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Effects of *Irvingiaga gabonensis* kernel and oil extract on the serum glucose of Wistar albino rat

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Abstract

Irvingia gabonensis Kernel powder and the oil extracts (±testa) were mixed with commercial animal feed (50:50) and fed to groups of animals.Animals in groups A and B were fed with the powder at an equivalent concentration of 67mg/kg body weight while those in groups C and D were fed with the equivalent 4ml of the oil extract in the mixture.Animals in group E, the control, were fed on the commercial feed only. All the animals were fed in an aluminum cage for 21 days and sacrificed the following day. Blood from the tail of the animal was used for determining blood glucose on the first and the 22nd day of the experiment. Relative to effects of oil extracts, animals fedonkernel samples exhibited improved glucose utilization. The study has shown that consuming *Irvingia gabonensis* kernel whole was more beneficial than the oil extract and that under unrestricted dietary condition, incorporation of *Irvingia gabonensis* kernel in animal feed had beneficial effects

Keywords: *Irvingia gabonensis*; serum glucose; Kernel; Wistar albino rat

1. Introduction

Irvinga is a non- timber forest tree comprising the stem, leaves, roots and fruits ([1]).Commonly referred to as wild bush mango and African bush mango, the tree is named after a Royal Navy surgeon and botanist, George Irving ([2]). It is of the order *Malpighiales*, family *Irvingianceae* and comprises seven species. In the family *Irvingiaceae*, *Irvingia gabonensis* and *Irvingia wombolu* are well known. *Irving*ia is native to Central and West African Countries. Specifically, the species *wombolu* and *gabonensis* span through the humid forest zones of West and Central Africa.

The flesh and the kernel of *I. gabonensis var. gabonensis* are edible while only the kernel of var. *wombolu* is edible. The former is for this reason called sweet bush mango and the latter bitter bush mango. Some local names for the kernels of African bush mango include*: ogbono* among the Ibos, *dikanut* among the Camerounians, *oro –egili* and *oro –aikpele* among the Igala people of Kogi State, Nigeria.

Indigenous African tribes have used the fruits in various ways including its usage as a thickening agent for traditional soups. When squeezed, the oil from the fruit can also be used for cooking. The western world, however, consider it a super fruit because of studies showing that extracts from its seeds and the fruit as a wholecouldhelp in loss ofweight, control of blood cholesterol as well as reduction in blood glucose ([3])

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1.1. Justification for the Study

Irvingia gabonensis has been known to cause reduction in weight, waist circumference and systolic blood pressure. In addition, the presence of appreciable fibre content in *I. gabonensis* makes it a very good option in reduction of blood sugar and hence management of diabetes mellitus ([3]).

Although literature reports abound on the role of *Irvingia gabonensis* in weight and glucose control, they are rather scanty on the contribution of the oil extract and especially the testa to the observed glycemic changes. The current study was aimed at addressing this knowledge gap.

Aim and Objectives

The aim of the study was to determine the effect of *I. gabonensis* var. *wombolu* kernel powder and oil extracts (with and without testa) on serum glucose of *wistar* albino rat
The specific objectives of the study were to determine the effects of *I .wombolu* kernel powder and oil extracts (with and without testa) on serum glycemic variations that occur between the first and the final day following administration of *I. wombolu* kernel powder and oil extract to *wistar* albino rats

2. Material and methods

2.1. Collection and Treatment of Kernel Samples

Mature *I. wombolu* fruits were plucked from the tree at Aloko, Bassa Local Govt., Kogi State, Nigeria. The fruits were then split open with a stainless steel knife; the kernels were removed from the shell and then divided in to two equal portions. The testa of one of the portions was was left intact (Iwkt) while the other was removed (Iwk).

Oil was extracted from part of Iwk and Iwkt by Soxhlet extraction method as described by Pearson ([4]). The oil samples so extracted were labeled Iwot and Iwo respectively. The Iwkt or Iwk kernel powder sample was undefatted in this study.

2.2. Purchase of Reference Commercial Feed

The commercial feed used in this study was pelletised growers mash procured from a commercial shop located opposite Grimard Hospital. Anyigba, Kogi State. The composition of the feed according to the manufacturers was as follows; crude protein (15%), fat, (7%), crude fibre (10%), calcium (1.0%), available phosphorus (0.35%) and metabolisable energy (2550 Kcal/Kg).

