Research Journal of Pharmacology 1 (1): CCCC, 2008
ISSN: 1815-9362

Effect of Aqueous Methanolic Stem Bark of *Maerua angolensis* (*Capparidaceae*) Extract on Blood Glucose Levels of Streptozocin-induced Diabetic Wistar Rats

[1]A. Mohammed, [1]Y. Tanko, [1]M.A. Okasha, [1]Y. Sadiq and [2]A.I. Isa
[1]Department of Human Physiology, Ahmadu Bello University, Zaria, Nigeria
[2]Department of Biology, College of Education, P.M.B 1021 Jalingo, Nigeria

Abstract: The hypoglycemic effect of aqueous methanolic extract of *Maerua angolensis* stem bark was investigated in streptozocin-induced diabetic rats. A single administration of the extract at the doses of 250,500 and 1000 mg kg^{-1}. There was a significant decreased in the blood glucose levels after 4 of extract administration at the doses of 250 and 500 mg kg^{-1}. Also after 8 and 24 h of extract administration there was a significant decreased ($p<0.05$) in the 3 dose administered. The effective dose resides at the dose of 500 mg kg^{-1}. The Preliminary phytochemical screening revealed the presence glycosides, tannins, saponins, terpenes, flavonoids, carbohydrate, protein and alkaloids. The median Lethal Dose (LD_{50}) in rats was calculated to be 3807.8 mg kg^{-1} body weight. In conclusion the aqueous methanolic extract of *Maerua angolensis* stem bark possess anti-diabetic effect in streptozocin induced in diabetic rats.

Key words: *Maerua angolensis*, hypoglycemic activity, streptozocin, diabetes mellitus

INTRODUCTION

Diabetes is a disorder of carbohydrate, fat and protein attributed to a diminished production of insulin or mounting resistance to its action. Chronic hyperglycemic during diabetes causes glycation of the body protein that in turn leads to secondary complications affecting eyes, kidney, nerves and arteries (Kameswara, 1999). Along with hyperglycaemia and abnormalities in serum lipids (Virella and Virella, 2003; NCEP, 2002). Diabetes is associated with microvascular and macrovascular complications which are the major causes of morbidity and death in diabetic subjects (Nagappa *et al*., 2003). It can be manage by exercise, diet and pharmaceutical drugs, which are either too expensive or have undesirable sides effects or contraindications (Serrano, 1990). The search for more effective and safer hypoglycemic agents therefore has continued to be an area of research of interest (Krishna *et al*., 2004; Pepato *et al*., 2003). The World Health Organisation has recommended and encouraged the use of alternative therapy especially in countries where access to the conventional treatment of diabetes is not adequate (WHO, 1980).

Maerua angolensis dc synonyms *Maerua arenicola* sensu Eyles; *Maerua bukobensis* Gilg and Bened; *Maerua schinzii* sensu O.B. Mill; *Maerua tomentosa* Pax, family (*Capparidaceae*). The plant is a medium to big self-planted tree up to 20 m heights. Growing in bush and rocky areas. The plant is used locally for the treatment of psychosis, ecthyma, epilepsy, laxative, diarrhea, dysentery, jaundice, hepatitis, purgative, sedative, dyspepsia, neurasthenia, liver disease (Adjanohoun *et al*., 1989; Baerts and Lehmann, 1989). Also it is useful to treat vomiting, preventing abortion, skin rash, nasal infection, stomach ulcer, boils, pimples, miscarriage (Adjanohoun *et al*., 1989; Chhabra *et al*., 1989; Kokwaro, 1976).

The present study was designed to test the hypoglycemic effect aqeous methanolic extract of *Maerua angolensis* stem bark *in* streptozocin-induced diabetes.

MATERIALS AND METHODS

Plant material: The stem bark of *Maerua angolensis* was collected from bush area of Basawa, Sabongari L.G. Zaria, Kaduna State Nigeria in the Month of December 2006. The plant spacimen was identified by Mal M. Musa of the Herbaruim Unit, Department of Biological Sciences, Ahmadu Bello University, Zaria- Nigeria, where a voucher spacimen was deposited.

Extract preparation: The stem bark of *Maerua angolensis* was dried under shade for several days and the pulverized into fine powder in a pestle and mortar and passed through a mesh sieve. The powdered plant was packed

Corresponding Author: A. Mohammed, Department of Human Physiology, Ahmadu Bello University, Zaria, Nigeria

in a Soxhlet apparatus (238 g) and defatted with petroleum ether. The dried defatted powder was extracted sequentially with 70% methanol, 30% water. After completion of the extraction, filtered and the extracts was concentrated with water bath at a temperature at 40°C.

