Blood Sugar Lowering Effect of Gum Extract of *Mucuna sloanei Fawc.* & Rendle (Fam.: Papilionaceae) Seed

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Abstract

The hypoglycemic effect of the gum extract of Mucuna sloanei (Fawc. & Rendle) was evaluated on normoglycemic and hyperglycemic rats. Hyperglycemia was induced in rats using alloxan (120 mg/kg body weight, intraperitoneally). Normoglycemic and hyperglycemic rats were treated orally with three different doses of the gum extract of mucuna sloanei, tolbutamide (positive control) and normal saline (negative control). The glucose level of the withdrawn blood samples was determined by O-toluidine spectrophotometric method. The classes of chemical components of the gum extract of the plant were determined. Proteins, fixed oils and fats and carbohydrates were found to be present. Acute toxicity test in mice gave an LD_{50} of 4580 mg/kg. The gum extract produced a dose-dependent reduction ($P < 0.05$) in blood sugar levels of normoglycemic and hyperglycemic rats. In normoglycemic rats, the gum extract of Mucuna sloanei (100, 200 and 300 mg/kg) exhibited 23.14, 27.05 and 33.18 % reduction respectively of the blood glucose levels within 6 h of administration, while tolbutamide (200 mg/kg) showed 33.29 % ($P < 0.05$) reduction. In alloxan-induced diabetic rats, the gum extract (100, 200, 300 mg/ml) exhibited 31.22, 40.69 and 44.06 % reduction respectively of blood glucose concentration within 6 h of administration, while tolbutamide (200 mg/kg) caused 46.75 % reduction. The studies showed that the gum extract of Mucuna sloanei do possess a significant, dose-dependent hypoglycemic activity in normoglycemic and alloxan-induced diabetic rats and almost as effective as the standard drug, tolbutamide. This also supports its use in folkloric management of diabetes.

Key words: *Mucuna sloanei,* antidiabetic activity, gum extract, LD_{50}

Introduction

Many plant species are known in folk medicine to be used for the treatment of diabetes due to their hypoglycemic activities (Lewis and Elvin, 1977). *Trigonella foenum – graecum* seeds have been shown to posses hypoglycemic properties in experimental animals (Ribess et al, 1987) and in diabetic patients (Sharma and Raghuran, 1990). *Allium sativum* (Sharaf et al, 1963), *Vernonia amydalina* (Akah and Okafor, 1992) and *Anacardium occidentale* (Ezugwu et al, 2001) extracts decrease the blood sugar levels in alloxan diabetic rats and rabbits.

Mucuna sloanei is a climber of the family Papillionaceae. It is widespread in the tropics and exists in thick forests, near villages and along footpaths of rural areas. Few ethnic groups in Nigeria use the seeds of the plant as condiments.

It is widely used in Nigeria for the management of diabetes mellitus, but there is no scientific proof for its antidiabetic activity so far. Hence, to ascertain the claim, we felt the need to study the antidiabetic effect of the seed extract using experimental animals.

Materials and Methods

Plant material: *Mucuna sloanei* seeds were collected from Nsukka (Nigeria) and authenticated by Dr. C. O. Ezugwu of the Department of Pharmacognosy, University of Nigeria, Nsukka and a voucher specimen (UN/PCOG/03/008) was deposited at the herbarium of the Department of Pharmacognosy, University of Nigeria.

Reagents: The reagents were source commercially. Glucose, tolbutamide, sodium Ethlyenediaminetetracetate, ortho-toluidine were products of May and Baker while glacial acetic acid, trichloroacetic acid, alloxan-monohydrate, thiourea were products of Sigma, St Louis, MO, USA.

Preparation of extract: The tough dry seed coats were removed exposing the cotyledons. The cotyledons were dried in an oven at 40 °C for 4 h and later pulverized with a hammer mill. The resulting powder was dispersed in 1 % solution of sodium metabisulphite for 24 h. The viscous mixture was sieved with a muslin cloth. Acetone was then added to the viscous extract until precipitation was complete. The whitish precipitate was recovered and dried in a desiccator containing calcium chloride. Standard solutions of the gum were made in Tween 80 solution.

Phytochemical screening: Phytochemical analyses were done on the extract to establish the presence or absence of starch, proteins, alkaloids, glycosides, flavonoids, tannins, saponins, sterols and triterpenoids following the established method (Harborne, 1984).

