Sub-Acute Toxicity Evaluation of Aqueous Stem Bark Extract of Sarcocephalus Latifolius

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Abstract

Aqueous extract of the stem bark of Sarcocephalus latifolius was administered to wistar albino rats to assess sub-acute toxicity. Twenty-four wistar albino rats were divided into four groups of six animals per group. Three groups were administered increasing doses of the extract 125, 250 and 500 mg/body weight whereas the fourth group was used as normal control. The duration of the experiment was two weeks. This study revealed that the aqueous extract of stem bark extract of Sarcocephalus latifolius affected the biochemical parameters at the test doses of 125, 250 and 500 mg/body weight. The biochemical parameters studied showed some consistent changes. There was an elevation in ALT, ALP, AST, Total Bilirubin, Direct Bilirubin, Urea, Creatinine, Bicarbonate, Chloride, Potassium, Cholesterol and Triglyceride levels in the treated groups when compared to the control groups. There were statistically significant difference (p<0.05) observed when these biochemical parameters in the treated groups were compared with the normal control. This increase in biochemical parameters was higher as the doses of the aqueous extract of the stem bark of Sarcocephalus latifolius increased. On the other hand, there was a decrease in the concentrations of Protein, Albumin, Sodium and HDL-Cholesterol in the treated groups when compared to the Control group. This decrease was observed to be statistically significant (p<0.05) when these biochemical parameters in the treated groups were compared with the normal control. There was no statistically significant difference (p>0.05) observed in the hematological parameters of the test animals compared to the control. The histopathology results of the sub-acute toxicity of the aqueous extract of the stem bark of Sarcocephalus latifolius concurs with the results of the biochemical parameters. From the result, there were no severe pathological changes in the cell architecture of the liver, kidney and heart of the extract treated animals. These results indicate that the extract may be toxic at higher doses and short term exposure.

Keywords

Sarcocephalus latifolius; Aqueous Extract; Albino Rats; Sub-Acute Toxicity

Introduction

Sarcocephalus is a genus of flowering plants in the Rubiaceae family. It consists of two species of shrubs or trees native to tropical Africa [1-3]. Sarcocephalus latifolius has edible fruits known as African peach. The African Peach is known by different names by the natives in the areas where it grows, in Igbo (Nigeria), it is known as Ubuluinu, its French name is Liane a fraises and Trade name Opepe [4] Sarcocephalus latifolius is reported to
have a wide range of medicinal properties some common traditional uses which have been mentioned in different literatures include fever, diarrhea, dysentery, pain, malaria, hypertension, mouth odor, tooth decay and diseases of the central nervous system such as epilepsy [5-7]. *Sarcocephalus latifolius* is a multi-stemmed tree or shrub up to 12 m. It has an open canopy flowers with terminal spherical head-like cymes of small whitish flowers. In Nauclea, the flowers are joined by their calyces [4].

The fruit is a syncarp. The tribe Naucleae to which *Sarcocephalus latifolius* belongs shows similarities to the family Combretaceae. Some authors have separated the tribe into a new family Naucleceae [4].

In Nigeria, the plant is widely distributed in the South-east and South-south regions of the country. *Sarcocephalus latifolius* is reported to have a wide range of medicinal properties and its medicinal uses vary from one traditional setting to another; some common traditional uses which have been mentioned in different literatures include treatment of fever, pain, dental caries, septic mouth, malaria, hypertension, dysentery, diarrhea and diseases of the central nervous system such as epilepsy [5-7]. Anticonvulsant, anxiolytic and sedative properties of *Sarcocephalus latifolius* roots decoction had also been reported [6].

Due to limited availability and/or affordability of pharmaceutical medicines in many tropical countries, the majority of the populations depend on traditional medical remedies mainly from plants [8, 9]. Since, alteration in the chemical composition of a natural composition, due to contact with hazardous substances like heavy metals, toxins, pesticides, and effluents from industries usually affect the behaviors, biochemistry, and physiology of the body system and the vital organ, it therefore becomes very important to continue to scientifically subject plants to various analyses to establish its usefulness, expose any possible dangers in form of toxicities and to exploit its obvious potentials as a source of chemical leads for development of modern useful and essential drugs [10, 11]. Therefore, this study is aimed at evaluating the sub-acute toxicity of aqueous stem bark extract of *Sarcocephalus latifolius*.

