasmodic agent [6].

### Therapeutic phytochemicals

The therapeutic phytochemicals in *Desmodium adscendens* include alkaloids of the family of indolic, alkaloids flavonoids (such as astragalins, cosmosins), soyasaponins (such as dehydrosoyasaponin) and bioamine (tyramine) [7].

The triterpenoid glycosides (and other phytochemicals such as beta-phenylethylamines and tetrahydroisoquinolines) found in *Desmodium adscendens* are very potent potassium channel agonists. They activate the calcium-dependent potassium ion channels; when potassium ions cross the cell membranes, while the tone in the smooth muscles is maintained [7].

### Liver enzymes and liver function tests

Liver function test (FLT) is a procedure that checks how well the liver is working. It consists of different blood tests [8].

#### Alkaline phosphatase (ALP)

Alkaline Phosphatase (ALP) is an enzyme in the cells lining the biliary ducts of the liver. It is used extensively as a tumour marker and is also present in bone injury, pregnancy, or skeletal growth with elevated readings [8]. Low levels are sometimes found in hypoadrenia, protein deficiency, malnutrition and a number of vitamin deficiencies ALP levels in plasma will rise when large bile duct obstruction is present or there is intrahepatic cholestasis or infiltrative diseases of the liver. ALP is also present in bone and placental tissue, so it is higher in growing children as their bones are maturing and also in elderly patients who have Paget's disease [9]. Alkaline Phosphatase is present in bile-secreting cells in the liver and also in bones. High levels often mean bile flow out of the liver is blocked [9].

Normal range: Between 30 - 120 IU/L [10].

#### Aspartate aminotransferase (AST)

Aspartate Aminotransferase (AST) An aspartate aminotransferase (AST) test measures the amount of this enzyme in the blood [9]. AST is normally found in red blood cells, liver, heart, muscle tissue, pancreas, and kidneys. AST formerly was called serum glutamic oxaloacetic transaminase (SGOT). Low levels of AST are normally found in the blood. When body tissue or an organ such as the heart or liver is diseased or damaged, additional AST is released into the bloodstream. The amount of AST in the blood is directly related to the extent of

the tissue damage. After severe damage, AST levels rise in 6 to 10 hours and remain high for about 4 days [9]. The AST test may be done at the same time as a test for Alanine Aminotransferase, or ALT. The ratio of AST to ALT sometimes can help determine whether the liver or another organ has been damaged, to ascertain the AST to ALT ratio, which can be useful in differentiating between the causes of liver damage. Elevated AST levels are not 'specific' for liver damage because it can also be used as a cardiac marker, nevertheless Both ALT and AST levels can test for liver damage [10].

An Aspartate Aminotransferase (AST) test is done to check for liver damage, help identify liver disease, especially hepatitis and Cirrhosis liver disease may produce symptoms such as Pain in the upper abdomen, nausea, vomiting, and sometimes jaundice, check on the success of treatment for liver disease, find out whether jaundice was caused by a blood disorder or liver disease and keep track of the effects of medicines that can damage the liver.

An elevated ALT helps identify liver disease or damage from any number of causes, including hepatitis [10].

Normal range: 10 - 40 U/L (International units per liter) [10].

### Alanine Aminotransferase (ALT)

Alanine Aminotransferase (ALT): An Alanine Aminotransferase (ALT) test measures the amount of this enzyme in the blood. ALT is found mainly in the liver, but also in smaller amounts in the kidneys, heart, muscles, and pancreas. ALT was formerly called serum glutamic pyruvic transaminase (SGPT). ALT is measured to see if the liver is damaged or diseased. Low levels of ALT are normally found in the blood. But when the liver is damaged or diseased, it releases ALT into the bloodstream, which makes ALT levels go up. Most increases in ALT levels are caused by liver damage. The ALT test is often done along with other tests that check for liver damage, including aspartate aminotransferase (AST), alkaline phosphatase, lactate dehydrogenase (LDH), and bilirubin. Both ALT and AST levels are reliable tests for liver damage [10].

The Alanine Aminotransferase (ALT) test is done to identify liver disease, especially cirrhosis and hepatitis caused by alcohol, drugs, or viruses, help check for liver damage, find out whether jaundice was caused by a blood disorder or liver disease, keep track of the effects of medicines that can damage the liver, and for research purpose as in the case of this study. Along with an elevated ALT, the AST checks for liver damage [10].