Chemicals used: All chemicals and drugs were obtained commercially and were of analytical grade.

Acute toxicity study: The Lethal Doses (LD_{50}) of the plant extract was determined by method of Lorke (1983) using 12 mice. In the first phase rats were divided into 3 groups of 3 rats each and were treated with the extract at doses of 10, 100 and 1000 mg kg^{-1} body weight intraperitoneal. They were observed for 24 h for signs of toxicity. In the second phase 4 rats were divided into 4 groups of 1 rat each and were also treated with the extract at doses of 1600, 2900 and 5000 mg kg^{-1} bodyweight (*i.p*). The median Lethal Dose (LD_{50}) was calculated using the second phase.

Phytochemical screening: The preliminary phytochemical screening of the crude extract of *Maerua angolensis* was carried out in order to ascertain the presence of its constituents Utilizing standard conventional protocols (Trease and Evans, 1983).

Animals and induction of diabetes mellitus: Twenty five Wistar rats of both sexes weighing 200-230 g were used for the study of the effects of *Maerua angolensis* extract on the blood glucose levels of the animals. They were kept in standard cages at 25°C and 12 h light/dark condition in the animal room of the Department of Human Physiology, ABU, Zaria. The animals were fed on commercial feeds and were given water *ad libitum.* The animals were fasted from feeds for 12 h before the commencement of each experiment, but were allowed water *ad libitum.* The rats were injected with streptozocin dissolved in citrate buffer pH 4.5 in a dose of 60 mg kg^{-1} body weight intraperitoneal. Since Streptozocin is capable of producing fatal hypoglycemia as a result of massive pancreatic release of insulin, the rats were treated with 20% glucose solution intraperitoneally after 6 h (Stanley *et al*., 2001). The were kept for the next 24 h on 5% glucose solution bottles in their cages to prevent hypoglycemia. After a period of three days the rats with a blood glucose levels greater than 180 mg dL^{-1} were considered diabetic and used for this research work.

Experimental design: The Streptozocin-induced diabetic Wistar rats were randomly assigned into 5 groups (1-5) of five rats (n = 5) each as follows, namely

- Group 1-Received normal saline i.p.
- Group2-Received Biphasic Isophane Insulin 6 i.u kg^{-1} i.p (Stanley *et al*., 2001).
- Group3-Received 250 mg kg^{-1} body weight of the *Maerua angolensis* extract i.p.
- Group4-Received 500 mg kg^{-1} body weight of the *Maerua angolensis* extract i.p.
- Group5-Received 1000 mg kg^{-1} body weight of the *Maerua angolensis* extract i.p.

Determination of blood glucose levels: All blood samples were collected by cutting the tail-tip of the rats. Blood samples for blood glucose determination were collected from the tail at intervals of 0, 2, 4, 8 and 24 h. Determination of the blood glucose level was done by the glucose-oxidase principle (Beach and Turner, 1958) using the One Touch Basic (Lifescan, Milpitas, CA) instrument and results were reported as mg dL^{-1} (Rheney and Kirk, 2000).

Statistical analysis: Blood glucose levels were expressed in mg dL^{-1} as mean±SEM. The data were statistically analyzed using ANOVA with multiply comparisons versus control group. The values of $p<0.05$ were considered as significant (Duncan *et al*., 1997).

RESULTS

Phytochemical analysis: Freshly prepared extracts were subjected to preliminary phytochemical screening test for various constituents. This revealed the presence of tannins, proteins, carbohydrate, terpenes, saponins, flavonoids and its glycosides and alkaloids.

Acute toxicity study (LD_{50}): The sign of toxicity were first noticed after 2-8 h of extract administration. There was decreased locomotor activity and decreased in sensitivity to touch. Also there was decreased feed intake and prostration after 12 h of extract administration. The median Lethal Dose (LD_{50}) in rats was calculated to be 3807.8 mg kg^{-1} body weight.

