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Effects of N-Hexane Fraction of *Senna tora* Leaves on Aspartame-Induced Toxicity

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A B S T R A C T

This study was carried out to evaluate the effect of n-hexane fraction of *Senna tora* leaves on aspartame-induced toxicity on Wistar albino rats. The study was designed to analyze the lipid profile and determine the antioxidant activities of *Senna tora.* The study was carried out at Department of Biochemistry's Laboratory, Federal University, Wukari between September to November, 2022. A total of twenty five (25) adult Wistar albino rats were used for the experiment and were divided into 5 groups (Group 1, 2, 3, 4, 5) with 5 animals in each group. Groups 1 served as a normal control (no treatment) and received only distilled water, Group 2 were induced with aspartame but no treatment was given (negative control), Group 3 were induced with aspartame and treated with 140mg of silymarin drug (positive control), Group 4 and 5 were likewise induced with aspartame but treated with 100 mg/kg and 200 mg/kg of *Senna tora* leaves respectively, treatment lasted for three weeks. Table 1 contains the results for lipid profile of triglycerides, high density lipoproteins, low density lipoproteins and total cholesterol of n-hexane fraction of *Senna tora* leaves. There was no significant difference in the levels of High Degree Lipoprotein concentration across the group compared to the normal control (Group 1). An increase in the levels of Low Degree Lipoprotein was observed across the groups compared to the normal control (Group 1). while for total cholesterol, apart from group 5 (Aspartame induced, treated with 200 mg *Senna tora* extract) all others increased in their level of total cholesterol as compared to the normal control (Group 1) and for triglycerides, a decrease was observed in the levels of triglycerides across the groups as compared to the normal control (Group 1). Results for kidney function tests (KFT) shows increase in the levels of potassium across the groups as compared to the normal control (Group 1). while for levels of bicarbonate a decrease in the level of bicarbonate was observed in group 3 (Induced with aspartame and treated with 140mg of silymarin drug) and 5 (Aspartame induced, treated with 200 mg *Senna tora* extract) and also an increase in group 2 (Induced with aspartame but no treatment was given) and 4 (Aspartame induced, treated with 100 mg *Senna tora* extract) was noted. For creatinine and urea levels, an increase was observed across the groups and a normal levels of sodium was seen and also a significant decrease was seen in the levels of chloride. This study suggests that n-hexane fraction of *Senna tora* leaves have active ingredients that are capable of improving blood lipid profile and this might be useful in the management of cardiovascular diseases.

Introduction

Much attention has been given for the search of secondary metabolites from plants as substitutes for synthetic drugs. This can be because medicinal plants have been discovered to have active therapeutic properties against many diseases with less or no side effect compared to synthetic drugs. A short while ago, disease or infection treatment with different medicinal plants has been a common practice among the people particularly in the rural areas (Hosseinzadeh *et al.,* 2015; Randrianarivony *et al.,* 2017). The rural inhabitant depends on herbal medicine, since they cannot afford the orthodox medicine and this practice has provided the needed cure for their ailments (Falodun, 2010; Mafimisebi and Oguntade, 2010). The use of Plant-Based Systems by different cultures has been extensively documented as they continue to play an essential role in healthcare. Phytochemicals represents an important pool for the identification of novel drugs and has been a rich source for successful drugs discovery.

In the pharmaceutical industry, scientific evaluation of medicinal plants makes possible evidence-based alternative medicines which form the basis of herbal drug industry and discovery of drug targets. The existence of ethnopharmacological information providing information for compounds therapeutically effective in humans is the main asset of medicinal plant-based drug discovery (Cragg and Newman, 2013; Atanasov *et al.,* 2015; Abat *et al.,* 2017).