Normal range: 7 - 56 U/L (units per liter) [10].

### Serum bilirubin

Bilirubin is a tetrapyrrole and a breakdown product of heme catabolism. Most bilirubin (70% - 90%) is derived from hemoglobin degradation and, to a lesser extent, from other hemo proteins. In the serum, bilirubin is usually measured as both direct bilirubin (DBil) and total-value bilirubin (TBil) [11]. Direct bilirubin correlates with conjugated bilirubin but tends to overestimate actual conjugated bilirubin, as it includes both the conjugated bilirubin and bilirubin covalently bound to albumin (delta-bilirubin). Indirect bilirubin correlates with unconjugated bilirubin but tends to underestimate unconjugated bilirubin, as a portion of the unconjugated bilirubin reacts with diazosulfanilic acid, producing azobilirubin, which is measured as direct bilirubin [11]. The reference range of total bilirubin is 0.2 - 1.2 mg/dL. The reference range of direct bilirubin is 0.1 - 0.4 mg/dL. Elevated bilirubin levels (> 2.5 - 3 mg/dL) cause jaundice and can be classified into different anatomical sites of pathology: prehepatic (increased bilirubin production), hepatic (liver dysfunction), or post-hepatic (duct obstruction) [11].

### Unconjugated

The measurement of unconjugated bilirubin is underestimated by measurement of indirect bilirubin, as unconjugated bilirubin (without glucuronidation), reacts with diazosulfanilic acid to create azobilirubin which is measured as direct bilirubin [12].

### Conjugated

In the liver, bilirubin is conjugated with glucuronic acid by the enzyme glucuronyl transferase, making it soluble in water: the conjugated version is the main form of bilirubin present in the "direct" bilirubin fraction. Much of it goes into the bile and thus out into the small

intestine. Though most bile acid is reabsorbed in the terminal ileum to participate in enterohepatic circulation, conjugated bilirubin is not absorbed and instead passes into the colon [13].

Another way of approaching hyperbilirubinemia is to divide it into two general categories: unconjugated hyperbilirubinemia and conjugated hyperbilirubinemia. The prevalence of hyperbilirubinemia varies depending on the cause.

**Conjugated hyperbilirubinemia:** is common in individuals with hepatocellular injuries and biliary obstruction and is also common in persons with sepsis. Some of the inherited diseases associated with conjugated hyperbilirubinemia, such as Gilbert syndrome, are estimated to affect 4% - 13% of the US population [14], while Dubin-Johnson syndrome (DJS) is rare except in Iranian Jews, in whom the prevalence is about 1 in 1300 [14].

**Unconjugated hyperbilirubinemia:** is common in new borns and is likely related to a higher hematocrit (50%-60%) with increased cell turnover (the average lifespan of a red cell is about 85 days in the neonate) combined with decreased uridine diphosphoglucuronate glucuronosyltransferase (UGT) activity. One study found that up to 6.1% of neonates had unconjugated bilirubin levels higher than 12.9 mg/dL. Breastfeeding was more common in neonates with higher levels of unconjugated hyperbilirubin [15].

Causes of unconjugated and conjugated hyperbilirubinemia are discussed below.

### Unconjugated hyperbilirubinemia

**Increased bilirubin production via haemolysis and dyserythropoiesis:** Increased destruction of red blood cells (haemolysis) can increase the production of unconjugated bilirubin. Ineffective erythropoiesis is another cause of increased unconjugated bilirubin production that involves rapid haemoglobin turnover and destruction of a fraction of developing erythroid cells within the bone marrow [15]. The percentage of bilirubin production from this mechanism can reach 70% in dyserythropoiesis disorders such as thalassemia major, megaloblastic anaemia, congenital erythropoietic porphyria, and lead poisoning. If the production of unconjugated bilirubin is prolonged, it can precipitate bilirubin salts, leading to the formation of gallstones. Treatment is aimed at managing the underlying disease process [15].

