INTRODUCTION

Diabetes mellitus has been defined by the world health organization (WHO), on the basis of laboratory findings as a fasting venous plasma glucose concentration greater than 7.8 mmol/l (140mg/dl) or greater than 11.1 mmol/l (200mg/dl) two hours after a carbohydrate meal or two hours after an oral ingestion of the equivalent of 75g glucose, even if the fasting concentration is normal (Nwanjo and Nwokoro, 2004). It is a metabolic disease characterized by hyperglycaemia and glycosuria due to absolute or relative lack of insulin (Agwu, 1996).

Medicinal plants have formed the basis of health care throughout the world since the earliest days of humanity and are still widely used and have considerable importance in International trade (Ahmad et al., 2006). In certain African countries for instance, up to 90% of the population still relies exclusively on plants as a source of medicines (Hostettmann et al., 2000). As a consequence, the world health organization (WHO) had in one of its charters in Geneva recommended further investigation into this area, particularly, as it concerns chronic and debilitating disease such as diabetes mellitus (WHO, 1980).

A complex disease like diabetes mellitus, where little is talked about in aspects of prevention and curation, but rather management, there is an increased focus on plants in the search for appropriate hypoglycaemic / antihyperglycaemic agents (Ebong et al., 2008). Firstly, by leads provided by traditional medicine to natural products that may be better treatments than currently used conventional drugs (Rates, 2001). Secondly the plants by secondary metabolic means contain a variety of herbal and non-herbal ingredients that are thought to act on a variety of targets by various modes and mechanisms (Tiwari and Rao, 2002) given the multifactorial pathogenicity of the disorders.

Vernonia amygdalina Del (Compositae) popularly known as bitter leaf is a shrub of 2 – 5m tall (Ojiako and Nwajo, 2006). It is popularly called bitter leaf because of its abundant bitter principles. It is cultivated in Nigeria mainly for its nutritional value (Igile et al., 1995a, Owen et al., 2009). The plant (especially the leaf) has been found useful in the ethnotherapy of diabetes (Akah and Okafor, 1992; Uhegbu and Ogheuei, 2004; Nwajo, 2005), asthma, schistosomiasis, malaria (Masaba, 2000), measles, diarrhea, tuberculosis, abdominal pain and fevers, cough (Akpemelu, 1999).

Phytochemicals contained in V. amygdalina include saponins, sesquiterpenes, lactones and flavonoids, steroid glucosides such as Vernoniosides A1, A2, A3, As, B1, B2, B3, D and E have been isolated from the plant (Ohigashi, 1994; Aregbese et al., 1997; Igile et al., 1995b). But it is yet to be ascertained which of these are responsible for some observed biological effects of the plant (Ekpo et al., 2007). However, there is dearth of scientific data to support the folkloric use of this plant in the treatment of diabetes mellitus disease in Nigeria herbal homes. Therefore, the present work was designed to provide scientific proof of the use of V. amygdalina in the treatment of diabetes mellitus and we hope that the results of this short-term investigation will have important implications for the management of diabetes.

MATERIALS AND METHODS

The fresh leaves of V. amygdalina were collected in June, 2009 from a garden in Port Harcourt, South-South of Nigeria. The harvested leaves were spread and air-dried for 60 days and sun-dried for one additional day to ensure perfectly dried, milled and packed into jute bags. Using 0%, 5%, 10% and 15% VALM to replace groundnut cake in broiler finishers’ feed, a total of 144 Marshal brooded broilers weighing 500 – 610g were used in a study that lasted for 28 days in the Teaching and Research Farm of the Rivers State University of Science and Technology, Port Harcourt.

The birds were housed in a deep litter with wood shavings as litter material. Before the arrival of the birds, the pens were cleaned, washed and disinfected. The birds were divided into 4 groups of 36 birds each. Each treatment group was further subdivided into 3 replicates of 12 birds in a Completely Randomised Design (CRD). Feed and water were offered ad libitum. At the expiration of the experiment, 3 birds per treatment were randomly selected and bled by severing the jugular vein.

