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Evaluation of the anti-diabetic potential of methanol seed extract of *Telfairia occidentalis*

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Abstract

The aim of this study was to evaluate the anti-diabetic potential of *T. occidentalis* seed extract in wistar rats. Exactly 500 g of powdered *T. occidentalis* seed sample was processed into extract. Twenty five adult male wistar rats were divided into five groups of five rats each.

Group I was the normal control and was fed rat chow and water only,

Group II was the untreated diabetic rats.

Groups III and IV were diabetic rats administered 100 and 200 mg/kg of extract respectively.

Group V was diabetic rats administered standard drug (200 mg/kg of metformin). Administration of drug and extract lasted for 28 days after which the animals were sacrificed and blood sample collected for analysis. Blood sugar level reported for animals administered 200 mg/kg of extract as well as the activity of the catalase and superoxide dismutase significantly ($p < 0.05$) increased. The activity of aspartate aminotransferase (AST), alanine transaminase (ALT) and alkaline phosphatase (ALP) was significantly ($P < 0.05$) high in the untreated diabetic control. However, oral administration of extract significantly ($p < 0.05$) reduced the activity of the aforementioned enzymes. In conclusion, it can be deduced from this study that administration of *T. occidentalis* seed extract salvaged diabetic condition, increased antioxidant enzyme activity and was not deleterious to the liver.

Keywords: Diabetics; *Telfairia occidentalis*; Enzyme; Blood; Catalase

1. Introduction

Diabetes mellitus which has been projected the 7th leading cause of death by year 2030 is a metabolic disorder and one of the nightmares of global public health. It is characterized by excessive level of blood glucose which can translate to retinopathy, neuropathy, nephropathy and cardiovascular diseases accounting for mortality and morbidity in both developed and developing countries [1]. It is orchestrated by impaired insulin production and or target tissue resistance [2]; [3]. Reactive oxygen production by mononuclear cells is critical to the pathogenesis of the said metabolic disorder which metamorphoses to the destruction of cellular apparatuses such as protein, DNA, lipid, carbohydrate and its attendant consequences [4]. It has been known that anti-diabetic therapies such insulin as well as various anti-diabetic

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agents such as sulfonylureas, biguanides and glinides are characterized by numerous pitfalls thus, necessitating the need for health friendly options.

The use of medicinal plant by human in the treatment of diseases has been in existence for decades [5]. It is a common knowledge that plants have diverse antioxidants among numerous health benefits inherent in them [6] the reason for which the vast 80% of the populations of developing countries depend on plant based therapies in the treatment human diseases [7].

Telfairia occidentalis Hook f. commonly called ugu, fluted gourd and fluted pumpkin is a tropical vine cultivated for its edible seed and leafy vegetable [8]. It is a creeping vegetative shrub with big lobed leaves and long twisting tendrils spreading low across the ground [9].

It is found predominantly in the forest of Nigeria and Cameroon among other West and Central African countries. It originated in South-Eastern part of Nigeria where its cultivation dates back to decades ago [10]. The plant which is an embodiment of nutrients such as vitamins, protein, carbohydrate, fibre and minerals has demonstrated hepatoprotective potential [11]

Although notable members of the Curcubitaceae family reportedly wield anti-diabetic effect, no such information has been held for the *T. occidentalis* seed [12]. Thus, the imperativeness of this study is defined.

2. Material and methods

2.1. Collection of plant material

Telfairia occidentalis fluted gourds were bought from Eke market in Afikpo Local Government of Ebonyi State. The gourd was conveyed in a plastic basket to the herbarium unit of the Department of Forestry, Michael Okpara University of Agriculture Umudike Abia State South-Eastern Nigeria

2.2. Extraction of *Telfairia occidentalis* seed

Freshly obtained seeds of *Telfairia occidentalis* were decocted and subsequently dried at room temperature to attain a constant weight for five weeks. The dried *T. occidentalis* seeds were ground into fine powder. Exactly 500 g of *T. occidentalis* seed sample was suspended in 1000 ml of methanol for 2 day during which it stirred at two hourly and was subsequently filtered. The resulting filtrate was concentrated, and then stored at room temperature.

2.3. Animals

Adult male wistar rats which were obtained from the Animal House of the Department of Science Laboratory Technology, Akanu Ibiam Federal Polytechnic Unwana Afikpo Local Government, South Eastern Nigeria were placed in plastic cages in a well-ventilated house (30 °C) under a laboratory condition of twelve-hour light and dark cycle for 14 days to acclimatize before the commencement of the experiment. They were allowed access to food and water *ad-libitum*. The animals were fasted 2 h prior to and 2 h after administration of drug and extract.

2.4. LD₅₀ Determination

Lethal Dose 50 (LD₅₀) was performed in two phases. The first phase involved nine adult male wistar rats which were divided into three groups of three rats each. The groups labeled 1-3 were separately administered 10, 100 and 1000 mg/kg of extract orally respectively. The rats were observed for 24 h for signs of toxicity. Being that no death was recorded at the initial phase, the second phase which involved three groups of one rat each was separately administered 1600, 2900 and 5000 mg/kg of extract, after which animals were observed for 48 h for signs of toxicity according to Lorke [13].

2.5. Experimental Design

Twenty five (25) adult male wistar rats weighing between 180-200g were divided into five groups of five rats each.

- **Group I:** (Normal control) was fed rat chow and water.
- **Group II:** Diabetic-induced rats without treatment (negative control).
- **Group III:** Diabetic-induced rats treated with 100 mg/kg bw of the extract.

- **Group IV:** Diabetic-induced rats treated with 200 mg/kg bw of the extract
- **Group V:** Diabetic-induced rats treated with a standard drug (200 mg/kg metformin).