### Decreased hepatic clearance

Decreased hepatic clearance may be caused by congestive heart failure, cirrhosis/portosystemic shunts, and/or certain drugs. Impaired delivery of bilirubin to the liver in conditions such as congestive heart failure or in patients with portosystemic shunts can decrease the hepatic bilirubin uptake by the liver. Occasionally, cirrhosis can cause unconjugated hyperbilirubinemia, as hepatic fibrosis leads to capillarization of the sinusoids, causing decreased bilirubin uptake by hepatocytes. Treatment includes treating the underlying condition. Drugs such as rifamycin, rifampin, probenecid, flavaspidic acid, and bunamiodyl inhibit bilirubin uptake, which can be reversed upon cessation of these drugs [16].

### Defective bilirubin conjugation

Inherited disorders associated with defective bilirubin conjugation include Crigler-Najjar syndrome types I and II and Gilbert syndrome. Ethinyl estradiol and hyperthyroidism are also associated with defective bilirubin conjugation. Crigler-Najjar syndrome is a very rare autosomal-recessive disorder caused by an alteration of the coding region of the gene responsible for producing bilirubin-UGT, which normally conjugates bilirubin. This results in the production of an abnormal protein, which can cause a complete or near loss of function (type I) or a very low level of function (type II).

Individuals with type I Crigler-Najjar syndrome usually present with very high levels of unconjugated hyperbilirubin at birth, resulting in kernicterus. Treatment involves emergent plasma exchange to treat kernicterus followed by regular phototherapy. If left untreated, type I is fatal by about age two years. Patients with type II may not require any therapy or may be treated with phenobarbital, which can induce the expression of UGT. Patients with type I do not respond to phenobarbital, as the mutation is a loss-of-function mutation.

Gilbert syndrome has also decreased UGT activity (typically 10% - 33% of normal), but results from a mutation in the promoter region and therefore decreased levels of a normal protein are produced. Gilbert syndrome is completely benign and has no effect on life expectancy. Therefore, management is centered on reassurance, and no medical therapy is indicated.

### Multifactorial etiologies

- Chronic hepatitis is also associated with unconjugated hyperbilirubinemia.
- Conjugated hyperbilirubinemia
- Hepatitis
- Hepatitis (viral, alcoholic, autoimmune) is associated with conjugated hyperbilirubinemia

### Liver infiltration

### Biliary obstruction

Biliary obstruction may be caused by the following: Malignancies (cholangiocarcinoma, pancreatic cancer), chronic pancreatitis (pseudocysts, stricture), acute pancreatitis, primary sclerosing cholangitis (PSC), choledocholithiasis, postsurgical biliary strictures, and choledochal cysts.

A bilirubin test measures total bilirubin. It can also give levels of two different types of bilirubin: unconjugated and conjugated.

For adults human over 18, normal total bilirubin can be up to 1.2 milligrams per deciliter (mg/dl) of blood. For those under 18, the normal level will be 1 mg/dl. Normal results for conjugated (direct) bilirubin should be less than 0.3 mg/dl.

Men tend to have slightly higher bilirubin levels than women. African-Americans tend to have lower bilirubin levels than people of other races.

### Aim/Purpose of Study

Seeing that *Desmodium adscendens* is now widely used for medicinal purpose, this study is aimed at determining its impact on the functioning and histology of the liver as it's being used in the treatment of these disease conditions.

### Method

#### Experimental animals

A total of forty 48 adult male albino Wistar rats weighing between 120 - 160g were used for this experiment. The animals were obtained from the faculty of Basic Medical Sciences animal house, University of Calabar. The experimental animals were handled in accordance with the principles guiding the use and handling of experimental animals as stipulated by faculty animal research ethics committee of the faculty of Basic Medical Sciences. The rats were maintained on standard rat feed (growers feed) and tap water available all through the period of experiment. The animals were maintained at an ambient temperature between 28 - 30°C, humidity of 55 ± 5% and standard (natural) photoperiod of approximately 12 hours of light (06:30 hour - 18:30 hour) alternating with approximately 12 hours of darkness (18:30 hour - 06:30 hour). The rats were allowed to get familiarized with the environment for a period of 7 days before treatments commenced.

#### Experimental design

At the end of the acclimatization period, the animals were randomly assigned into four (4) groups, n = 12, as follows:

1. Control (Received normal rat chow and tap water).
2. Low dose treated group (Received low dose of extract (300 mg/kg)).