Senna tora is a well-known plant in Africa and Asia and also called *Cassia tora* (Pawar and Lalitha, 2015). *Senna tora* has long leaves resembling a feather (long pinnate leaves); with each leaf having three pairs of leaflets that are opposite, ovate, oblong and oblique at the base. In the axil of the leaves, the yellow-colored flowers are bearded. The flowers of *Senna tora* consist of half inch diameter five petals. The seeds of *Senna tora* are brown in colour and are rhombohedral (having three equal axes and oblique angles). The flowers of *Senna tora* blossoms in the rainy season and fruits in the winter. *Senna tora* leaves, roots and seeds are used as food ingredients and additives (Ingle *et al.,* 2012 and Shkula *et al.,* 2013). *Senna tora* has wide range of pharmacological activities. It is a medicinal plant and is recognized for its antihepatotoxic, laxative, antimutagenic and antiperiodic properties. It is also utile for the treatment of cardiac disorders, ringworm, leprosy, bronchitis, ophthalmic diseases, haemorrhoids cough, hepatic disorder, skin diseases, liver tonic (Meena *et al.,* 2010; Bhandirge *et al.,* 2016). Studies shows that seeds of *Senna tora* has antioxidant activity and contain a lot of active substances including emodin, chrysophenol, and rhein (Alao and Chukwujioke, 2013; Malan *et al.,* 2015; Chandrasekar and Sivagami, 2016; Roopashree and Dang, 2017).

Credence has been given to this plant *Senna tora* because of its many medicinal properties such as, antihepatotoxic, and antimutagenic activities (Bhandirge *et al.,* 2016). Medicinal plants are now being bethinked as convincing alternatives for the treatment of various infections (Alao and Chukwujioke, 2013; Malan *et al.,* 2015).

Materials and Methods

Study Area

The research was conducted at the Department of Biochemistry, Federal University, Wukari in the Wukari local government region of Taraba state. The geographical coordinates of the location are 9°47`E longitude and 7°51`N latitude, in the southern region of Taraba State, Nigeria. The region is distinguished by a savannah vegetation zone that is interspersed with riparian forests along watercourses and rocky outgrowths, which comprise the primary landforms of the area. The region experiences two primary climatic seasons, namely the rainy season and the dry season.

Experimental Animals

Twenty five adult male Wistar albino rats weighing between 150-200mg were used for the study. They were placed in an airy space (in this case, the animal house of the Department of Biochemistry, Federal University Wukari, Taraba State, Nigeria), with a light and dark period of nearly 12 hours. Free access of diet (finisher pellets) and water allowed *ad libitum.*

Collection of Plant Materials

Fresh leaves of *Senna tora* were collected in September, 2022 within Wukari Local government of Taraba State and contaminants removed by properly washing the harvested leaves with tap water. After that, at room temperature the washed leaves were air dried for two weeks to keep chemical constituents intact (Das *et al.,* 2011; Ncube *et al.,* 2008). The dried leaves were then pulverized into fine powder using a mortar and pestle.

Fractionation of N-Hexane

At room temperature, 500g of the powdered *Senna tora* sample after been macerated was dissolved in 200ml of ethanol for 48 hours. The extract was first sieved using a clean white mesh and with the use of a whatman's number 1 filter paper, the crude ethanol extract was obtained.

Using a measuring cylinder, 50ml of the ethanolic extract and 250 ml of n-hexane was measured into a separating funnel and allowed to separate into two layers. The ethanol fraction at the bottom was then collected in a beaker followed by the n-hexane fraction at the top. N-hexane was recovered with the use of a rotary evaporator (Yakubu *et al.,* 2014).

Experimental Design

After acclimatization, the twenty five Wistar albino rats were partitioned to five groups, each group consisting of five animals.

Group 1: Normal control

Group 2: Aspartame with no treatment given (Negative control group).

Group 3: Aspartame + Synthetic drug, Silymarin (Positive control group).

Group 4: Aspartame + 100 mg/ kg leave extract.

Group 5: Aspartame + 200 mg/kg leave extract.

Blood Sample Collection for Analysis

On the twenty first day of treatment, the rats were anesthetized with chloroform after being fasted for 12 hours. Using sterile needles and syringes, the whole blood was collected via cardiac puncture for the analysis of lipid profile and determination of antioxidant activities of *Senna tora.*

Statistical Analysis

Using One-Way Analysis of Variance (ANOVA) the biochemical results were subjected to statistical analysis and further with Duncan Multiple Comparisons with the use of Statistical Package for Social Science (SPSS) version 23. The means were compared for significance at $p \leq 0.05$ and the group results were presented as mean ± standard deviation.

