

Effects of Ethanolic Leaf Extract of *Telfairia Occidentalis* on an Alloxan Induced Diabetic Male Wistar Rats

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ABSTRACT

Telfairia occidentalis is a leafy vegetable commonly consumed in West Africa, known not only for its nutritional benefits but also for its diverse medicinal properties. Traditionally, it has been employed in managing a variety of ailments, including diabetes mellitus—a chronic metabolic disorder marked by elevated blood glucose levels due to insulin deficiency or resistance. Given the increasing interest in plant-based therapeutic agents, this study investigates the antidiabetic potential of ethanolic leaf extract of *Telfairia occidentalis* in experimental diabetic models.

To evaluate the hypoglycemic and physiological effects of ethanolic leaf extract of *Telfairia occidentalis* on body weight, pancreatic function, and blood glucose levels in alloxan-induced diabetic male Wistar rats.

A total of thirty-five (35) adult male Wistar rats were randomly assigned into five groups (A–E) of seven rats each. Group A served as the positive control (non-diabetic), Group B was the negative control (diabetic untreated), and Groups C, D, and E received 200 mg/kg, 400 mg/kg, and 600 mg/kg of the extract, respectively, after alloxan-induced diabetes. Extract administration was carried out for 14 days. Body weight, pancreatic weight, and blood glucose levels were monitored and statistically analysis expressed as mean $\pm$ SEM and data was analyzed using T-test and ANOVA followed by post-hoc difference in mean where considered significant at $p < 0.05$.

The extract significantly reduced blood glucose levels in the treated groups, particularly by day 14. There was also an observable modulation in body weight and pancreatic weight in the treatment groups compared to the diabetic control.

Conclusively, ethanolic extract of *Telfairia occidentalis* exhibits antidiabetic potential and may serve as a complementary therapeutic agent for managing diabetes and its associated complications in both humans and animals.

KEYWORDS: Wistar rats, *telfaria occidentalis* diabetes mellitus, blood glucose, pancreatic weight, phytotherapy.

ARTICLE DETAILS

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1.0. INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder globally and continuous to pose significant public health challenges characterized by primarily persistent hyperglycemia resulting from defects in insulin secretion, insulin action, or both.(American Diabetes Association, 2022).

The disease exists in two primary forms: Type 1 diabetes mellitus, which is insulin-dependent and caused by autoimmune destruction of pancreatic β -cells, and Type 2 diabetes mellitus, which is non-insulin-dependent and typically results from insulin resistance and relative insulin deficiency. Globally, the burden of diabetes is increasing at

an alarming rate due to lifestyle changes, poor dietary habits, and sedentary behavior, making the need for effective management strategies more crucial than ever.

Current therapeutic approaches for diabetes include insulin injections and oral hypoglycemic agents such as sulfonylureas and biguanides. While these treatments can be effective in managing the disease, they are often associated with significant side effects, including hypoglycemia, weight gain, gastrointestinal disturbances, and long-term organ toxicity. In light of these limitations, there has been growing interest in the use of medicinal plants as alternative or complementary therapies for diabetes management. Medicinal plants are widely recognized for their affordability, accessibility, cultural acceptability, and minimal side effects. Among these, *Telfairia occidentalis* has emerged as a promising candidate due to its rich phytochemical composition and traditional usage in ethnomedicine.

Telfairia occidentalis, commonly known as fluted pumpkin or “ugu,” is a tropical plant cultivated primarily in West Africa. Its leaves are widely consumed as a vegetable and are also traditionally used for their therapeutic effects in the treatment of anemia, inflammation, liver disorders, and diabetes. Phytochemical studies have shown that the leaves contain a range of bioactive compounds including flavonoids, alkaloids, saponins, tannins, and phenols. These compounds are believed to exert antioxidant, anti-inflammatory, and hypoglycemic effects. (Kayode & Koyade, 2011) Making the plant a suitable candidate for scientific investigation in metabolic diseases such as diabetes.

