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Sub-acute nephrotoxicity of ethanol fraction of *Senna tora* on Wistar Albino Rats

Emochone Roy Yohanna * and Ojochenemi Ejeh Yakubu

Department of Biochemistry, Faculty of Pure and Applied Sciences, Federal University, Wukari, Nigeria.

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Abstract

Plant materials as sources of medical compounds continue to play a dominant role in the maintenance of human health since antiquity. The present study was designed to ascertain the toxicity of ethanolic extract of *Senna tora* leaves on Wistar rats. A total of twenty (25) Wistar rats were distributed into 5 group of 5 animals each. Group I, received normal saline, group II received 100 mg/kg, group III received 200 mg/kg, group IV received 400 mg/kg, and group V received 800 mg/kg of *Senna tora* leaf fraction respectively. The treatments lasted for 28 days of which the animals were sacrificed. Kidney test which includes the electrolyte like Sodium ion (Na^+), potassium ion (k^+), bicarbonate (HCO_3^-) Chloride ion (Cl^-), Urea and Creatinine was done. The results revealed significant increase in the level of sodium ion (Na^+), potassium ion (k^+), and Chloride ion (Cl^-) concentrations between and within the groups of the rats administered dose of 200 mg, 400mg and 800 mg when compared with Normal control. However, the result also revealed that there was no significant increase in the concentration of bicarbonate (HCO_3^-) and urea. In addition, the result revealed that there is significant ($p \leq 0.05$) increase in the level of serum urea and creatinine concentration between and within the groups of administered dose of 100 mg, 400 mg and 800 mg when compared with the normal control group. There is significant ($p > 0.05$) increase in total cholesterol (T.CHOL), high density lipoprotein (HDL), low density lipoprotein (LDL), and Triacylglycerol (TGs) on the treatment with *Senna tora* leaf fraction. The present study revealed that *Senna tora* as a traditional herb for the treatment and management of diseases associated with kidney toxicity is effective.

Keywords: *Senna tora*; Nephrotoxicity; Sub-acute; Wistar rat

1. Introduction

Senna tora is one of the most widely used herbal plants among people of tropical and sub-tropical regions of the world (Veronique and Gabriel, 2013). It is used for various therapeutic purposes in traditional medicine (Yadav *et al*., 2010, Silva *et al*., 2011). In Nigeria, this plant is locally called Sanga-sanga or Raidore in Hausa language (Nuhu and Aliyu, 2008; Sadiq *et al*., 2012); Akidiagbara in Igbo language and Abo rere in Yoruba language (Egharevba *et al*., 2010). Roots, leaves, flowers and seeds of *Senna tora* are the different parts of the plant used in medication (Veronique and Gabriel, 2013). The lethal dose (LD_{50}) of aqueous leaf fraction of *Senna tora* was found to be safe up to 5000 mg/kg body weight (Silva *et al*., 2011; Shafeen *et al*., 2012; Tanimu and Wudil, 2012).

Furthermore, the plant has been used in different parts of the world by the traditional healers in treating different forms of diseases. It has been documented in literatures that extract of *Senna tora* as antimicrobial activity (Mariano-Souza *et al*., 2010; Mohammed *et al*., 2012), larvicidal and pupicidal activity (Ibrahim *et al*., 2010), antioxidant and hepatoprotective activity (Gowrisri *et al*., 2012), anti-inflammatory actions (Yadav, 2010), antimalarial activity (Gwarzo *et al*., 2014), antianxiety and antidepressant activity (Shafeen *et al*., 2012), analgesic activity (Silva *et al*., 2011) and antidiabetic activity. In addition, due to poverty and lack of access to modern medicines; about 65-80% of the world's populations living in developing countries depend essentially on plants for primary health care (Calixto, 2000). Traditional healers dispense herbal preparations without much consideration to the quantity of the extract ingested by