**Materials and Methods**

**Identification and Collection of Samples:**

**Plant Identification**

Different parts of the plant were collected from Amaiyi Obohia in Ahiazu Mbaise Local Government area of Imo State. The plant was identified as *Sarcocephalus latifolius* by Mr. K.I. Ndukwe of the Department of Forestry and Environmental Management, Michael Okpara University of Nigeria. The Voucher number of the plant is 3343.

**Plant Extraction Process**

The plant’s stem bark was harvested in large quantities on the April, 2014, and washed thoroughly in tap water. The stem bark was cut into pieces (about 3cm) and dried under shade at room temperature for about seven weeks before grounding it into a powdered form using mortar and pestle. Using a soxhlet extractor, 30 g of the sample was extracted separately in deionised water for 6 hours each until a reasonable amount of extract was gotten. The aqueous filtrate (infusions) was concentrated using water bath at 45°C. The semi-solid extract was stored at -4°C in the refrigerator until required. However, the percentage yield of the extract was determined.

**Experimental Animals**

30 male Swiss Albino Rats were purchased from the Department of Veterinary Medicine, University of Nigeria Nsukka (UNN) and transported to Federal University of Technology Owerri (FUTO); where the research was carried out. The Rats were acclimatized for 2 weeks, after which they were grouped into four according to their body weights, for drug administration.

**Administration of Extracts**

Twenty-four wistar albino rats were divided into four groups of six animals per group according to their body weights. The extract was dissolved in normal saline according to the specified doses and the experimental groups were administered increasing doses of 125, 250 and 500 mg/kg body weight respectively of the extract, daily for 14 days. The animals in the Control group did not receive any extract but were administered only normal saline. The extract administration was performed intraperitoneally once daily for two weeks and observed for another two weeks before the termination of the experiment.

At the end of the experiment, all the animals were sacrificed according to their groups. The blood was drained by cardiac puncture with sterile syringes and needles. It was then emptied into different labeled test tubes by means of sterile syringes and needles. The blood was allowed to clot and sera gotten from them were used to assay for the biochemical parameters. Another set of blood
were collected in EDTA (Ethylendiaminetetraacetic acid) bottles for the determination of the hematological parameters.

**Biochemical Parameters**

Assays were carried out to estimate the liver, kidney and heart functions using practical biochemical markers. The sera samples collected from the clotted whole blood were analyzed for alkaline phosphatase activity (ALP) [12], serum aspartate amino transferase activity (AST) [13], serum alanine amino transferase activity (ALT) [13], bilirubin concentration [14], albumin concentration [15]. Protein estimation in serum was carried out using the Biuret Method [16]. Other biochemical parameters analyzed were: cholesterol concentration [17], triglyceride concentration [18], high density lipoprotein concentration (HDL) [19], serum urea concentration [20], potassium concentration [21], chloride concentration [22], bicarbonate concentration [23] and sodium concentration [24], employing standard kits (Biosystems S.A., Iso 13485-TUV Rheinland-Reg: SX 60010383 0001).

**Hematological Parameters**

Hematological screening was carried out on the whole blood of all the rats in each group using anticoagulated blood preserved with an EDTA bottle. The full blood counts of the whole blood of the rats were done according to standard methods [25].

**Histological Studies of the Animals’ Organs**

Histological study was carried out on the organs of two rats from each group. The animal’s Liver, Kidney and Heart tissues were studied. This was carried out to crosscheck the results that were obtained from the biochemical assays [26].

**Statistical Analysis**

The statistical analyses of the data obtained from this research work were analyzed using the statistical package for social sciences (SPSS) version 20.0 for MS Windows. Analyses of Variance (One way ANOVA) were used to compare means, Student “T” was used to test for significance, values were considered significant at (p < 0.05).

**Results**

**Sub-Acute Toxicity Evaluation of Aqueous Stem Bark Extract of Sarcocephalus latifolius**

The aqueous extract of the stem bark of *Sarcocephalus latifolius* when administered to the rats induced signs of toxicity in the treated groups. The signs of toxicity were recorded to increase as the extract dose given increased. There were no deaths recorded during the sub-acute toxicity evaluation, but the weights of the rats in the treatment group dropped significantly (p <0.05) when compared with the weight of the control group during the 14 days administration period of the extracts as illustrated by in Table1. There was also a reduction in food and water consumption as the doses of the extracts administered increases, leading to weakness, paleness and sluggishness by the animals in the treatment groups.

