Cyphostemma Glaucophilla: Lipid lowering and micro nutrient booster

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ABSTRACT

Cyphostemma glaucophilla is used in treating malnutrition traditionally in the Igala speaking area of Kogi state of Nigeria. [18] had reported its potential in cardiovascular health and in electrolyte balance. The effects of aqueous leave extract of Cyphostemma glaucophilla on lipid profile and plasma electrolytes were evaluated in albino rats. The lipid profile was determined using standard kits obtained from Randox and electrolytes were analyzed using a flame photometer. Significant (p<0.05) lipid lowering effect of the extract was maximized at 2.0mg/lkg body weight. The percentage decrease in total cholesterol, triacylglycerol, low density lipoproteins and very low density lipoproteins were 20.83, 65.83, 36.33, 37.63% while the percentage maximum increase in high density lipoprotein was 51.92%. There was also significant (p<0.05) decreases in the concentrations of sodium and chloride ion by 15 and 25% respectively. However, there were significant (p<0.05) increases in the levels of potassium, calcium and zinc by 38.20, 40.50 and 43.20%. Extract had non significant (p>0.05) effect on the concentration of Hydrogen carbonate. Result has established ethno medical claim on extract in managing cardiovascular health and macro nutrient malnutrition.

Keyword: Cyphostemma glaucophilla, Electrolyte, cardiovascular, Micronutrients, Lipoproteins, Artherosclerosis.

INTRODUCTION

The swollen abdomen in kwashiorkor has been attributed to a grossly enlarged liver due to fat deposit [14]. However,[21] recorded that in protein energy malnutrition, the HDL cholesterol of children is markedly very low independent of age and sex, this decrease is more for children with Kwashiorkor than those with marasmus or marasmic-kwashiorkor.
Numerous epidemiological studies have also linked elevated concentrations of total cholesterol in plasma with increased incidence of atherosclerosis and hypertension[8]. Research findings have proved that lowering the plasma lipids could diminish the complications of atherosclerosis and hypertension thereby prolonging life, because deposition of cholesterol in arteries is the underlying cause of most cardiovascular disease [5].

Apart from the fact that essential nutrients such as proteins, fatty acids, minerals and vitamins are deficient in a malnourished state, the infections associated further increases nutrient deficiency. Micronutrient malnutrition is closely related to protein energy malnutrition. Deficiency of micro nutrients such as zinc and Iron are known to adversely affect immunity as a result, malnourished individual are prone to a wide range of disease and infection [9]. Studies carried out by [19] also reported that malnourished children are predisposed to increased incidence of prolonged diarrhoea and vomiting which further leads to deficiency of these micronutrients and corrodes the gastro intestinal tract, preventing absorption of nutrients.

Various electrolyte level can be altered by many disease and disorder in which electrolytes are lost from the body such as vomiting, diarrhea, protein energy malnutrition or are not excreted and accumulated as in renal failure [2].

*Cyphostemma glaucophilla* is a flowering plant which belongs to the family of vitaceae. These species are caudiform and use to belong to the genus Cissus[13]. It has gained wide acceptance in Nigeria especially the Igala speaking areas of Kogi State in the treatment and management of diverse ailments ranging from systemic disease and malnutrition. Result of acute toxicity of the leaf extract recorded by[16] Indicated that extract has no adverse effect at the limit dose of 3000mg/kg body weight orally administration and 1000mg/kg body weight intraperitoneal(ip) administration to rats. The efficacy of *Cyphostemma glaucophilla* in enhancing protein synthesis and minerals has been investigated [18], also the anti inflammatory effect of extract has been examined and confirmed [17]. Since malnutrition is prevalent in developing countries where food, nutrients and supplements are mostly Unavailable and expensive to be afforded by patients, this study was aimed at evaluating the effect of *Cyphostemma glaucophilla* aqueous extract on plasma lipids and its potential in the treatment of micronutrient malnutrition.