* Corresponding author: Emochone Roy Yohanna

their clients. More to that, despite the growing demand for herbal medicines, there are still concerns associated with not only their use, but also their safety (Winston and Maimes, 2007). Thousands of decades ago, people most especially rural dwellers relied heavily on traditional medicine using herbs for treatment of illnesses; this has been the practice in Northern Nigeria in particular Sokoto State and all over the world (Nuhu and Aliyu, 2008). The kidneys serve essential regulatory roles in animals by removing excess organic molecules from the blood as waste products of metabolism (Arthur and John, 2006; Inderbir, 2007). Kidneys are one of the vital organs affected by accumulation of toxic substances in the body; exposure to toxic substances can cause injury or death of tissues in the kidney resulting in leakage of essential biomolecules into the blood stream alongside with histomorphological changes (Vashishtha *et al*., 2009; Nwaehujor *et al*., 2011). Similarly, people consume Sennatoraextract either alone or mixed up with other mineral and organic matter as therapy (Garba *et al*., 2015). The leaves of this plant are widely used in our community without enough knowledge of its possible side effects on vital organs. In addition, Harshal and Priscilla (2011) summarized the updated information on various aspects such as pharmacognosy, phytochemistry and biopotential of C. toraLinn. They also focused on correlation between active constituents and medicinal uses of this plant. Therefore, this study sought to investigate the sub-acute nephrotoxicity of *Senna tora* in wistar albino rats.

Current non-communicable diseases (NCDS) trend in Africa can be attributed to rapid shift from traditional foods which contain mostly vegetables to western food products resulting in elevated intake of saturated fats and food preservatives with reduced intake of dietary fibre, vital nutrients and phytochemicals when compared to basic dietary guidelines (Nahrung *et al* .,2019; Uguru *et al*., 2005). *Senna tora* leaf is a leafy vegetable with immense nutritional, phytochemical and medicinal potential but is underutilized (Nwankwo, 2015). Anecdotal evidence suggests that there is antidiabetic activity in *Senna tora* leaf. The leaf is used as a soup vegetable only in some parts of Northern Nigeria (Kubmarawa, 2011).

There is dearth of information in the Nigerian literature on the anti-diabetic potentials of *Senna tora* leaves. Hence, this study focused on the scientific investigation of the effect of methanol extract of *Senna tora* leaves on blood glucose, nephrotoxicity and lipid profile of wistar abino rats.

2. Materials and Methods

2.1. Materials

Wooden mortar and pestle, digital analytical weighing balance (Ohaus: PA-1000), Beakers, Whatman number 1 filter paper, Conical flask, Spatula, measuring cylinder, Aluminum foil, Sample bottles, Plastic funnels, masking tape, Thermostatic water cabinet (Model: HH-W420), cannula attached to a graduated syringe**,** U/V Spectrophotometer (Diwakar Instruments Company,Ambala, India), Dissection Kits, Dessicator (Garg Process Glass, Mumbai, India).

2.2. Reagents/Chemicals

Ethanol, N-Hexane, Acetone, Distilled water, Chloroform

2.3. Sample Collection and Preparation

The stem leaves of the *Senna tora,* plant was collected within Wukari Local Government Area of Taraba state, Nigeria. The leave was critically examined to be free of disease and contamination of any sort. Only healthy plant was used for the analysis. The plant material was dried in the laboratory at room temperature and pulverized using traditional mortar and pestle.

2.4. Ethanol Extraction

The method of Yakubu *et al.,* (2014) was adopted for this protocol. One hundred grams (100 g) of pulverized sample each of leaf and stem-bark was weighed into a plastic container and filled with 400 mL ethanol and was allowed to stand for 72 hours with occasional shaking, thereafter, filtered with Whatman No. 1 filter paper.

2.5. Fractionation of crude ethanol extract of *Senna tora* leaves

50 ml of crude ethanol extract was measured using a measuring cylinder into a separating funnel, 100 ml of N-Hexane was also measured into the separating funnel and the funnel was shaken several times, it was kept undisturbed to separate into two layers. The ethanol fraction settled at the bottom of the separating funnel and N-hexane settled at the top of the separating funnel. The N-hexane fraction was collected into a beaker. The ethanol fraction was then collected into a beaker and was concentrated using rotary evaporator under reduced pressure and concentrates transferred into air-tight container and preserved in the refrigerator at 4 ^{o}C prior to administration.

2.6. Experimental Animal

Healthy male Wister rats of about 120-150 g in weight were used for this study. They were purchased from animal house of College of Health Science, Benue State University, Makurdi, Nigeria and transported to the Animal house of the Department of Biochemistry, Federal University Wukari, Nigeria. They were acclimatized for 2 weeks and weighed prior to the commencement of the experiment (Yakubu *et al*., 2020).

