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Antidiabetogenic Effects of Sweet Potatoes (Ipomea batatas) Tubers in Alloxan Induced Diabetic Rats

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ABSTRACT

In most part of the world sweet potato (Ipomoea batatas) is being heavily cultivated in some of these areas, local population is putting parts of the plant to a good medical. Therefore this study investigated the anti diabetic properties of the ethanol extract of ipomoea in alloxan induced diabetic rats. Forty eight albino rats were divided randomly into six groups of eight in each group. The animals were starved for 48hrs before the commencement of treatment. Group A: served as normal control, Group B: served as diabetic control, Group C:was treated with a standard drug (Glucophage) at 100mg/kg body weight, Group D:was treated extract 200mg/kg body weight, Group E was diabetic group treated with extract at 400mg/kg body weight and Group F 600mg/kg body weight by oral administration respectively and water was adlibitum. Diabetes was induced in albino rats by intraperitoneal injection of alloxan at a single dose of 120mg/kg body weight in group B, C, D, E and F. Group D, E,F were fed with ethanol extract of Ipomoea batatas (except group A, B,&C) for a period of 28days serum biochemical parameters were analyzed . The animals treated with 200mg/kg extract of *Ipomoea batatas* produced a pronounced remarkable glucose lowering potential. Conclusively this study has demonstrated that ethanol possess weight enhancing and anti diabetic effects.

Keywords: Antidiabetogenic, Sweet Potatoes, Ipomea batatas, Tubers, Alloxan and Diabetic Rats

INTRODUCTION

Diabetes mellitus (DM) is a critical general medical condition, considered one of the greatest difficulties in our century owing to the quantity of individuals suffering from DM has enormously increased over the most recent 20 years [1]. DM is a metabolic problem that is described by chronic high blood glucose level that prompts complications in the eyes, kidneys, heart, vessels and nerves [2]. Elevated diabetes level is a consequence of uncontrolled glucose and prompts hazardous injury to many of the body's systems [3]. Glucose happens either when the pancreas doesn't deliver adequate insulin (type I diabetes) or when the body can't utilize the insulin it produces (type II diabetes). Patients with glucose type II constitute about 90%-95% in around the world [4]. This chronic complex illness requiring permanent clinical consideration involving hazard reduction techniques is beyond glucose control [5]. More treatment drugs are financially accessible in the administration of glucose however they have results and extravagant, subsequently the requirement for natural items as a substitution treatment. Sweet potato is being intensely developed in many pieces of the world and in a portion of these spaces, local people use portions of the plants for medicinal purposes. In the Philippines for instance, the plant is professed to be valuable in the management of diabetes without logical proof [6]. The plant is plentiful in dietary fiber, minerals, vitamins and compound of substance with organic impact, for example, β-carotene, phenolic corrosive and anthocyanin which gives it the one of a kind tissue tones (cream, yellow,orange and purple) [7]. The anthocyanin found in sweet potato could control the blood

glucose level by inhibiting the alpha-glucosidase [8,9] and could likewise increase the phosphorylation of insulin receptor[9].

Statement of Problem

Current medications, for example, Pioglitazone has better adequacy for diabetes yet additionally have results like hypoglycemia, gastro-intestinal lot unsettling influence, heftiness, water intoxication, and hyponatremia. Hence, it is essential to investigate elective wellspring of medicine which could have better viability with less or no results and furthermore financially savvy for low income networks.

Aim of the Study

The aim of this study is to evaluate the effect of ethanol extract of sweet potato (*Ipomoea batatas*) on alloxan induced diabetic albino rat.

MATERIALS AND METHODS

Material

Plant Material: fresh tubes of *I.batatas* was punrchased from nkwo market in mgbakwu town, Awka North Anambra State. It was sent to the department of Zoology. Nnamdi Azikiwe University, Awka for proper identification by Dr. Bibian Aziagba, a taxonomist Voucher specimens were number: NAUH: 147[A] and was deposited at the departmental Herbarium Animals Materials: sixty male wister albino rats weighing between 100 and 120 was purchased from Chris Research farms, Awka and used for the LD_{50} while Male rats weighing between 150g and 200g was used for the antidiabetic studies

Procurement, identification and preparation of plant

Fresh tubers of *I.batatas* were purchased from major market in Enugu south Local Government Area, Enugu State. The tubers were then taken to the Department of Botany, Nnamdi Azikwe University, Awka for identification by an expert. Dry cooked tubers of *I. batatas* were macerated and made into extract through sun-drying, crushing (in pestle and mortar) and dissolution in 4L of 70% ethanol for 2 hours. The filtrate was concentrated using water bath (k420) at 50^{o}C before use.

METHODS

Study design

A total of forty-eight male Wister albino rats of approximately the same age and an average body weight of between 150 and 200g were purchased from Chris Research farm, Ngbakwu Awka. They were housed in standard aluminum cages (4 per cage, such that the number per cage will not interfere with clear observation of eachrats), in a 12-hour light and dark cycle with temperature of 22±2°C. The rats were allowed two weeks' period of dietary accommodation to acclimatize before they were randomly grouped into six (group A, B, C, D, E, and F) as shown in Table 1.