**MATERIALS AND METHODS**

**Preparation and extraction of plant materials:** Leaves of *Cyphostemma glaucophilla* were collected from Egah along Idah-Ibaji road, Kogi State, Nigeria. The plant material was Authenticated by Mr. A. Ozioko, a plant taxonomist of Bioresources Development and Conservation Programme (BDCP) center, Nsukka. Nigeria. The leaves were air dried and pulverised into a coarse powder. 180g of the powdered leaves was macerated in five volumes distilled water (w/v) and allowed to stand for 18 hours then filtered. The Whatman No 4 filtrate was evaporated in a water bath and yielded a residue of 20.5% (w/w).

**Animals:** Albino rats (110-130g) of both sexes obtained from the Animal House of the Department of Veterinary Medicine, University of Nigeria Nsukka were used in this study. The animals were housed under standard condition (25± 2°C and 12 hours light/dark cycle). They were fed with standard pellets (Top Feed Nigeria, Ltd) and had access to clean drinking water.

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Experimental design: Five groups A, B, C, D and E of five animals each. Group A served as the control and was administered (0.85% NaCl; 5 ml/kg) normal saline while group B,C,D and E received daily doses of 5.0, 10.0, 15.0 and 20.0mg/kg body weight single oral doses of extract respectively for 14 days. Animals were sacrificed by ether anaesthesia 24 hours after the last administration and their blood samples collected into EDTA bottles were spun at 5000 rpm for 10 minutes in a refrigerated centrifuge. The supernatant plasma was used for the analysis.

Reagent: The reagent kit employed in the assay of cholesterol, Low Density Lipoproteins, Very Low Density Lipoproteins, Triacylglycerols and High Density Lipoproteins were obtained from Randox laboratories ltd, Diamond Road, Crumlin, Co. Antrim United Kingdom.

Determination of Sodium and Potassium: Plasma concentrations of these ions were determined using a flame photometer following the[3].

Statistical analysis: All the data were analyzed using analysis of variance and student independent t-test. Significant differences were accepted at P<0.05. Data were expressed as means ± standard error of means.

RESULTS

<table>
<thead>
<tr>
<th>GROUP</th>
<th>DOSE mg/kg</th>
<th>TOTAL CHOLESTEROL</th>
<th>TRIACYCLGLYCE Rol</th>
<th>LOW DENSITY LIPOPROTEINS</th>
<th>VERY LOW DENSITY LIPOPROTIENS</th>
<th>HIGH DENSITY LIPOPROTEINS</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5ml/kg normal saline</td>
<td>120.00±0.05</td>
<td>60.00±0.10</td>
<td>71.00±0.40</td>
<td>18.60±0.40</td>
<td>52.00±0.10</td>
</tr>
<tr>
<td>B</td>
<td>5.0</td>
<td>109.00±0.02a</td>
<td>40.10±0.20a</td>
<td>60.50±0.30a</td>
<td>16.40±0.20a</td>
<td>60.00±0.02a</td>
</tr>
<tr>
<td>C</td>
<td>10.0</td>
<td>106.00±0.02b</td>
<td>28.20±0.12b</td>
<td>56.10±0.50b</td>
<td>15.00±0.05b</td>
<td>68.00±0.01b</td>
</tr>
<tr>
<td>D</td>
<td>15.0</td>
<td>100.00±0.04c</td>
<td>26.00±0.05c</td>
<td>50.90±0.50c</td>
<td>13.50±0.05c</td>
<td>70.00±0.05c</td>
</tr>
<tr>
<td>E</td>
<td>20.0</td>
<td>95.00±0.04d</td>
<td>20.50±0.03d</td>
<td>45.20±0.10d</td>
<td>11.60±0.10d</td>
<td>79.10±0.12d</td>
</tr>
</tbody>
</table>

N=5. Means with different superscript in a column a,b,c.. is statistically significant(p<0.05)

