**ABSTRACT**

**Objective:** The effect of *Irvingia gabonensis* O’ Rorke Baill ethanol leaf extract on cadmium-induced dyslipidemia in Wistar albino rats was investigated.

**Methods:** Thirty (30) female wistar albino rats of weights between 88 and 148g were distributed into six groups of five rats each. Group 1 (control) received normal feed and water *ad libitum*. Groups 2, 3 and 4 were administered 10mg/kg body weight (mg/kg bw) cadmium chloride (CdCl₂), 10 mg/kg bw CdCl₂ and 200 mg/kg bw extract, 10 mg/kg bw CdCl₂ and 400 mg/kg bw extract respectively. Groups 5 and 6 received 200 mg/kg bw and 400 mg/kg bw extract respectively and treatments lasted for 28 days.

**Results:** Results obtained revealed that cadmium significantly (p<0.05) induced hypolipidaemia when group 2 was compared with control. However, administration of the extract at different doses mitigated the hypolipidaemic effect of cadmium in non-significant and significant fashion in dose-dependent manner when groups 3 and 4 were respectively compared with group 2 except total lipid and VLDL (very low density lipoprotein) levels for group 3 which were significant and HDL (high density lipoprotein) level for group 4 which was insignificant. Furthermore, administration of the extract only, at different doses indicates its protective effect when groups 5 and 6 were respectively compared with the control.

**Conclusions:** *Irvingia gabonensis* O’ Rorke Baill ethanolic leaf extract may therefore be very useful in the attenuation of cadmium-induced hypolipidaemia.

**Keywords:** Cadmium, Hypolipidaemia, *Irvingia gabonensis* O’ Rorke Baill, Lipid profile, Attenuation
**Introduction**

The International Agency for Research on Cancer (IARC) has classified cadmium and its compounds as group 1 human carcinogen. The reason for this is not farfetched; cadmium an heavy metal, and an environmental pollutant belonging to group IIB of the periodic table of elements poses a serious environmental hazard for human health without any known physiological function.\(^1\) It is a relatively rare element that occurs naturally in ores alongside zinc, lead and copper or it’s emitted into the air through volcanic emission.\(^3,4\) It can also be introduced in the environment through anthropogenic activities such as use of phosphate fertilizers, fossil fuel combustion and some industrial activities like welding and soldering.\(^5,6\) These act as sources of exposure to humans culminating in death when in excess.\(^7\) Cadmium affects organs like the liver, kidneys and many bodily processes such as lipid metabolism, hematological functions amongst others.\(^1\) It is a risk factor associated with several disease conditions including atherosclerosis, hypertension, cardiovascular disease and blood disorders.\(^6\)

Plants of medicinal value have over the years been utilized by herbal medicine practitioners and most locals for therapeutic, preventive and curative purposes. This may be due to the ready availability and cost effectiveness of such plants which contrasts orthodox drugs that are rather expensive and not readily available.\(^8\) *Irvingia gabonensis* O’Rorke Baill is one of such plants. It is a species that belongs to the family Irvingiaceae. It is commonly called bush mango or African mango since the trees produce small mango-like fruits.\(^9\) *I. gabonensis* O’Rorke Baill is a tropical forest tree commonly found in Southern and Eastern Nigeria, Sierra Leone and Equatorial Africa. It has a sweet and edible fruit pulp with a characteristic turpentine flavour.\(^10\) Traditionally, the leaves are widely used for the treatment of several illnesses.\(^11\) The aqueous maceration of the leaves is used as antidote to combat the effects of poisonous substances. When combined with palm oil, the leaves are used to stop haemorrhage in pregnant women. The decoction of the stem bark is used in the treatment of gonorrhoea, hepatic and gastrointestinal disorders in Senegal.\(^12\) The ethanol leaf extract of the plant has also been reported to mitigate nephrotoxicity, hepatotoxicity and haematological derangements in cadmium-exposed Wistar albino rats.\(^13,14\) Knowing that cadmium negatively affects lipid metabolism and with the wide utilization of the leaf of *I. gabonensis* O’Rorke Baill for medicinal purposes, this study was therefore carried out to investigate the effect of ethanol leaf extract of *I. gabonensis* O’Rorke Baill on cadmium-induced dyslipidaemia in Wistar albino rats.\(^1\)

**Materials and Methods**

**Chemicals and reagents**

Cadmium chloride (CdCl\(_2\)) was purchased from Kermel chemical co. ltd, China. Absolute ethanol was purchased from JHD chemicals, China Ketamine hydrochloride (anesthetic) was purchased from NIRMA limited, Sachama, India. All other reagents and chemicals used were of analytical grade.

