Full Length Research Paper

Studies on the administration of Vernonia amygdalina Del. (Bitter leaf) and glucophage on blood glucose level of alloxan – Induced diabetic rats

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This study was aimed at investigating the glycemic effect of Vernonia amygdalina Del, a common Nigerian plant in combination with a hypoglycemic drug, metformin. 21 experimental animals were used. Diabetes was induced using Alloxan Monohydrate. When the blood glucose level was tested using the glucose oxidase kit, it was observed that the group of animals administered with a combination of Vernonia amygdalina extract and metformin shows significant decrease in the blood glucose level compared to the diabetic control and group of animals administered with plant extract alone having the result (4.9 ± 1.2 Fasting blood sugar level, 6.1 ± 1.2 two hours postprandial) plant extract singly (6.2 ± 3.8 Fasting blood sugar level 8.1 ± 3.8 two hours postprandial of the combination of metformin with plant extract singly respectively). A change was observed in the body weight of the experimental rats. Group I (Normal control) shows continuous increase in the body weight from the first week of experiment to the fourth week, having the peak of the body weight to be in the fourth week of the experiment. Group II (diabetic control) shows significant reduction in the body weight from the first week to the last week Group III and IV were observed to have decrease in body weight from induction period to week two, but a steady increase was observed from week three to four of the experiment (at the onset of treatment). Therefore combining metformin with the plant extract of vernonia amygdalina as drug extract mixtures produced more hypoglycemic effect than using metformin or the plant extracts singly.

Key words: Bitter leave, glucophage, diabetes, glucose.

INTRODUCTION

Diabetes mellitus is a metabolic disorder found in all nations of the world (Okolie et al., 2008). It is one of the most prevalent epidemics of the 21st century. Diabetes Mellitus is a syndrome of impaired carbohydrate fat and protein metabolism caused by either lack of insulin secretion or decreased sensitivity of the tissues to insulin characterized by hyperglycemia and glycosuria. World Health Organization (WHO) has defined Diabetes mellitus based on laboratory findings as a fasting venous plasma glucose concentration greater than 7.8 mmol/l (140 mg/dl) or greater than 11.1 mmol/l (200 mg/dl) two hours after a carbohydrates meal or two hours after an oral ingestion of the equivalent of 75 g glucose. This rapidly increasing prevalence is a significant cause for concern.

The use of conventional medical approach of simply using insulin and oral drugs to control diabetes Mellitus is not only costly but inadequate, boring and lack compliance; thus the patient’s exposure to long term complication remains a risk (Okolie et al., 2008). In response to world Health Organization, drawing attention to the use of herbal medicine as being of great importance to the health of individuals and communities (Adebanjo et al., 2006). Some wild herbs and species have been shown to be most effective, relatively non-toxic and have substantial scientific documentation to attest to their efficacy in diabetes management (Okeke, 1998). In Africa, several plants have been screened, such

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Table 1. Blood glucose levels of alloxan induced diabetic and normal rats on treatment after 4 weeks.

<table>
<thead>
<tr>
<th></th>
<th>Normal control</th>
<th>Diabetic control</th>
<th>Extract only</th>
<th>Extract + metform-in</th>
<th>Ref. value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fasting blood sugar (mmol/L)</td>
<td>3.6±0.4</td>
<td>12.4±2.6</td>
<td>6.2±3.8</td>
<td>4.9±1.2</td>
<td>4.2 + 6.4</td>
</tr>
<tr>
<td>2 hours post prandial (mmol/L)</td>
<td>4.9±0.5</td>
<td>14.1±1.9</td>
<td>8.1±3.8</td>
<td>6.1±1.2</td>
<td>7.8–11.1</td>
</tr>
</tbody>
</table>

n=5. Values are means ± SD.

plants include *Anacardium occidentalis*, *Congronema latifolium*, *Vernonia amygdalina* etc. have been found to lower glycemia in chemical induced diabetes. This is due to their perceived effectiveness, minimal side effect in clinical experience and relatively low cost.

