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In Vitro Antioxidant and Hypoglycemic Potentials of *Musa paradisiaca* Aqueous Extract on Alloxan Induced Diabetic Albino Rats

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Abstract: Diabetes is one of the common pathologies involving oxidative stress in its aetiology and complications. This research was carried out to evaluate the antioxidant and hypoglycaemic properties of aqueous extract of unripe *Musa paradisiaca* on blood glucose of alloxan-induced albino rats. Thirty (30) albino rats were divided into six groups, each group containing five rats. Group 1 (positive control) Groups 2 (negative control) and Group 3, 4, and 5 received 140, 180 and 220 mg / kg per body weight of *Musa paradisiaca* once daily for 14 days. Group 6 were administered chlorpropamide 84 mg / kg per body weight. The serum concentration of glucose of all the rats in each group was determined 72 hours after induction of diabetes and on the 7th and 14th days. There was significant ($p<0.05$) reduction of serum glucose in Groups 3, 4 and 5 when compared to the negative control group on day 7th and 14th. Group 6 showed no significant ($p>0.05$) reduction of serum glucose compared to 5. The extract also increased the total reduced glutathione (GSH) level, Superoxide dismutase (SOD) and Catalase activities *in vitro*. The aqueous extract of *Musa paradisiaca* possesses antioxidant and anti-diabetic effects on alloxan induced diabetic rats.

Keywords: *Musa paradisiaca***,** hypoglycaemia**,** diabetic rats, antioxidant

Introduction

Diabetes mellitus (DM) is ranked as the fourth leading cause of death globally [1] It has a complex aetiology with interacting genetic factors and lifestyle factors including adiposity, physical activity and diet [2].Uncontrolled DM is associated with oxidative stress, which predisposes to an increase in the incidence of diabetic complications including cardiovascular

disease (CVD), retinopathy, nephropathy and microangiopathy, neuropathy and several other complications [2].

A research conducted by Shaw *et al.* [3] estimated the prevalence of diabetes in Nigeria as 4.7% with rural areas having the lowest rates. The cure for diabetes is currently unknown, but the disease could adequately be managed using agents that have hypoglycaemic effect.

Musa paradisiaca commonly known as plantain is a widely cultivated plant in many parts of the world. It belongs to the family *Musacea**e***. According to several ethno-pharmacological surveys, different parts of *Musa paradisiaca* cultivar are used in folk medicine for a variety of ailments [4] Fruits, leaves, peels, root and stalks from plantain plants have been used orally or topically as a medicine for treating intestinal lesions in colitis, antilithic, inflammation, pains, snakebite and antiulcerogenic activity [5].

The aim of this research was to investigate *in vitro* the antioxidants effect and hypoglycaemic potentials of dried *(Musa paradisiaca)* plantain on alloxan induced diabetic rats.

I. Materials and Methods

I.1. Sample Collection and Preparation of Unripe Plantain Fruits

Unripe plantains were purchased from "Yankura" market, Kano, Nigeria. The plantain was washed, peeled, sliced and shade dried. The dried slices were powdered .800 g of the powdered was macerated with 3000 ml of distilled water. The mixture was filtered after a day and the filtrate allowed to evaporate at 45°C on water bath.

I.2. **Animal:** Thirty (30) Healthy adult male Wister rats weighing 120–210 g and were procured from Zoology department of the Faculty of science, Bayero University, Kano, Nigeria. The animals were kept in a well-ventilated room allowed free access to both food and water throughout the period of study. Guide lines of the National Institute of Health Guide for the care and use of laboratory animals was followed [6].The animals were divided into six (6), each group comprised five (5) rats. Group 1 (positive control receives normal saline only). Group 2 (negative control; received 150 mg / kg alloxan only). Groups 3, 4 and 5 were administered orally, with 140 mg $kg^{-1,}$ 180 mg kg^{-1} 220 mg kg^{-1} of the *Mus*a extract respectively while group 6 was treated with 84 mg kg^{-1} body weight of chlorpropamide. The animals were treated once daily for a period of fourteen days. Blood samples (About 5 ml) were collected in EDTA tubes and used for glucose determination.