2.3. Experimental Animals

The experimental animals used were *wistar* albino rats with weight range of 120 – 180g obtained from the animal house of Kogi State University, Anyigba. The animals were kept in standard aluminum cubicles at the animal house of Biochemistry Department, Kogi State University, Anyigba.

Twenty-five animals were grouped into five with each cubicle containing five rats. The cubicles were labeled A, B, C, D and E.

2.4. Treatment Protocol

Kernel powder and the oil extracts (±testa) were mixed with commercial animal feed (50:50) and fed to groups of animals. Animals in groups A and B were fed with the powder at equivalent concentration of 67mg/Kg body weight while those in groups C and D were fed with the equivalent 4ml of the oil extract. Group E, the control, was fed only with commercial animal feed. They were also provided with potable water *ad libitum.*

The treatment lasted for a total of twenty-one days. On the twenty-second day, blood from the tail of the animals was allowed to flow directly on the test strip of a glucometer for determination of glucose.

Table1 Protocol for Animal Treatment

Sample Types	Animal groups (5/ group)
(Iwkt)	A
(Iwk)	B
(Iwot)	C
(Iwo)	D
Control	E

Iwkt = *Irvingia* Kernel Powder (+testa); Iwk = *Irvingia* Kernel Powder (-testa); Iwot = *Irvingia* Kernel Oil (+testa); Iwo = *Irvingia* Kernel Oil (-testa); Control = Commercial Animal feed

2.5. Determination of Blood Glucose ([5])

The blood glucose was first determined on day 1, using Accu-Check glucometer purchased from Roche Diagnostics GmbH , Germany, according to Somogyi principle ([5]).

With the aid of a lancet, a tiny cut was made at the tip of the animal's tail and blood allowed to drop on the glucometer strip which was already in position in the glucometer. After a few seconds the result was displayed on the screen. This was recorded and the procedure replicated twice. The whole procedure was repeated on the 22nd day.

3. Results

There were no significant differences ($P \geq 0.05$) in glucose concentrations on day 1 among all the groups but the concentrations depressed within 21 days for the treated groups. On the 22nd day, group B had the highest depression followed by (A, C and D). The control had the least depression.

Table 2 Blood glucose of wistar albino rats fed with *Irvingia gabonensis* var. *wombolu* kernel powder and oil (±testa) for 21 Days

Parameter Powder (+t)	A Powder(-t)	B Oil (+t)	C Oil (-t)	D Control	E	LSD
Glucose (mg/dl)						
Day 1	112±5.50^{a}	118.33±3.84^{a}	125±1.20^{a}	122.33±0.90^{a}	119.33±3.70^{a}	9.80
Day 22	89.33±3.51^{a}	93.00±1.90^{a}	111±0.60^{b}	116.70±0.90^{b}	118.33±3.70^{b}	7.00
Difference(mg/dl)	23^{a}	25^{b}	14^{a}	6^{a}	1^{a}	23.80

Results are expressed as mean ± standard error of mean for n=3; A-D refer to animals treated with Iwkt, Iwk, Iwot and Iwo respectively and E is the control. Values with similar alphabets in a row show no significant difference at $P \geq 0.05$

4. Discussion

The observed depression of glucose level in all the treated groups had similarly been reported by several scholars ([3]) and ([6]). The fact that the depression was significantly greater ($p < 0.05$) in the powdered groups than the oil groups might be due to a preponderance of fibre in the former. Fibre is a factor responsible for the glucose – lowering property of *Irvingia gabonensis* ([3]). On the contrary, the control had similar glucose level as the oil groups ($P \leq 0.05$). These relatively higher values than the powdered groups indicated the oil extracts had no adverse effects on carbohydrate (glucose) metabolism. Rather, the powdered samples promoted glucose metabolism. It could have been possible that active compounds such as polyphenolic substances known to be present in Irvingia kernels ([7]) could have repressed lipolysis. Furthermore, adiponectin level in the plasma could have increased to stimulate insulin activity ([8]). The mechanism of action implicated PPAR gamma agonist ([9]).

5. Conclusion

This study has corroborated the hypoglycemic property of *Irvingia gabonensis*: It has gone further to demonstrate that the use of the whole kernel product either for weight management, management of diabetes or, indeed, as food condiment is better than the oil alone.

Compliance with ethical standards

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Disclosure of conflict of interest

The study was conclude without any conflict of interests.

Statement of ethical approval

Preparatory to this work, ethical approval was sought and obtained from the ethical committee of the university.

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