



Evaluation of The Weight and Sugar Level Upon Administration of Aqueous Extract of the Pulp of *Annona Muricata* on Alloxan Induced Diabetic Adult Wistar



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Submission: September 09, 2019; Published: October 09, 2019

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Abstract

Background: *Annona muricata* Linn. Of the family Annonaceae, commonly known as soursop, is a very common fruit in the Sub-Saharan Africa with slightly juicy, acidic taste when ripe, whitish and aromatic with abundant seeds. It is a plant well known for its folklore use for varied disease conditions in Africa particularly diabetes mellitus described as a group of metabolic diseases characterized by hyperglycaemia resulting from defects in insulin secretion, and/or insulin action. Elevated blood sugar is a common effect of uncontrolled diabetes.

Aims: The aim of this study is to investigate the effects of aqueous extracts of the pulp of soursop fruit in an alloxan induced diabetic wistar rat when compared with Metformin, with the specific objectives of determining the effect of *Annona muricata* juice on the diabetic pancreatic islet cells and to compare its effect with that of the drug metformin also called Glucophage through weight and fasting blood sugar level determination.

Methods: A total of Twenty-five albino adult wistar rat were used and allocated into five groups of five animals each designated as groups 1, 2, 3, 4, and 5. The experimental groups 2, 3, 4, and 5 were administered through oral route in different doses of extract and metformin. Group 1: served as the control, Group 2: Diabetes + Metformin 100mg, Group 3: Diabetes + Low dose *Annona muricata* 10ml/kg, Group 4: Diabetes + high dose of *Annona muricata* 20ml/kg, Group 5: Diabetes only. Experimental rats of the groups were kept without feed for 24 hours prior to induction and then induced with alloxan solution through intraperitoneal injection. Data was analyzed using split-plot analysis of variance for body weight and fasting glucose level, followed by post hoc test.

Results: Results were presented as mean \pm SEM with significant difference determined at $P < 0.05$. With control group treatment with alloxan+Metformin (Group II) it resulted in a significant reduction ($P < 0.05$) in body weight after administration. Treatment with alloxan + high dose AME (20ml/kg) resulted in a significant increase ($P < 0.05$) in body weight after administration. The fasting sugar level of alloxan \pm AME treated group and alloxan-treated group was significantly different when compared with the control group 1 and Metformin-treated group.

Conclusion: The study concludes that the plant extract of *Annona muricata* moderately reduces sugar level and weight value which invariably can aid in management of diabetes; and when compared with Metformin, the effect was moderate hence it is recommended that a combined treatment option be administered in case of severe hyperglycaemia so as to rapidly counter its effect and thus minimize long term complications.

Keywords: *Annona muricata*; Diabetes; Weight, Blood sugar, Wistar rat

Introduction

Herbal remedies from medicinal plants have been used traditionally in many parts of the world where access to formal healthcare is limited. Studies on the use of medicinal plants is of importance as its remedies may have recognizable therapeutic effects as well as toxic side-effect [1,2]. *Annona muricata* Linn. of the family Annonaceae, commonly known as soursop, is a very

common fruit in the Sub Saharan Africa with slightly acidic taste when ripe. The fruit is juicy, whitish and aromatic with abundant seeds. It is a plant well known for its folklore use for varied disease conditions. Researchers have seen it as a medicinal tree with anti-bacterial, antiviral, molluscicidal, anti-oxidative stress and diuretic. These various alleviating properties of *Annona muricata* can be attributed to the presence of notable phytoconstituents

such as alkaloids, flavonol, triglycosides, phenolics, cyclopeptides, megastigmanes and essential oils [3]. Solomon Wisdom et al. [4] observed it possess vitamins, ions and other dietary components that possess sedative and antispasmodic properties. Significantly interesting in all of these is the need to harness its potential, specifically the pulp portion in raising a scientific point with regards to one of the commonest African ailment, Diabetes.

