Effects of *Garcinia kola* on the Lipid Profile of Alloxan-Induced Diabetic Wistar Rats

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Abstract: In this study, the effects of *Garcinia kola* on the lipid profile of alloxan-induced diabetic Wistar rats were studied. A total of twenty four (24) albino rats of wistar strain weighing between 100-150g were made diabetic by single freshly prepared intraperitoneal injection of 150 mg/dL of alloxan monohydrate. Eight (8) weeks after confirmation of diabetes, the rats were randomly divided into four (4) experimental groups (n = 6). Group I (Control) rats were treated with 1ml of 5% ethanol, Group II (diabetic rats received 1ml of 5% ethanol), Group III (Diabetic rats treated with 400 mg/kg of extract of *Garcinia kola* and 1mL of 5% ethanol) and Group IV, (Diabetic rats received 400 mg/kg of extract of *Garcinia kola*, 1mL of 5% ethanol and 1ml of honey). The extracts were administered twice daily for four (4) weeks. The blood glucose level and Lipid profile was analysed. The results shows that *Garcinia kola* has a significant (p<0.05) hypoglycaemic effect on diabetic rats and significantly (p<0.05) decreased the level of Total Cholesterol (TC), Low Density Lipoprotein (LDL) and Triglyceride (TG) and significantly (p<0.05) increase in the level of High density lipoprotein compared with the diabetic non-treated group. These findings if applied can be of help in the management of diabetic patients.

Key words: Diabetes mellitus, *Garcinia kola*, lipid profile

INTRODUCTION

World Health Organization (1999) estimated that there were 135 million people in the world with diabetes and that this would rise to 380 million by 2025, this report also highlighted the fact that low and middle income countries will bear the brunt of the increase with Africa contributing significantly to this rise (King *et al.*, 1998). In Nigeria, World Health Organization has disclosed that more than 1.71 million citizens above 15 years are diabetic, 70,000 children under 15 years develop insulin dependent diabetes each year, if nothing is done, diabetes sufferers will grow to about 484 million by 2030 (Winifred, 2008). Diabetes mellitus and other numerous pathological events such as atherosclerosis and inflammatory processes are associated with the generation of Reactive Oxygen Species (ROS) and consequently the induction of several chain reactions among them, lipid peroxidation (Grober, 2010). Evidence suggests that oxidative cellular injury caused by free radicals contributes to the complications of diabetes mellitus (Baimbolkar and Sainani, 1995). Some of these radicals are extremely reactive and therefore interact with some vital macromolecules including lipids, nucleic acids and protein (Nia *et al.*, 2003). Historically, plants have served as a source of herbs for drugs development. Several plants are now being used in parts or whole to treat many diseases (Adedeji *et al.*, 2006). Before the introduction of insulin in 1922, the treatment of diabetes mellitus relied heavily on the use of tradition plants therapies (Gray and Flatt, 1999). In Africa and beyond, application of traditional medical practices to the treatment of diabetes is quite popular; several plant species have been used for this purpose Nwaegerue *et al.* (2007). Active components of these plants are now being investigated and their extract are developed into drugs and little or no negative effects as contraindications, one of such plants is *Garcinia kola* (Adedeji *et al.*, 2006). *Garcinia kola* commonly called “Bitter Kola” widely distributed in Africa, Asia and Europe (Plowden, 1972) can be used as an antidiabetic agent, it could exert a beneficial effect in the diabetics by enhancing insulin secretion or improving the mimicking of insulin secretion action (Gray and Flatt, 1999), the plant phytochemical constituents include dimeric flavoid, biflavoid, xanthone and benzophenones (Alaba, 2007). Hydroxycitric acid is the principal acid of the fruit, this acid was shown to be a potent inhibitor of ATP-dependent citrate lyase which catalyses the cleavage of citrate to oxaloacetate and Acetyl-CoA (Manhendran *et al.*, 2000). Acetyl-CoA is...
used by Acetyl-CoA carboxylase, the regulatory enzyme of lipogenesis in the Liver Vance and Vance (1996).

Before the remarkable bioactivities were explored, it was initially consumed as a stimulant Atawodi et al. (1995). The plant has been cultivated for various medical uses such as an antidiote for strophantus gratus infection Holmes (1960); bronchitis, throat infection, anti-purgative and anti-purargentic and anti-parasitic (Madubuyi, 1995); others include guinea worm remedy, antiatherogenic effect and antilipoperoxative effects, anti-hepatotoxic effects (Holmes, 1960; Madubuyi, 1995; Okunji and Iwu, 1991; Lewis, 1997; Iwu, 1993; Tita et al. 2001), it is been reported of been capable of treating infection such as cough among the Yoruba race of West Africa Iwu and Igboke (1993).

Therefore, the aim of the present study is to investigate the effects of *Garcinia kola* on the lipid profile parameters of alloxan-induced diabetic Wistar rats.