2.7. Sub-acute toxicity studies

Healthy young albino rats were administered with different doses of the extract orally to five groups containing 5 rats in each group. Group 1 animals served as normal control and received normal saline. Groups 2, 3, 4 and 5 received 100 mg/kg, 200 mg/kg, 400 mg/kg, 800 mg/kg body weight respectively orally with a cannula attached to a graduated syringe. The animals were acclimatized for a week after which the numbers of dead rats were recorded.

2.8. Experimental Design

Twenty-five (25) albino rats was used for the experiment and distributed randomly into 5 groups with 5 rats per group.

Group 1: Normal control
Group 2: Each rat was given 100 mg/kg of the ethanol fraction
Group 3: Each rat was given 200 mg/kg of the ethanol fraction
Group 4: Each rat was given 400 mg/kg of the ethanol fraction
Group 5: Each rat was given 800 mg/kg of the ethanol fraction

Each rat in the test groups was served with volumes of the ethanol fraction using an oral cannula according to their weight; those in the normal control group each was given equivalent volume of distilled water and the administration of the plant ethanol fraction lasted for 21 days respectively.

2.9. Animal sacrifice and serum preparation

After 21 days, the animals were fasted overnight and sacrificed under Chloroform anesthesia. Blood samples was collected from each of the animals through cardiac puncture into a plain tubes and serum was separated after centrifugation.

2.10. Samples Collection

The blood samples collected in the plain containers were allowed to stand for 30 minutes and subsequently centrifuged using refrigerated centrifuge at 4000 rpm for 5 minutes at 4 ^{o}C. After the centrifugation, the serum (supernatant) was dispensed into labeled tubes using a Pasteur pipette and then subjected to kidney function test and lipid profile assessment (Ochei and Kolhatkar, 2008).

2.11. Biochemical Analysis

Electrolytes estimation, urea and creatinine, lipid profile test were carried out using the methods described by (Ochei and Kolhatkar, 2008).

2.12. Data Analysis

Data analysis was performed using GraphPad instat3 version 3.02 (GraphPad Corp., San Diego, USA). Data were presented as mean ± SEM. Statistical comparison between groups were made using one-way analysis of variance (ANOVA) with post hoc Bonferroni Multiple Comparison Test to identify differences in means where appropriate and a $p \leq 0.05$ was taken as statistically significant value.

3. Results

The table below (table1) show that the level of serum electrolytes in sub-acute nephrotoxic Wistar rats.

In potassium ion, (K^+), group II show level of significances ($p \leq 0.05$) Compared to group I, group III show no level of significances ($p \geq 0.05$) compared to group I. Administration of 400 mg/kg of *Senna tora* leaf fraction to group IV and 800 mg/kg of *Senna tora* leaf fraction to group V show level of significances ($p \leq 0.05$). There is significant increase in the level of potassium upon the administration of 100mg, 400 mg, and 800 mg of *Senna tora* leaf fraction compared to group I (normal control) in Table 1.

In sodium (Na^+) group II administered with 100 mg/kg of *Senna tora* leaf fraction show no level of significance ($p \geq 0.05$) compared to group I, 200 mg/kg, 400 mg/kg, and 800 mg/kg of *Senna tora* fraction administered to group III, group IV, and group V shows no level of significance ($p \geq 0.05$) compared to group I. Therefore, administration of 200 mg, 400 mg, and 800mg *Senna tora* leaf fraction shows increased in the level of significances of sodium compared to group I (normal control) in Table 3

In chloride (CL), *Senna tora* leave fraction administration of 100 mg/kg to group II shows significance ($p \leq 0.05$) decreased compared to group I, group III and group IV shows level of significances ($p \leq 0.05$) decreased when administered with 200 mg/kg and 400 mg/kg of *Senna tora* leaves fraction when compared to group I, Administration of 800 mg/kg of *Senna tora* leave fraction to group V shows significance ($p \geq 0.05$) increase when compared to group I (normal control) in Table 3.