Animals were made diabetic by a single intraperitoneal (I.P.) injection of alloxan monohydrate, dissolved in normal saline at a dose of 150 mg / kg body weight[7].

I.3. In vitro Antioxidant Assay

Reduced glutathione was determined by the method of Moron *et al.* [8]]. Catalase activity was assayed as described by Pant *et al*. [9].SOD was assayed according to the method of Kakkar *et al*. [10]. with modification. 0.102 M Phosphate buffer (pH 7.4) was used instead of 0.025M sodium pyrophosphate buffer (pH 8.3) and potassium phosphate buffer (50mM, pH 6.4).

Statistical Analysis

The data was statistically analysed using Graph Pad Instat3 Software (2000) version 3.05 by Graph Pad Inc. Data are presented as Mean ± SD.

II. Results

The result of this study is presented in the chart and table 1

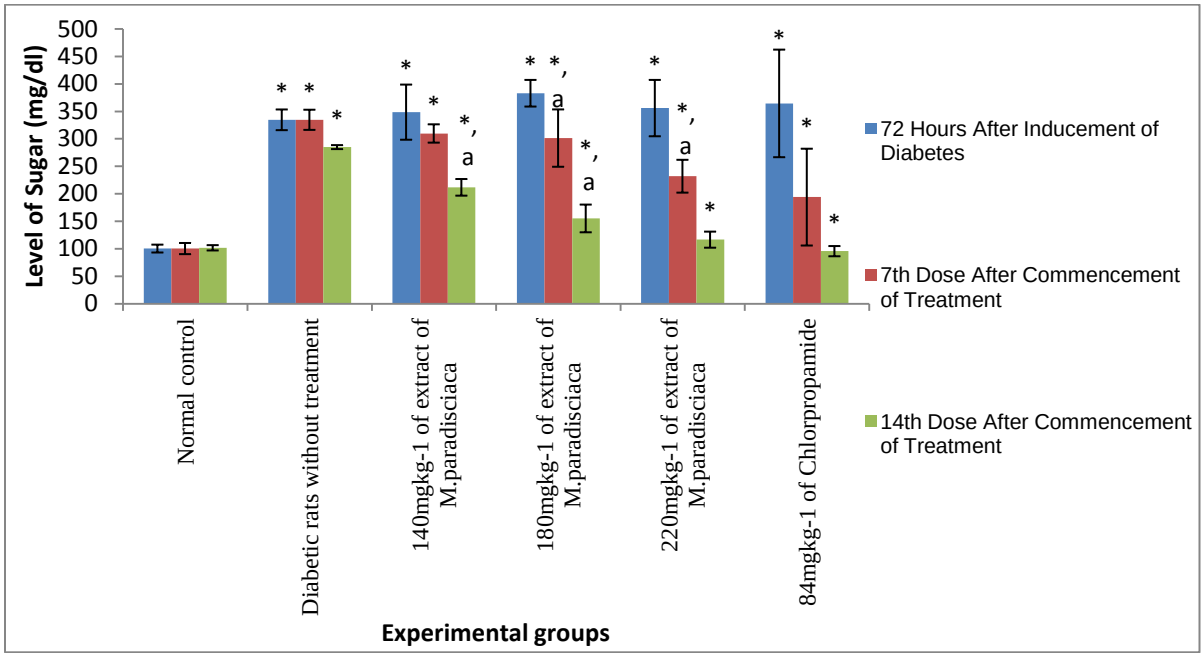

Figure 1: *Blood glucose level 7th and 14th days After Commencement of Treatment with aqueous extract of unripe plantain and standard drug. Values with asterisk in each column are significantly different at p<0.05 compared to normal control; Values bearing superscript (a) in each column are significantly different at p<0.05 compared to diabetic control.*