The blood samples were collected into bottles without anticoagulant and taken to the chemical pathology laboratory of the University of Port Harcourt Teaching Hospital (UPTH) for biochemical analysis. The biochemical indices determined includes Glucose, Urea, Creatinine, Total protein and Globulin. All the data collected were subjected to Analysis of Variance (ANOVA) according to Steel and Torrie (1980) and means where appropriate were partitioned using Duncans New Multiple Range Test (DNMRT) as outlined by Obi (1990).
RESULTS
Table 1 depicts the effects of *Vernonia amygdalina* (VA) on the biochemical indices of broiler finisher chickens. The use of *V. amygdalina* did not significantly (P>0.05) affect the serum urea and creatinine of broiler birds. However, there was a significant (P<0.05) decrease in blood glucose of the chicken as the level of inclusion of VA increases. Also significant (P<0.05) differences were observed in total protein and globulin of the birds. There was no significant (P>0.5) difference in the urea levels between the treated and the control groups.

**DISCUSSION**

The data from the present investigation showed that *V. amygdalina*, a plant commonly used for dietary and medicinal purposes, caused an overall glucose lowering effects on the treated birds when compared to the control group. The percentage reduction was 14.30%, 22.90% and 26.60% for treatments B, C and D having 5%, 10% and 15% VALM inclusion rates respectively. These results clearly indicate that the administration of *V. amygdalina* at varying levels produced hypoglycaemic effects. There are many bioactive constituents present in the leaves and hence, at present, it is not certain, which of them is/are responsible for the observed effect. However, certain flavonoids in *V. amygdalina* may confer hypoglycaemic property on the leaf extract of this plant (Ezekwe and Obidio, 2001).

According to the report of Igile et al. (1994), the leaves of *V. amygdalina* contains biflavonoids such as luteolin, luteolin 7 – 7, 8 flavone and luteolin 7 – 0 – B – glycoside and luteolin 7 – 0 – B – glucuronoside. Besides several stigmastane type saponins such as vernoniosides A1, A2, A3, D3 and C have been isolated from the leaves of *V. amygdalina* (Jisaka et al., 1992). In addition, *V. amygdalina* leaves had been reported to contain a bioactive sesquiterpene lactones such as vernoldione and vernodal (Erasto et al. 2006). Thus, it is probable that the hypoglycaemic activity of *V. amygdalina* as reported in this study, may be a function of its rich flavonoid content.

The study of Adewole et al. (2007) showed that flavonoid such as quercitin improves hyperglycaemic and islet morphology in STZ – induced diabetic rats. Besides, Adewole and Caxton – Martins (2006) reported the beneficial effect of aqueous leaf extract of *Annona muricata* Linn on blood glucose levels of STZ-induced diabetic rats. They concluded that plant bioflavonoids and coumarins may play roles in the establishment of normoglycaemia in diabetic rats. Similar inference had been drawn by (Ojewole, 2006; Akinola et al., 2009).

The hypoglycaemic effect at all levels of *V. amygdalina* inclusion as observed in this work is therefore not surprising. It confirms the effectiveness of the leaves of this plant in the ethnomedicine of diabetes mellitus (Akah and Okofo, 1992). Although not fully understood, several reports have attempted insights into the hypoglycaemic mechanisms of plant extracts. There is a report that *Azadirachta indica* does not modulate insulin effect on glycogen metabolism (Chattopadhyay, 1993), rather it blocks the inhibitory effect of serotonin on insulin secretion/release in pancreas of rats mediated by glucose eventually control.

Sonja and Srinivasan (1999) in their report presupposed increased peripheral glucose uptake by an inhibition on the action of insulin by inhibiting glycogenesis. Atangwho et al. (2007) had suggested in their earlier report on *Vernonia amygdalina* that two possible mechanisms exist: one targeting insulin production from the islet cells and the second on peripheral carbohydrate mechanism. Mechanism involving insulin productions are usually more potent (Ebong et al. 2008). It is not surprising therefore that *V. amygdalina* tends to be a potent hypoglycaemic agent. Moreso, that other plants of the same family-composite, such as *Chrysanthemum coronarium* has shown potent hypoglycaemic and anti-hyperglycaemic activity (Kim et al., 2006).