In bicarbonate (HCO_3^-) group II, administered with 100 mg/kg of *Senna tora* leaf fraction shows no level of significances ($p \geq 0.05$) compared to group I (normal control). Group III, administered with 200 mg/kg of *Senna tora* leaf fraction showed level of significances ($p \leq 0.05$) compared to group I (normal control). Administration of 400 mg/kg, 800mg/kg of *Senna tora* leaf fraction to group IV, group V, shows level of significance ($p \leq 0.05$) compared to group I (normal control). This is to say that, there was significant increase in the level of bicarbonate upon the administration of 100mg, 200mg, and 400mg of *Senna tora* leaves fraction compared to group I (normal control) in Table 1

Table 1: Effects of *Senna tora* leaves Extract on Serum Electrolytes of Wistar Rat

Parameters	K^+ (mmol/l)	Na^+ (mmol/l)	CL^- (mmol/l)	HCO_3^- (mmol/l)
GROUP 1	5.31 ± 0.88^a	142.69 ± 8.55^a	102.02 ± 6.34^c	33.97 ± 0.42^c
GROUP 2	11.70 ± 1.26^b	133.70 ± 1.45^a	101.58 ± 5.33^c	35.09 ± 0.66^c
GROUP 3	4.92 ± 0.14^a	162.46 ± 5.43^a	28.90 ± 0.13^a	20.46 ± 3.05^b
GROUP 4	11.50 ± 1.01^b	143.52 ± 3.55^a	87.56 ± 4.91^b	6.91 ± 0.56^a
GROUP 5	10.77 ± 0.42^b	147.21 ± 1.45^a	106.18 ± 4.72^c	6.99 ± 0.65^a

Result presented as mean ± Standard deviation. Result within a column with the same superscript indicate no levels of significance while result within the same column with different superscript indicate level of significances ($p \leq 0.05$)
($p \leq 0.05$)

In table 2 below creatinine shows no level of significance ($p \geq 0.05$) in group II, administered with 100 mg/kg of *Senna tora* leaf fraction compared to group I (normal control). Administration of 200mg of *Senna tora* leaf fraction to group III shows the level of significances ($p \leq 0.05$) compared to group I (normal control). Group IV administered with 400 mg/kg of *Senna tora* leaf fraction shows a level of significance compared to group I (normal control). Group V shows level of significance ($p \leq 0.05$), which was administered with 800mg/kg of *Senna tora* leaf fraction compared to group I (normal control). There was significance increased in the level of creatinine, upon the administration of 400 mg, 800 mg compared to group I (normal control).

Table 2: Effects of *Senna tora* leaves extract on urea and creatinine of Wistar Rat

Parameters	Creatinine (mmol/l)	Urea (mmol/l)
GROUP 1	2.13 ± 1.35^b	426.94 ± 6.55^c
GROUP 2	2.26 ± 1.22^b	324.77 ± 9.77^b
GROUP 3	0.75 ± 0.05^a	244.13 ± 4.01^a
GROUP 4	4.49 ± 0.25^c	$390.54 \pm 8.47b^c$
GROUP 5	5.47 ± 0.25^c	263.10 ± 6.56^a

Result presented as mean ± Standard deviation. Result within a column with the same superscript indicate no levels of significance while result within the same column with different superscript indicate level of significances ($p \leq 0.05$)

In urea, it shows some level of significance ($p \leq 0.05$) in group II, administered with 100 mg/kg of *Senna tora* leaf fraction compared to group I (normal control). Administration of 200 mg/kg of *Senna tora* leaf fractoin to group III shows level of significance ($p \leq 0.05$) compared to group I(normal control). Group IV was administered with 400 mg/kg of *Senna tora*

leaf fractoin which shows no level of significances (p≥0.05) compared with group I (normal control). Administration of 800 mg/kg of *Senna tora* leaf fraction to group V shows level of significances (p≤0.05) compared to group I (normal control). The analysis shows no significant increase in the level of Urea administered with 100 mg, 200 mg, 400 mg, and 800 mg of *Senna tora* leaf fraction compared to group I (normal control).

In table 3, triacylglycerol (TAGs) level of group II administered with 100 mg/kg of *Senna tora* leaf fraction shows some level of significance (p≤0.05) compared to group I (normal control). The group III show no level of significance (p≥0.05) compared to group I (normal control) when administered with 200 mg/kg of *Senna tora* leaf fraction. The administration of 400 mg/kg of *Senna tora* leaf fraction to group IV shows no level of significance (p≥0.05) compared to group I (normal control). Group V shows level of significance (p≤0.05) compared with group I (normal control) when administered with 800 g/kg of *Senna tora* leaf fraction. Thus the level of triacylglycerol increased upon the administration 100mg/kg , 200 mg/kg, 400 mg/kg, and 800 mg/kg of *Senna tora* leaves fraction to group II, group III, group IV, and group V compared to group I (normal control) in table 3.