3. Median dose treated group (Received middle dose of extract (450 mg/kg).
4. High dose treated group (Received high dose of extract (600 mg/kg).

Treatments lasted for a period of four (4) weeks, all animals had free access to feeds and water *ad libitum*.

#### Preparation of extract

Two (2) grams of the aqueous leaves extract of *Desmodium adscendens* was dissolved in 10 ml of distilled water as follows; 2 g = 10 ml of water (200 mg = 1 ml). If 200 mg = 1 ml, therefore, 300 mg = 1.5 ml, 450 mg = 2.25 ml, and 600 mg = 3 ml of water. Volume per animal was determined as follows; for the low dose treated group, 300mg of extract was dissolved in 1.5 ml of water. A rat in the low dose group with a body weight 120g received 36mg of the extract. If 300 mg of extract was dissolved in 1.5 ml of water, 36 mg of the extract will be dissolved in 0.18 ml of water. Therefore, an animal in the low dose group with a body weight of 120g will receive 0.18 ml of the extract daily all through the treatment period. Same was applicable to all the experimental animals all the extract treated groups.

Extract administration was done orally with the aid of an orogastric cannula and treatment lasted for four (4) weeks.

#### Collection of blood samples

At the end of treatment period, animals from all the experimental groups were sedated and made unconscious using chloroform anesthesia. Blood sample from each rat was collected via cardiac puncture [16] into EDTA and plain sample bottles for the estimation of biochemical parameters.

#### Analysis of serum

Serum from the different groups was obtained for biochemical analysis of the following parameters: Liver Enzymes (ALT, AST, ALP), and Serum Bilirubin (Conjugated and Unconjugated).

#### Determination of serum transaminases using Randox kit

Transferases are made up of a group of enzymes which catalyse the interconversion of amino acids and alpha ( $\alpha$ ) keto acids ( $\alpha$ -ketoglutaric acid) by transfer of amino groups. They are called amino transferases (AST and ALT) or amino transaminases (GOT and GPT). Principle of ALT: Glutamic- pyruvic transferases are measured by monitoring the concentration of pyruvate hydrozone formed with 2,4- dinitrophenylhydrazine [17]. ALT catalyzes the transfer of an amino group from L-alanine to  $\alpha$ -ketoglutarate to form L-glutamate and pyruvate. Lactate dehydrogenase catalyzes the conversion of pyruvate to lactate. Concomitantly, NADH is oxidized to NAD<sup>+</sup>, as illustrated below; ALT L-Alanine +  $\alpha$ -Ketoglutarate  $\rightarrow$  L-Glutamate + Pyruvate LDH Pyruvate + NADH + H<sup>+</sup>  $\rightarrow$  Lactate + NAD<sup>+</sup> The rate of change of the absorbance difference between 340 nm and 405 nm is due to the conversion of NADH to NAD<sup>+</sup> and is directly proportional to the amount of ALT present in the sample. Principle for AST: Glutamic - oxaloacetic transaminase is measured by monitoring the concentration of oxaloacetate hydrozone formed with 2,4 Dinitrophenyl hydrazine [18]. AST catalyzes the reaction of L-aspartate and  $\alpha$ -ketoglutarate into oxaloacetate and L-glutamate. Oxaloacetate is converted to malate and NADH is oxidized to NAD<sup>+</sup> by the catalyst MDH. AST L-aspartate +  $\alpha$ -ketoglutarate  $\rightarrow$  Oxaloacetate + L-glutamate MDH Oxaloacetate + NADH  $\rightarrow$  Malate + NAD<sup>+</sup> The rate of absorbance change at 340 nm/405 nm caused by the conversion of NADH to NAD<sup>+</sup> is directly proportional to the amount of AST present in the sample. Method for AST and ALT; Two test tubes labelled blank and sample were used for each of the test, 0.1 ml of serum sample was added to the sample tube, 0.5ml of solution 1 was added to the blank. Mix and incubate for exactly 30 minutes at 37°C. 0.5 ml of solution 2 was added to blank and sample tube. Mix and allowed to stand for exactly 20 minutes at 25°C. 5 ml of sodium Hydroxide was added to the test and sample tube. The tubes were mixed and absorbance was read at 540 nm against the blank. The activity for AST and ALT were obtained from a standard table [18].

