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FOREWORD

It is with great delight I welcome you to volume 4 issue 2 of Federal Polytechnic – Journal of Pure and Applied Sciences (FEPI-JOPAS). It is a peer-reviewed open-access multi-disciplinary Journal of global recognition which is referenced and indexed in African Journal Online (AJOL). It is a highly commendable Journal that publishes excellent research contributions and exhibiting also special attention to experience papers coming from the many application areas of pure and applied Sciences. FEPI-JOPAS publishes full-length research work, short communications, critical reviews and other review articles.

The aim of FEPI-JOPAS is to provide intellectual bedrock for both indigenous and international scholars with quality research outputs to express and communicate their research findings to a broader populace. It serves as a valuable platform for the dissemination of information to 21st Century researchers, professionals, policymakers, manufacturers, production staff, R & D personnel as well as governmental and non-governmental agencies. It also aimed to provide a platform for academics and industry practitioners to share cases on the application of management concepts to complex real-world situations in pure and applied sciences and related fields.

This volume 4 issue 2 of FEPI-JOPAS is loaded with quantum and well-featured diversity of trending topics in applied and basic research. These hot and trending topics are: Sustainable Art and Design: Activating Sighting as the Phenomenon of Representational Drawing; Assessment of Heavy Metals in Processed Meat (Tinko) Sold within Igbesa Community; The Hypoglycemic Effect of Musa Sapientum in Alloxan Induced Diabetic Albino Wistar Rat; Rainwater Quality Evaluation for Agricultural Use: Case Study of a Portland cement Producing Area; Analytical Approach to Investigating the Influence of Blood Group and Blood Genotype on the Performance of Students of Federal Polytechnic, Ilaro; Dough Mixing Time: Impact on Dough Properties, Bread-Baking Quality and Consumer Acceptability; Chemical Composition of Harvested Rainwater Around a Cement Factory in Ibeshe, Yewa North, Ogun State.

Furthermore, other topics to be encountered in this issue that have added colour and beauty to this edition are: Physicochemical properties and sensory evaluation of milk candy ‘toffee’ (a

NIGERIA candy) enrich with coconut, tigernut and groundnut; Informal Settlements in Developing Countries: Issues, Challenges and Prospects; Comparison of Sensory Properties of Meals Produced from Cowpea and Pigeon Pea; Automated Lecture Timetable Generation Using Genetic Algorithm; Septic Tanks Contamination in Groundwater Quality around Elementary Schools in Ibadan, Oyo State Nigeria; and Waste Disposal Systems in Some Selected Abattoirs Located in Ilaro Metropolis. FEPI-JOPAS has been centered on discerning the changing needs of the academic world and is committed to advancing research around the world by publishing the latest research in various academic fields and ensuring that the resources are accessible in print, digital, and online formats.

In addition, I would like to thank many people who worked so hard to ensure that publishing this issue 2 of volume 4 is a reality. I would like to thank the Editorial Board for their guidance and the publishing team for the continued support and effort in streamlining the publication process. I am grateful to the reviewers who provided timely and constructive reviews for the papers assigned to them. The authors are solely responsible for the information, date and authenticity of data provided in their articles submitted for publication in the Federal Polytechnic Ilaro – Journal of Pure and Applied Sciences (FEPI-JOPAS).

I am looking forward to receiving your manuscripts for the subsequent publications. You can visit our website (https://fepi-jopas.federalpolyilaro.edu.ng) for more information, or contact us via e-mail us at fepi.jopas@federalpolyilaro.edu.ng

Thank you and best regards.

Prof. Olayinka Oyewale AJANI

(Editor-in-Chief)

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The Hypoglycemic Effect of *Musa Sapientum* in Alloxan Induced Diabetic Albino Wistar Rat1

Afuye O.O.[1], Alabi N.O.[2] and Omoyeni O.C.[1]

[1]Department of Science Laboratory Technology, Federal Polytechnic Ilaro, Ogun State

[2]Department of Mathematics and Statistics, Federal Polytechnic Ilaro, Ogun State Ogun State