Table 1: Protocol for treatment

Group	Treatment
A	Normal control (fed with rat growers feed+ H_20 adlibitum)
B	Diabetic untreated (negative control fed with rat growers feed + H_20 adlibitum)
C	Diabetic (positive control) – treated with standard drug e.g Glucophage + fed with rat growers feed+ H_20 adlibitum)
D	Diabetic treated with 200mg/kg of *Ipomoea batatas* + growers feed
E	Diabetic treated with 400mg/kg of *Ipomoea batatas* + growers feed
F	Diabetic treated with 600mg/kg of *Ipomoea batatas* + growers feed

All the rats were given standard feed and water *ad libitum*. The rats in group A were not induced with diabetes; group B were induced but not treated; group C were induced but treated with standard drug (Glucophage); group D to F were induced but treated with extracts at 200, 400 and 600mg/kg body weight. The extracts were prepared with distilled water [7] and given daily by oral route (cannula feeding). The standard drug dose were equivalents of human therapeutic dose of the drug and were prepared as described by [8].

Induction of Diabetes Mellitus

Following fourteen days of acclimatization, alloxan monohydrate was utilized to initiate type II diabetes in exploratory creatures. Intraperitoneal administration of 100mg/kg body weight of alloxan monohydrate was managed once. A gentle pressing factor was then applied at the spot of infusion to improve ingestion. Following three days of administration, creatures fasting blood glucose levels were checked utilizing the glucose observing gadget (Acu Check).

Sample collection

At the end of experimental administrations, the wistar rats were anesthetized in a desiccator containing cotton wool soaked with chloroform. After they had attained deep anesthesia, they were brought out of the desiccator and a laparotomy was carried out (by making a V-shape incision in the abdominal region with the aid of a surgical scissors) and the visceral organ (liver) were then exposed and harvested foranalysis.

Ethical clearance

Animal handling was performed with regard to Guide for the Care and Use of Laboratory Animals [5], and the University's research ethics. Procedures were performed in strict accordance with the recommendations in the Guide of the Chukwuemeka Odumegwu Ojukwu University Animal Ethical Committee and the protocols were appropriately approved. Study was also conducted in accordance with the Current Animal Care Regulations and Standards approved by the institute for Laboratory Animal Research.

Statistical analysis

Data were presented as mean ± standard deviation (SD) following one-way analysis of variance (ANOVA) and Tukey–HSD test using Microsoft Excel 2016. Differences between $\mathbf{p}<0.05$ were considered significant.

RESULTS

Showing the mean and standard deviation of the percentage change in body weight, percentage change in growth rate

Table 2

Group	Initial	Final	PC (%)	PG (%)
A	166.60±4.28	139.60±46.04	16.21 (decrease)	81.82 (increase)
B	162.60±3.98	153.60±7.50	5.54 (decreased)	- 40.0 (decrease)
C	141.00±6.04	159.80±10.28	-13.33 (increase)	-56.97 (decrease)
D	139.80±13.76	159.00±6.29	- 13.73 (increase)	- 58.18 (decrease)
E	153.00±8.00	169.40±6.11	-10.72 (increase)	- 49.70 (decrease)
F	152.60±24.79	175.20±19.99	- 14.81 (increase)	- 68.49 (decrease)

Between the group and within the group from ANOVA result, rats of group A, C and E were statistically significantly different with , B, D, and F groups at $p<0.05$, at the end of the experiment.

The Administration of the sweet potatoes incorporated feed to the diabetic rats of group D to F, resulted in decrease in the resulting hyperglycemia, compared with the diabetic controls (B) and non-diabetic (A) rats which showed an increase in their hyperglycemia.

Table 3: Showing the percentage change in fasting blood glucose (FBG) in the different group

Group	Initial	Final	PC (%)
A	85.80±12.50	89.60±11.80	- 4.43 (increase)
B	80.00.20±73.12	194.2±97.13	-142.75 (increased)
C	386.0±135.35	284.0±202.90	26.43 (decrease)
D	434.0±124.28	251.20±213.34	71.36 (decrease)
E	501.20±67.98	255.0±164.17	86.44 (decrease)
F	419.40±103.94	115.40±25.99	72.49 (decrease)

From ANOVA result, between the group and within the group, rats of group E was statistically significantly different with A, B, C, D and F at $p<0.05$ at the end of the experiment

DISCUSSION

The *Convulvulaceae* is an important family in traditional medicine for the treatment of many ailments, *I.batatas* tubers which is a member of the family as a vegetable has great economic importance. In the present study, ethanol extract of *I. batatas* tuber was found to have significant effect on serum hematological parameters and biochemical parameters within limits of dose less than acute toxicity of the plant extract. Decrease in hyperglycemia in the diabectic rat administered standard drug and sweet potato extract at different concentrations as shown in table 3 above confirm the ability of sweet potatoes to ameliorate hyperglycemia the reduction of body weight as shown in the result could be explained in the basis of loss structural proteins as this structural proteins contribute to body weight [5]. However, the increase in the body of the diabectic rat treated concentrated with the different concentration of sweet potatoes in coporated in suggestive of better glycemic index control by the *ipomea batatas* extract feed.

CONCLUSION AND RECOMMENDATION

From the obvious results, Sweet potatoes is not toxic but safe for consumption as revealed from the result from the toxicity done on it. It can be used to reverse, control or in the management of hyperglycemia due to the observed reduction in the glycemia of diabetic rat administered with various concentration of *ipomoea batatas* extract

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