Antidiabetic potential of methanolic leaf extracts of *Icacina trichantha* in alloxan-induced diabetic mice

Ihechiluru I. Ezeigbo

Department of Veterinary Physiology, Biochemistry and Pharmacology, College of Veterinary Medicine, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria

Background: The effect of the methanolic leaf extracts of *Icacina trichantha* on blood glucose levels in alloxan-induced diabetes in mice was investigated. **Methods:** Hyperglycemia was induced by the injection of 150 mg/kg (i.p.) of alloxan monohydrate freshly dissolved in distilled water. Three doses (200, 300, and 450 mg/kg) per os, of the extracts were administered in the study. The activity was compared with reference standard glibenclamide (2 mg/kg, p.o.) and negative control. **Results:** Treatment of alloxan-induced diabetic mice with the crude extract of *I. trichantha* leaves brought down the raised blood glucose levels significantly ($P < 0.01$) in a dose-dependent manner. **Conclusion:** The result suggests that *I. trichantha* possesses antidiabetic property.

KEY WORDS: Alloxan monohydrate, diabetes mellitus, *Icacina trichantha*

DOI: 10.4103/0973-3930.66511

Introduction

Diabetes mellitus (DM) is a syndrome resulting from a variable interaction of hereditary and environmental factors, characterized by damaged β-cells of the pancreas and an increased risk of complications of vascular disease.[1] Diabetes is one of the most prevalent chronic diseases in the world.[1] DM is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both.[2] Type 2 DM is by far the commonest form of the disease globally, with rapidly developing countries being at the forefront as far as this epidemic is concerned.[3] Type 1 DM is treated with exogenous insulin and type 2 with synthetic oral hypoglycemic agents and/or insulin.[4] Though different types of oral hypoglycemic agents are available along with insulin for the treatment of diabetes, there is an increasing demand by patients to use natural products with blood glucose lowering activity.[5]

The use of ethnobotanicals has a long folkloric history for the treatment of blood glucose abnormalities.[3] Therefore, the search for more effective and safer hypoglycemic agents has continued to be an important area of active research.

Icacina trichantha (Pflamzenfen), Icacinaceae, is known as 'urumbia' or 'eriagbo' meaning it induces vomiting when eaten and 'ji-muo' meaning spirit yam in Igbo land, in the eastern part of Nigeria[6] or 'gbegbe' (meaning carry away) by the Yoruba of Western Nigeria.[7] It thrives better in secondary forests and usually grows in colonies.[8] The tuber has been used extensively by herbalists and traditional doctors in the treatment of human ailments including poisoning, constipation, to induce emesis, and to cure malaria.[6] The leaves are used for wrapping processed oil bean seeds locally known as 'ugba' in Igbo.[6,9,10] The leaves are also used by the Yorubas for coronating their chiefs called 'Obas'.[7,8] The plant is very extensively used in the rural areas and this is supported by the fact that it is regarded as a major handy household medicine for emergency treatment; hence, virtually all households have the macerated tuber in ethanol which is stored in corked bottles.[6]

An attempt has been taken to investigate the antidiabetic activity of methanolic extract of *I. trichantha* leaves on type 2 diabetes model to ascertain the folkloric claims

Correspondence to: **Dr. Ihechiluru I. Ezeigbo**, Department of Veterinary Physiology, Biochemistry and Pharmacology, College of Veterinary Medicine, Michael Okpara University of Agriculture, Umudike, Abia State, Nigeria. E-mail: ihechi2109@yahoo.com

Manuscript received: 13.08.2009; Revision accepted: 15.05.2010

of local healers based on its bitter principle.

Experimental

Animals

White albino mice (22–32 g) of both sexes procured from the animal farm of the Faculty of Veterinary Medicine, University of Nigeria, Nsukka, were used for the experiment. They were kept under standard environmental conditions of temperature, relative humidity, dark/light cycle, and were fed with standardized pellets and tap water *ad libitum* during the quarantine period. The mice were fasted for 12 hours before experimentation but were allowed free access to water. Ethical guidelines in animal handling and use were adhered to strictly in the execution of the study.