✉*oyewale.afuye@federalpolyilaro.edu.ng*

Abstract

Diabetes mellitus is a chronic disease identified with abnormal high level of glucose in the blood and excretion in the urine. Traditionally, Musa sapietum (banana) is a perennial herb that has been used to lower glucose level in the blood of diabetic patients. This research aimed to determine the effect of methanolic extract of Musa sapientum (Musaceae) sucker (root) on blood glucose and glutathione levels in alloxan-induced diabetic albino wistar rats and compared with a reference drug, gilbenclamide. Twenty-nine rats were grouped into five. Groups A and B were induced with alloxan and orally administered with methanol extract of Musa sapientum sucker (root) at doses of 5mg/body weight and 10mg/body weight simultaneously for 4 weeks, group C was fed with normal feed for 4 weeks, group D was induced with alloxan and not treated for 4 weeks while group E was induced with alloxan and treated with gilberclimide (drug) for 4 weeks after which the rats were sacrificed and the levels of fasting blood glucose and glutathione were measured. Tests of homogeneity of variance using One-Way Analysis of Variance (ANOVA) were conducted. The blood glucose of the rats induced with alloxan only significantly increased while the level of glutathione significantly reduced compared with control showing induction of diabetes and oxidative stress. Rats treated with Musa Sapientum at doses of 5mg/bodyweight and 10mg/body weight lowered the glucose level and increased glutathione level significantly when compared with control and gilbenclamide groups.

Keywords: *Musa Sapientum, alloxan, fasting blood glucose, glutathione.*

INTRODUCTION

Musa Sapientum commonly known as banana, is the fourth largest fruit of the world and they are grown in several tropical parts of the globe such as Latin America, South East Asia, and Africa (Pari & Umamaheswari, 2000). The effectiveness of all parts of the plant as anti-ulcerogenic, anti-helminthic and anti-diabetic is well reported (Pari & Umamaheswari, 2000; Kalash, Bharathi & SriniVasan, 1993; Best, Lewis & Nasser, 1984; pari & Maheswari, 1999). *Musa Sapietum* has significantly decreased the hyperglycaemic peak in hyperglycaemic rabbits (Alarcon-Aguilar, Roman-Ramos & Perez-Gutierrez, 1998). It has been shown by Pari and Umamaheswari (2000) that extract from *Musa Sapientum* flower has anti- hyperglycaemic action and antioxidant effect. Every part of the banana plant is useful in medicine and the Indian Ayurvedic medical system used them as follows – fresh plantain sap is taken orally as a purgative; the flower extracts are used to treat bronchitis or dysentery, ulcers, diabetes, diarrhea, and insect bites. Young leaves of the banana plants are used to prevent infections in poultries and the stem extracts is used to treat kidney stones (Gibson, 1998). The anti-diabetic potentials of the plant can be related to the phytochemicals present which includes flavonoids, alkaloids, steroid, and glycoside (Dhanabal, Sureshkumar, Ramanathan & Suresh, 2005). The damage caused by oxidative stress to the pancreas is mainly one of the causes of diabetes mellitus (Rao, Dwivedi & Swarup, 1994); hence, research has revealed the reversal of the condition by herbal products (Nageswara, kumarappana, Mohanalakshimi & Mandal, 2007; Rao *et al*., 1994; Chakrarathy, Gupta, Gambhir & Gode, 1981; Soto, Recoba, Baron, Alveres & Favari, 2003). Though literature contains huge reports on the hypoglycemic effect of the flower and fruit of *Musa Sapientum* (Singh, Kesari, Rai & Watal, 2007; Lewis & Shaw, 2001), but there are limited published reports on the anti-hyperglycemic effect of the methanolic extract of *Musa sapientum* sucker, as a result, this research investigates the anti-diabetic and antioxidant activities of the extract of *Musa sapientum* sucker in order to

reveal its efficacy in the treatment or management of diabetes mellitus.

MATERIALS AND METHODS

Plant material and extraction preparation

The root of *Musa Sapientum* sucker was uprooted at Olabisi Onabanjo University, Ikenne Campus farm. The sucker (root) was recognized and validated at the Forestry Research Institute, Ibadan, Nigeria. The sucker (root) was rinsed and cut into small parts for easy and quick drying. These pieces were exposed to air in a shady ventilated area at a temperature of about 20-30^{o}C for two weeks. The chopped pieces were ground into powdery form at Falawo Market Sagamu, to maximize the surface area. The powdered *Musa sapietum* was taken to the laboratory at the Pharmacology Department, Olabisi Onabanjo University, Ogun State, for extraction using 70% methanol as solvent (Par & Maheswari, 1999). The filtrate was solidified using a rotary evaporator at the laboratory and collected in a dry, dark air-tight container until used. Adopting the methods of Joshi (2000), the investigation of the preliminary phytochemicals of *Musa Sapientum* methanol extract was conducted.

