Effect of ethanolic extract of *Bougainvillea spectabilis* leaves on haematological and serum lipid variables in rats

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Received 8 April 2005

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Abstract

The effect of ethanolic extract of *Bougainvillea spectabilis* leaves on some haematological and serum lipid parameters in rats during a seven day administration of the doses of 50, 100 and 200mg/kg body weight orally was investigated. The parameters evaluated include serum lipids, red and white blood cell indices. The results show that the extract administered significantly reduced (P<0.05) packed cell volume, haemoglobin concentration and red blood cell count at the dose of 200mg /kg body weight when compared with controls while other doses administered had no significant effect (P<0.05) on these parameters. Also, the extract significantly reduced (P<0.05) white blood cell count at all doses administered when compared with control. However, the extract had no significant effect (P>0.05) on MCH, MCHC, MCV and platelet count when compared with controls. Moreover, the extract significantly reduced (P<0.05) total cholesterol concentration in the serum while it had no significant effect (P>0.05) on serum HDL-cholesterol concentration at all doses administered when compared with controls. However, the extract significantly increased (P<0.05) serum triacylglycerol concentration at the dose of 50mg/kg body weight while other doses administered had no significant effect (P>0.05) on serum triacylglycerol concentration. The results of this study suggest that the extract may have beneficial effect on serum cholesterol concentration reduction, although it possibly possesses the potential of adversely affecting haematological indices.

Key words: *Bougainvillea spectabilis*, haematological parameters, serum lipids

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**INTRODUCTION**

Diabetes Mellitus (DM) is the commonest endocrine disorder that affects over 100 million people worldwide. The conventional treatment for DM is oral hypoglycemic agent/insulin therapy. However, a lot of herbs are now being used in the management of DM, although the active principles some of them have been isolated. One of such herbs is *Bougainvillea spectabilis*. *B. spectabilis* belongs to the family Nyctaginaceae. It is a deciduous climbing shrub with thin wooden stem. Parts of the plant which have been used for medicinal purposes are the leaves and fruits. The alcoholic extract of the leaf has been reported to possess hypoglycemic effect and has been used for the management of DM. The hypoglycemic principle of the leaf extract has been isolated and named pinitol. Despite the isolation of the hypoglycemic principle, the crude extract is still being used for the management of DM in some local settings today.

Ingestion of some plant materials (either in the raw form or their extracts) has been reported to cause anaemia, which may result from sequestration of red blood cell in the spleen, impaired red blood cell production or primary bone marrow dysfunction. Also, a number of dietary factors have been reported to alter serum lipid profile which in turn has significant effect on initiation and progression of cardiovascular disease. In this study, we have sought to verify the effect of the administration of ethanolic extract of *B. spectabilis* leaves on some haematological parameters which could serve as indices of anaemia and bone marrow function. Also the effect of administration of the extract on serum lipid profile was considered.

**MATERIALS AND METHODS**

**Plant extract preparation**

*B. spectabilis* leaves collected from trees within Bida town, Niger state, Nigeria, were air dried and milled into powder, which was percolated in absolute ethanol as earlier reported. The percolated mixture was then filtered and evaporated at room temperature according to the method of Majekodunni et al.. A homogenous aqueous suspension of the extract was made before being administered to the experimental animals.

**Animal handling and administration of the extract**

Male albino rats (*Rattus norvegicus*), weighing 150 ± 30g, obtained from the Animal Holding Unit of the Department of Biochemistry, University of Ilorin, Ilorin, Kwara state, Nigeria, were used for the study. They were maintained in standard conditions of temperature, relative humidity and light/night cycles. They were fed with normal rat chow and water *ad libitum*. The animals were divided into two main groups: Group I for serum lipid parameters and Group II for haematological parameters. They were treated orally for seven days as follows:

1. **Group I** (consisting of four groups made up of five rats each):
   - Group A1 received 10ml/kg body weight of distilled water.
   - Group B1 received 50mg/kg weight of *B. spectabilis* extract.
   - Group C1 received 100mg/kg weight of *B. spectabilis* extract.
   - Group D1 received 200mg/kg weight of *B. spectabilis* extract.