Diabetes mellitus have emerged as one of the major causes of morbidity and mortality [5] and is described as a group of metabolic diseases characterized by hyperglycaemia resulting from defects in insulin secretion, and/or insulin action. Elevated blood sugar is a common effect of uncontrolled diabetes, and over time can damage the heart, blood vessels, eyes, kidneys, and nerves [6]. The increasing number of people suffering from diabetes is potentially dangerous for Nigeria and many other African countries where hospitals have to deal with other communicable illnesses such as Tuberculosis, HIV and Malaria.

Purpose of the study

The aim of this study is to investigate the effects of aqueous extracts of the pulp of soursop fruit in an alloxan induced diabetic wistar rat when compared with Metformin, with the specific objectives of determining the effect of *Annona muricata* juice on the diabetic pancreatic islet cells and to compare its effect with that of the drug metformin also called Glucophage through weight and fasting blood sugar level determination. The significance of this study if positive on the beneficial effect of *Annona muricata* extract on diabetic pancreas would be an indicator for potential treatment option.

Methodology

Materials and equipment

20 adult wistar rats, cages, feed, water, saw dust, syringes (2ml, 5ml and 10ml), cannula, 5% dextrose, measuring cylinder, 100ml beakers, white muslin cloth, sensitive balance, Metformin (Glucophage), soursop (*Annona muricata*), gloves, alloxan, sample bottles, fine test glucometer.

Chemicals

Alloxan solution was prepared at the evening period due to its sensitivity to light, with stock solution prepared at a concentration of 50mg/ml by dissolving 0.5g of alloxan in 10ml of water. Metformin solution was prepared at a concentration of 50mg/ml the animal dose deduced as 1/5th of human dose.

Extract

Fresh extract was prepared everyday throughout the period of administration by extracting the juice of *Annona muricata* edible pulp part with a muslin cloth.

Diabetic induction procedure

Doses of alloxan solution per rat was determined with a concentration of 50mg/ml at a standard dosage of 160mg/kg using the formula:

$$\text{Dosage} = \frac{\text{standard dosage} \times \text{body weight}}{\text{Concentration} \times 100\text{g}}$$

Experimental rats of the groups were kept without feed for 24 hours prior to induction and then induced with alloxan solution through intraperitoneal injection. 5ml of 5% dextrose sugar solution were administered one hour after induction to counter the initial effect of hypoglycaemia.

Diabetes was then allowed to develop and stabilize in alloxan treated animals for a period of 2-4 days. Before commencement of experiment, both normal and alloxan treated rats were fasted overnight and their fasting sugar level were determined using digital glucometer in mg/dl. Hence, fasted alloxan-treated rats with blood glucose level >200mg/dl were considered diabetic.

Animal grouping

Control group (group 1) and Experimental group (group 2-5)

Group 1: Control group

Group 2: Diabetes + Metformin 100mg

Group 3: Diabetes + Low dose *Annona muricata* 10ml/kg

Group 4: Diabetes + high dose of *Annona muricata* 20ml/kg

Group 5: Diabetes only

Administration of extract and Metformin commenced the 5th day post alloxan injection for 14 days in standard doses. Five hours after administration, fasting sugar levels were determined and recorded in the subsequent days throughout the period of administration. On the last day of administration, fasting glucose level and weights of the animals of the all groups were determined and recorded.

Data Analysis

Data was analyzed using split-plot analysis of variance for body weight and fasting glucose level, followed by post hoc test. Results were presented as mean ± SEM with significant difference determined at P<0.05.

Results

On the effects on body weight, Table 1 depicts the effect of *Annona muricata* of treatment and control groups. From the analysis the mean weights of group II and IV showed a significant difference (P<0.05) from the mean body weight of control group. Treatment with alloxan + Metformin (Group II) resulted in a significant reduction (P<0.05) in body weight after administration. Treatment with alloxan + high dose AME (20ml/kg) resulted in a significant increase (P<0.05) in body weight after administration. On the effect of fasting glucose level, Table 2 shows the effect of the aqueous extract of *Annona muricata* on experimental animals when compared with control animals and Metformin group. The result showed that the fasting sugar level of alloxan ± AME treated group and alloxan-treated group was significantly different when

compared with the control group 1 and Metformin-treated group. Treatment with AME at both low and high doses significantly reduced ($P<0.05$) the blood glucose level following 14 days

administration in a similar manner as the Metformin treated group. This reduction was however not as low as that observed with Metformin treated group.