### MATERIALS AND METHODS

**Plant materials:** The *Garcinia kola* were purchased from a local Market in Abraka, Delta State and then authenticated at the department of Botany, Delta State University, Abraka. They were sun dried after removal of the seed coats and ground to a fine powder, this powder was transferred into a 70% ethanol solution in an air tight jar and kept for one week after which it was filtered and the extract concentrated using a rotary evaporator at 70°C by method of distillation. The resulting residue was further air-dried to finally produce a 100% *Garcinia kola* extract. The research was conducted in the department of Physiology, College of Medicine, Delta State University Abraka, in the year 2010.

**Animals:** A total of twenty four (24) albino rats of wistar strain weighing between 100-150 g were purchased from the animal house unit of Faculty of Basic Medical Science, Delta State University, Abraka where they were also habited for a week for acclimatization. They were allowed free access to water and standard feed diet *ad libitum*.

After one week of acclimatization, the rats were weighed and subjected to 12 h fast. Diabetes was induced with a single subcutaneous injection of 150 mg/kg of Alloxan monohydrate as a 5% w/v in distilled water Williamson et al. (1996). The animals were sacrificed under chloroform anaesthesia and blood specimens were collected by cardiac puncture. The serum triglyceride, total cholesterol, High Density Lipoprotein and Low Density Lipoprotein levels were analysed using standard laboratory techniques by spectrophotometer at Eku Baptist Hospital, Delta State.

**Biochemical analyses:** Total lipids were estimated according to method described by Knight et al. (1972), serum cholesterol was estimated according to method described by Stein (1986), serum triglycerides was estimated according to method described by Chawla (2003). The Low Density Lipoprotein (LDL), high density lipoprotein (HDL) was estimated according to method described by Kostner et al. (1985)

**Statistical analysis:** The values were recorded as Mean ± Standard Deviation. Students t-test and computer software package SPSS was also used for the analysis. p<0.05 was considered statistically significant.

### RESULTS

Table 1 shows blood glucose level of normal control albino rats, diabetic controlled rats (induced with alloxan without treatment), diabetic rats treated with *Garcinia kola* and diabetic rats with *Garcinia kola* and honey. The result showed that *Garcinia kola* caused a significant (p<0.05) reduction in glucose level when compared with the post alloxan glucose level.

Table 2 shows body weights of normal control albino rats, diabetic controlled rats (induced with alloxan without treatment), diabetic rats treated with *Garcinia kola* and diabetic rats with *Garcinia kola* and honey. The results shows that diabetes mellitus caused a significant (p<0.05) reduction in the weight of the rats but treatment with *Garcinia kola* and/or honey did not show any significant difference.

Table 3, shows the lipid profile of normal control adult albino wistar rats (Group I), diabetic controlled rats (induced with alloxan without treatment of *Garcinia kola* (Group II), diabetic rats treated with *Garcinia kola* (Group III) and diabetic rats with *Garcinia kola* and honey (Group IV). The result shows that there was a significant (p<0.05) increase in the level of total cholesterol, LDL and Triacylglyceride and a significant (p<0.05) decrease in the level of HDL. Also, the result
Table 1: The Mean ± Standard deviation on effect of *Garcinia kola* extract on the blood glucose of diabetic rats

<table>
<thead>
<tr>
<th>Groups</th>
<th>Treatment received</th>
<th>Initial glucose level (mg/dL)</th>
<th>Post alloxan glucose level (mg/dL)</th>
<th>Post <em>Garcinia kola</em> glucose level (mg/dL)</th>
<th>Final glucose level (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (I)</td>
<td>Non diabetic rats</td>
<td>62.0±0.71</td>
<td>-</td>
<td>-64.2±1.06</td>
<td></td>
</tr>
<tr>
<td>Two (II)</td>
<td>Diabetic rats</td>
<td>70.6±6.14</td>
<td>276.0±38.10</td>
<td>-369.0±29.87</td>
<td>226.0±22.66*</td>
</tr>
<tr>
<td>Three (III)</td>
<td>Diabetic rats treated with <em>Garcinia kola</em> extract</td>
<td>74.6±6.83</td>
<td>253.6±21.14</td>
<td>230.0±22.37</td>
<td>226.0±22.66*</td>
</tr>
<tr>
<td>Four (IV)</td>
<td>Diabetic rats with <em>Garcinia kola</em> and honey</td>
<td>71.2±3.14</td>
<td>288.0±6.45</td>
<td>284.2±8.40</td>
<td>288.4±9.22</td>
</tr>
</tbody>
</table>

Values are presented as means ± SD; *: p<0.05 compared with the post alloxan glucose level

Table 2: The Mean ± Standard deviation of effect of *Garcinia kola* on the body weight of diabetic rats