The percentage increase in body weights of the rats were found to be highest in the Control group (36.7%), followed by the Groups treated with 125mg/kg body weight (17.62%), 250mg/kg (6.98%), 500mg/kg (5.90%) as shown in Figure 1 below.

**Figure 1:** Percentage change in body weight of the rats used for the sub acute toxicity evaluation

Bars represent Mean of Six (n=6) Determinations

The biochemical parameters studied showed some consistent changes. There was an elevation in ALP, ALT, AST, Total Bilirubin, Direct Bilirubin, Urea, Creatinine, Bicarbonate, Chloride, Potassium, Cholesterol and Triglyceride levels in the treated groups when compared to the control groups. There were statistically significant difference (p<0.05) observed when these biochemical parameters in the treated groups were compared with the normal control. This increase in biochemical parameters was higher as the doses of the aqueous extract of the stem bark of *Sarcocephalus latifolius* increased (Figures 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16). On the other hand there was a decrease in the concentrations of Protein,
Albumin, Sodium and HDL-Cholesterol in the treated groups when compared to the Control group. This decrease was observed to be statistically significant ($p<0.05$) when these biochemical parameters in the treated groups were compared with the normal control.

**Figure 2:** Alkaline Phosphatase Levels in Rats treated with different Doses of Aqueous Stem Bark Extract of *Sarcocephalus latifolius*

![ALP Activity](image)

Bars represent Mean ± Standard Deviation of six ($n=6$) Determinations and Bars with different Letters are statistically Significant ($p<0.05$)

**Figure 3:** Alanine Amino Transferase Levels in Rats Treated with different Doses of Aqueous Stem Bark Extract of *Sarcocephalus latifolius*

![ALT Activity](image)

Bars represent Mean ± Standard Deviation of six ($n=6$) Determinations and Bars with different Letters are Statistically Significant ($p<0.05$)

**Figure 4:** Aspartate Amino Transferase Levels in Rats Treated with Different Doses of Aqueous Stem bark Extract of *Sarcocephalus latifolius*

![AST Activity](image)

Bars represent Mean ± Standard Deviation of six ($n=6$) Determinations and Bars with different Letters are Statistically Significant ($p<0.05$)

**Figure 5:** Total Bilirubin Levels in Rats Treated with Different Doses of Aqueous Stem bark Extract of *Sarcocephalus latifolius*

![Total Bilirubin Conc.](image)

Bars represent Mean ± Standard Deviation of six ($n=6$) Determinations and Bars with different Letters are Statistically Significant ($p<0.05$)
Figure 6: Direct Bilirubin Levels in Rats Treated With Different Doses of Aqueous Stem bark Extract of *Sarcocephalus latifolius*

Bars represent Mean ± Standard Deviation of Six (n=6) Determinations and Bars with Different Letters are Statistically Significant (p<0.05)

Figure 7: Protein Levels in Rats Treated With Different Doses of Aqueous Stem bark Extract of *Sarcocephalus latifolius*

Bars represent Mean ± Standard Deviation of Six (n=6) Determinations and Bars with Different Letters are Statistically Significant (p<0.05)

Figure 8: Albumin Levels in Rats Treated With Different Doses of Aqueous Stem bark Extract of *Sarcocephalus latifolius*

Bars represent Mean ± Standard Deviation of Six (n=6) Determinations and Bars with Different Letters are Statistically Significant (p<0.05)

Figure 9: Urea Levels in Rats Treated With Different Doses of Aqueous Stem bark Extract of *Sarcocephalus latifolius*

Bars represent Mean ± Standard Deviation of Six (n=6) Determinations and Bars with Different Letters are Statistically Significant (p<0.05)

Figure 10: Creatinine Levels in Rats Treated With Different Doses of Aqueous Stem bark Extract of *Sarcocephalus latifolius*

Bars represent Mean ± Standard Deviation of Six (n=6) Determinations and Bars with Different Letters are Statistically Significant (p<0.05)

Figure 11: Bicarbonate Levels in Rats Treated With Different Doses of Aqueous Stem bark Extract of *Sarcocephalus latifolius*

Bars represent Mean ± Standard Deviation of Six (n=6) Determinations and Bars with Different Letters are Statistically Significant (p<0.05)
Figure 12: Sodium Levels in Rats Treated With Different Doses of Aqueous Stem bark Extract of *Sarcocephalus latifolius*