**Collection and preparation of plant sample**

Fresh and matured leaves of *I. gabonensis* O’Rorke Baill were harvested from Amanagwu village in Arochukwu Local Government Area of Abia State, Nigeria. The leaves were identified by Mr. Daniel Etefia of the Department of Pharmacognosy and Herbal Medicine, Faculty of Pharmacy, University of Uyo, with the Herbarium no. James Daniel UUH 042116 (Uyo). The leaves were washed with distilled water and air-dried for seven days in Biochemistry laboratory, University of Uyo. The dried leaves were then pulverized using manual grinder and 1000g of this was macerated in 80% v/v ethanol for 72 hours with intermittent stirring for proper extraction. The sample was sieved through a muslin cloth and the filtrate was concentrated in a stainless steel bowl using water bath (Precisterm) at 45°C. The paste-like gel extract obtained after continuous concentration was then transferred into preweighed transparent containers, weighed and stored in the refrigerator prior to use.
Experimental design

Thirty (30) female Wistar albino rats of weights between 88–148g were obtained from the animal house, Derindam Research Institute of Biotechnology, Uyo, Akwa Ibom state, Nigeria. Based on the research hypothesis that ethanolic extract of *I. gabonensis* O’Rorke Baill ethanol leaf extract will have a positive effect on possible changes in the lipid profile of wistar rats exposed to cadmium in toxic amounts, they were divided into six (6) groups of five (5) animals each in standard cages in a well ventilated room under standard conditions in accordance with CPCSEA guidelines and allowed to acclimatize for 34 days prior to experimental procedures. They were fed normal rat chow and water *ad libitum*. Treatment was done once daily by oral intubation and lasted for 28 days as shown in Table 1 below.

<table>
<thead>
<tr>
<th>Experimental groups</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1 (control)</td>
<td>Normal feed and Water</td>
</tr>
<tr>
<td>Group 2</td>
<td>10 mg/kgbw CdCl₂</td>
</tr>
<tr>
<td>Group 3</td>
<td>10 mg/kgbw CdCl₂ + 200 mg/kgbw ELEIG</td>
</tr>
<tr>
<td>Group 4</td>
<td>10 mg/kgbw CdCl₂ + 400 mg/kgbw ELEIG</td>
</tr>
<tr>
<td>Group 5</td>
<td>200 mg/kgbw ELEIG</td>
</tr>
<tr>
<td>Group 6</td>
<td>400 mg/kgbw ELEIG</td>
</tr>
</tbody>
</table>

ELEIG = Ethanolic Leaf Extract of *Irvingia gabonensis* O’ Rorke Baill, bw = body weight

Collection and preparation of blood samples

After the last treatment, the animals were fasted overnight with access to water only. They were anaesthetized using ketamine hydrochloride and blood was collected by cardiac puncture using sterile needles and syringes into labeled plain blood collection bottles. The whole blood samples were then spun at about 3000rpm for about 15 minutes to obtain the sera which were carefully siphoned using micropipettes into fresh plain sample bottles and used for the analyses.

Lipid profile analyses

Lipid profile assays (total cholesterol (TC), triglycerides (TG), total Lipids, high density lipoprotein (HDL) and low density lipoprotein (LDL)) were done using Kamiya Biomedical Company assay kits (Seattle, USA) according to manufacturer’s protocol / procedure. Very low density lipoprotein (VLDL) concentration in the serum was estimated using the Friedewald equation\(^1^5\) as shown below:

\[
\text{VLDL} = \frac{\text{Triglyceride}}{5}
\]

Data analysis

Results were presented as mean ± standard deviation (SD) and were analysed by one – way analysis of variance (ANOVA) for differences between groups with the aid of SPSS Software. P values less than (<) 0.05 were considered statistically significant for differences between means.