2. **Group II** (consisting of four groups made up of four rats each):
   - Group A2 received 10ml/kg body weight of distilled water.
   - Group B2 received 50mg/kg weight of *B. spectabilis* extract.
   - Group C2 received 100mg/kg weight of *B. spectabilis* extract.
   - Group D2 received 200mg/kg weight of *B. spectabilis* extract.

**Determination of haematological and serum lipid parameters**

At the end of the experiment period, the rats in Group I were sacrificed and venous blood was collected into sample bottles containing no anticoagulant as earlier reported. The blood samples were allowed to clot and the serum was obtained by centrifuging at 3000rpm for 5 minutes. The clear serum was removed by pipetting and the serum lipid variables were then determined. The total cholesterol concentration...
in the serum was estimated by the method of Fredrick et al. while serum HDL – cholesterol concentration was determined by the method of Albers et al. The serum triacylglycerol concentration was estimated by the method of Jacobs et al.

Also, rats in Group II were sacrificed at the end of the seven-day experimental period and venous blood was collected into EDTA-containing sample bottles as earlier reported. The haematological parameters of the blood samples were then estimated using an Automated Haematological Analyzer, SYSMEX – KX21 (supplied by SYSMEX Corporation, Japan). The haemoglobin concentration (Hb), packed cell volume (PCV), red blood cell count (RBC), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), mean corpuscular volume (MCV), white blood cell count (WBC), and platelet count (PLC) were thus determined.

Statistical analysis
Data are presented as mean ± SD. Data were analysed using the Duncan Multiple Range test and differences at P< 0.05 were considered significant.

RESULTS AND DISCUSSION
The effect of the oral administration of ethanolic extract of B. spectabilis leaves on some serum lipid indices is presented in Table 1.

<table>
<thead>
<tr>
<th>Lipid Parameters</th>
<th>Control</th>
<th>50mg/Kg b.w.</th>
<th>100mg/Kg b.w.</th>
<th>200mg/Kg b.w.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Triacylglycerol</td>
<td>0.91 ± 0.12 a</td>
<td>1.18 ± 0.05 b</td>
<td>0.99 ± 0.11 a,b</td>
<td>1.13 ± 0.10 a,b</td>
</tr>
<tr>
<td>concentration (mmol/L)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total cholesterol</td>
<td>2.32 ± 0.01 a</td>
<td>2.03 ± 0.08 b</td>
<td>2.12 ± 0.10 b</td>
<td>2.04 ± 0.06 b</td>
</tr>
<tr>
<td>concentration (mmol/L)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HDL - cholesterol</td>
<td>0.85 ± 0.11 a</td>
<td>0.86 ± 0.11 a</td>
<td>0.95 ± 0.15 a</td>
<td>0.98 ± 0.08 a</td>
</tr>
<tr>
<td>concentration (mmol/L)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Values are mean ± SD. Values with different superscripts across the row are significantly different at P<0.05. b.w. = body weight.
Table 2: Effect of ethanolic extract of *B. spectabilis* leaves on some haematological parameters in rats