### Determination of serum bilirubin

Serum bilirubin concentration was determined using Randox Test Kits (Randox Laboratories Ltd, Crumlin, England, UK). Two tubes were set up labeled T1 (sample blank) and T2 (test sample). T1 contained 0.20 mL Randox sulphanilic acid Reagent, 1.0 ml Randox caffeine solution and 0.2 ml of serum, while Randox sulphanilic acid Reagent 0.05 ml Randox sodium nitrite solution, 1.0 ml of Randox titrate solution their content were mixed and allowed to stand for 30 minutes at 25°C in a water bath, before reading the absorbance (ATB) at 578 nm against the sample blank in a spectrophotometer [19].

### Statistical analysis

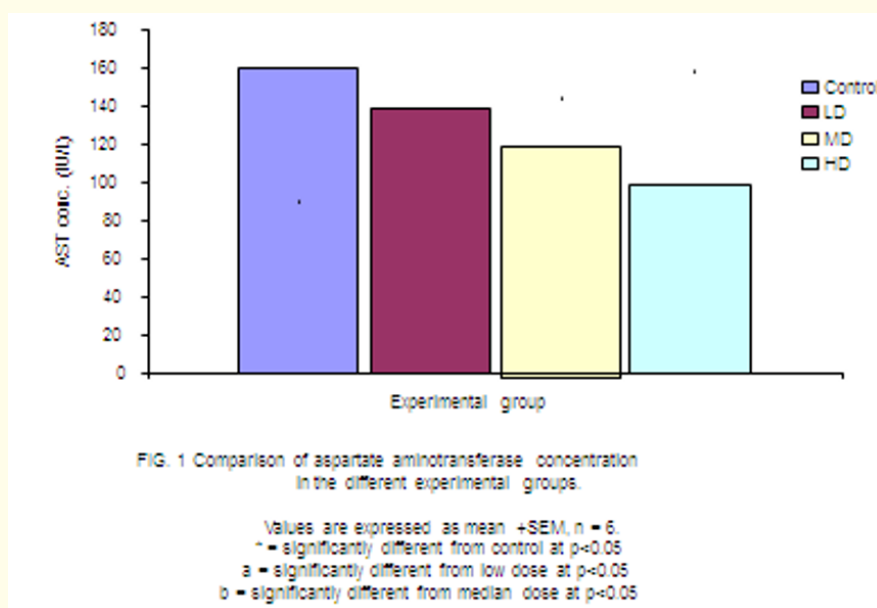
Data were presented as mean  $\pm$  SEM. Experimental data were analyzed using Analysis of variance (ANOVA) followed by a post HOC test (least square difference {LSD} test) to determine significant differences between means. The analysis was done with an SPSS 18 statistical package. Mean values was considered significant at  $p < 0.05$ .

## Results

### Comparison of liver enzymes in the different experimental groups

#### Aspartate aminotransferase (AST)

The comparison of Aspartate Aminotransferase (AST) concentration in the different experimental group is shown in figure 1. Result indicates significant ( $p < 0.05$ ) and decrease in AST concentration in the groups treated with low, median and high doses of *Desmodium adscendens* extract when compared with the control ( $89.33 \pm 0.88$  IU/L) group. The groups given median and high doses of extract also showed significant ( $p < 0.05$ ) decrease when compared with the group treated with low dose of extract (in dose-dependent manner).