Results and Discussion

**Percentage yield of extract**

Sequel to the maceration of 1000 g of dried leaves of *I. gabonensis* O’Rorke Baill in 80% v/v absolute ethanol, 148.78 g of paste-like extract was obtained making the percentage yield 14.88% as shown in Figure 1 below.
Effect of I. gabonensis O’Rorke Baill ethanol leaf extract on body weights of experimental animals

The body weights of the experimental animals taken before the commencement of treatments was recorded as initial body weights and the body weights taken just before sacrifice as final body weights. These were used to calculate the percentage body weight gain as shown in table 2 below. There was significant difference (p<0.05) in the final and initial body weight. The final body weight of group 3 (115.00±13.32) was significantly different when compared to the control (group 1) and group 4 (144.60±21.03 and 142.25±13.18 respectively). Group 5 was significantly different (166.50±8.35) when compared to groups 1 and 6 (144.60±21.03 and 138.40±14.03) respectively. There was no significant (p>0.05) difference in the final body weight of group 2 when compared to other groups (Table 2).

The percentage body weight gain of groups 2 and 3 (5.98±3.31% and 5.14±5.20% respectively) were significantly decreased (p<0.05) when compared to groups 1 and 4 (21.02±4.55% and 14.31±6.14% respectively). There was no significant (p>0.05) difference in the percentage body weight gain of groups 5 and 6 when compared to group 1 as shown in Table 2 below.

Effect of ethanol leaf extract of I. gabonensis O’Rorke Baill on lipid profile of experimental animals

There was a significant decrease (p<0.05) in the serum total cholesterol level of group 2 (22.50±3.51) compared to group 1 (67.00±5.39). The total cholesterol level of group 4 (33.50±4.80) was significantly lowered (p<0.05) when compared to the level of group 1 (67.00±5.39). There was also a similar significant reduction (p<0.05) when total cholesterol level of group 5 (56.00±3.56) was compared with group 6 (61.80±2.39).

There was a significant increase (p<0.05) when the triglyceride level of group 4 (21.00±2.94) was compared with that of group 2 (10.00±2.31). There was also a significant increase (p<0.05) when group 4 triglyceride level (21.00±2.94) was compared with the triglyceride level of group 3 (13.60±1.52).

The HDL levels of groups 2,3,4,5 and 6 showed a significant reduction (p<0.05) when compared with group 1.

Table 2: Effect of I. gabonensis O’Rorke Baill ethanolic leaf extract on the body weights of experimental animals.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Initial body weight</th>
<th>Final body weight</th>
<th>% Body weight gain</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (control)</td>
<td>113.60±12.84</td>
<td>144.60±21.03</td>
<td>21.02±4.55</td>
</tr>
<tr>
<td>2) 10 mg/kgbw CdCl₂</td>
<td>123.00±10.86</td>
<td>130.75±9.36</td>
<td>5.98±3.31</td>
</tr>
<tr>
<td>3) 10 mg/kgbw CdCl₂+200 mg/kgbw ELEIG</td>
<td>110.80±13.41</td>
<td>115.00±13.32</td>
<td>5.14±5.20</td>
</tr>
<tr>
<td>4) 10 mg/kgbw CdCl₂+400 mg/kgbw ELEIG</td>
<td>121.50±9.04</td>
<td>142.25±13.18</td>
<td>14.31±6.14</td>
</tr>
<tr>
<td>5) 200 mg/kgbw ELEIG</td>
<td>136.50±10.66</td>
<td>166.50±8.35</td>
<td>17.85±7.78</td>
</tr>
<tr>
<td>6) 400 mg/kgbw ELEIG</td>
<td>109.40±14.03</td>
<td>138.40±14.91</td>
<td>21.03±3.89</td>
</tr>
</tbody>
</table>

Data expressed as mean ± standard deviation, n=5; ELEIG = Ethanolic Leaf Extract of Irvingia gabonensis (O’Rorke) Baill, bw = body weight.

a = mean difference significant at p<0.05 when compared with group 1 (control)
b = mean difference significant at p<0.05 when compared with group 2.
c = mean difference significant at p<0.05 when compared with group 3.
d = mean difference significant at p<0.05 when compared with group 4.
e = mean difference significant at p<0.05 when compared with group 5.
f = mean difference significant at p<0.05 when compared with group 6.
LDL level of group 2 (35.25±6.90) was significantly (p<0.05) decreased compared with control (69.40±5.77). The level of LDL in group 4 (44.25±4.57) showed a significant increase (p<0.05) when compared with groups 2 (35.25±6.90) and 3 (33.80±3.70). However, the LDL level of group 5 (46.75±6.65) showed a significant decrease (p<0.05) when compared with groups 1 and 6 having values of (69.40±5.77) and (56.40±8.02) respectively.