In low density lipoprotein (LDL), group II shows level of significance (p≤0.05) when administered with 100 mg/kg of *Senna tora* compared with group I(normal control). The administration of 200 mg/kg of *Senna tora* leaf fraction to group III shows level of significances (p≤0.05) when compared with group I(normal control), group IV, administered with 400 mg/kg of *Senna tora* shows level of significance (p≤0.05) when compared with group I(normal control). The administration of 800 mg/kg of *Senna tora* leaf fraction to group V shows the level of significances (p≤0.05 when compared with group I. This is to say that, there was increased in the level of low density lipoprotein (LDL) upon the administration of 100 mg/kg, 200 mg/kg, 400 mg/kg, and 800 mg/kg to group II, group III, group IV, and group V compared to group I(normal control) seen in table 3.

In high density lipoprotein (HDL), there was no level of significance (p≤0.05) in group II when compared with group I, group III which was administered with 200mg/kg of *Senna tora* leaf fraction shows level of significance (p≤0.05 compared with group I (normal control). Group IV, group V, administered with 400 mg/kg, 800 mg/kg of *Senna tora* leaf fraction shows level of significance (p≤0.05) when compared with group I (normal control). There was decreased in level of high density lipoprotein HDL in the administration of 100 mg/kg, 200 mg/kg ,400 mg/kg, and 800 mg/kg to group II, group III, group IV, and group V compared to group I (normal control) in table 3.

Table 3 Effects of *Senna tora* leaves extract on lipid profile test

Parameters	TAGs (mmol/l)	HDL (mmol/l)	LDL (mmol/l)	T.CHOL (mmol/l)
GROUP 1	124.25±2.95^{a}	110.59±3.08^{c}	195.91±2.24^{a}	331.35±2.26^{a}
GROUP 2	202.10±8.55^{b}	75.43±2.91^{b}	367.93±2.81^{c}	483.78±2.84^{b}
GROUP 3	153.46±3.41^{a}	98.11±1.11^{b}	281.52±1.38^{b}	406.69±3.77^{b}
GROUP 4	184.10±5.10^{ab}	38.43±4.68^{a}	848.97±7.37^{e}	913.27±6.99^{c}
GROUP 5	175.90±4.94^{a}	95.59±3.31^{b}	786.70±3.65^{d}	923.73±4.21^{c}

Result presented as mean ± Standard deviation. Result within a column with the same superscript indicate no levels of significance while result within the same column with different superscript indicate level of significances (p≤0.05)

In total cholesterol, group II shows level of significance (p≤0.05) compared to group I, level of significance (p≤0.05) was shown when compared with group I (normal control), group III administered with 200 mg/kg of *Senna tora* leaf fraction shows the level of significance (p≤0.05) compared to group I (normal control), group IV was administered with 400 mg/kg and group V was administered with 800 mg/kg of *Senna tora* leaf fraction which shows high level of significances (p≤0.05) when compared with group I(normal control). Administration of 100 mg, 200 mg, 400 mg, and 800 mg to group II, group III, group IV, and group V shows increased significance in the level of total cholesterol seen in table 4.

4. Discussion

Blood acidity, water balance, muscle function, nerve conduction, blood coagulation, and the production of body fluids necessary for life are all influenced by serum electrolyte concentrations (Chernecky and Berger, 2013). Electrolyte imbalance usually happens as a result of kidney failure, dehydration, fever, and vomiting, disrupting regular cellular functioning (Husain et al., 2009). The influence of the extracts on kidney functions and part of the extracts' abundance in micronutrients including potassium, sodium, calcium, and magnesium can be used to explain the high serum

electrolyte concentrations found in this study (Uroko and Njoku, 2014). Serum electrolyte concentrations provide a more accurate assessment of renal functioning and serve as a guide when combined with creatinine and urea.