Animals and treatment

Twenty-nine adult albino Wistar rats were bought at the Department of Animal Science in the University of Ibadan, Oyo State and randomly assigned into five groups:

Group A: Six rats treated with 5mg/body weight of the plant extract for 4 weeks.

Group B: Six rats treated with 10mg/body weight of the plant extract for 4 weeks.

Group C: Six rats neither treated nor induced for 4 weeks (Control).

Group D: Five rats induced with alloxan for 4 weeks.

Group E: Six rats treated with Glibenclimide (Standard drug) for 4 weeks.

Before the commencement of the experiment, all rats were weighed using electronic weighing balance (Wensar make ELECTEONIC BALANCE TTB 3 15KG X 0.5 GRAM). The rats weighed an average of 250g. All the rats were fed with normal feeds and water and they adapted to the environment for seven days. Guidelines by the US Public Health service Guidelines (NRC, 1999) was adopted for animal care which was approved by the Olabisi Onabanjo University, College of Health Sciences and Animal Ethics committee. On the seventh day, the animals were grouped into five groups and were made to fast for 12 hours. The blood glucose level of the rats was checked using one touch ultra smart glucometer to establish their initial blood glucose level before induction of the alloxan on that dayAfter 3 days of induction with alloxan, the blood glucose level of the rats was measured adopting Dhanabal et al (2005) method. Blood was collected by orbital sinus puncture under mild ether anesthesia and serum glucose levels were determined by using Ultra smart glucometer kit. All rats except control group had glucose level above 11.11mmol/L (diabetic), then the plant extract was administered and the blood glucose level of the rats were monitored for four weeks. The weights of the rats were checked once a week for four weeks**.** At the end of experiment, the rats were anesthetized with diethyl ether and sacrificed, then they were dissected to carefully remove the organs (heart and brain) and blood samples were collected for homogenization and determination of the concentration of reduced glutathione according to the method of Pari and Umamaheswari (2000).

The authors employed the one-way analysis of variance (ANOVA) to make comparisons between the mean values of variables among the groups. All data were expressed as$\bar{x} \pm 2\sigma_{\bar{x}}$. The size of the tests were set at a level of significance of $\alpha = 0.05$. Hence, the null hypothesis of no significant differences amongst the means were rejected at *p*–values less than 0.05. SPSS statistical software was used as analytical tool throughout the analysis.

RESULT AND DISCUSSION

Preliminary Phytochemical Analysis

Preliminary phytochemical screening of *Musa sapientum* methanolic extract indicates that tannin, saponin glycosides, saponins, indole alkaloids, and alkaloids were present.

Effect of Treatment on the Fasting Blood Glucose Level

Table 1 shows the outcome of the effect of the plant on diabetic rats. During the four weeks of continual treatment of the methanolic extract of the plant and the standard drug, the blood glucose level of the groups treated with the extract (A and B) were significantly lowered compared to the standard drug group(E) and untreated group (D). It was observed that the fasting blood glucose level of group B (10 $mg.kg^{-1}$) was significantly higher compared to the group A (5mgkg-1) but significantly lower to group E (glibenclamide).

Table1. The anti-hyperglycemic effect of methanolic extract of *Musa sapientum* in diabetic rats.

GROUPS	DAY 1 (µg/dl)	DAY 4 (µg/dl)	DAY 11 (µg/dl)	DAY 18 (µg/dl)	DAY 25 (µg/dl)	DAY 32 (µg/dl)
A (5mg/kg)	160.33 ±14.66	165.00 ±22.79	146.00 ±20.43	126.83 ±19.42	105.83 ± 13.54	57.33 ±31.10
B(10mg/kg)	174.17 ± 26.48	170.67 ±23.53	164.00 ±14.74	140.00 ±39.51	123.00 ±28.74	73.17 ± 11.37
C(Control)	0.00 ± 0.00	71.17 ±13.36	66.50 ± 6.22	62.50 ±9.48	58.17 ±5.57	57.37 ±8.53
D(Untreated)	54.00 ± 7.58	210.00 ±53.02	244.60 ±59.23	252.20 ±58.56	188.00 ± 38.29	00.00 ± 00.00
E(Drug)	184.80 ± 6.79	180.00 ±6.96	172.00 ±8.12	150.60 ±12.78	142.80 ±19.63	127.00 ±27.88

Glutathione Levels in the Heart and Brain of *Musa Sapientum* Treated Diabetic Rats

Table 2 gives the outcome of the treatment on the level of glutathione in the heart and brain of the diabetic rats. After induction with alloxan and four weeks of continual treatment with the extract of the plant and gilbenclamide, the level of glutathione of groups A, B, and E was significantly higher than the diabetic group D and normal group C. The observed glutathione levels of the heart and brain of group B was also lowered significantly compared to group A, but significantly higher to group E.