Results and Discussion

Lipid Profile

Table 1 contains the results for lipid profile of triglycerides, high density lipoproteins, low density lipoproteins and total cholesterol of hexane fraction of *Senna tora.* There was no significant difference ($P<0.05$) in the levels of HDL concentration across the group. An increase was seen in the levels of LDL across the groups, while for total cholesterol, an increase was seen in the levels of total cholesterol for group 2 (Aspartame induced with no treatment given), 3 (Aspartame induced group, treated with silymarin tablet), and 4 (Aspartame induced, treated with 100 mg *Senna tora* extract) compared to the normal control (Group 1) but a decrease was seen in group 5 (Aspartame induced, treated with 200 mg *Senna tora* extract) compared to the normal control (Group 1) and for triglycerides, a decrease in the level of triglycerides was seen across the groups compared to the normal control (Group 1).

Kidney Function Test (KFT)

Table 2 shows the results of kidney parameters, Sodium ion, Chloride ion, Potassium ion, bicarbonate. For Sodium ion (Na^+), no significant difference ($P<0.05$) was seen in the levels of Na^+ across the groups and also a significant decrease was seen across the groups, compared to the normal control. For Chloride ion (Cl^-), no significant difference ($P<0.05$) was seen in the levels of Chloride across the group although a significant increase in group 2 (Aspartame induced with no treatment given) and 4 (those aspartame induced Wistar albino rats treated with 100 mg of *Senna tora*) as compared to the normal control and also a significant decrease was seen in group 3 (Aspartame induced group, treated with silymarin tablet) and 5 (Aspartame induced, treated with 200 mg *Senna tora* extract) as compared to the normal control (Group 1). For bicarbonate (HCO_3^-), a significant difference exists between group 2 (Aspartame induced with no treatment given) and group 3 (Aspartame induced group, treated with silymarin tablet) but no significant difference between group 2 (Aspartame induced with no treatment given) and 4 (Aspartame induced, treated with 100 mg *Senna tora*

extract), a significant difference exist in group 3 (Aspartame induced group, treated with silymarin tablet) as compared to the normal control (Group 1) but no significant difference between group 3 (Aspartame induced group, treated with silymarin tablet) and 5 (Aspartame induced, treated with 200 mg *Senna tora* extract), Apart from group 3 (Aspartame induced group, treated with silymarin tablet) and 5 (Aspartame induced, treated with 200 mg *Senna tora* extract) there is a significant increase in the levels of bicarbonate as compared to the normal control (Group 1).

For potassium ion (K^+), group 2 (Aspartame induced with no treatment given) which are the negative control group shows higher levels of potassium ion (K^+) in the blood and also a significant difference was seen in group 3 (Aspartame induced group, treated with silymarin tablet) as compared to the normal control (Group 1) and also an increase was seen in the level of potassium ion (K^+) across the group as compared to the normal control (Group 1), and also group 5 (those treated with 200mg of *Senna tora*) showed slight increase in the level of potassium ion (K^+) compared to normal control (Group 1).

Creatinine and Urea

Table 3 shows results for kidney parameters, urea and creatinine. Results for creatinine, a significant difference ($p>0.05$) existed between group 2 (Aspartame induced with no treatment given) and group 3 (Aspartame induced group, treated with silymarin tablet) compared to normal control and between 3 (Aspartame induced group, treated with silymarin tablet) and 4 (Aspartame induced, treated with 100 mg *Senna tora* extract); 3 (Aspartame induced group, treated with silymarin tablet) and 5 (Aspartame induced, treated with 200 mg *Senna tora* extract) respectively.

A significant increase was seen in the levels of creatinine across the group as compared to the normal control (Group 1). Results for urea test, a difference in significance was revealed in group 2 (Aspartame induced with no treatment given); group 3 (Aspartame induced group, treated with silymarin tablet); 4 (Aspartame induced, treated with 100 mg *Senna tora* extract) and 5 (Aspartame induced, treated with 200 mg *Senna tora* extract) as compared to normal control (Group 1) but no significant difference between 2 (Aspartame induced with no treatment given); group 3 (Aspartame induced group, treated with silymarin tablet) and 5 (Aspartame induced, treated with 200 mg *Senna tora* extract). A rapid significant increase in the levels of urea was revealed across the groups compared to normal control (Group 1).