Also, there was a significant decrease in total lipid level when group 2 (33.13±5.11) was compared with control (134.60±8.50). Groups 3 (43.20±4.02) and 4 (72.00±7.70) showed significant increases in total lipid levels as compared with group 2 (33.13±5.11). There was a significant decrease in VLDL level when group 2 (1.05±0.17) was compared with the control (8.21±0.44). Comparison of the test groups (groups 3 and 4) with group 2 however revealed significant increases in VLDL level as shown in Table 3 below.

Also, there is a daily intercourse of human and animal populations with their environment which leads to exposure to heavy metals like cadmium through the air, water and food. Exposure to cadmium stems from its continuous utilisation in industrial and agricultural processes among others. This exposure has been reported to disrupt normal lipid metabolism in the body system. Lipid profile analyses are very vital in ascertaining the health status of humans and experimental animals alike. A perturbation of the normal levels of major lipids viz a viz: total cholesterol, triglyceride, high density lipoprotein (HDL), low density lipoprotein (LDL), very low density lipoprotein (VLDL) and total lipid which could manifest as either hyperlipidaemia or hypolipidaemia are a pointer to a compromised health of subjects. In the present study, the effect of ethanol leaf extract of *I. gabonensis* O’Rorke Baill on cadmium-induced dyslipidaemia in Wistar albino rats was investigated.

Results obtained from this study showed that

Table 3: Effect of *I. gabonensis* ethanolic leaf extract on the different parameters in lipid profile of experimental rats.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Total cholesterol (mg/dl) (24-73mg/dl)</th>
<th>Triglyceride (mg/dl) (14-46mg/dl)</th>
<th>HDL-c (mg/dl) (25-60mg/dl)</th>
<th>LDL-c (mg/dl) (≤75mg/dl)</th>
<th>Total Lipid (mg/dl) (50-150mg/dl)</th>
<th>VLDL-c (mg/dl)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>67.00 ± 5.39&lt;sup&gt;b,c,d,e,f&lt;/sup&gt;</td>
<td>41.80±2.39&lt;sup&gt;b,c,d&lt;/sup&gt;</td>
<td>54.60±4.22&lt;sup&gt;b,c,d&lt;/sup&gt;</td>
<td>69.40±5.77&lt;sup&gt;b,c,d&lt;/sup&gt;</td>
<td>134.60±8.35&lt;sup&gt;b,c,d,e,f&lt;/sup&gt;</td>
<td>8.21±0.44&lt;sup&gt;b,c,d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Group 2</td>
<td>22.50±3.51&lt;sup&gt;a,d&lt;/sup&gt;</td>
<td>10.00±2.31&lt;sup&gt;a,d&lt;/sup&gt;</td>
<td>23.75±4.50&lt;sup&gt;a&lt;/sup&gt;</td>
<td>35.25±6.90&lt;sup&gt;a,d&lt;/sup&gt;</td>
<td>33.13±5.11&lt;sup&gt;a,c&lt;/sup&gt;</td>
<td>1.05±0.17&lt;sup&gt;a,c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Group 3</td>
<td>22.60±2.51&lt;sup&gt;a,d&lt;/sup&gt;</td>
<td>13.60±1.52&lt;sup&gt;a,d&lt;/sup&gt;</td>
<td>22.20±1.64&lt;sup&gt;a,d&lt;/sup&gt;</td>
<td>33.80±3.70&lt;sup&gt;a,d&lt;/sup&gt;</td>
<td>43.20±4.02&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>3.62±0.93&lt;sup&gt;a,b,d&lt;/sup&gt;</td>
</tr>
<tr>
<td>Group 4</td>
<td>33.50±4.80&lt;sup&gt;a,b,c&lt;/sup&gt;</td>
<td>21.00±2.94&lt;sup&gt;a,b,c&lt;/sup&gt;</td>
<td>30.25±5.91&lt;sup&gt;a,b,c&lt;/sup&gt;</td>
<td>44.25±4.57&lt;sup&gt;a,b,c&lt;/sup&gt;</td>
<td>72.00±7.70&lt;sup&gt;a,b,c&lt;/sup&gt;</td>
<td>4.95±0.48&lt;sup&gt;a,b,c&lt;/sup&gt;</td>
</tr>
<tr>
<td>Group 5</td>
<td>56.00±3.56&lt;sup&gt;a,b&lt;/sup&gt;</td>
<td>38.00±5.48&lt;sup&gt;a&lt;/sup&gt;</td>
<td>39.25±9.43&lt;sup&gt;a&lt;/sup&gt;</td>
<td>46.75±6.65&lt;sup&gt;a,f&lt;/sup&gt;</td>
<td>60.50±3.11&lt;sup&gt;a,f&lt;/sup&gt;</td>
<td>7.51±1.01&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>Group 6</td>
<td>61.80±2.39&lt;sup&gt;a,e&lt;/sup&gt;</td>
<td>40.60±3.51</td>
<td>45.20±7.40&lt;sup&gt;a&lt;/sup&gt;</td>
<td>56.40±8.02&lt;sup&gt;a,e&lt;/sup&gt;</td>
<td>90.20±8.07&lt;sup&gt;a,e&lt;/sup&gt;</td>
<td>7.94±0.81&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
</tbody>
</table>