Serum total protein, globulin and urea; markers of liver synthetic ability were assessed after treatment for 28 days. Blood urea nitrogen (BUN) test measures the amount of nitrogen in the blood that comes from the waste product urea. Urea is made when protein is broken down in the body. It is produced in the liver and passed out of the body in urine. A primary consideration in the assessment of the efficacy of a potential therapeutic agent for hepatic injury (damage) is its effect on liver.

*V. amygdalina* also did not seem to have adverse effect on the kidney, since the creatinine levels were not significantly altered. This corroborates the data of Ekpo et al. (2007) where it was noted that administering the extract of *V. amygdalina* on rats did not significantly alter the creatinine levels. Creatinine is derived from muscles and released into the blood. It is removed from the body by the kidneys.

When creatinine level is elevated, a decrease in kidney function is suggested. It could be inferred that *V. amygdalina* besides exhibiting hypoglycaemic activity is also safe for consumption as food or medicine, since there were no indication of toxicity judging from the values of the biomolecules evaluated.

Therefore, in view of the central role of diet in diabetic management (Mann, 1980), several attempt have been made to suggest acceptable dietary regimes for diabetics. These recommendations, though beneficial to diabetic in general, are based on foreign diets. Thus, they did not take cognizance of the specific socio-economic and cultural attributes of African societies especially with respect to their eating habits (Taiwo et al., 2009).

Thus, dietary treatment of diabetes in Africa is still a major challenge because strict adherence to various recommended dietary regimes is often difficult (Naidu, 1992). Such problems may not arise with *V. amygdalina* because it is widely consumed as bitter leaf soup.

Their use in diabetic management agrees with Nigerian socio-cultural attributes. If the results of this work are confirmed in other animal and human experimental studies, the use of this plant in the treatment of diabetes can be justified considering the central role of diet in diabetic management. In order to formulate appropriate dietary regime for African diabetics, more studies are needed to reveal the glycemic effects and composition of African local herbs and foodstuffs. Any therapeutic advice given to African diabetics should reflect their traditional eating habit.

**REFERENCES**


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**Table 1: The effects of graded levels of *V. amaygdalina* on biochemical parameters of broiler finishers**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Treatments</th>
<th>A (0% VALM)</th>
<th>B (5% VALM)</th>
<th>C (10% VALM)</th>
<th>D (15% VALM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Glucose mmol/l ± SEM</td>
<td></td>
<td>3.50±0.20</td>
<td>3.00±0.15</td>
<td>2.70±0.19</td>
<td>2.50±0.20</td>
</tr>
<tr>
<td>Glucose reduction %</td>
<td></td>
<td>0</td>
<td>14.30</td>
<td>22.90</td>
<td>28.60</td>
</tr>
<tr>
<td>Urea mmol/l</td>
<td></td>
<td>3.00</td>
<td>3.00</td>
<td>3.10</td>
<td>3.10</td>
</tr>
<tr>
<td>Creatinine mmol/l</td>
<td></td>
<td>64.20</td>
<td>64.00</td>
<td>63.50</td>
<td>63.00</td>
</tr>
<tr>
<td>Total protein g/l ± SEM</td>
<td></td>
<td>28.60±0.45</td>
<td>40.00±0.30</td>
<td>40.00±0.15</td>
<td>40.00±0.18</td>
</tr>
<tr>
<td>Globulin g/l ± SEM</td>
<td></td>
<td>14.00±0.20</td>
<td>14.00±0.20</td>
<td>14.00±0.18</td>
<td>14.00±0.21</td>
</tr>
</tbody>
</table>

Within rows, means ± SEM with different superscript differs significantly at p<0.05. SEM: Standard Error of Means.