Relative to control, there was a significant (P<0.05) dose dependent decrease in total cholesterol in rats that were treated with scaler doses of the extracts. Table 1 shows a decrease of 109.00mmol/L in group B and 95.00mmol/L in group E from the control value of 120.00±0.05. similar treatment caused a significant (P<0.05) dose dependent decrease in the concentrations of triacylglycerol to 40.10mmol/L in group B and 20.50mmol/l in group E from the control value of 60.00±0.10. Also VLDL significantly (P<0.05) decreased to 16.40mmol/L in group B and 11.60mmol/L in group E respectively. However, extract increase significantly (P<0.05) in a dose dependent manner the concentration of HDL form a value of 52.00mmol/L to 60.00mmol/L in group B and 79.10mmol/L in group E respectively. The lipid lowering effect of the extract was maximized at 20.0mg/kg body weigh.
TABLE 2: Effect of extract on sodium, chloride, bicarbonate and potassium ion (mmol/L)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>TREATMENT mg/kg</th>
<th>SODIUM ION</th>
<th>CHLORIDE ION</th>
<th>POTASSIUM ION</th>
<th>BICARBONATE ION</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5ml/kg NaCl</td>
<td>135.00±2.01a</td>
<td>92.00±0.10a</td>
<td>10.50±2.62a</td>
<td>8.80±1.03a</td>
</tr>
<tr>
<td>B</td>
<td>5.0</td>
<td>130.00±0.01b</td>
<td>85.00±0.01b</td>
<td>10.50±0.10b</td>
<td>8.50±1.05a</td>
</tr>
<tr>
<td>C</td>
<td>10.0</td>
<td>123.00±0.11c</td>
<td>68.00±1.01c</td>
<td>8.38±1.10c</td>
<td>8.50±0.85a</td>
</tr>
<tr>
<td>D</td>
<td>15.0</td>
<td>135.00±2.01d</td>
<td>62.00±0.10d</td>
<td>12.87±2.00d</td>
<td>8.70±0.62a</td>
</tr>
<tr>
<td>E</td>
<td>20.0</td>
<td>140.00±1.10e</td>
<td>55.00±0.01e</td>
<td>14.08±2.10e</td>
<td>8.70±0.62a</td>
</tr>
</tbody>
</table>

N=5. Means with different superscript a,b,c,d,e in a column is statistically significant (p<0.05)

On table 2 there was a significant (P<0.05) dose dependent decrease in the concentration of sodium ion from a value of 135.00±0.01 mmol/L in group B, 130.00±0.11 in group C, which were administered lower doses. However groups D did not show any difference from the control but a significant increase in sodium concentration of 140.00±1.10 mmol/L was observed in group E which took the highest dose of extract. Similar treatment decreased the concentration of chloride significantly from 92.00±0.10 mmol/L to 85.00±0.01 in group B, 68.00±1.01 in group C, 62.00±0.10 in group D and 55.00±0.10 in group E respectively. Although there was no significant effect on the concentrations of Bicarbonate ions, there was a significant (P<0.05) decrease to 9.84±2.10 in the level of potassium ion in group B, 8.38±1.10 in group C and a significant (P<0.05) increase to 12.87±2.00 and 14.08±2.10 mmol/L in groups D and E from the control value of 10.50±2.62 respectively.

TABLE 3: Effect of extract on calcium and zinc (mmol/L)

<table>
<thead>
<tr>
<th>GROUP</th>
<th>Treatment mg/kg</th>
<th>Calcium</th>
<th>Zinc</th>
<th>Change in calcium</th>
<th>Change in zinc</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>5ml/kg normal saline</td>
<td>5.42±0.66a</td>
<td>0.28±0.06a</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>5.0</td>
<td>5.85±0.49a</td>
<td>0.32±0.07a</td>
<td>0.43±0.07</td>
<td>0.04±0.01</td>
</tr>
<tr>
<td>C</td>
<td>10.0</td>
<td>7.52±0.40b</td>
<td>0.34±0.09a</td>
<td>2.10±0.09</td>
<td>0.06±0.02</td>
</tr>
<tr>
<td>D</td>
<td>15.0</td>
<td>7.91±0.42b</td>
<td>0.43±0.07b</td>
<td>2.49±0.02</td>
<td>0.15±0.02</td>
</tr>
<tr>
<td>E</td>
<td>20.0</td>
<td>7.92±0.68b</td>
<td>0.51±0.06b</td>
<td>2.50±0.01</td>
<td>0.23±0.01</td>
</tr>
</tbody>
</table>

N=5. Means with different superscript a,b in a column is statistically significant (p<0.05)

On table 3 extract induced a non-significant (p>0.05) increase in the concentration of calcium in group B and significant (p<0.05) increase of 2.10±0.09, 2.49±0.02, 2.50±0.01 mmol/L in group C, D and E when compared with the control group A. Similar treatment effect a non significant (p>0.05) increase in zinc concentration in group B and C however, there was a significant (P<.0.05) increase in group D and E when compared with the control.