Bars represent Mean ± Standard Deviation of Six (n=6) Determinations and Bars with Different Letters are Statistically Significant (p<0.05)

Figure 13: Chloride Ion Levels in Rats Treated With Different Doses of Aqueous Stem bark Extract of *Sarcocephalus latifolius*

Bars represent Mean ± Standard Deviation of Six (n=6) Determinations and Bars with Different Letters are Statistically Significant (p<0.05)

Figure 14: Potassium Levels in Rats Treated with Different Doses of Aqueous Stem bark Extract of *Sarcocephalus latifolius*

Bars represent Mean ± Standard Deviation of Six (n=6) Determinations and Bars with Different Letters are Statistically Significant (p<0.05)

Figure 15: Cholesterol Levels in Rats Treated With Different Doses of Aqueous Stem bark Extract of *Sarcocephalus latifolius*

Bars represent Mean ± Standard Deviation of Six (n=6) Determinations and Bars with Different Letters are Statistically Significant (p<0.05)

Figure 16: Triglyceride Levels in Rats Treated With Different Doses of Aqueous Stem bark Extract of *Sarcocephalus latifolius*

Bars represent Mean ± Standard Deviation of Six (n=6) Determinations and Bars with Different Letters are Statistically Significant (p<0.05)

Figure 17: The Effect of the Extract on HDL-Cholesterol of Animals Used For the Sub Acute Toxicity Study

Bars represent Mean ± Standard Deviation of Six (n=6) Determinations and Bars with Different Letters are Statistically Significant (p<0.05)
Weights of Animals Used in the Sub Acute Studies (Table 1)

Table 1: Mean Body Weight Change of the Experimental Animals (Rats)

<table>
<thead>
<tr>
<th>Group</th>
<th>No. of Mice</th>
<th>Drug Dose (mg/kg)</th>
<th>Initial weight of Rat in Day 0 (g)</th>
<th>Final weight of Rat in Day 28 (g)</th>
<th>Mean Change In Body Weight Of Rat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>6</td>
<td>-</td>
<td>89.80±2.16</td>
<td>122.28±12.36</td>
<td>32.48</td>
</tr>
<tr>
<td>Group A</td>
<td>6</td>
<td>500</td>
<td>126.07±2.93</td>
<td>133.51±8.39</td>
<td>7.44</td>
</tr>
<tr>
<td>Group B</td>
<td>6</td>
<td>250</td>
<td>135.33±3.15</td>
<td>144.78±13.98</td>
<td>9.45</td>
</tr>
<tr>
<td>Group C</td>
<td>6</td>
<td>125</td>
<td>115.24±2.68</td>
<td>135.54±10.00</td>
<td>20.30</td>
</tr>
</tbody>
</table>

Values of three (n=6) determinations are presented as mean ± standard deviation.

4.5.2. Hematological Parameters

The hematological tests carried out on the rats administered different sub-acute doses of the aqueous stem bark extract of *Sarcocephalus latifolius* showed no statistically significant difference (p<0.05) with the normal control. The only slight difference recorded was in the White Blood Cell of 500mg/kg and 250mg/kg, the Hemoglobin of 500mg/kg and the Platelet Counts of 250mg/kg animal treated groups as shown in Table 2(a), Table 2(b).

Table 2(a): Hematology Test Results of Animals used for the Sub Acute Toxicity Studies

<table>
<thead>
<tr>
<th>RAT TEST GROUP</th>
<th>White Blood Cell</th>
<th>Neutrophils</th>
<th>Lymphocytes</th>
<th>Eosinophils</th>
<th>Monocytes</th>
<th>Basophils</th>
<th>Hemoglobin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>2.33±0.80a</td>
<td>13.67±7.26a</td>
<td>81.50±7.69a</td>
<td>1.50±0.84a</td>
<td>3.33±0.82a</td>
<td>0.00±0.00a</td>
<td>11.23±0.98ab</td>
</tr>
<tr>
<td>500mg/kg</td>
<td>4.35±2.00a</td>
<td>14.00±7.04a</td>
<td>81.00±9.23a</td>
<td>0.83±1.60a</td>
<td>4.17±2.04a</td>
<td>0.00±0.00a</td>
<td>10.45±0.96c</td>
</tr>
<tr>
<td>250mg/kg</td>
<td>3.27±1.69a</td>
<td>11.33±4.18a</td>
<td>84.00±4.29a</td>
<td>0.67±1.21a</td>
<td>4.00±1.10a</td>
<td>0.00±0.00a</td>
<td>9.55±1.05a</td>
</tr>
<tr>
<td>125mg/kg</td>
<td>4.55±2.45a</td>
<td>12.00±4.73a</td>
<td>81.83±5.19a</td>
<td>2.33±2.07a</td>
<td>4.17±1.17a</td>
<td>0.00±0.00a</td>
<td>9.18±1.59a</td>
</tr>
</tbody>
</table>