Table 1: *In vitro antioxidant activity of Aqueous Extract of unripe M. paradisiaca*

Groups	Antioxidants parameters			
	SOD (U/ml)	CAT (U/ml)	GSH (mg/ml)	MDA (nmol/ml)
Untreated (control)	2.40±0.14	245.23±81.40	3.60±0.18	17.05±4.94
H_2O_2	2.97±1.72	60.73±914.85	3.57±0.33[a]	19.91±1.08[a]
H_2O_2 +extract	2.12±0.41	286.70±129.24	5.35±0.57[b]	11.86±1.96[b]

Values are expressed as mean ± standard deviation, values bearing different superscript (a and b), under the same column respectively were significant different from the controls at p<0.05, N=3.

III. Discussion

Antidiabetic activity of the aqueous extract of *M. Paradisiaca* was determined in rats administered orally with the extract for 7 and 14 days. The result obtained after treatment with the extract showed a significantly higher ($p<0.05$) serum level of glucose in diabetic control when compared with the normal control rats. Of the three groups orally administered with different doses of the extract, Group 3 and Group 4 did not decrease the serum levels of glucose significantly ($p>0.05$) compared to diabetic control rats. The serum level of glucose in Group 5 had their glucose level lowered ($p<0.05$) when compared to the diabetic control group. The serum level of glucose in chlorpropamide treated rats was found to be significantly lower ($p<0.05$) when compared to the treatment groups. On the 14^{th} day of treatment the serum level of glucose was found to be significantly higher in diabetic control rats ($p<0.05$) when compared to normal control rats. Treatment with different doses of the extract caused a significant ($p<0.05$) fall in the serum levels of glucose, compared to diabetic induced rats. even though there was no significant difference ($p>0.05$) between the normal control rats and Group 5. The serum level of glucose, in chlorpropamide treated rats was found to be significantly lower ($p<0.05$) when compared to Group 3 and Group 4. There was no significant difference in normal control ($p>0.05$) when compared to the Group 5 and the group administered with 84 mg / kg of chlorpropamide.

Therefore, we found that the efficacy of the extract was dose dependent (effective at high dosage). The fasting blood glucose levels was found to decrease as the duration of administration increased. This means that for effective glucose depletion, the extract must be taken for a longer period. It was reported that green fruit of *M. paradisiaca* have hypoglycemic effect due to stimulation of insulin production and glucose utilization [11]. Fibers from *M. paradisiaca* fruit increased glycogenesis in the liver and lowered fasting blood glucose [12]. These findings may be attributed to the hypoglycemic effects observed in this study.

Since cellular oxidative stress has been reported to play cardinal role in the development of hyperglycaemia-related tissue damage [13], we further studied the antioxidants activities of the plantain extract. The enzyme system SOD-CAT represents the first line of defence against free radical's molecular atrocities. SOD catalyses the dis mutation of the superoxide anion radical. As a result, H_2O_2 is produced and decomposed by the CAT.

The in vitro study shows increased SOD and CAT activities in the treated extract treated group when compared to untreated controls. This slight depletion in the levels of the enzymes could be attributed to their involvement in the scavenging of H_2O_2. This agrees with the findings of Shodehinde and Oboh [14].

IV. Conclusion

The finding in this study indicated that the aqueous extract of *Musa paradisiaca* exert its antidiabetic effect by lowering blood glucose and inhibiting oxidative stress in concentration dependent manner.

V. Authors' contributions

This work was carried out in collaboration among all authors. Author Muhammad B. Y Conceptualized, designed and supervised the study. Author Babandi, A. performed the experiment collected all data, and wrote the first draft of the manuscript. Author Kindzeka, L. S did the literature search performed the statistical analysis and wrote the final manuscript. All authors read and approved the final manuscript

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