<table>
<thead>
<tr>
<th>Groups</th>
<th>Treatment received</th>
<th>Initial weight (g)</th>
<th>Post alloxan weight (g)</th>
<th>Final weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (I)</td>
<td>Non diabetic rats</td>
<td>100.2±2.61</td>
<td>-</td>
<td>103.2±1.93</td>
</tr>
<tr>
<td>Two (II)</td>
<td>Diabetic rats</td>
<td>104.0±5.95</td>
<td>84.0±5.92</td>
<td>80.5±6.11*</td>
</tr>
<tr>
<td>Three (III)</td>
<td>Diabetic rats treated with <em>Garcinia kola</em> extract</td>
<td>131.8±14.22</td>
<td>124.6±14.24</td>
<td>128.6±14.11</td>
</tr>
<tr>
<td>Four (IV)</td>
<td>Diabetic rats with <em>Garcinia kola</em> and honey</td>
<td>138.6±10.29</td>
<td>135.4±10.58</td>
<td>127.8±14.80</td>
</tr>
</tbody>
</table>

Values are presented as means ± SD; *: p<0.05 compared with initial weight

Table 3: The Mean ± Standard deviation on effect of *Garcinia kola* on the blood lipid profile of diabetic rats

<table>
<thead>
<tr>
<th>Groups</th>
<th>Treatment received</th>
<th>Total Cholesterol (TC) (mg/dL)</th>
<th>High Density Lipoprotein (HDL) (mg/dL)</th>
<th>Low Density Lipoprotein (LDL) (mg/dL)</th>
<th>Triacylglyceride (TAG) (mg/dL)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (I)</td>
<td>Non diabetic rats</td>
<td>79.6±7.20</td>
<td>61.20±2.44</td>
<td>6.20±2.06</td>
<td>5.4±3.85</td>
</tr>
<tr>
<td>Two (II)</td>
<td>Diabetic rats</td>
<td>92.8±4.5*</td>
<td>42.6±1.33*</td>
<td>20.84±4.24*</td>
<td>24.00±5.67*</td>
</tr>
<tr>
<td>Three (III)</td>
<td>Diabetic rats treated with <em>Garcinia kola</em> extract</td>
<td>64.6±2.66+</td>
<td>59.4±0.87+</td>
<td>12.0±4.21+</td>
<td>34.40±5.50+</td>
</tr>
<tr>
<td>Four (IV)</td>
<td>Diabetic rats with <em>Garcinia kola</em> and honey</td>
<td>71.8±5.85+</td>
<td>54.6±3.39+</td>
<td>19.0±2.17</td>
<td>22.4±2.50</td>
</tr>
</tbody>
</table>

Values are presented as means ± SD; *: p<0.05 compared with group I; ++: p<0.05 compared with group II

shows that treatment with *Garcinia kola* significantly improved the above named parameters (TC, HDL, LDL, TAG). The concomitant administration of honey did not cause any significant difference.

**DISCUSSION**

In this present study, it was observed that *Garcinia kola* has a significant (p<0.05) hypoglycaemic effect in alloxan-induced diabetic Wistar rats (Table 1). This observation is in line with the previous report of Chandrika et al. (2006) who reported a hypoglycaemic effects of *Garcinia kola* especially as it is said to contain a complex mixture of phenolic compounds such as biflavonoids, xanthones and benzophenone known to cause a reduction in glucose level.

Also observed (Table 2) is a significant (p<0.05) loss of weight in the diabetic rats which is also in accordance with other reports Fatemeh et al. (2009). The treatment with *Garcinia kola* and/or honey did not cause any significant change in the final body weight. This observation is contrary to a previous report by Dada and Ikuerowo (2009) who reported that ethanolic extract of *Garcinia kola* in C. Gariepinus broodstock of fish, improved their growth and weight.

Furthermore, the present study observed that alloxan-induced diabetes mellitus caused a significant (p<0.05) increase in the levels of Total cholesterol, Low density Lipoprotein and Triglyceride and a significant (p<0.05) decrease in the level of High density lipoprotein compared with the control group (Table 3, Group I). This observation is in agreement with previous reports that diabetes causes dyslipidaemia Grober (2010). The treatment of the diabetic rats (Table 3, Group III) with *Garcinia kola* lead to a significant (p<0.05) decrease in the levels of Total cholesterol, Low density Lipoprotein and Triglyceride and a significant (p<0.05) increase in the level of High density lipoprotein compared with the diabetic group (Table 3, Group II). The addition of honey in the treatment did not show any significant change in the parameters.

**CONCLUSION**

It is therefore, concluded from this present study that *Garcinia kola* seeds extract has both hypoglycemic and Lipid attenuating effects in alloxan-induced diabetic Wistar rats. The administration of Honey did not improve the blood glucose level or the lipid profile. Hence, it could be recommended as an antidiabetic and lipid modifying agent in the management of diabetic patients.

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REFERENCES