Values of three (n=6) determinations are presented as mean ± standard deviation. Column with different superscripts are statistically significant (p<0.05)

Table 2(b): Hematology Test Results of Animals used for the Sub Acute Toxicity Studies

<table>
<thead>
<tr>
<th>RAT TEST GROUP</th>
<th>Packed Cell Volume</th>
<th>Red Blood Count</th>
<th>Mean Corpuscular Volume</th>
<th>Mean Corpuscular Hemoglobin Concentration</th>
<th>Platelet</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>35.15±3.30a</td>
<td>5.56±0.55a</td>
<td>63.10±1.85a</td>
<td>20.17±0.44a</td>
<td>187,500.00±47,137.03a</td>
</tr>
<tr>
<td>500mg/kg</td>
<td>32.67±2.66ab</td>
<td>5.21±0.40a</td>
<td>62.33±1.86a</td>
<td>19.98±0.97a</td>
<td>313,166.67±142,467.42b</td>
</tr>
<tr>
<td>250mg/kg</td>
<td>29.83±2.71ab</td>
<td>4.85±0.37a</td>
<td>61.47±2.63a</td>
<td>19.65±1.47a</td>
<td>301,333.33±145,453.31b</td>
</tr>
<tr>
<td>125mg/kg</td>
<td>28.00±7.46a</td>
<td>4.53±1.46a</td>
<td>63.72±8.72a</td>
<td>22.57±9.37a</td>
<td>369,000.00±56,181.85ab</td>
</tr>
</tbody>
</table>

Values of three (n=6) determinations are presented as mean ± standard deviation. Column with different superscripts are statistically significant (p<0.05)
Histopathological Studies of Organs

Macro and microscopic examinations of the liver showed normal central vein (CV) with multicystic spaces (MS) within the stroma (S). Some of the hepatocytes (H) appeared slightly enlarged with cytoplasmic halo (CH) in the 500mg/kg treatment group. The sinusoidal spaces (SS) seemed distorted by cystic spaces. The arrangement of the laminae (L) (plate) of hepatic cells seemed distorted. In the groups administered 250mg/kg and 125mg/kg body weight of the extract, the histologic sections of the liver showed completely distorted stromal tissue and enlarged central vein in the group administered 500mg/kg body weight. There were several cystic spaces within the stroma and this makes it difficult to recognize the sinusoids. The laminae is distorted and the hepatocytes seem pyknotic and scattered within the stroma (Plates 2, 3, 4, 5). Whereas the Control group showed no pathological changes (Plate 1).

Plate 1: Histopathology of Liver of Rats in the Control Group Showing no Distortion (x400), Stain: H and E

Plate 2: Histopathology of Liver of Rats Administered 500mg/kg body Weight of Aqueous Stem Bark Extract of Sarcocephalus latifolius (x400), Stain: H and E

Plate 3: Histopathology of Liver of Rats Administered 250mg/kg body Weight of Aqueous Stem Bark Extract of Sarcocephalus latifolius (x400), Stain: H and E

Plate 4: Histopathology of Liver of Rats Administered 125mg/kg body Weight of Aqueous Stem Bark Extract of Sarcocephalus latifolius (x400), Stain: H and E

Plate 5: Histopathology of Kidney of Rats in the Control Group Showing no Pathological change (x400) Stain: H and E
The Histologic sections of the Kidney shows enlarged tubules (T). The glomerulus (G) was slightly shrunken, thus increasing the bowman’s capsular space (BCS) and the entire tissue stroma appeared edematous and pale, in the group administered 500mg/kg, 250mg/kg and 125mg/kg body weight of the aqueous extract of the stem bark of *Sarcocephalus latifolius* (Plates 6, 7, 8). Whereas the Control group showed no pathological changes (Plate 7).