According to statistical analysis, oral administration of the ethanol leaf fraction of *Senna tora* did cause some negative damage to the kidneys in several of the examined renal parameters. Regardless of the leaf fraction concentration, none of the mice exhibit global sclerosis or inflammatory cells, and only a small number of the animals in the treated groups exhibited mild to moderate focal sclerosis. Convulated tubules at the proximal and distal ends were intact, and the interstitium was free of inflammation. Few animals showed mild to severe sclerosis that is not dose-dependent, but overall the architecture of the kidney was well preserved. Results from this investigation showed that group III and V potassium levels did not decrease significantly at (p0.05) when group II, IV, and this study supports the findings of Rehab (2006), Farombi *et al*., (2000), and Watanabe *et al*., (2004) that potassium levels in group II, group V of mice significantly decreased, in contrast to Okolie and Ikewuchi's (2004) findings that potassium levels in group II, IV significantly increased.

The relative analysis of Soduim revealed significant changes ($p \leq 0.05$) in group III, IV, and V, whereas significant changes ($p \geq 0.05$) in group II and group IV when compared to group V, but significant changes ($p \geq 0.05$) in sodium level in group I when compared to group II. This conclusion is consistent with the findings of Farombi et al. (2000), Rehab (2006), and Watanabe et al. (2004), who found that injection of *Senna tora* considerably, decreased the potassium level. This indicates both a curative and a protecting effect after Senna tora leaf fraction intake.

The efficacy of any nephro-protective and curative drugs is dependent on its capacity of either reducing the harmful effect or restoring the normal renal physiology that has been disturbed by a nephrototoxin (Ikhajiangbe *et al*., 2014). In this study, the elevated level of urea and creatinine observed in group II that received 100 mg/kg of *Senna tora* induced nephrotoxicity in the experimental rats. The administration of ethanolic leaves fraction of *Senna tora* as observed in

(tables 2) for curative and protective properties revealed a decrease in the level of urea in the serum of experimental group IV and V and creatine group III when compared with group II at $P \leq 0.05$ prior to the elevation of the biochemical indices following pre and post administration of potassium as nephrotoxin. The blood urea and creatinine levels increased after the kidneys were failed to remove them and other waste products from the blood (Harper, 1979). So, in this study, the elevation in blood creatinine and decrease in urea levels used to treat rats (as seen in tables 2) is considered as suitable markers of renal dysfunction. This result is in agreement with reports of Ikhajiangbe *et al.,* (2014), Kopple *et al*., (2002). Results also obtained from this current study showed that *Senna tora* treatment significantly attenuate the potassium mediated increase in creatinine and decrease in urea levels. This effect may be related to the antioxidant properties of

Senna tora since it has been found that potassium may be involved in the impairment of glomerular filtration rate (Pedraza *et al.,* 2000). The protective and curative effects of *Senna tora* might also be due to ability of the extract to inhibit hydrogen peroxide-induced oxidative injury in renal cell line as has been elucidated by Cohly *et al*.,(1998). It is thus possible to suggest that *Senna tora* is able to suppress potassium nephrotoxicity in kidney as it was demonstrated in the studies with adriamycin (Venkatesan, 2000; Farombi and Ekor, 2006), and cyclosporine (Tirkey *et al*., 2005). On the other hand, the findings in the studyagrees with findings of Isah *et al.,* (2018), Nnama *et al.,*(2019) andSilva *et al.,*(2011) which revealed that statistically, there was significances effect seen on the renal parameters indicating oral administration of aqueous leaves fractions of *Senna tora* did not exert detrimental effect to the kidneys.

Potassium ion concentration accesses kidney function and when kidney functions detoriates the potassium levels is elevated. Sodium accesses hydration and osmotic state of the body. Chloride ions and bicarbonate ions accesses acid-base status in the electrolyte balance of humans and rats (Reyes and Gadsby, 2006). The elevation of these ions in the blood serum indicates alkalinity and the excess decrease signifies acidosis (Clement *et al*., 2015). In this study, findings showed a significance ($p \leq 0.05$) decrease in chloride ion in groups III, IV and a non significant ($p \geq 0.05$) decrease in group V when compared to group II but when group I was compared to group II, there was a significance ($p \leq 0.05$) increase in chloride ion while Bi-carbonate ion result showed a significance ($p \leq 0.05$) decrease in group IV, V and a non-significance ($p \geq 0.05$) decrease in group III when compared to group II but when group I was compared to group II, there was a non-significance ($p \geq 0.05$) increase in bicarbonate ion (table 2). It showed that kidney related diseases may be cured or protected following the administration of ethanol leaves fraction of *Senna tora* reduced the effect of raised electrolytes excretion by the kidney.