This study was designed to evaluate the antidiabetic potential of ethanolic leaf extract of *Telfairia occidentalis* in an alloxan-induced diabetic rat model. The experiment focused on assessing changes in body weight, blood glucose levels, and pancreas weight across different treatment groups. The findings are intended to provide scientific validation for the traditional use of *Telfairia occidentalis* in managing diabetes and to support its potential application in developing plant-based therapies for glycemic control.

This study aims to evaluate the effects of ethanolic leaf extract of *Telfairia occidentalis* on blood glucose levels and pancreatic function in alloxan-induced diabetic male Wistar rats.

2.0. MATERIALS AND METHODS

2.1. Ethical Approval

Ethical approval was obtained from the animal ethics committee, Faculty of Basic Medical Sciences, College of Medicine and Health Sciences, Nnamdi Azikiwe University okofia, nnewi.

2.2. Materials:

35 Adult male wistar rats
Ethanolic leaf extract of *Telfairia occidentalis*
Alloxan monohydrate
Electronic weighing balance
Standard plastic cage

Paper tape
Cotton wool
Chloroform
Cannula
Refrigerator
Mechanical grinder
Glucose test with Glucometer(Accu-chek)
Filter paper
Hematocrit centrifuge
Dissecting sets
Beaker
5ml syringe
Dissecting board
Test tubes
Latex medical hand gloves
Formalin
Marker
Capillary tube
Spatula
Stirrer
Organ bottle
Measuring cylinder
Laboratory cost
Growers mash
Distilled water
Saw dust
Animal weighing balance
Marker

2.3 Location Of Study

This project was carried out in the animal house of the faculty of Basic Medical sciences, college of health sciences, Nnamdi Azikiwe University, Nnewi campus, Anambra State, Nigeria.

2.4. Plant collection and Extraction

The leaves of *Telfairia occidentalis*(Ugu) was purchased from a local market at Nkwo Nnewi, Anambra state, Nigeria and was authenticated in the taxonomical unit of Department of Botany, Nnamdi Azikiwe University, Awka. The vegetable leaf was washed and cut into pieces, air dried completely for two weeks. The dried Ugu leaf was grounded into a powdered form using the mechanical grinder and the powdered leaf was dissolved in ethanol and kept for forty-eight hours(48hrs),after which it was filtered using the wattman filter paper and lastly, the extract was oven dried into a gel-like form using the hot air oven at 75°C.

2.5 Induction of experimental diabetes

Alloxan monohydrate was used to induce diabetes in normoglycemic adult male wistar rats and a concentration of 120mg/kg body weight was given intraperitoneally to overnight fasted rats. After twenty-four hours(24hrs) of the Alloxan induction, rats with blood glucose level above $\geq 200\text{mg/DL}$ were confirmed diabetic.

Effects of Ethanolic Leaf Extract of *Telfairia Occidentalis* on an Alloxan Induced Diabetic Male Wistar Rats.

2.6. Experimental Animals

A total of thirty five adult male wistar rats weighing 120-190g were used in this experiment. The animals were allowed to acclimatize to the environment for two weeks and they were kept in standard cages and housed at standard room temperature relative humidity. The animals were fed with rat chows and were allowed to drink water throughout the entire period of the experiment.

2.7 Experimental Design

A total of thirty-five adult male wistar rat were used for this experiment and was divided into five groups with seven rats in each group:

Group A: (Positive Control group) Distilled water

Group B: (Negative control group) Induced diabetes without treatment

Group C: (Test group) Alloxan+200mg/kg body weight of *telfaria occidentalis* extract

Group D: (Test group) Alloxan+400mg/kg body weight of *Telfaria occidentalis* extract

Group E: (Test group) Alloxan+600mg/kg body weight of *telfaria occidentalis* extract

2.8 Estimation of Blood glucose level

The blood samples for the blood glucose estimation were collected through the tail puncture at the 7th and 14th day. The blood glucose level was estimated using the Accu-chek glucose test-strips with Glucometer and the results were expressed in mg/dl.

