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# Hypoglycemic Effect of the Seed Extract of *Telfairia occidentalis* in Rat

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**Abstract:** The blood glucose lowering effect of the ethanolic extract of the seed of *Telfaria occidentalis* in normoglycemic, alloxan-diabetic and glucose loaded rats was determined. Ethanolic extract of the seed of *Telfairia occidentialis* was administered at two dose levels (100 and 250 mg $kg^{-1}$) to both normoglycemic and alloxan diabetic Wilstar albino rats. Blood was collected from the tail vein of the rats at 1, 2 and 4 h. Oral Glucose Tolerance Test (OGTT) was carried out by administering 100 and 250 mg $kg^{-1}$ of the extract to glucose loaded rats (1 g $kg^{-1}$) and blood was collected from the tail vein of rats at 0, 15, 30, 45 and 60 min. Blood glucose level was determined using a glucometer. Standard methods were used for phytochemical screening of the extract. The results showed that 100 mg $kg^{-1}$ ethanolic extract of seed of *T. occidentalis* reduced blood glucose concentration significantly only in the alloxan diabetic and not in the normoglycemic rats. 250 mg $kg^{-1}$ extract did not show this effect. The extract did not affect the oral glucose tolerance of rats when administered simultaneously or 1 h before glucose loading. Phytochemical screening indicated the presence of alkaloids, steroids, tannins and terpenes. It could be concluded that the ethanolic extract of the seed of *Telfairia occidentalis* possesses hypoglycemic effect in alloxan diabetic rats and could be useful in the ethnotherapy of type 2 diabetes.

**Key words:** Diabetes, hypoglycemic, *Telfairia occidentalis*

## INTRODUCTION

*Telfairia occidentalis* Hook F (Cucurbitaceae), popularly known as fluted pumpkin is cultivated mainly in West Africa, especially Nigeria, Ghana and Sierra Leone (Akoroda, 1990; Bosa *et al*., 1983). It is grown for its leaf and its oily seeds. The leaves are cooked and eaten while the seeds which contain about 30% protein can be boiled and eaten, or ground into powder for soup. The seed can also be fermented for several days and eaten as a slurry (Asiegbu, 1987; Odoemena, 1991; Lucas, 1988; Badifu *et al*., 1991). The medicinal importance of the plant is being gradually investigated. *T. occidentalis* is now known to possess anti-inflammatory effect (Oluwole *et al*., 2003), anti-bacterial activity (Odoemena *et al*., 1995), erythropoietic value (Ajayi *et al*., 2000) anticholesterolemic and immune building properties (Eseyin *et al*., 2005a) and hypoglycaemic effect (Eseyin *et al*., 2000; Eseyin *et al*., 2005b; Aderibigbe *et al*., 1991; Nwozo *et al*., 2004).

The seed of *T. occidentalis* is a rich source of minerals such as calcium, phosphorous, iron, zinc and copper. The seed contains 47% oil. The oil obtained from the seed contains 61% unsaturated fatty acids which offer protective role against atherosclerosis and cardiovascular disease (Odoemena *et al*., 1998).

The phospholipis, glycolipids and neutral lipid contents of the seed are 58, 26 and 15%, respectively (Anosike, 1994).

Both the leaf and root (Unpublished data) of *T. occidentalis* have been screened for hypoglycemic activity. This research was undertaken to screen the seed of *T. occidentalis* for possible hypoglycemic activity, since the leaf has been confirmed to possess this activity.

## MATERIALS AND METHODS

**Plant materials:** Fresh and mature pods of *T. occidentalis* were purchased at Ikot Edim village in Ika local government area of Akwa Ibom State, Nigeria. The pods were sliced open and the seeds removed and washed. The seed coats were removed and the endosperm was pulverized with a homogeniser.

**Extraction:** The seed powder was soaked in 96% ethanol for 72 h. The extract obtained was filtered and concentrated *in vacuo* with a rotary evaporator. The brownish residue obtained was dried in a desiccator.

**Animals:** Wilstar albino rats obtained from the animal house of the university of Uyo were used. Unless otherwise indicated the animals had free access to

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standard pelleted rat feeds and tap water. They were kept under the care of experienced animal technicians. Food was withdrawn overnight before experiments. Approval for this research was obtained from the Animal Ethics committee of the University of Uyo.

**Induction of diabetes:** Diabetes was induced in rats by intraperitoneal injection of 150 mg $kg^{-1}$ alloxan monohydrate. The rats were allowed to rest for seven days to stabilize the blood glucose concentrations. All rats with glucose level above 5.5 mmol $L^{-1}$ were considered diabetic and used.

**Effect of extract on blood glucose level in normoglycemic rats:** Fifteen overnight faster normoglycemic rats were divided into three equal groups A, B and C. Each group was given parenterally 1 mL distilled water, 250 mg $kg^{-1}$ and 100 mg $kg^{-1}$ of the seed extract. Blood glucose level was determined at 0, 1, 2 and 4 h.