**Plate 6:** Histopathology of Kidney of Rats Administered 500mg/kg body Weight of Aqueous Stem Bark Extract of *Sarcocephalus latifolius* (x400), Stain: H and E

![Plate 6](image1)

T = Enlarged Tubules, G = Slightly Shrunken Glomerulus, BCS = Increased Bowman’s Capsular Space

**Plate 7:** Histopathology of Kidney of Rats Administered 250mg/kg body Weight of Aqueous Stem Bark Extract of *Sarcocephalus latifolius* (x400), Stain: H and E

![Plate 7](image2)

T = Enlarged Tubules, G = Slightly Shrunken Glomerulus, BCS = Increased Bowman’s Capsular Space

**Plate 8:** Histopathology of Kidney of Rats Administered 125mg/kg body Weight of Aqueous Stem Bark Extract of *Sarcocephalus latifolius* (x400), Stain: H and E

![Plate 8](image3)

T = Enlarged Tubules, G = Slightly Shrunken Glomerulus, BCS = Increased Bowman’s Capsular Space

Histologic Sections of the heart shows normal tissue architecture in all the treated groups and the Control group, therefore, no pathological changes were seen (Plates 9, 10, 11, 12).

**Plate 9:** Histopathology of Heart of Rats in the Control Group Showing no Lesion (x400), Stain: H and E

![Plate 9](image4)

**Plate 10:** Histopathology of Heart of Rats Administered 500mg/kg Body Weight of Aqueous Stem Bark Extract of *Sarcocephalus latifolius* Showing no Lesion (x400), Stain: H and E

![Plate 10](image5)
The results of the histopathological analyses of the organs concur with the results of the biochemical parameters.

Discussion
Studies have shown that biochemical, hematological and histological parameters are commonly affected by drugs and medicinal plant extracts, causing various physiological abnormalities. For example, some herbal extracts are known to increase serum liver enzymes [27, 28]. In the current study, the sub-acute toxicity of the plant has also shown a similar trend in the test results. It has been suggested that elevated levels of diagnostic enzymes in plasma may be a consequence of increase in the rate at which enzymes are synthesized involving induction of appropriate liver enzymes by certain drugs among other factors [27, 28].

AST is raised in acute liver damage, but is also present in red blood cells, and cardiac and skeletal muscle, so is not specific to the liver. The ratio of AST to ALT is mostly useful in differentiating between causes of liver damage [29]. Alanine Transaminases, ALT elevations instead of ALP elevations favor liver cell necrosis as a mechanism over cholestasis. AST/ALT levels elevated minorly may be due to rhabdomyolysis, among many possibilities [29]. Alkaline phosphatase (ALP) is an enzyme in the cells lining the biliary ducts of the liver. ALP levels in plasma rise with large bile duct obstruction, intrahepatic cholestasis, or infiltrative diseases of the liver. The total protein may be affected by factors such as age and gender.

The elevation of creatinine, bicarbonate, chloride and urea levels in the treated animal groups might be due to kidney impairment resulting from the administration of the extract. Creatinine is measured primarily to assess kidney function and has certain advantages over the measurement of urea. The plasma level of creatinine is relatively independent of protein ingestion, water intake, rate of urine production and exercise. Since its rate of production is constant, elevation of plasma creatinine is indicative of under-excretion, suggesting kidney impairment. Depressed levels of plasma creatinine are rare and not clinically significant [30, 31].

The balance of sodium, potassium, chloride and bicarbonate in the blood is a good indicator of how well the kidneys and heart are functioning. Knowing which electrolytes are out of balance can help your doctor determine a course of treatment [30, 31]. Low sodium levels are caused by kidney disease and adrenal disease, diuretics, diarrhea, and occasionally conditions that cause fluid buildup in the body. The most common cause of high sodium is dehydration [30]. Potassium concentrations that are too high can be due to kidney disease or drugs that can decrease potassium excretion from the body. Low potassium can be a consequence of using certain diuretics or of dehydration [30].

Low chloride levels can occur with chronic lung disease, prolonged vomiting, and with loss of acid from the body, called metabolic alkalosis. High chloride levels may result from dehydration, but can also occur with other problems that cause high blood sodium, such as kidney disease. Bicarbonate levels that are higher or lower than...
normal may signify an acid/base or electrolyte imbalance, often due to dehydration or drinking too much water. According to the lipid hypothesis, since cholesterol (like all fat molecules) is transported around the body (in the water outside cells) inside lipoprotein particles, elevated cholesterol concentrations (hypercholesterolemia)-potentially offers a lower cost way to detect elevated concentrations of LDL particles; possibly even low concentrations of functional HDL particles- both variations strongly associated with cardiovascular disease because LDL particles promote atheroma development in arteries (atherosclerosis)[32].