2.9 Histological Evaluation

At the 14th day, after the end of treatment, the animals of all groups were euthanized with cotton wool soaked with chloroform. The appropriate tissue samples were collected and weighed (pancreas) and were fixed in 10% neutral buffered formalin, sectioned at 5µ thickness and stained with haematoxylin-eosin for light microscope examination.

3.0. STATISTICAL ANALYSIS

Data was analyzed using Software package version 25 (SPSS) and results were expressed as mean ± (SEM) Standard error of mean. It was organized using T-test and ANOVA followed by post HOC and differences in between mean were considered significant at $p < 0.05$.

Presentation of Data

Table 3.1: Effects of ethanolic leaf extract of *Telfairia occidentalis* on Alloxan induced liver damage on body weight.

		Mean± SEM	P-VALUE	T-VALUE
Group A	Initial weight(g)	100.00± 0.00		
	Final weight(g)	124.25± 5.35		
Group B (Alloxan only)	Initial weight(g)	156.66± 6.00		
	Final weight(g)	120.00± 0.00	0.02*	-4.52
Group C (Alloxan + 200mg/kg of T O)	Initial weight (g)	121.33± 5.92		
	Final weight(g)	100.00± 0.00	0.02*	-6.10
Group D (Alloxan + 400mg/kg of T.O)	Initial weight(g)	182.66± 6.44		
	Final weight(g)	120.00± 0.00	0.41	1.02
Group E (Alloxan + 600mg/kg of T O)	Initial weight(g)	160.00± 0.00		
	Final weight(g)	143.00± 5.68	0.09	2.99

Table 3.2: Effects of ethanolic leaf extract of *Telfairia occidentalis* on Alloxan induced damage on absolute pancreas weight.

	MEAN± SEM	P-VALUE	F-VALUE
Group A (control)	0.48± 0.02	0.00*	
Group B (Alloxan only)	0.76± 0.01		
Group C (Alloxan + 200mg/kg of T.O)	0.29± 0.03	0.00*	34.16
Group D (Alloxan + 400mg/kg of T.O)	0.35± 0.05	0.00*	
Group E (Alloxan + 600mg/kg of T.O)	0.41± 0.01	0.00*	

Table 3.3: Effects of ethanolic leaf extract of *Telfairia occidentalis* on Alloxan induced damage on blood glucose level.

Blood glucose (mg/dl)		MEAN± SEM	P-VALUE	F-VALUE
Day 7	Group A(control)	79.60± 2.11	0.00*	
	Group B(Diabetic only)	413.60± 23.87		
	Group C(Diabetes+200mg/kg of T.O)	383.00± 45.68	0.48	

Effects of Ethanolic Leaf Extract of *Telfairia Occidentalis* on an Alloxan Induced Diabetic Male Wistar Rats.

Day 14	Group D(Diabetes +400mg/kg of T.O)	378.00±. 28.03	0.42	21.17
	Group E(Diabetes + 600mg/kg of T.O)	382.60±. 33.61	0.47	
		75.20±. 1.39	0.00*	
	Group A(control)	355.50±. 29.66		
	Group B(Diabetic only)			
	Group C(Diabetes+200mg/kg of T.O)	101.00±. 6.98	0.00*	
		93.67±. 5.00	0.00*	
	Group D(Diabetes + 400mg/kg of T.O)	110.00±. 2.88	0.00*	
	Group E(Diabetes + 600mg/kg of T.O)			90.30

DISCUSSION

The study investigated the hypoglycemic and therapeutic effects of ethanolic leaf extract of *Telfairia occidentalis* on alloxan induced diabetic rats. It was observed that control of blood glucose level is essential for preventing diabetic complications and enhancing life quality.(Otteko et al., 1995) Alloxan-induced diabetes is a well established model for studying hypoglycemic agents due to it's capacity to destroy pancreatic B cells by generating oxygen species. Administration of *Telfairia occidentalis* resulted in significant reduction in blood glucose level, increased pancreatic weight.(Akah et al., 2004)

Alloxan and the products of it's reduction, dialuric acid establishes a redox cycle with the formation of superoxide radicals. These radicals undergo dis mutation to hydrogen peroxide with a simultaneous massive increase in cystolic calcium concentration, resulting in the destruction of the pancreatic beta cells and diabetics. The result of this study is in line with previous report on the hypoglycemic effects of *Telfairia occidentalis* in rats.

