The hypoglycemic potential and likely anti-diabetic properties of the aqueous extract of unripe Musa paradisiaca (plantain) on blood glucose level of wistar rats was investigated and compared with known potent anti-diabetic drug (chlorpropamide) in an attempt to encourage exploration of hidden food substances with medicinal properties. Thirty wistar rats were used and divided into six groups of five rats each. Group 1 served as the normal control (positive control) and Groups 2, 3, 4, 5 and 6 were administered with alloxan (100 mg/kg) intraperitoneally. Group 2 served as the diabetic control (negative control). Groups 3, 4 and 5 were orally administered with aqueous extract of Musa paradisiaca (140, 180 and 220 mg/kg) once daily for 14 days. Wistar rats in Group 6 were orally administered with chlorpropamide (84 mg/kg) once daily for 14 days. The serum concentration of glucose of all the rats in each group was determined 48 h after indocement of alloxan. This was counted as day one of the test and daily treatment was carried out according to the respective dosages of each group. The serum concentration of glucose of all the rats in each group was again determined after the 7th and 14th dose. There was significant (p<0.05) reduction of serum glucose in Groups 3, 4 and 5 that were administered with the aqueous extract of Musa paradisiaca after the 7th and 14th dose when compared to the negative control group. Group 6 that was treated with chlorpropamide (84 mg/kg) showed no significant (p>0.05) reduction of serum glucose compared to most effective dose of the aqueous extract (220 mg/kg) after the 7th and 14th dose. This result suggests that the aqueous extract of Musa paradisiaca possesses some hypoglycemic potential and anti-diabetic effect on alloxan induced diabetic rats and thus could be recommended to diabetic patients.
**Effects of Oral Administration of Aqueous Extracts of Unripe Musa paradisica**

**Preparation of chlorpropamide**
Each tablet of chlorpropamide contains 500 mg. Ten (10) tablets of chlorpropamide were dissolved in 50 ml of distilled water following standard solution preparation.

**Induction of diabetes in rats**
Alloxan was produced by dissolving 1.2 g in 12 ml of normal saline. The normal saline was prepared by dissolving 0.95 g NaCl in 100 ml of distilled water. Diabetes was induced by single intraperitoneal injection of alloxan monohydrate (100 mg kg⁻¹). The animals were allowed 72 h of rest for blood glucose stabilization (Williamson et al., 1996), before the administration of the extract, the initial blood glucose of each of the rats were measured. The volume of the alloxan solution containing 100 mg/kg given to each rat was determined by its weight according to the equation:

\[ V = \frac{weight\ of\ rat\ in\ kg \times dose\ (mg\ kg^{-1})}{concentration\ of\ alloxan\ (mgmL^{-1})} \]

**Grouping of animals**
In the study, thirty (30) animals were used. The animals were divided into six (6), each group consisted of five (5) wistar rats.

- **Group 1:** Had an average weighed of 145 g and served as the positive control and received neither alloxan nor the aqueous extracts of *Musa paradisica*.
- **Group 2:** Had an average weighed of 163 g and served as the negative control and received alloxan only.
- **Group 3:** Had an average weighed of 180 g and received 140 mg kg⁻¹ body weight of aqueous extracts of *Musa paradisica*.
- **Group 4:** Had an average weighed of 187 g and received 180 mg kg⁻¹ body weight of aqueous extracts of *Musa paradisica*.
- **Group 5:** Had an average weighed of 212 g and received 220 mg kg⁻¹ body weight of aqueous extracts of *Musa paradisica*.
- **Group 6:** Had an average weighed of 194 g and received 84 mg kg⁻¹ body weight of chlorpropamide.