Plant collection and preparation

Fresh leaves of *I. trichantha* Pflamzenfam (ITLE) were collected in the month of April 2008, from the Michael Okpara University of Agriculture, Umudike botanical forest, Abia State. The leaves were identified as *I. trichantha* belonging to the family Icacinaceae[6] by Mr. A. Ozioko of the botany section of BDCP Nsukka. Voucher samples were deposited in the herbarium for reference. The leaves were air dried on a bench, pulverized into coarse powder and kept in polythene bags at room temperature (25°C), ready for extraction.

Extraction of plant material

Exactly 800 g of the dried pulverized leaves were extracted with 80% methanol and dried using an aeration oven (Genlab Ltd., Widnes, Cheshire, UK) at 40°C to yield 19% of solid residue and was stored in dessicators for further use.

Experimental design

Hyperglycemia was induced by a single intraperitoneal injection of 150 mg/kg body weight alloxan monohydrate (Sigma Chem. Co., St. Louis, MO, USA), freshly dissolved in distilled water immediately before use,[1,11,12] to overnight fasted (with water available) albino mice. After 8 days, animals with fasting blood glucose of 6.0 mmol/dL or more were considered diabetic and employed in the study. They were divided into five groups of six mice in each group as follows: group I served as negative control receiving the vehicle, distilled water (10 mL/kg, *per os*); groups II–IV received the test leaves (ITLE) extract at 200 mg/kg, *per os*, 300 mg/kg, *per os* and 450 mg/kg, *per os*, respectively. Group V served as a positive control and received Glibenclamide (2 mg/kg, *per os*).

The animals were treated once and fasting blood glucose concentration was measured at 0, 1, 3, 6 and 12 hours. Samples were collected by a snip-cut at the tip of the tail under mild anesthesia and blood sugar level was measured with an autoanalyzer by using AccuCheck Advantage II glucose kit.

Statistics

Data were expressed as mean ± SEM and subjected to one way analysis of variance (ANOVA) followed by Dunnett's *t*-test. *P* values <0.01 were considered significant.

Results

Table 1 shows the results of the study.

Discussion

Alloxan, a beta cytotoxin, destroys β-cells of islets of Langerhans of pancreas resulting in a decrease in endogenous insulin secretion and paves ways for the decreased utilization of glucose by body tissues.[13] It results in elevation of blood glucose level, decreased protein content, increased levels of cholesterol and triglycerides.[14]

Experimental studies conducted in alloxan-induced diabetic mice reveal that orally administered methanolic extracts of *I. trichantha* leaves at the dose of 300 mg/kg

Table 1: Blood glucose effect of ITLE

Chemicals	Groups	Weight	Blood glucose levels in mmol/L				
			Sampling time in hours				
			0	1	3	6	12
Negative control (distilled water)	I	26.40 ± 2.35	9.00 ± 3.53	8.30 ± 2.73	8.65 ± 3.14	8.98 ± 0.51	9.23 ± 4.21
ITLE 200 mg/kg	II	28.54 ± 2.69	6.76 ± 4.13	4.66 ± 0.74	2.93 ± 0.76	1.97 ± 0.34	1.23 ± 0.96
ITLE 300 mg/kg	III	24.7 ± 2.51	8.38 ± 4.93	7.17 ± 6.60	6.60 ± 6.65	4.87 ± 3.79*	4.45 ± 2.98*
ITLE 450 mg/kg	IV	27.98 ± 1.32	8.87 ± 3.69	6.76 ± 5.30	5.96 ± 0.53*	4.23 ± 2.07*	3.32 ± 1.02*
Positive control (Glibenclamide)	V	25.20 ± 1.43	10.18 ± 6.25	15.42 ± 9.10	7.04 ± 5.18*	6.48 ± 3.88*	3.00 ± 0.22*

*P <0.01 (Dunnett's multiple comparison test)

produced significant fasting blood glucose lowering activity in 6 and 12 hour samples compared with the control. An increase in the dose of ITLE (450 mg/kg) showed even a more observable hypoglycemic activity in the diabetic mice. This activity is, however, weak when compared to that of Glibenclamide.