Animals: Albino rats of both sex weighing 80 – 170 g and mice weighing 20 – 35 g were used. They were housed in white metal cages and were kept under standard conditions for 7 days with free

Table 1: Effect of *Mucuna sloanei* gum on blood glucose levels of Alloxan-diabetic rats

Dose of Drug (mg/kg)	Blood glucose level (mg/ml)				Maximum Reduction (%)
	0 h	1 h	3 h	6 h	
100	105.05 ± 6.90	98 ± 5.80	81 ± 5.6	72.25 ± 3.4	31.22
200	101.67±1.40	90.3 ± 1.82	78.67± 1.70	60.34 ± 1.14	40.69
300	103.70±0.84	93.3 ± 1.7	82 ± 1.53	57.08 ± 1.11	44.96
200 Tolbutamide	106.30±3.01	83 ± 3.01	64.69±6.72	56.60 ± 6.90	46.75
2 (ml/kg) Normal saline	117.67±6.20	117 ± 5.90	115.3± 7.21	115.01 ± 6.13	2.26

Values are expressed as Mean ± SEM; $p < 0.05$; $n = 5$

Table 2: Effect of *Mucuna sloanei* gum on blood glucose levels of normal rats

Dose of Drug (mg/kg)	Blood glucose level (mg/ml)				Maximum Reduction (%)
	0 h	1 h	3 h	6 h	
100	88.67± 4.20	85.35 ± 2.50	79.09 ± 2.94	68.15 ± 4.31	23.14
200	84.00±1.10	81.30±3.08	77.15±4.36	61.28±2.32	27.05
300	90.07±3.31	78.25±1.35	63.59±1.49	53.50±1.38	33.18
200 Tolbutamide	90.05±1.10	75.20±1.63	72.67±2.81	60.07±3.05	33.29
2 (ml/kg) Normal saline	82.91±1.61	82.63±2.50	81.35±1.42	81.25±2.23	2.00

Values are expressed as Mean ± SEM; $p < 0.05$; $n = 5$

access to water and feed before the experiment commenced. They were bred in the animal house of Department of Pharmacology and Toxicology, University of Nigeria, Nsukka.

Acute toxicity test: The toxicity tests in mice were carried out using Lorke's method (Lorke, 1983). Days prior to the test, the animals were fasted for 24 h (overnight) but had free access to water. Animals were grouped into 3, each containing five animals. Doses of 10, 100 and 1000 mg/kg of the gum were administered for the first stage and no death was recorded after 24 h. Doses of 2000, 3000 and 4000 mg/kg was administered for the second stage to another group of animals and no death was also recorded. Thus the dose of the extract was then increased to 5000 mg/kg for the third stage and few deaths were recorded after 24 h. The LD_{50} value was then calculated using the results obtained according to Lorke's assumption (Lorke, 1983).

Induction of experimental diabetes: Diabetes was induced by slow intraperitoneal injection of 1 % solution of alloxan (120 mg/kg body weight) dissolved in distilled water and administered within few minutes of its preparation. The diabetic state was confirmed on the seventh day by the blood glucose determination (Creutzfelat and Soling, 1961).

Investigation of the hypoglycemic effect of the gum: The animals were fasted for 12 h but were allowed access to water before and during the experiment. The blood glucose level was monitored before and after alloxanization by withdrawing blood from the tail by tail tipping method (Creutzfelat and Soling, 1961). At the end of the fasting, taken as the zero time (0 h), blood was withdrawn from the animal's tail vein and the sugar levels determined by o-toluidine method (Stroev and Makarowa, 1989). Only animals with blood glucose levels above 100 mg/dl were used.

Normal rats were then divided into 5 groups (I – V) of six animals in each group. Group I received normal saline (2 ml/kg body weight) while group II received 200 mg/kg body weight of tolbutamide. Group III – IV received 100, 200 and 300 mg/kg body weight of the extract, respectively. The diabetic rats were also divided into 5 groups on the same pattern and the experiment was repeated with them. Blood samples were drawn from the tail vein at 0, 1, 3 and 6 h after the administration of the gum.

Statistical analysis: Data obtained were reported as Mean ± SEM. The statistical significance of the change in blood glucose level was determined by the Student's t-test. A probability value of less than 0.05 was considered as the level of significance.

Results and Discussion

Mucuna sloanei fresh gum gave positive chemical reactions for proteins, fixed oils and fats and carbohydrate. A dose as high as 4580 mg/kg was obtained intraperitoneally as the LD_{50}, implying that the gum is relatively safe.

The gum extract showed a dose-dependent effect, since more pronounced hypoglycemic effect was produced when the dose was increased as shown in Tables 1 and 2.

In alloxan-induced diabetic rats, the gum extract produced significant hypoglycemic effect, giving a percentage ($P < 0.05$) reduction in blood sugar levels of 31.22, 40.69 and 44.96 % for 100, 200 and 300 mg/kg doses of the extract at 6 h of administration while tolbutamide exhibited 46.75 5 ($P < 0.05$) reduction of the blood sugar levels at the same time interval as shown in Table 1.

In the normoglycemic rats, the gum extract showed a significant ($P < 0.05$) decrease (Table 2), which was dose-dependent.

From the obtained results we can conclude that *Mucuna sloanei* is comparable with the reference drug tolbutamide. The comparable

effect of the *Mucuna sloanei* gum with tolbutamide on both normoglycemic and hyperglycemic animals may suggest similar modes of action. Alloxan monohydrate destroys the pancreatic β-cells (Zarrow et al, 1964) and the gum lowered blood sugar levels in alloxanized rats, an indication that the gum has extrapancreatic effects.

This resultant effect of *Mucuna* gum was due to its active constituents, which has neither been known nor the exact mode of action of the hypoglycemic effect determined. Further studies can be done to identify the active principles responsible for the hypoglycemic effect.

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