According to result in figure 4.1, it showed that there was a significant decrease in body weight of the rats in group B and C and this is due to induction of diabetes and extract administered.(Ekepyong et al.,2012)

There was a significant increase in group A(positive control) compared to B, due to normal rat chow and water given to the rats without induction of diabetes or administration of extract therefore leading to their weight gain.

In figure 4.2 there was was a noticeable decrease in pancreas weight in groups C, D and E when compared to B which could be as a result of oxidative stress or maybe due to the development of diabetes due to starvation according to Mark Cleasby (2014) and a significant increase in group A when compared to B because it's the positive control, their pacreas were increased than group B which where induced and has a less pancreas weight.

From my findings in Figure 4.3 it showed it showed that the ethanolic leaf extract of *Telfairia occidentalis* has the ability to reduce blood glucose level. On the 7th day of checking blood glucose level, there was a non-significant decrease and

on continuous administration of extract, blood glucose was checked on the 14th day and there was a significant decrease in groups C, D and E which was given the extract compared to group B which was induced without treatment.

Telfairia occidentalis act as an anti-diabetic agents due to it's bioactive phytochemicals such as alkaloid, flavanoid present in the leaf. The presence of this alkaloids and flavanoids helps to reduce blood glucose and it produces its hypoglycemic effects by stimulation of insulin secretion from the islets of Langerhans or by increasing the peripheral utilization of glucose by the cells. (Mark Cassidy, 2014).

CONCLUSION

The present study investigated the therapeutic and hypoglycemic effects of ethanolic leaf extract of *Telfairia occidentalis* on alloxan-induced diabetic male Wistar rats. The results provided compelling evidence that administration of the extract produced a marked improvement in diabetic parameters, including a dose-dependent reduction in blood glucose levels, modulation of body weight, and restoration of pancreatic organ weight. These observations strongly suggest that the bioactive constituents present in *Telfairia occidentalis* play a significant role in ameliorating the physiological and biochemical complications associated with diabetes mellitus. It was observed that rats in Groups C, D, and E—which received varying doses of the extract—demonstrated significant improvement in blood glucose levels by day 14, compared to the negative control group. This confirms the extract's potential in enhancing glycemic control over time, especially with continuous administration. Furthermore, the reduction in body weight observed in diabetic rats was partially reversed in the treatment groups, indicating improved metabolic function and possible regenerative effects on pancreatic tissue. The significant increase in pancreatic weight in the positive control group and moderate recovery in treated groups also suggest that the extract may offer protective or restorative benefits to pancreatic β-cells. The hypoglycemic effects observed in this study can be attributed to the presence of flavonoids and alkaloids, which are known to stimulate insulin secretion and enhance

Effects of Ethanolic Leaf Extract of *Telfairia Occidentalis* on an Alloxan Induced Diabetic Male Wistar Rats.

peripheral glucose utilization. These bioactive compounds may also reduce oxidative stress, a major contributing factor in β -cell destruction and insulin resistance. The traditional use of *Telfairia occidentalis* in managing chronic ailments such as diabetes, therefore, finds strong scientific backing through this research.

In conclusion, this study has successfully demonstrated that ethanolic leaf extract of *Telfairia occidentalis* holds significant promise as a natural therapeutic agent in the management of diabetes mellitus. Its ability to reduce blood glucose levels, support pancreatic health, and improve general physiological parameters makes it a viable candidate for future drug development. However, further investigations including dose optimization, chronic toxicity testing, and clinical trials are recommended to establish its safety profile and efficacy in human populations. The findings underscore the importance of integrating traditional medicine into modern health systems, especially in resource-limited settings where access to conventional therapies may be limited.

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