Results indicate the presence of active diabetes principles in *I. trichantha* methanolic leaves extract, which seems to confirm its folkloric uses.

Further pharmacologic investigations to determine the possible mechanism(s) of action, activities on cholesterol and triglycerides, as well as isolate its active principles, are needed, as ITLE may be a more affordable diabetes therapy in the tropics.

Acknowledgment

Prof. I.U. Asuzu of the University of Nigeria is gratefully acknowledged for allowing the author to use his laboratory and for the supply of the Alloxan monohydrate used in the experiments.

References

1. Vinuthan MK, Kumara G, Narayanaswamya M, Veenab T. Lipid lowering effect of aqueous leaves extract of *Murraya koenigii* (curry leaf) on alloxan-induced male diabetic rats. Phcog Mag 2007;3:112-4.
2. Edwin E, Sheeja E, Dhanabal SP, Suresh B. Antihyperglycemic activity of *Passiflora mollissima* Bailey. Indian J Pharm Sci 2007;64:570-1.
3. Sharma S, Chaturvedi M, Edwin E, Shukla S, Sagrawat H. Evaluation of the phytochemicals and antidiabetic activity of Ficusbengalensis. Int J Diabetes Ctries 2007;27:57-9.
4. Pepato MT, Mori DM, Baviera AM, Harami JB, Vendramini RC, Brunetti IL. Fruit of the jambolan tree (*Eugenia jambolana* Lam.) and experimental diabetes. J Ethnopharmacol 2005;96:43-8.
5. Edwin E, Sheeja E, Dhanabal SP, Suresh B. Pharmacognostic and phytochemical evaluation of two species of Passiflora. Plant Arch 2005;5:213-6.
6. Asuzu IU, Abubakar II. The effects of *Icacina trichantha* tuber extract on the nervous system. Phytother Res 1995;9:21-5.
7. Asuzu IU, Egwu OK. Search for the centrally active component of *Icacina trichantha* tuber. Phytomed 1997;4:353-7.
8. Dalziel JM. *Icacina trichantha* Oliv. Family ICACINACEAE: The useful plants of West Tropical Africa. London: Crown Agents Press; 1937. p. 291.
9. Iwu MM. Traditional Igbo Medicine, Report of a project sponsored by the Institute of African Studies, University of Nigeria, Nsukka. 1983. p. 48.
10. Asuzu IU, Ugwueze EE. Screening of *Icacina trichantha* extracts for pharmacological activity. J Ethnopharmacol 1990;28:151-6.
11. Ravikumar P, Anuradha CV. Effect of fenugreek seeds on blood lipid peroxidation and antioxidants in diabetic rats. Phytother Res 1999;13:197-201.
12. Kameswararao B, Kesavulu MM, Apparao C. Evaluation of antidiabetic effect of *Momordica cymbalaria* fruit in alloxan-diabetic rats. Fitoterapia 2003;74:7-13.
13. Yamamoto H, Uchigata Y, Okamoto H. Streptozotocin and alloxan induce DNA strand breaks and poly (ADP-ribose) synthetase in pancreatic islets. Nature 1981;294:284-6.
14. Dhanabal SP, Raja MK, Ramanathan M, Suresh B. Hypoglycemic activity of *Nymphaea stellata* leaves ethanolic extract in alloxan induced diabetic rats. Fitoterapia 2007;78:288-91.

Source of Support: Nil, **Conflict of Interest:** None declared