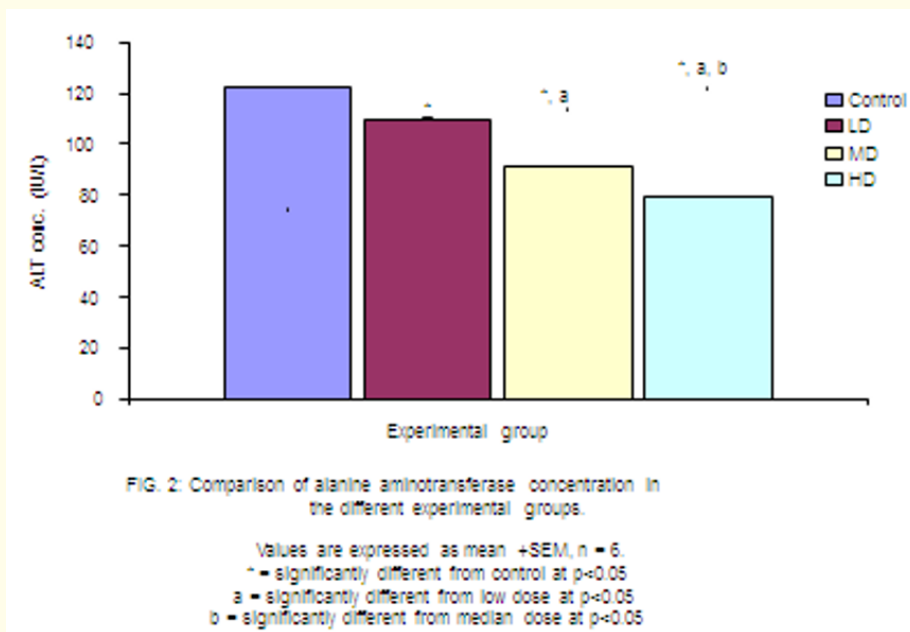


#### Alanine aminotransferase (ALT)

The ALT concentration represented in figure 2 shows that the extract caused significant decrease in the concentration of ALT in the groups treated with low, median and high dose of extract when compared with the control group at  $p < 0.05$ . The group treated with high

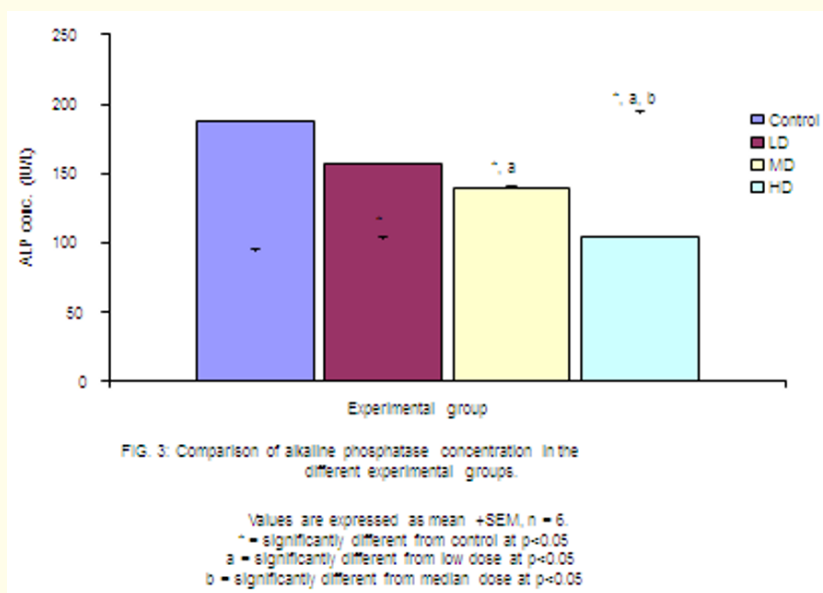


dose also caused significant ( $p < 0.05$ ) decrease in the concentration of ALT when compared with the group given low and median doses of extract at  $p < 0.05$  (dose dependent manner).



**Alkaline phosphatase (ALP)**

The Alkaline Phosphatase ((ALP) concentration in the different experimental groups is shown in figure 3. Result shows that the group treated with low and median doses of extract showed a significant ( $p < 0.05$ ) decrease in ALP concentration when compared with control, also in dose-dependent manner.