**Induction of Diabetes mellitus.** It induces diabetes by damaging insulin secreting cells of the pancreas leading to hyperglycaemia (Szułdelski, 2001). In alloxan induced diabetes, there is selective necrosis of β-cells of islet of langerhans in the pancreas so that insulin production is totally or partially inhibited, depending on the concentration of the alloxan (Etuk, 2010). The action of reactive oxygen species causes rapid destruction of beta cells (Szułdelski, 2001). One of the targets of the reactive oxygen species is DNA of pancreatic islets. Its fragmentation takes place in beta cells exposed to

**Table 1: Serum glucose level (mg/dl) in alloxan induced diabetic rats before administration of extract, after 7th and 14th dosage of oral administration with aqueous extract of *Musa paradisicacand chlorpropamide**

<table>
<thead>
<tr>
<th>Groups</th>
<th>72 Hours After Induction of Diabetes</th>
<th>7th Day After Commencement of Treatment</th>
<th>14th Day After Commencement of Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal control</td>
<td>100.4±7.162</td>
<td>100.4±10.139</td>
<td>101.8±8.117</td>
</tr>
<tr>
<td>Diabetic rats without treatment</td>
<td>334.66±18.833*</td>
<td>334.66±18.33*</td>
<td>285±3.606*</td>
</tr>
<tr>
<td>140 mgkg⁻¹ of extract of <em>M. paradisica</em></td>
<td>348±6.50.168*</td>
<td>309±8.16.679*</td>
<td>211±8.15.123.7*</td>
</tr>
<tr>
<td>4.180 mgkg⁻¹ of extract of <em>M. paradisica</em></td>
<td>383±2.24.236*</td>
<td>301±4.52.17*</td>
<td>15.2±25.193*</td>
</tr>
<tr>
<td>220 mgkg⁻¹ of extract of <em>M. paradisica</em></td>
<td>356±51.254*</td>
<td>232±29.858*</td>
<td>116±61.622*</td>
</tr>
<tr>
<td>84 mgkg⁻¹ of Chlorpropamide</td>
<td>364±59.8781*</td>
<td>194±88.042*</td>
<td>95.66±79.292*</td>
</tr>
</tbody>
</table>

Values with asterisk in each column are significantly different at p<0.05 compared to normal control; Values bearing superscript (a) in each column are significantly different at p<0.05 compared to diabetic control.

The significant increase in serum glucose level in diabetic control rats compared to normal control rats is as a result of damage of the pancreatic beta cells by the effect of alloxan. Alloxan monohydrate is one of the chemicals used to induce diabetes mellitus. It induces diabetes by damaging insulin secreting cells of the pancreas leading to hyperglycaemia (Szułdelski, 2001). In alloxan induced diabetes, there is
Effects of Oral Administration of Aqueous Extracts of Unripe Musa paradisiaca

alloxan (Takasu et al., 1991). Following its administration, alloxan is concentrated in the islets and in the liver, where it is reduced to dialuric acid. This acid is unstable in aqueous solutions and undergoes oxidation back to alloxan, accompanied by generation of O2 ·, hydrogen peroxide and hydroxyl.

Historical records provide a reservoir of basic information on the use of traditional medicine in the management of diabetes mellitus with plant extracts (Srinivasan, 2005). In this study, the comparative studies of antidiabetic potentials of crude extract of Musa paradisiaca and chlorpropamide a known diabetic drug has unveiled the high efficacy of both. However, the efficacy of the extract was dose dependent (high dosage). But there was no strong significant difference between Group 3 and Group 4 i.e. the low and middle dosages in terms of the blood fasting glucose. The fasting blood glucose levels decreased as the period of administration of the extract increased. This means that for effective glucose depletion the extract must be taken for a longer period. However, other factors like, the degree of processing e.g., method, time, heat, the starch content (Niba, 2004) may influence the glucose response to the extract (Pi-Sunyer, 2002). The interaction between the glucose and protein may also influence the effect of extract, (Manders et al. 2005). The major interest of this study was to determine the antidiabetic potentials of plantain extract and the future approach of likely isolation and purification of the hypoglycemic active ingredient for possible use as an antidiabetic drug. This informed the comparison with chlorpropamide, a potent antidiabetic drug.

Conclusion
The findings of this study indicated that the aqueous extract of Musa paradisiaca exert its hypoglycemic potential and antidiabetic effect by lowering blood glucose in alloxan induced diabetic rats. The study has given a lead that medicinal ingredients abound in plants which may be from the leaves, fruits, stems or roots. There’s need to explore the potentials of these plants and not just totally depend on orthodox drugs that may not only be as effective as herbal plants but with side effects and complications (Nwafor et al., 2005).

References