DISCUSSION

Result of effect of extract on cholesterol and the lipoproteins presented on table one showed that aqueous extract of Cyphostemma glaucophilla posses hypolipidemic activity in rats. The extract caused significant (p<0.05) dose dependent decrease in the concentration of total cholesterol, triacylglycerol, LDL and VLDL.

Deposition of cholesterol in arteries is the underlying cause of most cardiovascular disease[14], the cholesterol lowering effect of extract is a possible mechanism by which it is able to tamper the fatty changes in kwashiorkor. Extract also caused a significant (p<0.05) decrease in the concentrations of LDL, which has been implicated in arteriosclerosis: one of the major event in
cardiovascular disease [15]. The triacylglycereral lowering effect of the extract is a two pronged attack on both triacylglycerol and cholesterol bioavailability in kwashiorkor. However, HDL helps to protect the body’s cardiovascular health. Observation that the extract induced significant (p<0.05) increase in the concentration of HDL is beneficial in maintaining cholesterol level. This result is in support of the view of [18]. HDL is involved in the clearance of cholesterol from the circulation back to the liver for excretion. Such increase promotes the removal of excess cholesterol in the plasma of kwashiorkor infant to the liver for excretion.

The significant (p<0.05) decrease in sodium concentration in group B and C as showed on table 2 and the significant increases in group E that received the highest dose of extract and extract induced dose dependent significant decrease in the concentration of chloride ion is of significant interest.

Na⁺ and Cl⁻ ion plays a significant role in the regulation of blood pressure. Extract lowering effect on Na+ at low doses could be enhanced in the management of high blood pressure as [7] reported that a high Na+ diet with low K+ intake influences vascular volume and tend to elevate the blood pressure. The increase in sodium in group E indicate that prolonged administration and in high doses of extract could produce hypernatremia which in turns alter osmotic pressure of body fluid. It has been argued that hypernatremia is a major risk factor in osteoporosis[11] peripheral Oedema and occassional pulmonary congestion [12]. This also implies that the extract at high doses can reverse the decrease in sodium ion level due to losses from dehydration associated with malnutrition. This is in support of the report of [2]. Chloride ion plays an important role in acid base balance and can form salts with Na+, K+[4]. The significant(p<0.05) decrease in chloride ion concentration implies that extract has potentials in the management of plasma Cl⁻ level and in the maintenance of dietary salt intake.

Extract induced decrease in K+ concentration in groups B and C and significant (P<0.05) dose dependent increase in the level of K+ in group D and E. K+ is the major intracellular ion[20]. Increase plasma K+ as recorded by[6,10] Contribute to Osmotic diuretic activity which is related to the way in which K+ causes significant decrease in systolic and diastolic blood pressure,which is also in support of the view of [5] . Increased level of K+ can reverse conditions such as muscular weakness, nervous irritability and mental disorientation that result from profound loss of K+ from vomiting and diarrhoea present in a malnourished state.

The increase in calcium concentration in plasma on table 3 is a pointer to the extract usefulness in preventing bone breakdown in the osteoclast due to Ca⁺ deficiency. These suggest that the use of this extract improves bone mineralization in growing children and prevent the development of rickets and other physiological abnormalities associated with a deficiency of calcium.

[1] reported that deficiency of zinc is one of the manifestation of malnutrition. The extract was observed to increase zinc concentration in the plasma in a dose dependent manner. The zinc increasing effect of extract can help tamper immune deficiency, dermatitis and early death associated with an isolated deficiency of zinc in a malnourished state. Thus the extract could be useful in reducing these physiological abnormalities.
These results justify the use of extract in ethnomedicine in managing cardiovascular health and in the treatment of micronutrient malnutrition. However, caution should be observed on prolonged use and in high doses as it could cause hypernatriemia, high blood pressure and further increases oedema seen in kwashiorkor. In conclusion, the present study demonstrated that Cyphostemma glaucophilla possesses hypolipidemic effect and can boost micronutrient deficiency. These properties may be attributed to an active principle of the plant, further study is warranted to isolate, characterize and screen the active principle from the plant extract.

REFERENCES