The global world today is faced with challenges relating to cardiovascular diseases. Some of the key manifestations of these diseases include stroke, coronary heart diseases and hypertension. The risk factors in cardiovascular problems are elevated concentrations of plasma lipids and important lipids whose elevations are implicated in these conditions are triglycerides and cholesterol (Brown and Goldstein, 1992). Lipids are carried in the blood by combination of lipids and proteins complexes called lipoproteins (Nwanjo, 2005). The main identified determinants of hyperlipidemia (High amount of lipid in the blood) are increased Low Degree Lipoprotein and reduced High Degree Lipoprotein (Ugwu, 2013). In this way, any attempt to lower serum concentrations of Low Degree Lipoprotein and increase High Degree Lipoprotein concentration is considered as one of the strategies that can delay or hinder the on-set of chronic disorders that are associated with hyperlipidemia in humans and animals (Ezekwesili, 2008). In this study, the effects of administering Senna tora leaves on five groups of Wistar albino rats were investigated. It was revealed that the levels of Low Degree Lipoprotein (LDL) increased across the groups as compared to the normal control.

This poses threats of hyperlipidemia but in group 5 (Aspartame induced, treated with 200 mg *Senna tora* extract) a slight increase in the level of Low Degree Lipoprotein was noted. This indicates that if the dosage taken is increased or if *Senna tora* extract is taken for longer period, there might be a tendency of the extract depicting a drop in the risk of cardiovascular diseases and thus exposing the potency of *Senna tora* leaves in the treatment of cardiovascular diseases.

An increase was seen in the levels total cholesterol for group 2 (Aspartame induced with no treatment given), 3 (Aspartame induced group, treated with silymarin tablet), and 4 (Aspartame induced, treated with 100 mg *Senna tora* extract) compared to the normal control (Group 1) but a decrease was observed in group 5 (Aspartame induced, treated with 200 mg *Senna tora* extract) compared to the normal control (Group 1). This indicates that high levels of cholesterol can increase the risk of heart diseases but in group 5 (Aspartame induced, treated with 200 mg *Senna tora* extract), it seems as though this

risk, decreased drastically compared to the normal control, this reveals the effectiveness of the *Senna tora* extract (200 mg of the extract) in eradicating completely the risk of cardiovascular diseases.

There was no definite trend ($p>0.05$) in the levels of High Density Lipoprotein (HDL) concentration across and also a decrease in the levels of High Density Lipoprotein (HDL) was seen in group 2 (Aspartame induced with no treatment given) and 3 (Aspartame induced group, treated with silymarin tablet) compared to the control (group 1) but an increase in the levels of High Density lipoproteins was recorded in group 4 (Aspartame induced, treated with 100 mg *Senna tora* extract) and 5 (Aspartame induced, treated with 200 mg *Senna tora* extract). Since increasing concentration of High Density Lipoprotein (HDL) particles are strongly associated with decreasing accumulation of atherosclerosis within the walls of arteries, group 4 (Aspartame induced, treated with 100 mg *Senna tora* extract) and 5 (Aspartame induced, treated with 200 mg *Senna tora* extract) indicates that the accumulation of atherosclerosis within the walls of arteries decreased drastically. This confirms the effectiveness of *Senna tora* leaves extract in the treatment of cardiovascular diseases as the accumulation of atherosclerosis results in sudden plaque ruptures, cardiovascular disease, stroke and other vascular diseases (Betteridget, 2008). While for triglycerides, there was a decrease in the levels of triglycerides across the groups compared to the normal control (group 1). This indicates that there are no risk of cardiovascular diseases.

The kidney helps in the maintenance of the body's homeostasis by reabsorbing important material and excreting waste products. The results for creatinine shows a significant difference in group 2 (Aspartame induced with no treatment given) compared to normal control and also between group 2 (Aspartame induced with no treatment given) and 3 (Aspartame induced group, treated with silymarin tablet); 3 (Aspartame induced group, treated with silymarin tablet) and 4 (Aspartame induced, treated with 100 mg *Senna tora* extract); 3(Aspartame induced group, treated with silymarin tablet) and 5 (Aspartame induced, treated with 200 mg *Senna tora* extract), also no significant difference was seen in group 2(Aspartame induced with no treatment given), 4(Aspartame induced, treated with 100 mg *Senna tora* extract) and 5(Aspartame induced, treated with 200 mg *Senna tora* extract) respectively. A significant increase was observed in the levels of creatinine across the group as compared to the normal control. Creatinine, a breakdown waste product formed in the muscle by creatinine phosphate metabolism is synthesized in the liver, passes into the circulation, and then is taken up almost entirely by skeletal muscle for energy production. The retention of creatinine in the blood is an evidence of kidney impairment (David *et al.,* 2014).