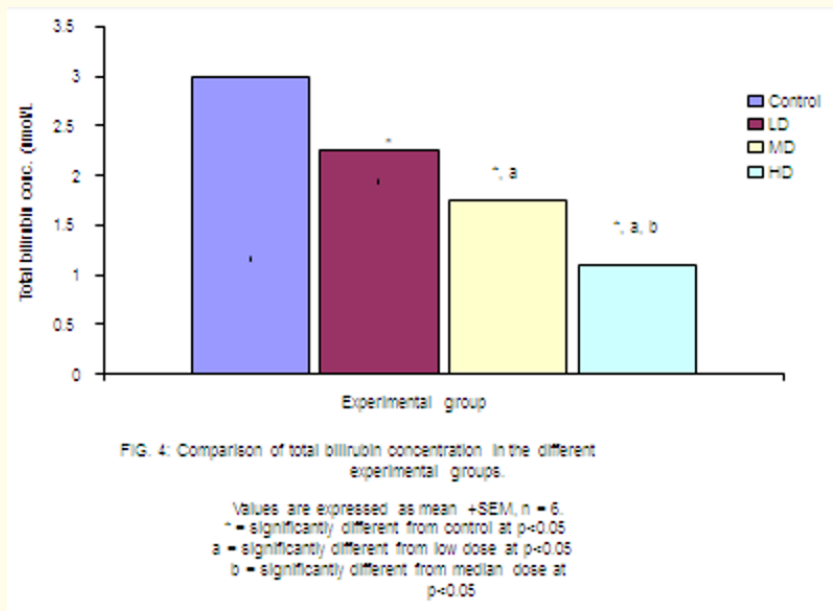




Comparison of serum bilirubin in the different experimental groups

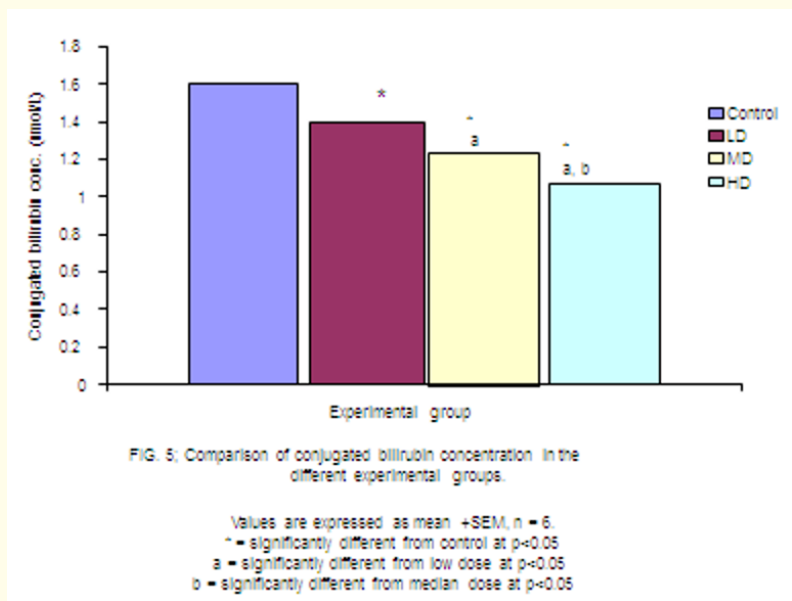
Total bilirubin (TB) concentration

Comparison of Total Bilirubin (TB) concentration in the different experimental groups is shown in figure 4. Result shows a dose-dependent increase in the level of TB, as the extract treated groups significantly ( $p < 0.05$ ) decreased the serum total bilirubin level compared with the control ( $1.13 \pm 0.05 \mu\text{mol/L}$ ) group in dose-dependent manner.