Table 1: Effect of Aqueous Extract of *Annona muricata* on Weights of Experimental Animals when compared with control and Metformin group.

Groups	Treatment	Weight Before Induction (g)	Weight During Administration (g)	Weight After Administration (g)
1	Control	114.72±4.17	117.22±4.22	134.84±4.88
2	Metformin (100mg)	128.50±0.91	139.00±0.81*	104.20±0.91*
3	Low dose of extract (10ml/kg)	121.58±4.68	120.75±7.68	114.00±9.27
4	High dose of extract (20mg/kg)	139.33±12.59*	137.98±12.61*	156.89±14.41
5	Only diabetes	122.45±0.75	125.35±0.74	165.50±0.46*

Table 2: Effect of Aqueous Extract of *Annona muricata* on Fasting glucose level of experimental animals when compared with control group.

Groups	Treatment	Blood Glucose After Induction (mg/dl)	Blood Glucose Day After Final Administration (mg/dl)
1	Control	100.60±4.76	104.40±2.80
2	Metformin (100mg)	188.00±1.41	99.00±1.41
3	Low dose of extract (10ml/kg)	392.50±63.20*	227.75±26.02*
4	High dose of extract (20ml/kg)	387.50±68.56*	316.00±23.86*
5	Only diabetes	108.50±1.36	266.00±32.27*

Discussion

Based on the result, it is observed that the plant extract moderately reduces sugar level which invariably manages diabetes. This is consistent with the findings of Gavamukulya et al. [7], who discovered the various medicinal properties of *Annona muricata* including its hypoglycaemic capacity, using in-vivo studies and work done by Adewole et al. [8] on pancreatic tissue using *Annona muricata* leaf that showed significant decreased pancreatic/serum insulin levels. Generally, reduction in body weight, polyuria, polydipsia and dehydration are symptoms of severe hyperglycemia [9]. Throughout the 15 days' duration of this research, significant changes in body weight and the above symptoms were observed. These observed changes are important as determinant factor in the beneficial effect of the plant extract on diabetes. Elevated blood sugar level is an indicative factor of uncontrolled diabetes. In this study, throughout the duration of the experiment, administration of aqueous pulp extract of *Annona muricata* was able to manage elevated blood sugar level and when compared with Metformin, the effect was moderate. In comparison with the work of Adefegha et al. [10] with *Annona muricata* pericarp and seed separately on amylase and glucosidase, it was observed that pericarp had highest inhibitory dose dependent while seed extract had the least, hence it is thus it would be naturally more potent if all parts of *Annona muricata* (pulp, seed, pericarp) extract are utilized in checking the sugar level. This accentuate with the opinion of Omolara et al. [11] that revealed the presence of bioactive compounds possessing radical scavenging activities in all parts of *Annona muricata*, even as is considered to possess fair amount of the B-complex vitamins, potassium and dietary fibers according to Solomon Wisdom et al. [4].

Conclusion

Based on the findings of this work, the treatment with aqueous pulp extract of *Annona muricata* reduces sugar level and weight value and thus can aid management of diabetes. Since the effect was moderate when compared with Metformin administration, it is recommended that a combined treatment option be administered in case of severe hyperglycaemia so as to rapidly counter its effect and thus minimize long term complications [12].

Acknowledgement

We acknowledged Mr. and Mrs. vidona, Mrs. Vidona W and Dr. wadioni. for their priceless support.

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DOI: [10.19080/JCMAH.2019.10.555793](https://doi.org/10.19080/JCMAH.2019.10.555793)

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