Results for urea test shows significant difference in group 2 (Aspartame induced with no treatment given) compared to normal control and also between group 3 (Aspartame induced group, treated with silymarin tablet) and 4 (Aspartame induced, treated with 100 mg *Senna tora* extract); 4 (Aspartame induced, treated with 100 mg *Senna tora* extract) and 5 (Aspartame induced, treated with 200 mg *Senna tora* extract) respectively but no significant difference between group 2 (Aspartame induced with no treatment given), 3 (Aspartame induced group, treated with silymarin tablet) and 5 (Aspartame induced, treated with 200 mg *Senna tora* extract). A rapid significant increase is seen across the groups compared to normal control. Urea is the most important end product of protein catabolism. Amino acid deamination takes place in the liver, which is also the site of the urea cycle, where ammonia is converted into urea and excreted through urine (David *et al.,* 2014). It represents 90% of the total urinary nitrogen excretion. Urea varies directly with protein intake and inversely with excretion rate. Renal diseases that lessen urea's glomerular filtration rate will lead to its retention in the blood (David *et al.,* 2014). In this study, it is evident that elevation in urea and creatinine levels can be attributed to the damage of nephron structural integrity (Imo and Uhegbu, 2015).

The kidney also maintains a marginal concentration of electrolytes in the body system. Electrolytes are small inorganic ions prevalent in body fluid that are vital in normal physiological functions (Palmer 2014). They are mainly sodium ion (Na^+), chloride ion (Cl^-), potassium ion (K^+), bicarbonate ion (HCO_3^-), and hydrogen ion (H^+). The volume of extracellular fluid (ECF) depends on the body's sodium content because Na^+ and its salt are the major osmotic solute in extracellular fluid (ECF) (Vasudevan *et al.,* 2011). The results for Sodium ion (Na^+) indicate no significant difference in the levels of Na^+ across the groups. Based on individual groups, only those Aspartame induced group with no treatment had a sharp decline. This indicates that there was normal blood Na^+ levels present in the kidney as the normal blood Na^+ level is between 135 and 145 mEq/L.

Table.1 Results on Lipid Profile

Groups Treatments	Triglycerides (mg/dL)	HDL (mg/dL)	LDL (mg/dL)	TCHOL (mg/dL)
1 Normal control	110.05±2.55^{c}	1.24±0.31^{a}	221.05±5.76^{a}	331.35±3.56^{b}
2 Negative control	67.45±3.75^{ab}	1.20±0.25^{a}	392.75±5.97^{b}	456.76±7.25^{c}
3 Positive control	72.40±4.35^{b}	1.14±0.12^{a}	445.84±7.33^{c}	513.51±6.52^{d}
4 Aspartame + 100 mg *Senna tora*	63.76±3.65^{a}	1.37±0.22^{a}	372.14±6.64^{b}	444.87±5.78^{c}
5 Aspartame + 200 mg *Senna tora*	61.92±2.33^{a}	1.63±0.21^{a}	224.97±2.45^{a}	287.16±3.66^{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≤0.05)

Table.2 Results of Kidney Function Test (serum electrolyes)

Groups Treatment	K^+ (mEq/L)	Na^+ (mEq/L)	Cl^- (mEq/L)	HCO_3^- (mEq/L)
1 Normal control	5.31±0.99^{a}	142.69±6.56^{a}	102.03±5.22^{a}	33.96±4.33^{b}
2 Negative control	14.43±3.34^{c}	126.94±4.65^{a}	102.45±4.79^{a}	34.01±3.34^{b}
3 Positive control	7.00±0.89^{b}	141.55±5.97^{a}	93.50±3.32^{a}	27.95±3.27^{a}
4 Aspartame + 100 mg *Senna tora*	6.92±1.12^{b}	136.13±3.67^{a}	105.28±6.43^{a}	35.13±3.55^{b}
5 Aspartame + 200 mg *Senna tora*	5.50±0.45^{a}	140.86±5.33^{a}	101.79±3.35^{a}	26.26±2.33^{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≤0.05)

Table.3 Results on Kidney Function Test (creatinine and urea)

Groups Treatments	Creatinine (mg/dL)	Urea ((mg/dL)
1 Normal control	2.13±0.12^{a}	113.14±4.63^{a}
2 Negative control	3.40±0.31^{b}	295.71±5.34^{b}
3 Positive control	4.88±0.69^{c}	283.05±5.55^{b}
4 Aspartame + 100 mg *Senna tora*	3.03±0.34^{b}	337.52±6.89^{c}
5 Aspartame + 200 mg *Senna tora*	3.60±0.45^{b}	284.76±4.99^{b}

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).