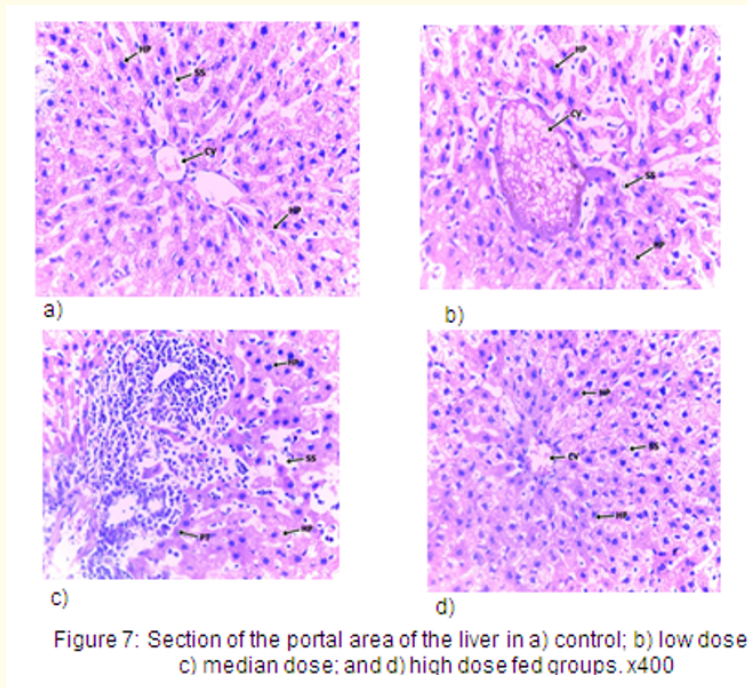
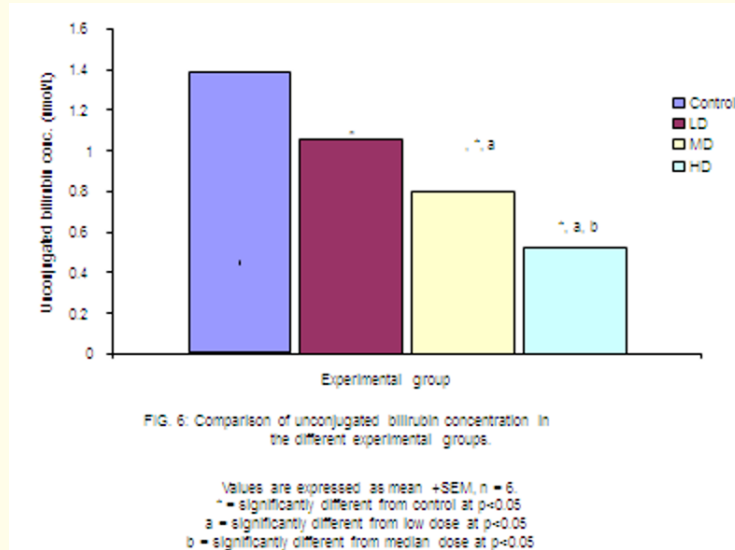
Conjugated bilirubin (CB) concentration

The graph in figure 5 represents a comparison of conjugated bilirubin (CB) concentration in the experimental groups. Result also showed a dose-dependent decrease ( $p < 0.05$ ) in the level of CB in the extract treated group compared with control.



**Unconjugated bilirubin (UB) concentration**

Figure 6 represents a comparison of Unconjugated Bilirubin (UB) concentration in the different experimental groups. Result showed a similar pattern as observed in total and conjugated bilirubin concentration. There was significant ( $p < 0.05$ ) decrease in the level of serum bilirubin in the group treated with extract when compared with control ( $0.44 \pm 0.03$  IU/L).



## Discussion

In this study, administration of *D. adscendens* extract at doses of 300 mg, 450 mg and 600 mg/kg bwt for period of 28 days (4 weeks) caused a significant and dose-dependent decrease ( $p < 0.05$ ) in the serum concentration of bilirubin and Liver marker enzymes (ALP, ALT, and AST), implying that the extract is not toxic to the liver but rather improves the liver cell membrane.

Generally, elevated levels of serum liver marker enzymes; AST, ALT and ALP are indicative of cellular leakage and loss of functional integrity of the cell membrane in liver. This could be a result of hepatotoxicity [20,21].

Elevated serum levels of Total Bilirubin (TBIL) (Conjugated and Unconjugated) could also be attributed to impaired hepatic clearance due to hepatic parenchymal damage or biliary obstruction [22-24].

But in this study, *Desmodium adscendens* significantly decreased the concentration of serum liver biomarker enzymes (AST, ALT and ALP), and bilirubin; indeed the serum concentration of these enzymes and also of bilirubin decreased with increasing dose of extract, indicating that the integrity of the liver is not only maintained but has even improved. It therefore shows that the extract did not inflame the membrane of the cells of the liver tissues.

Histology of the liver of the control group and the groups treated with extract showed a preserved architecture and plates of hepatocytes radiating outward. The hepatocytes present abundant cytoplasm and deeply stained oval to round nuclei with fine chromatin patterns. The sinusoidal spaces reduced slightly. The portal area contains hepatic artery, bile duct and portal vein. The limiting plate hepatocytes were intact. This indicates a preserved integrity of the liver, and further showing that the cells are not inflamed either by low or high dosage of the extract.

## Conclusion

*Desmodium adscendens* used in the management and treatment of several disease conditions is not toxic to the liver but rather improves the integrity of the liver membrane and tissues in dose-dependent manner, as shown by serum liver enzymes and bilirubin level, and also by the histology of the liver tissues.

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