**Effect of extract on oral glucose tolerance**

**When seed extract was administered simultaneously with Glucose:** Fifteen rats were divided into three equal groups-Groups A, B and C were given orally glucose (1 g $kg^{-1}$) only; glucose (1 g $kg^{-1}$) and 250 mg $kg^{-1}$ seed extract; glucose (1 g $kg^{-1}$) and 100 mg $kg^{-1}$ seed extract, respectively. Both the glucose and extract were administered simultaneously. Blood glucose concentration was determined at 0, 15, 30, 45 and 60 min.

**When seed extract was administered 1 (one) hour before glucose:** Fifteen rats were divided into three equal groups A, B and C. Each group received glucose (1 g $kg^{-1}$) one hour after they were given distilled water, 250 mg $kg^{-1}$ seed extract and 100 mg $kg^{-1}$ seed extract, respectively.

Blood glucose level was determined at 0, 15, 30, 45 and 60 min after administration of glucose.

**Effect of seed extract on blood glucose level in alloxan induced diabetic rats:** Fifteen alloxan diabetic rats were divided into 3 equal groups A, B and C. Each group received 100 and 250 mg $kg^{-1}$ of the seed extract and distilled water only, respectively. Blood glucose level was determined at 0, 1, 2 and 4 h.

**Phytochemical screening:** Standard methods were used to undertake the phytochemical screening of the ethanolic seed extract of *T. occidentalis*.

**Determination of blood glucose concentrations:** Blood samples were obtained from the tail vein of the rats and were analysed using One Touch$^{R}$ glucometer (Lifescan Inc., USA).

**Statistical analysis:** Data were expressed as Mean±SEM, n = 5. The data were analysed by ANOVA and scheffe's post test: $p<0.05$ was taken as significant.

Percentage variation in blood glucose level was calculated by the formula:

$$\frac{Gt \times 100}{Go}$$

$G_t$ = Blood glucose concentration at time t
$G_o$ = Blood glucose concentration at time 0

## RESULTS AND DISCUSSION

The results show that the ethanolic seed extract of *T. occidentalis* did not have any significant hypoglycemic effect on normoglycaemic rats at the dose of 100 and 250 mg $kg^{-1}$ (Table 1). And when administered to glucose (1 g $kg^{-1}$) loaded rats either simultaneously or 1 h before glucose loading, the extract did not lower the glucose level at any of the dose levels. Rather, a significant increase in blood glucose concentration was observed at 45 min in rats which received glucose one hour after the administration of extract (Fig. 1 and 2).

However, 100 mg $kg^{-1}$ of the extract significantly reduced blood glucose concentration at the dose of 100 mg $kg^{-1}$ at 1, 2 and 4 h. 250 mg $kg^{-1}$ of the extract did not show this effect (Table 2).

Phytochemical screening of the extract indicated the presence of alkaloids, steroids, tannins and terpenes.

Table 1: Effect of the seed extract of *T. occidentalis* on the blood glucose concentration (mmol $L^{-1}$) of normoglycaemic rats

| Dose (mg $kg^{-1}$) | 0 h | 1 h | 2 h | 4 h |
|---|---|---|---|---|
| 250 | 2.62±1.084 (100) | 2.76±0.58 (105.3) | 2.66±0.46 (101.5) | 2.36±0.76 (90.1) |
| 100 | 2.56± 0.22 (100) | 2.68±0.26 (104.7) | 2.72±0.21 (106.3) | 2.10±0.17 (82.0) |
| Control | 2.76±0.45 (100) | 3.22±0.32 (116.7) | 3.06±0.31 (110.9) | 2.48±0.11 (89.9) |
| F-value | 0.489 | 0.489 | 0.159 | 0.436 |

Mean±SEM, * $p<0.05$, n = 5, Figures in parenthesis represent percentage change in blood glucose concentration

Table 2: Effect of the seed extract of *T. occidentalis* on the blood glucose concentration (mmol $L^{-1}$) of alloxan diabetic rats

| Dose (mg $kg^{-1}$) | 0 h | 1 h | 2 h | 4 h |
|---|---|---|---|---|
| 250 | 10.8±1.90 (100) | 9.82±2.34 (90.9) | 8.28±2.53 (76.7) | 4.76 ±0.54 (44.1) |
| 100 | 10.12±1.60 (100) | 5.78±1.0* (57.1) | 4.5±1.18* (44.5) | 1.86±0.10* (18.4)* |
| Control | 9.3±1.88 (100) | 8.96±1.85 (96.3) | 8.0±1.64 (86.0) | 4.94±0.70 (53.1) |
| F-value | | 71.43 | 31.96 | 20.553 |

Mean±SEM, * $p<0.05$, n = 5, Figures in parenthesis represent percentage change in blood glucose concentration