After 28 days of administration, animals were humanely sacrificed and blood sample was collected

2.6. Induction of Diabetes mellitus

Animals used for the study were starved overnight prior to the determination of blood sugar level. This was followed by the intraperitoneal injection of streptozotocine (STZ) dissolved in 0.1 M sodium citrate buffer pH 4.5 at a single dose of 45 mg/kg body weight to induce diabetes mellitus. 30 minutes after diabetes had been induced; rats were fed with food and water. 72 h after STZ was administered, the plasma blood glucose level of each animal was determined and rats with fasting blood glucose above 200 mg/dl were considered diabetic and were included in the study [14].

2.7. Antioxidant Activity

The level of superoxide dismutase (SOD) was determined in accordance with the method of Misra and Fridovich [15] while the approach of Aebi [16] was employed to determine catalase activity.

2.8. Data Analysis

Data generated from this study were expressed as mean \pm standard deviation using SPSS (Ver. 23). Data were analysed with the aid of one way analysis of variance (ANOVA). Differences in mean values were compared using Duncan Multiple Test Range. *P-values* less than 0.05 were considered statistically significant.

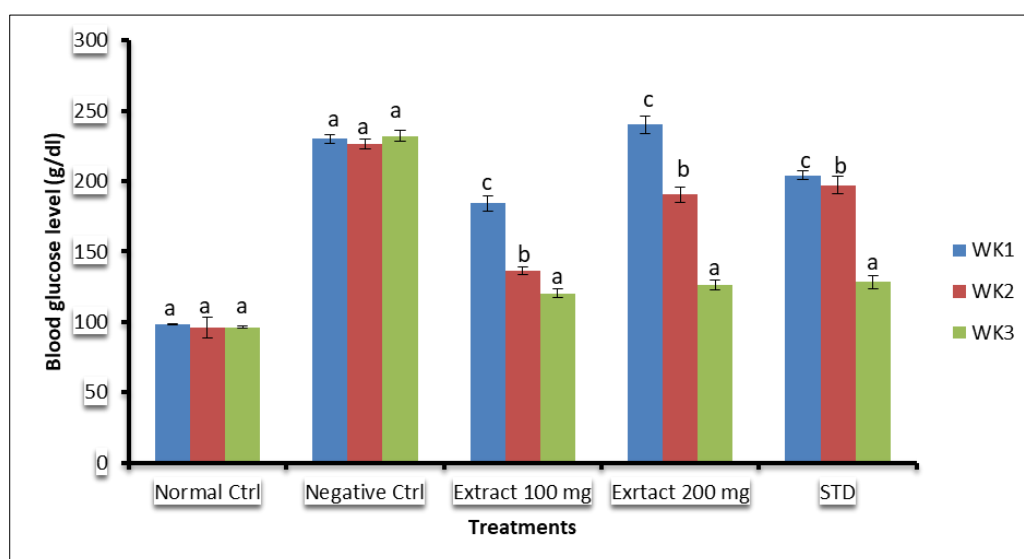


Figure 1 Blood glucose level of diabetic rats administered methanol seed extract of *T. occidentalis* seed extract

Table 1 Antioxidant Enzyme Activity of Diabetic Wistar Rats treated with Methanol Seed Extract of *T. occidentalis*

Treatments	SOD	CAT
Normal Ctrl	1.60 \pm 0.20 ^b	40.90 \pm 0.15 ^b
Negative Ctrl	0.90 \pm 0.30 ^a	32.00 \pm 0.58 ^a
Extract 100 mg/kg	1.50 \pm 0.02 ^b	41.08 \pm 1.50 ^b
Extract 200 mg/kg	2.00 \pm 0.06 ^c	45.02 \pm 1.62 ^c

Results are expressed as mean \pm standard Deviation of three determinations. Values with different superscript are significantly ($P < 0.05$) different.

3. Results and discussion

Diabetes is a chronic disease characterized by the abnormally high level of glucose in the blood which is linked to the activities of free radicals. Figure 1 shows the blood glucose level of diabetic rats administered methanol seed extract of *T. occidentalis* indicating that oral administration of the said extract significantly ($P < 0.05$) caused a progressive and dose dependent reduction in the blood sugar level of treated rats in the three weeks study. It is also important to note that the untreated diabetic rats manifested a significantly ($P > 0.05$) higher level of blood sugar compared to other groups. The reduced blood sugar levels observed on the treated diabetic rat could be attributed to the presence of phytochemicals such as flavonoids, saponins, alkaloids and tannins reportedly inherent in them. This is consistent with the findings of James et al. [17] which showed the hypoglycemic activity of some fractions of *T. occidentalis* leaf extract in rats. Table 1 shows the activity of antioxidant enzymes in diabetic rats administered methanol seed extract of *T. occidentalis* indicating that the activity of antioxidant enzymes in diabetic rats administered 200 mg/kg of extract was significantly ($p < 0.05$) higher than that reported for rats administered 100 mg/kg of extract which in turn was not significantly ($p > 0.05$) different from that reported for the normal control but higher than that report the negative control. This could be attributed the presence of certain antioxidants such terpinen-4-ol and pentanoic acid. This is in tandem with the finding of Ntinya et al. [18] which revealed the presence of certain antioxidant in the seed of fluted pumpkim.

4. Conclusion

It can be deduced from the outcome of this study that methanol seed extract of *Telfairia occidentalis* is anti-diabetic and may wield the potential to scavenge free radicals.

Compliance with ethical standards

Disclosure of conflict of interest

Authors hereby declare that no conflict of interest exists.

Statement of ethical approval

Approval was secured from the university ethical committee on the use and handling of laboratory animals for research purposes.

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