The insignificant elevation of cholesterol and triglyceride level in the treated animals indicates that the heart was not impaired by the administration of their extract. Abnormally low levels of cholesterol are termed hypocholesterolemia. Research into the causes of this state is relatively limited, but some studies suggest a link with depression, cancer, and cerebral hemorrhage. In general, the low cholesterol levels seem to be a consequence, rather than a cause, of an underlying illness[33].

In the human body, high levels of triglycerides in the bloodstream have been linked to atherosclerosis and, by extension, the risk of heart disease and stroke[32].

Increasing concentrations 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. HDL particles are sometimes referred to as “good cholesterol” because they can transport fat molecules out of artery walls, reduce macrophage accumulation, and thus help prevent or even regress atherosclerosis. However, studies have shown that HDL-lacking mice still have the ability to transport cholesterol to bile, suggesting that there are alternative mechanisms for cholesterol removal[34].

The hematological tests carried out on the rats administered different sub-acute doses of the aqueous stem bark extract of Sarcocephalus latifolius showed no statistically significant difference (p<0.05). The only slight difference recorded was in the WBC of 500mg/kg and 250mg/kg, the Hemoglobin of 500mg/kg and the Platelet Count of 250mg/kg. Also there was no statistically significant change in the hematological parameters of the test animals. Complete blood counts are done to monitor overall health, to screen for some diseases, to confirm a diagnosis of some medical conditions, to monitor a medical condition, and to monitor changes in the body caused by medical treatments[35].

This study revealed that higher doses of the test plant aqueous extract of stem bark extract of Sarcocephalus latifolius exerted changes in the histological parameters as shown in the micro graphs. The liver, kidney and heart of the test groups showed histological changes in varying degrees. But these changes were not permanent or irreversible adverse effect in to the organs therefore it will be in line to infer that these parameters after administration of extracts caused no damage to the liver, kidney and heart[35]. Since there was no permanent damage to the organs by the administration of this plant extract to the test animals, it is necessary to note that the distortions and pathological changes seen were as a result of the introduction of xenobiotics to the system and will be easily reversed and the organs architecture get clearer if the administration of the extracts is discontinued[36].

The histopathology results of gotten from the sub-acute toxicity of the aqueous extract of the stem bark of Sarcocephalus latifolius concurs with the results of the biochemical parameters. Alteration in the chemical composition of a natural composition, due to contact with hazardous substances like heavy metals, toxins, pesticides, and effluents from industries usually affect the behaviors, biochemistry, and physiology of the body system and the vital organ[10]. This changes may be seen is the histopathology studies of the liver and kidney. It becomes very imperative to continue to scientifically subject plants to various analyses to establish its usefulness, expose any possible dangers in form of toxicities and to exploit its obvious potentials as a source of chemical leads for development of modern useful and essential drugs[11].

In a similar study by Ene[37], the acute toxicity study of chloroform extract of Artemisia macivera Linn produced clinical signs of toxicity at higher doses of the extract. There were lesions observed in the liver and kidney of the test animals when high doses of this extract were administered.

**Conclusion**

It can be deduced that the aqueous extract of the stem bark of Sarcocephalus latifolius is relatively safe if the proper lower doses are administered because of its direct proportionality with the effect on the liver and kidney with regards to the parameters investigated in this study. In addition, while medicinal plants continue to gain acceptance as alternative medicines for quick and accessible healthcare delivery, it is necessary to intensify
efforts in screening such medicinal plants to unmask any side effects and possible potential for toxicity, apart from their efficacies in the control of some of these health challenges. This would be best achieved through scientifically isolating the active components from these plants and incorporating same as ingredients in modern drugs. It is absolutely necessary for these screening to be carried out since plant materials contain numerous secondary metabolites, and many of them bear certain capacities that are yet not well defined or even not yet properly identified. In view of the high acceptence of medicinal plants in health care delivery, efforts should be intensified by researchers to screen available medicinal plants to aid the teaming local users of these products avoid ingesting material that could be injurious to their health.

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Conflict of Interest Statement

We declare that we have no conflict of interest

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