**Aim and objectives**

The Investigation was aimed at determining the antidiabetic effect of a combination of the extract from the leaves of *Vernonia amygdalina* with oral hypoglycemic agent.

**Objectives of the study**

- To confirm the hypoglycemic effect of *Vernonia amygdalina*
- To investigate the combine effect of *vernonia amygdalina* and metformin (an oral hypoglycemic drug).

**MATERIALS AND METHODOLOGY**

**Plant materials**

The fresh leaves of *Vernonia amygdalina* were collected from Monday market in Maiduguri and identified by a botanist in the Biological Science Department of University of Maiduguri.

**Preparation of the extract**

The leaves were sorted out to obtain only fresh leaves and washed with distilled water without squeezing to remove debris and dust particle. They were shade dried and pulverized into powder and a portion of the powered leaves was cold macerated with distilled water for 24 hours and filtered to obtain the *Vernonia amygdalina* aqueous extract.

**Animal experimentation**

Twenty albino rats (150 - 200 g) of both sexes obtained from the animal house in department of biochemistry Maiduguri were used.

**Grouping of animals**

The animals were distributed into 4 groups of 5 rats each namely:

<table>
<thead>
<tr>
<th>Group</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Normal control</td>
</tr>
<tr>
<td>2</td>
<td>Diabetic control</td>
</tr>
<tr>
<td>3</td>
<td>Extract</td>
</tr>
<tr>
<td>4</td>
<td>Extract + glucophage</td>
</tr>
</tbody>
</table>

**Induction of diabetes**

Diabetes mellitus was induced by intraperitoneal injection of 150 mg/kg body weight of alloxan monohydrate, suspended in distilled water. Three days later diabetes was confirmed using one touch glucometer. Animals with blood glucose level ≥ 200 mg/dl were considered diabetic and included in the study.

**Administration of extract and glucophage**

The administration of both extract and glucophage was done using oral intubation metformin, a hypoglycemic drug was prepared as aqueous drug suspension, (500 mg was dissolve in 4ml of distilled water and 1 ml containing 100 mg was given to each rat).

Group III were administered extract alone; Group IV were administered extract + glucophage; Group I and II were given normal feed.

**Blood collection**

Blood sample was withdrawn from the tail vein and tested using glucose test strips and glucometer after an overnight fast.

**RESULTS**

The Table 1, above shows the glucose levels of normal and alloxan - induce diabetic rats after treatment. After treatment, the fasting glucose levels of diabetic Group II (bitter leaf control) and Group IV (Bitter leaf + glucophage) decrease to 6.2±3.8 and 4.9±1.2 mmol/L respectively which is normal when compared with the fasting sugar level of normal group 3.6±0.4 mmol/L and the normal reference value which is 4.2 to 4.6 mmol/L for fasting.

The two hours postprandial sugar level of Group III is 8.1±3.8 mmol/L and that of Group IV is 6.1±1.2 mmol/L which is also normal when compared with the reference
Table 2. Weight of experimental rats before and after induction of alloxan monohydrate.

<table>
<thead>
<tr>
<th></th>
<th>Normal Control</th>
<th>Diabetic control</th>
<th>Extract only</th>
<th>Extract + metform-in</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight before induction (g)</td>
<td>171.5</td>
<td>197.2</td>
<td>199.1</td>
<td>198.8</td>
</tr>
<tr>
<td>Weight after induction (g)</td>
<td>175.3</td>
<td>195.7</td>
<td>196.5</td>
<td>198.4</td>
</tr>
</tbody>
</table>

n=5. Values are means ± SD.

Figure 1. The chart showing the weekly mean of the experimental rats.

value 7.8 - 11.1 mmol/L (Table 2).