When blood sodium level is below 136 mEq/L it may mean that one has low blood sodium (Hyponatremia) and when it's greater than 145 mEq/L it is considered high (Hypernatremia) but from the results it appears that across the group, there is no risk of hyponatremia or hypernatremia as the levels of sodium is normal. For Chloride ion (Cl^-), there is no significant difference across the group although a significant decrease is seen in group 3 (Aspartame induced group, treated with silymarin tablet) and 5 (Aspartame induced, treated with 200 mg *Senna tora* extract) as compared to the normal control and a significant increase in group 4 (those aspartame induced Wistar albino rats treated with 100 mg of *Senna tora*) and 2 (Aspartame induced with no treatment given) as compared to the normal control. Group 3 (Aspartame induced group, treated with

silymarin tablet) didn't fall within the normal range of chloride (which is between 96 to 106 mEq/L) in the blood and low levels of chloride ion have several possible causes including common temporary problems such as dehydration and vomiting. For bicarbonate (HCO_3^-), no significant difference exist in group 2 (Aspartame induced with no treatment given) as compared to normal control but significant difference exist between group 2 (Aspartame induced with no treatment given) and 3 (Aspartame induced group, treated with silymarin tablet) and between 4 (those aspartame induced Wistar albino rats treated with 100 mg of *Senna tora*) and 5 (Aspartame induced, treated with 200 mg *Senna tora* extract), but no significant difference between group 3 (Aspartame induced group, treated with silymarin tablet) and 4 (those aspartame induced Wistar albino rats treated with 100 mg of *Senna tora*).

Apart from group 3 (Aspartame induced group, treated with silymarin tablet) and 5 (Aspartame induced, treated with 200 mg *Senna tora* extract), a significant increase was seen in the levels of bicarbonate as compared to the normal control. Kidney experts recommend that patients should not have their serum bicarbonate level fall below 22 mEq/L. When there is high level of bicarbonate (like it's seen in those Aspartame induced with no treatment given and those aspartame induced Wistar albino rats treated with 100 mg of *Senna tora* groups) in the blood it can form metabolic alkalosis, a condition that causes a pH increase in tissue.

Metabolic alkalosis can happen from a loss of acid from the body, such as through vomiting and dehydration. For potassium ion (K^+) there is significant difference in group 2 (Aspartame induced with no treatment given) as compared to the normal control, there is an increase in the level of potassium ion (K^+) across the group as compared to the normal control and higher level of potassium ion (K^+) in the blood can be dangerous and usually require immediate treatment because high potassium ion (K^+) in the blood (Hyperkalemia) can cause kidney disease and some effects such as nausea, weakness, numbness and slow pulse. From the results, group 2 (Aspartame induced with no treatment given) which are the negative control shows higher levels of potassium ion (K^+) in the blood, severe hyperkalemia is a life threatening condition and it's advised to avoid or limit food of high potassium ion (K^+) levels to avoid risk of hyperkalemia and also in group 5 (Aspartame induced, treated with 200 mg *Senna tora* extract) a slight increase is seen in the level of potassium ion (K^+) compared to normal control this shows that if probably *Senna tora leaves* are consumed for longer period there might be a tendency of the leave reducing the levels of potassium ion (K^+) to a much more normal level.

The findings from this study depict that oral administration of n-hexane fraction of *Senna tora* leaves lead to significant improvement in the levels of blood lipid profile. This is an indication that if the leaves of *Senna tora* is consumed for longer period of time, there might be a tendency of reducing risk of hyperlipidemia. This research work showed that the leaves of *Senna tora* possesses some degree of hypolipidemic activity and improvement in kidney functions profile may be useful in the management of cardiovascular diseases and kidney functions.