The global world today is challenged with cardiovascular diseases. Some of the key manifestations include coronary heart diseases, stroke and hypertension. Elevated concentrations of plasma lipids are risk factors in cardiovascular problems and important lipids whose elevations are implicated in these conditions are cholesterol and triglycerides

Brown, (1992). Lipids are transported in the blood by combination of lipids and proteins complexes called lipoproteins (Morris and Ferdinand, 2009). The main identified determinants of hyperlipidemia are increased LDL-cholesterol and reduced HDL-cholesterol(Nazawi and El-Bahr, 2012).Thus, any attempt to lower serum concentrations of LDL and increase HDL concentration is considered as one of the strategies that can hinder or delay the on-set of chronic disorders that are associated with hyperlipidaemia in humans (Hunteret *et al*., 2010).

In this study, the effects of administering *Senna tora* on five groups of albino rats were investigated. It was revealed that the levels of total cholesterol and LDL-cholesterol increased across the groups compared to the normal control (group1). This observation is an indication that there is an increment of cholesterol transported by LDL-cholesterol from extracellular fluids to the blood vessels; hence this would increase accumulation of cholesterol in the blood vessels in a process that would lead to retrogression of atherosclerosis. This observation is similar to the researches on lipoprotein and lipid studies which emphasized a positive relationship between the total cholesterol, LDL-cholesterol, and triglycerides on one hand and the risk of cardiovascular disease on the other (Kromhout *et al.,* 1995; Sambanthamurthi *et al.,* 2000). There was general decrease in the levels of HDL-cholesterol across the groups compared to the control (group 1), this might be due to the effects of administration of *Senna tora* on the reduction of synthesis of HDL in albino rats. Although increasing concentration of HDL particles are strongly associated with decreasing accumulation of atherosclerosis within the walls of arteries. This is important because atherosclerosis eventually results in sudden plaque ruptures, cardiovascular disease, stroke and other vascular diseases. However, the HDL decrease which was observed in this study across the treatments could be seen to have slight semblance with the study which showed that HDL-lacking mice still have the ability to transport cholesterol to bile, suggesting that there are alternative mechanisms for cholesterol removal from the blood.

There was no definite trend in the levels of triglycerides across treatment groups compared to the control. This observation could be as a result of varying responses (in terms of synthesis of triglycerides in the liver) of the groups administered the extracts of *Senna tora* which contain tropane alkaloids. It is therefore necessary to carry out further research with the view of elucidating or establishing the mechanism of action of fraction of *Senna tora* on lipid research. The observation in this study is similar to the research carried out by who reported that diets rich in vegetables did not affect triglycerides in the healthy experimental rats fed rat cubes and extracts of leafy vegetable formulated diets, as it showed there was significance increase levels in the triglycerides of the experimental rats (Lewington *et al.,* 2007; McQueen *et al.,* 2008). The highest level of triglycerides in this study was obtained in groups 2 and 6 experimental rats with the value of 202.25±8.95mmol/l, while the lowest was recorded for group 3 Albino rats with the value of 153.46±8.55mmol/l. Triglycerides is the most common type of lipid synthesized in animals. The body converts any form of excess calories into triglycerides for long term storage. High levels of triglycerides are related to a higher risk of heart and blood vessels.

Serum total cholesterol, and LDL-cholesterol, HDL-cholesterol, concentrations increased significantly ($p \leq 0.05$) in the group administered compared to group I (Normal control). The effect of *Senna tora* leaves fraction on serum lipid profile parameters increase compared which in this study lead hyperlipidemia or atherosclerosis.

5. Conclusion

The scientific studies and research *on Senna tora* suggests an enormous biological potential of this plant. There is no doubt that this plant is a reservoir of potentially useful chemical compounds which serve as drugs, as newer leads and clues for modern drug design and production. It can be concluded however, that the extract is biologically safe at low dosage or concentration as studied. Irrespective of its aforementioned biological importance its toxicity in biological systems if administered at higher dose or concentration more than the dosages studied above should be studied.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that there is no conflict of interest.

Statement of ethical approval

This study with Wister rats has been cleared by the laboratory ethical committee of the Federal University Wukari.

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