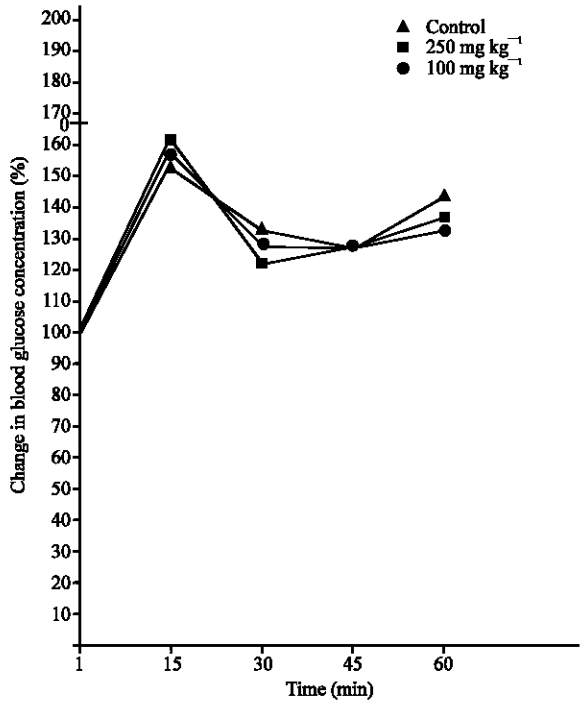


Fig. 1: Effect of the seed extract of *T. occidentails* on the blood glucose concentration (mmol $L^{-1}$) when administered simultaneously with glucose (1 g $kg^{-1}$)

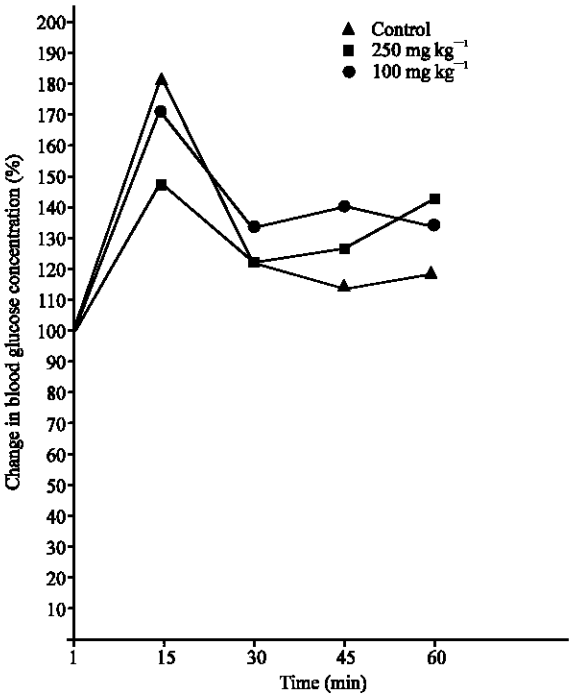


Fig. 2: Effect of the seed extract of *T. occidentails* on the blood glucose concentration (mmol $L^{-1}$) when administered 1 h before glucose (1 g $kg^{-1}$)

The hypoglycaemic effect of the leaf of *Telfairia occidentalis* has already been confirmed. Hypoglycaemic activity of the seed extract (100 mg $kg^{-1}$) was observed only in the alloxan induced diabetic rats and none in the normoglycaemic rats. In the normoglycaemic rats the Beta cells of the pancreas which produce insulin are intact. But alloxan destroys these Beta cells. Alloxan induced diabetic rats therefore no longer have functional pancreatic Beta cells and have lost the capacity to secrete insulin which is required for glucose absorption. It could be inferred therefore that the hypoglycaemic effect of the seed extract is not mediated through the stimulation of insulin release from Beta cells like the sulphonylureas (Akhtar *et al*., 1981) but through other mechanisms (Sharma *et al*., 1983).

Oral Glucose Tolerance Testing (OGTT) is a standard procedure used in the diagnosis of diabetes and in assessing extracts for hypoglycaemic effect (Meigs *et al*., 2003). The observed reduction of blood glucose concentration in glucose loaded rats at 60 min (when administered simultaneously) and an increase in blood glucose level at 45 min (when administered 1 h before glucose) shows that the seed extract is not effective in reducing blood glucose concentration in glucose loaded rats. This further buttresses the fact that the seed extract did not stimulate insulin production by the pancreas.

It is therefore clear that the seed extract may be useful in the management or ethnotherapy of type 2 diabetics mellitus. The seed of *T. occidentalis* is known to contain about 14.5% carbohydrates. (mostly sucrose, fructose, galactose, raffinose and stachyose), 47% lipids (phospho lipids - 58%, glyco lipids -26%, neutral lipids-16%) with the fatty acids exhibiting a high degree of unsaturation contributed mainly by the C 16 and C 18 fatty acids (Odoemena *et al*., 1998). And this study has shown that the seed contains alkaloids, steroids, tannins and terpenes. However, it is difficult at this stage to know which of these constituents of the seed of *T. occidentalis* is/are responsible for the hypoglycaemic activity. It is also not known why 250 mg $kg^{-1}$ of the seed extract did not reduce blood glucose level in the diabetic rats like the 100 mg $kg^{-1}$ dose. It may be that at that dose level (250 mg $kg^{-1}$) the carbohydrate content of the extract contributed significantly to the blood glucose level. Thereby countering the hypoglycemic effect of the extract. This work shows for the first time that the seed extract of *T. occidentalis* contains hypoglycaemic constituents which could be useful in the treatment of non-insulin dependent (i.e., type 2) diabetes mellitus.

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