Table 2. The antioxidant effect of *Musa sapientum* methanol extract on the glutathione levels (µmol/ml) in diabetic rats.

Groups	Glutathione level in the Heart (µmol/ml)	Glutathione level in the Brain (µmol/ml)
A(5mg/kg)	23.92 ± 0.82	15.6 ± 1.75
B(10mg/kg)	16.29 ± 2.24	9.28 ± 3.02
C(Normal control)	5.26 ± 0.08	7.85 ±0.37
D(Untreated)	0.92 ± 0.23	0.98 ± 0.15
E(Glibenclimide)	7.20 + 0.02	8.05 +0.31

3. Effect on the Weight of the Rats (Kg)

Table 3 indicates the outcome of the treatment on the weight of the rats. Groups A, B and E showed weight gained compared to group C but group D showed weight loss. The body weight of the group A is significantly higher compared to group E which is significantly higher than the group B.

Table 3. The effect of (*Musa Sapietum*)methanol extract on the body weights of diabetic rats.

GROUPS	DAY 1	DAY 4	DAY 11	DAY 18	DAY 25	DAY 32
A(5mg/kg)	176.97 ±47.58	182.57 ±39.26	185.55 ± 22.74	188.42 ±32.85	189.45 ±33.02	196.48 ±29.50
B(10mg/kg)	159.23 ±6.58	159.78 ±14.67	154.42 ±36.59	154.57 ±14.32	156.58 ±27.34	161.97 ±7.99
C(Control)	164.83 ± 8.13	176.83 ±2.56	182.67 ±3.77	189.00 ±5.44	197.08 ±9.20	200.50 ±11.45
D(Untreated)	224.00 ± 8.09	141.40 ±12.14	104.86 ±8.13	120.60 ±15.01	200.00 ±3.39	00.00 ± 00.00
E(Drug)	154.60 ± 10.33	164.50 ± 29.93	168.40 ±10.37	175.04 ±8.94	176.66 ± 10.18	180.12± 10.11

DISCUSSION

Various parts of *Musa sapientum* L. have been used for various medicinal purposes including the treatment of diabetes mellitus (Pari & Maheswari, 1999). Dhanabal et al., (2005) published that the ethanolic extract of flowers of *Musa Sapientum* showed hypoglycemic and antioxidant activities. Other parts of the plant like the peel, flower and pulp were reported to have both anti-hyperglycemic and antioxidant effect (Kanazawa & Sakakibara, 2000). This research revealed that orally administered methanolic extract of *Musa sapientum* showed significant difference at $p<0.05$ of blood glucose level in the rats. The glucose level in the blood of the treated rats was reduced within 31 days of administration compared with the control group. The result suggests that the decrease in blood glucose level with both doses of 5mg/body weight and 10mg/body weight was gradual and eventually reached normal value from day 24 to day 31, the last day of administration of *Musa Sapientum* sucker (root) extract. The result is in accordance with the publication of Nageswara *et al* (2007) which shows that plant extract may have better fasting blood glucose level reduction than standard drug gilbenclamide. It is also known that certain complications of diabetes mellitus can be caused by oxidative damage therefore, the antioxidant activity of the methanolic extract of *Musa Sapientum* sucker (root) in the diabetic rats was also explored. *Musa Sapientum* sucker extract increased the level of glutathione in the diabetic rats. Hearts and Brains from groups A and B showed high level of glutathione compared to groups E and C but the extract at a dose of 5mg/Kg body weight showed significant higher level of glutathione as compared with 10mg/Kg body wt. This study suggests that methanolic extract of *Musa Sapientum* has hypoglycemic and antioxidant effects which may be due to the presence of phytochemicals and its antioxidant responsiveness.

CONCLUSION

The present study authenticates the usefulness of methanol extract of *Musa Sapietum* sucker-root in ethno-medical practice for diabetic management and probably the therapeutic properties at dose 5mgkg^{-1}body weight per day.

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