Figure 1 shows the weekly mean weight of experimental rats. There was a continuous increase in the body weight of the normal rats from week one to week four (that is 179.4 - 202.7 g) but the peak of the weight was observed in the fourth week. The group II shows decrease in the body weight of the rats from week one to week four (that is 193.7 - 173.5 g) of the experimental rats. Groups III and IV shows decrease in body weight of the rats and it was observed that; in week one the body weight reduced from 199.1 to 196.5 g respectively before induction and further decrease was observed in Week I and II but increase was observed from Week III and IV of the experimental duration which can be attributed to the hypoglycemic properties of the extract. The combined effect of the plant extract and metformin lead to the increase in the body weight from Week III and IV of the experimental duration.

The glycemic effects of combining the plant extracts and metform

It was generally observed that the hypoglycemic tendency of drug/extract combinations as revealed in
Table 1 were significantly more than as separate solutions. This was particularly so when *Vernonia amygdalina* was combined with metformin for the test.

**Effect on the body weight**

It was observed that, there was a reduction in the weight of the experimental rats after induction but on treatment (Figure 1) there is a significant increase in body weight with time.

**DISCUSSION**

The efficacy of the extract on hyperglycemic rats corroborates the result of other researchers who had systematically demonstrated that the extract from the plant posses antidiabetic properties. The hypoglycemic effect of the combined agents suggests that their antidiabetic activities are additive and this could mean that the extract and metforming are acting through the same mechanism which involves inhibiting all glucose producing pathway (such as gluconeogenesis and glyconeogenesis) and support glucose absorption, other proposed mechanism of action of metformin is ability to lower glucose levels independently of the active pancreatic β - cells. This result is also consistent with the work of Sheriff et al. (2010).

The observation that the *Vernonia amygdalina* extract alone reduced the glycemic significantly in the alloxan treated rats lends credence that; it has peripheral action similar to that of insulin or glucose metabolism which can be attributed to the bioactive molecules present in the indigenous vegetable. Similar observations have been reported by other researchers (Fuentes et al., 2004; Sepici et al., 2004). The nutrient composition also revealed that *Vernonia amygdalina* contained moisture and fiber and so contributes less sugar to the blood sugar pool. This is because, study have revealed that foods rich in fiber contents induce lesser blood glucose response (Oli et al., 1982). A similar finding (Ylonen et al., 2003) also showed evidence that a high intake of dietary fiber as associated with enhanced insulin sensitivity and therefore may have a role in the prevention and control of type 2 diabetes.

Therefore combining *Vernonia amygdalina* with metformin improved glycemic response more considerably than using the plant extract and drug as separate solutions.

**Conclusion**

This investigation has demonstrated that the use of a combination of the extract from leaves of *Vernonia amygdalina* and metformin is safe, effective, cheap and more comfortable for the management of diabetes mellitus. This findings would further update scientists in the field of nutrition and all other concerned individuals about the effect on diet, nutrients and natural products in diabetes management.

The fact that hypoglycemic drugs have side effects which can further complicate the health of patients, the natural herbs can serve as compliments for hypoglycemic drugs.

**REFERENCES**


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growth fractions of *Vernonia*


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APPENDIX

The weekly mean of experimental rats.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Week 1 Weight (g)</th>
<th>Week 2 Weight (g)</th>
<th>Week 3 Weight (g)</th>
<th>Week 4 Weight (g)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal control</td>
<td>179.4±9.5</td>
<td>190.8±9.2</td>
<td>198.9±8.1</td>
<td>202.7±8.0</td>
</tr>
<tr>
<td>Diabetic control</td>
<td>193.7±8.3</td>
<td>185.2±6.9</td>
<td>178.4±7.4</td>
<td>173.5±7.2</td>
</tr>
<tr>
<td>Extract only</td>
<td>195.6±7.8</td>
<td>190.6±9.8</td>
<td>192.2±5.2</td>
<td>193.9±7.1</td>
</tr>
<tr>
<td>Extract + Glucophage</td>
<td>198.0±9.6</td>
<td>192.2±7.4</td>
<td>193.6±9.6</td>
<td>196.2±8.4</td>
</tr>
</tbody>
</table>