Table 1 showed the results of the effects of three doses (250, 500 and 1000 mg kg^{-1}) of *Maerua angolensis* extract, Insulin and control groups in streptozocin-induced diabetic Wistar rats. The dose of Insulin and the three doses of the extract did not show any significant change in the blood glucose levels when compared to untreated control after 2 h of extract administration while after 4 h of extract administration there was a significant decrease in the blood glucose level in 250 and 500 mg kg^{-1} when compared to control untreated. However, after 8 and 24 h of treatments there was a

Table 1: Effect of stem bark of *Maerua angolensis* on streptozocin-induced diabetic wistar rats

	Blood glucose levels (mg dL^{-1})				
Treatment	0 h	2 h	4 h	8 h	24 h
Group 1 Control (N/Saline)	258±35.8	309±26.4	339±28.6	330±27.2	346±25.2
Group 2 (Insulin 6.i.u kg^{-1})	261±27.4^{ns}	217±22.3^{ns}	160±12.5^{a}	147±19.0^{a}	126±14.3^{a}
Group 3 (250 mg kg^{-1})	260±54.2^{ns}	211±31.0^{ns}	185±19.7^{a}	166± 13.7^{a}	155±15.0^{a}
Group 4 (500 mg kg^{-1})	226±26.7^{ns}	214±27.5^{ns}	206±27.2^{a}	152±18.2^{a} (41%)	134±15.3^{a}
Group 5 (1000 mg kg^{-1})	260±51.3^{ns}	256.±49.7^{ns}	254±48.4^{ns}	239±46.0^{a}	214±34.9^{a}

Vales are given as mean ± SD for 5 rats in each group, experimental groups are compared with diabetic control. Values are statistically significant at ^{a} = $p<0.05$ ^{ns} = not significant

significant decrease ($p<0.05$) in the blood glucose levels when compared to untreated control in all the three doses given.

DISCUSSION

Streptozocin-induced hyperglycaemia has been described as a useful experimental model to study the activity of hypoglycaemic agents (Szkudelski, 2001). Streptozocin selectively destroyed the pancreatic insulin secreting β-cells, leaving less active cell resulting in a diabetic state (Kamtchouing *et al*., 1998; Szkudelski, 2001).

Many secondary metabolites participate in a variety of anti-diabetic functions *in vivo* (Kako *et al*., 1997). The glycemic change in blood glucose levels of diabetic rat at different time intervals after intraperitoneal administration of *Maerua angolensis* extract of at the doses of 250, 500, and 1000 mg kg^{-1} as showed in Table 1.

In relation to the diabetes rats that received 250, 500 and 1000 mg kg^{-1} bodyweight of *Maerua angolensis* extract of there was no significant change in the blood glucose levels when compared to the control untreated group after 2 h of extract administration. In regard to the dose of 250 and 500 mg kg^{-1} of the *Maerua angolensis* it significantly ($p<0.05$) lowered the blood glucose level when compared to control after 4 h of extract administration. Also as regard to the dose of 1000 mg kg^{-1} there was no significant change in the blood glucose levels. After 4 h of extract administration when compared to control untreated group. Also after 8 and 24 h of extract administration there was a significant change in the blood glucose level of all the doses given when compared to control untreated group. In relation to the reference drug biphasic insulin 6.i.u kg^{-1} there was a significant decrease in the blood glucose level when compared to control untreated group. The dose of 500 mg kg^{-1} was found to be more effective in the glycaemic change after 24 h of extract administration than the other two doses of the extract 250 and 1000 mg kg^{-1} body weight. The extract might possess Insulin like effect on peripheral tissues either by promoting glucose uptake and metabolism or inhibiting hepatic Gluconeogenesis. The phytochemical studies of *Maerua angolensis* extract of *revealed* the presence of flavonoids isolated from the other plant has been found to stimulate secretion or possess an insulin like-effect (Marles and Farnsworth, 1995).

CONCLUSION

In conclusion, the experiment evidence obtained in the present laboratory animal study indicate that aqueous methanolic extract *Maerua angolensis* stem bark possess anti-diabetic properties which suggest the presence of biologically active components which may be worth further investigation and elucidation.

ACKNOWLEDGEMENT

The authors wish to thank Mallam Bala Mohammed and Mallam Nura Mohammed, technical staff of the Department of Human Physiology, ABU, Zaria for the care of the experimental animals throughout the period of this research work.

REFERENCES

Adjanohoun, E., V.J. Adjakidje and M.R.A. Ahyi, 1989. Contribution aux etudes ethnobotaniques et floristiques en republique popularire du Benin. Agence de Cooperation Culturelle et Technique (ACCT) Paris, pp: 895.