<table>
<thead>
<tr>
<th>Lipid Parameters</th>
<th>Control</th>
<th>50mg/Kg b.w.</th>
<th>100mg/Kg b.w.</th>
<th>200mg/Kg b.w.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hb (g/dl)</td>
<td>13.60 ± 0.30 a</td>
<td>12.33 ± 1.05 a</td>
<td>12.48 ± 0.76 a</td>
<td>10.68 ± 1.48 b</td>
</tr>
<tr>
<td>RBC (x 10¹²/L)</td>
<td>7.05 ± 0.24 a</td>
<td>6.35 ± 0.44 a,b</td>
<td>6.96 ± 0.14 a,b</td>
<td>6.20 ± 0.40 b</td>
</tr>
<tr>
<td>PCV (%)</td>
<td>42.50 ± 1.29 a</td>
<td>39.50 ± 3.00 a,b</td>
<td>39.50 ± 3.00 a,b</td>
<td>37.75 ± 1.71 b</td>
</tr>
<tr>
<td>MCH (pg)</td>
<td>19.60 ± 0.55 a</td>
<td>19.20 ± 0.45 a</td>
<td>18.80 ± 0.45 a</td>
<td>18.80 ± 0.45 a</td>
</tr>
<tr>
<td>MCHC (g/dl)</td>
<td>32.40 ± 0.55 a</td>
<td>32.60 ± 0.55 a</td>
<td>32.20 ± 0.45 a</td>
<td>32.80 ± 0.45 a</td>
</tr>
<tr>
<td>MCV (fl)</td>
<td>60.40 ± 4.04 a</td>
<td>58.40 ± 1.14 a</td>
<td>57.00 ± 1.41 a</td>
<td>56.60 ± 1.52 a</td>
</tr>
<tr>
<td>WBC (x 10⁹/L)</td>
<td>11.80 ± 2.44 a</td>
<td>8.43 ± 0.63 b</td>
<td>8.98 ± 1.32 b</td>
<td>8.95 ± 0.61 b</td>
</tr>
<tr>
<td>PLC (x 10⁹/L)</td>
<td>401.75 ± 27.02 a</td>
<td>446.50 ± 160.28 a</td>
<td>518.50 ± 112.67 a</td>
<td>559.25 ± 91.37 a</td>
</tr>
</tbody>
</table>

Values are mean ± SD. Values with different superscripts across the row are significantly different at P<0.05. b.w. = body weight.

As observed in Table 2, the extract significantly reduced (P<0.05) Hb, RBC and PCV only at dose of 200mg/kg body weight, while other doses had no significant effect (P>0.05) when compared with controls. However, MCH, MCHC and MCV were not significantly altered (P>0.05) by the extract at all doses administered when compared with controls. Since MCHC, MCH and MCV relate to individual red blood cells while Hb, RBC and PCV relate to the total population of red blood cells in the blood, it thus imply that the extract may neither affect the incorporation of haemoglobin into red blood cells nor the morphology and osmotic fragility of red blood cells produced. However, the reduction in Hb, RBC and PCV implies that the extract may reduce the population of red blood cells produced from the bone marrow. Since MCH, MCHC and MCV were not affected, the extract may not affect the oxygen – carrying capacity of each red blood cell but may reduce the oxygen-carrying capacity of the whole blood because of the reduced population of red blood cells in the blood. Reduction in Hb, RBC and PCV observed in this study suggests anaemia which may result from impaired red blood cell production.¹¹,²⁵

The extract significantly reduced (P<0.05) WBC at all doses administered when compared with control (Table 2). This suggests that the extract may contain some bioactive agents that could cause destruction or impaired production of white blood cells. It has been reported that granulocyte-macrophage colony stimulating factor, macrophage colony stimulating factor, interleukins IL-2, IL-4 and IL-5 regulate the proliferation, differentiation, and maturation of committed stem cells responsible for the production of white blood cells.²⁶-²⁷ It may be that some components of the extract reduced the production of these regulatory factors or interfered with the sensitivity of the committed stem cells (responsible for the production of white blood cells) to these factors. Thus administration of the extract may predispose to infection. The extract did not significantly alter (P>0.05) the platelet count at all doses administered when compared with control (Table 2). The reduction of WBC at all
doses of the extract administered and that of RBC at the highest dose administered without corresponding reduction in platelet count at all doses administered, suggest that the extract may possess the potential of causing a progressive but selective bone marrow depression with increasing dosage. This is because the bone marrow is responsible for the production of red blood cells, white blood cells and platelets.\textsuperscript{26-28} Also the production of these components of blood may be susceptible to modulation by the extract in an order having white blood cell production as the most susceptible and platelet production as the least susceptible.

From the above result, it may be concluded that \textit{B. spectabilis} leaves, when extracted with alcohol (as done in management of DM), may adversely affect some haematological indices, especially those relating to red blood cells and white blood cells, although with some beneficial effect on serum cholesterol reduction.

REFERENCES