Data expressed as mean ± standard deviation. &nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&nbsp;&n...
Exposure of the experimental rats to cadmium only (group 2) led to significant decreases in serum total cholesterol level, high density lipoprotein level, low density lipoprotein level, very low density lipoprotein level, serum triglyceride level and total lipid levels as compared with the control group. Most of these significant decreases were below the normal levels which is indicative of hypolipidaemia.

Hypolipidaemia and hypocholesterolaemia are used interchangeably in literatures. It refers to reduced plasma cholesterol and plasma lipoprotein levels. Hypolipidaemia is generally uncommon and it could be caused by primary (genetic) or secondary (acquired) factors. The secondary causes are relatively common compared to the rare primary causes. The confirmed hypolipidaemia in this study may be due to the induction of anaemia in the experimental rats by cadmium. This is because anaemia has been reported to be a contributory factor in the induction of hypolipidaemia. Hypocholesterolaemia has been reported to occur in patients with chronic anaemia and increased erythropoietic activity and it has been suggested that this is due to increased cholesterol requirements by the proliferating erythroid cells. Also, we had earlier reported the induction of anaemia in this same set of experimental rats by cadmium. This therefore corroborates the link between anaemia and induction of hypolipidaemia. Other proposed mechanisms hypolipidaemia / hypocholesterolaemia in anaemia include: decreased production and absorption, increased excretion and re-distribution. Furthermore, hypocholesterolaemia has been reported to be caused by a reduction in all major lipoprotein families namely: HDL, LDL, VLDL and triglycerides. The type of anaemia has also been reported to have no effect on the hypocholesterolaemia.

Cholesterol, triglyceride and lipoproteins are very vital in the maintenance of homeostasis. Cholesterol is a component of biological membranes and a precursor of several important steroid hormones. Triglyceride is the storage form of fat in animals which helps in the release of energy when there is a deficiency of carbohydrates. Also, lipoproteins (HDL, LDL and VLDL) facilitate the transport of cholesterol and triglyceride in the blood stream. Therefore, a reduction or depletion of these very important biochemical entities below the levels required by the cells predisposes to disease conditions.

The findings from this study contradict some earlier reports indicating the induction of hyperlipidaemia by cadmium.

Treatment with ethanol leaf extract of *Irvingia gabonensis* O’Rorke Baill (groups 3 and 4) significantly increased serum levels of all assayed parameters compared with group 2 (cadmium only). This may not be unconnected with the very potent antioxidant activity of ethanol leaf extract of this plant since cadmium has been reported to elicit its toxicity via the induction of oxidative stress.

One of the signs of toxicity is a decrease in the body weight or a decrease in body weight gain. The observed decrease in percentage body weight gain in cadmium exclusively exposed rats (group 2) and group 3 in this study, is indicative of the toxic effect of cadmium. This corroborates the findings of Ahlawat and Josthna et al. This may also be linked to the reduction of serum triglyceride levels since triglyceride (storage form of fat in animals) contributes to the overall body weights of subjects. Treatment with *I. gabonensis* O’Rorke Baill ethanol leaf extract showed an increase in body weight gain at the higher dose compared with the cadmium exclusively exposed rats. This further indicates the therapeutic effect of the extract.

**Conclusions**

Following the mitigation of hypolipidaemia induced by cadmium in the experimental rats by *Irvingia gabonensis* O’Rorke Baill ethanol leaf extract as revealed from this study, *Irvingia gabonensis* O’Rorke Baill ethanol leaf extract may therefore be of immense benefit in attenuating cadmium-induced hypolipidaemia.
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References