Author Contributions

Ojochenemi Ejeh Yakubu: Investigation, formal analysis, writing—original draft. Celestina Chidinma Okoye: Validation, methodology, writing—reviewing. Onuh Gabriel Emmanuel:—Formal analysis, writing—review and editing. Caleb Enejoh Omede: Investigation, writing—reviewing. Janya Danjuma: Resources, investigation writing—reviewing.

Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethical Approval Not applicable.

Consent to Participate Not applicable.

Consent to Publish Not applicable.

Conflict of Interest The authors declare no competing interests.

References

Abat J K, Kumar S, & Mohanty A. Ethnomedicinal, Phytochemical and Ethnopharmacological Aspects of Four Medicinal Plants of Malvaceae Used in Indian Traditional Medicines: A Review.

Medicines, 2017, 4(6), 1-33. https://doi.org/10.3390/medicines4040075

Alao F O, & Chukwujioke E A. Antibiotics sensitivity and resistance patterns of uropathogens to quinolones in patients with urinary tract infections in a Nigerian community. *Pacific Journal of Science Technology,* 2013, 14(9), 24-333. Corpus ID: 30791784

Atanasov A G, Waltenberger B, Pferschy-Wenzig E, Linderd T, & Wawrosch C. Discovery and Resupply of Pharmacologically Active Plant Derived Natural Products: A Review. *Advanced Biotechnology,* 2015, 33(16), 1582-1614. https://doi.org/10.1016/j.biotechadv.2015.08.001

Betteridget T, De-Wei Z, Rita G, Wan-Jin T, Jonathan C C, & Helen H H. Structural requirements for PCSK9-mediated degradation of the low-density lipoprotein receptor. *Proceedings of National Academy of Sciences*, 2008, 105(35), 13045-50. https://doi.org/10.1073/pnas.0806312105

Bhandirge S K, Patel V, Patidar A, Pasi A, & Sharma V. An overview on phytochemical and pharmacological profile of *Senna tora* Linn. *International Journal of Herbal Medicine,* 2016, 4(2), 50-55. ISSN: 2394-0514

Brown S B, & Goldstein J L. Drugs used in the treatment of hyperlipoproteinaemias. In: Galman AG, Rall T W, Nies A S, Taylor P. (eds) Goodman & Gilman's. The Pharmacological Basis of Therapeutics, 1992. 8th edition. New York, NY:McGraw-Hill, 874-894.

Chandrasekar R, & Sivagami B. Alternative treatment for psoriasis - A Review. *International Journal of Response Devel in Pharmacology Life Science,* 2016, 5(6), 2188-2197. ISSN (E): 2278-0238

Cragg G M, & Newman D J. Natural Products: A Continuing Source of Novel Drug Leads. *Biochimica et Biophysica sinica Acta,* 2013, 1830(3670), 3670-3695. https://doi.org/10.1016/j.bbagen.2013.02.008

Das C, Dash S, Sahoo D C, Mohanty A, & Rout D. *Senna tora*- A Phyto pharmacological overview. *International journal of research in Ayurveda and Pharmacy*, 2011 2(4), 1162-1174. http://dx.doi.org/10.3923/jpt.2007.386.390

David W I, William E M, & Jeff M S. Urea and ammonia metabolism and the control renal nitrogen excretion. *Clinical Journal of the American Society of Nephrology,* 2014, 10(8), 1444-1458. https://doi.org/10.2215/cjn.10311013

Ezekwesili C N, Obidoa O, & Nwodo O F C. An effect of ethanol Extract of *Acalypha tora* leaves on the Lipid profile and serum Electrolytes of Rabbit. *Nigerian Journal of Biochemistry and Molecular Biology,* 2008, 23(1), 15-19.

Falodun A. Herbal medicine in Africa-distribution, standardization and prospects. *Resource Journal of Phytochemistry,* 2010, 4(7), 154-161. https://doi.org/10.3923/rjphyto.2010.154.161.

Hosseinzadeh S, Jafarikukhdan A, Hosseini A, & Armand R. The application of medicinal plants in traditional and modern medicine: A Review of Thymus vulgaris. *International Journal of Clinical Medicine,* 2015, 6(7), 635-642. http://dx.doi.org/10.4236/ijcm.2015.69084.