Baerts, M. and J. Lehman, 1989. Guerisseurs et plantes medicinales de la region des cretes Zaire-Nil au Burundi Muse's royal de I' Afrique centrale, Teruren Belgique. Ann. Sci. Eco., 18: 214.

Beach, E.F. and J.J. Turner, 1958. An enzymatic method for glucose determination uptake in body fluids. Clin. Chem., 4: 462-468.

Chlabra, S.C., R.L.A. Mahummeh and E.N. Mshiu, 1989. Plants used in traditional medicine in Eastern Tanzania 11. Angiosperms (*Capparidaceae to Ebenaceae*). J. Ethnopharmacol., 25: 339-359.

Duncan, R.C., R.G. Knapp and M.C. Miller, 1977. Test of hypothesis in population Means. In: Introductory Biostatistics for the health sciences. John Wiley and Sons Inc. NY., pp: 71-96.

Kako, M., T. Miura, Y. Nishiyama, M. Ichimaru, M. Moriyasu and A. Kato, 1997. Hypoglycemic Activity of Some Triterpenoid Glycosides. J. Nat. Prod., 60: 604-605.

Kamchouing, P., D.S. Sokeng, F.P. Moundipa, P. Watcho, B.H. Jatsa and D. Lontsi, 1998. Protective role of *Anacardium Occidentale* extract against streptozocin-induced in rats. J. Ethnopharmacol., 62: 55-99.

Kameswara Rao, B. Kesavulu, M.M. Giri and C.H. Appa Rao, 1999. Antidiabetic and hypolipidemic effects of *Momordica cymbalaria* Hook, fruit powder in alloxan diabetic rats. J. Ethnopharmacol., 67: 103-109.

Kokwaro, J.O., 1976. Medicinal plants of East African. East African literature bureau, Kampala, Nairobi, Dar'salaam, pp: 368.

Krisna, B., S.M.K. Nammi and R.V. Krshna Rao, 2004. Evaluation of hypoglycemic and antihyperglycemic effect of *Datura metel* Linn seeds in normal and alloxan-induced diabetic rats. J. Ethnopharmacol. 9: 95-95.

Lork, D., 1983. A New Approach to Practical Acute Toxicity Testing. Arch. Toxicol., pp: 275-287.

Marles, J.R. and N.R. Farnsworth, 1995. Antidiabetic plants and their active constituents. Phytomedicine, 2: 123-89.

Nagappa, A.N., P.A. Thakurdesai, N. Venkat Rao and Jiwan Singh, 2003. Antidiabetic activity of *Terminalia catappa* Linn fruits. J. Ethnopharmacol., 88: 45-50.

NCEP (Third Report of the Ntional Cholesterol Education Program), 2002. Expert Panel on Detection, Evaluation and Treatment of High Blood Cholesterol in Adult (Adult Treatment Panel III) final report. Circulation. 106: 3143-3421.

Pepato, M.T., A.M. Baviera, R.C. Vendramini, M.P. Perez, I.C. Kettelhut and I.L. Brunetti, 2003. *Cissus sicyoides* (Princess wine) in the long term treatment of streptozotocin-induced rats. Biotechnol. Appied Biochem., 37: 15-20.

Rheney, C.C. and K.K. Kirk, 2000. Performance of three blood glucose meters. Ann. *Pharmacother*, 34: 317-21.

Serrano, J.J., 1990. Toxico-pharmacologie experimentale des plante medicinales. Actes du 1er Colloque Europeen d'Ethnopharmacologie. Office de la Recherche Scientifique et Technique d'Outre Mer (ORSTOM), pp: 210-218.

Stanley Mainzen, P. and M.P. Venugopal, 2001. Anti-oxidant action of Tinospora cordifolia root extract in alloxan diabetic rats. Phytother. Res., 15: 213-218.

Szkudelski, T., 2001. The mechanism of Alloxan and Streptozocin action in cell of the rats pancreas. Physiol. Res., 50: 536-546.

Trease, G.E. and M.C. Evans, 1983. Textbook of Pharmacognosy. 13th Edn. Bailliere, Tindall, London, pp: 683-684.

Virlla-Lopes, M.F. and G. Virella, 2003. The role of immune and inflammatory processes in the development of macrovascular disease in diabetes. Frontiers in Boisc. 8: 750-768.

WHO Expert Committee on Diabetes Mellitus, 1980. Second Report, Technical. Report. Series No. 646. World Health Organization, Geneva.