Imo C, & Uhegbu O. Renal Protective Effect of Ethanolic Leaf Extract of *Gongronema latifolium* Benth in Acetaminophen induced Renal Toxicity in Male Albino Rats, *American Chemical Science Journal*, 2015, 8(3), 4-5. https://doi.org/10.9734/ACSJ/2015/18881.

Ingle A, Ranaware P, Ladke A, & Damle M. *Senna tora*: phytochemical and pharmacological activity. *International Imperial Journal of Pharmacognosy Nation Product*, 2012, 2(1), 14-23.

Mafimisebi T E, & Oguntade A E. Preparation and use of plant medicines for farmers health in Southwest Nigeria: sociocultural, magico-religious and economic aspects. *Journal of Ethnobiology and Ethnomedicine,* 2010, 6(10), 1-9. https://doi.org/10.1186/1746-4269-6-1.

Malan D F, Neuba D F R, & Kouakou K L. Medicinal plants and traditional healing practices in Ehotile people, around the aby lagoon (eastern littoral of Cote d'Ivoire). *Journal of Ethnobiology and Ethnomedicinal,* 2015, 11(7), 1-18. https://doi.org/10.1186/s13002-015-0004-8.

Meena A K, Niranjan U S, Yadav A K, Singh B, & Nagariya A K. *Cassia tora* Linn: A review on its ethnobotany, phytochemical and pharmacological profile. *Journal of Pharmacological Research*, 2010, 3(5), 557-560. ISSN: 0974-6943

Ncube N, Afolayan S A J, & Okoh, A I. Assessment techniques of antimicrobial properties of natural compounds of plant origin: current methods and future trends. *Afri. J. for Biotechnol,* 2008, **7**(12), 1797-1806. https://doi.org/10.5897/AJB07.613

Nwanjo, H. U. (2005). Efficacy of aqueous leaf extract of Vernonia amygdalina plasma lipoprotein and

oxidative status in diabetic rat models. *Nigerian Journal of Physiological Science,* 20, 39-42. PMID: 17220925.

Palmer B F. Regulation of potassium homeostasis. *Clinical Journal of the American Society of Nephrology*, 2014, 10(6), 1050-1060. https://doi.org/10.2215/CJN.08580813

Pawar H A, & Lalitha K G. Extraction, characterization, and molecular weight determination of *Senna tora* (L.) seed polysaccharide. *International Journal of Biomatology*, 2015, 15(13), 1-7. https://doi.org/10.1155/2015/928679

Randrianarivony T N, Ramarosandratana A V, Andriamihajarivo T H, Rakotoarivony F, & Jeannoda V H. The most used medicinal plants by communities in Mahaboboka, Amboronabo, Mikoboka, South-Western Madagascar. *Journal of Ethnobiology and Ethnomedicinal,* 2017, 13(5), 1-12. https://doi.org/10.1186/s13002-017-0147-x

Roopashree T S, & Dang R. Standardization and phytochemical investigation of *Calendula officinalis*, Cassiatora and *Momordica acharantia* seed extract. *Journal Pharm*acology *Response,* 2017, 16(10), 80-85. https://dx.doi.org/10.18579/jpcrkc/2017/16/1/112481.

Shukla S K, Kumar A, Terrence M, Yusuf J, & Singh, V P. The Probable Medicinal Usage of *Senna tora*: An Overview. *Journal of Biological Science*, 2013, 13(12), 13-17 https://doi.org/10.3844/ojbsci.2013.13.17

Ugwu O, Nwodo P C, Okwesili F C, Joshua P E, Odo C E, & Ossai E C. Effect of ethanolic extract of *Moringa oleifera* on lipid profile of mice. *Research Journal of Pharmaceutical Biological Chemical Science,* 2013, 4(1), 1324-32. ISSN: 0975-8585.

Vasudevan D, Sreekumar S, & Kanan V. Biochemistry for medical students. Jaypee Brothers Medical Publisher Limited 2011, (6th Edition). New Delhi, India.

Yakubu O E, Nwodo O F C, Joshua P E, Ugwu M N, Odu A D, & Okwo F. Fractionation and determination of total antioxidant capacity, total phenolics and total flavonoids contents of aqueous, ethanol and n-hexane extract of *Vitex doniana* leaves. *African Journal of Biotechnology*, 2014, 13, 693- 698. https://doi.org/10.5897/AJB2013.13225

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