African Journal of Pharmaceutical Research and Development

Short Communication

Antidiabetic property of *Detarium microcarpium* Guill and Perr. Gum (Family: Caesalpinaceae)

ODOH U. E*.,[1] EZUGWU C. O.,[1] NWODO J. N., AND[2] AJALI U.[2]

1. Dept. of Pharmacognosy, Faculty of Pharmaceutical Sciences, University of Nigeria, Nsukka.
2. Dept. of Pharmaceutical Chemistry, Faculty of Pharmaceutical Sciences, University of Nigeria, Nsukka.

* Correspondence

Accepted (revised) Oct. 2004

The blood sugar lowering effect of *Detarium microcarpium* Guill and Perr. Gum was investigated on normoglycaemic and hyperglycemic rats. The hypoglycemic activity was evaluated using alloxan - (120 mg/kg body weight intraperitoneally) induced hyperglycemic rats. The potency of the extract was compared with standard drug tolbutamide. A dose of 400 mg/kg body weight of the extracts caused maximum lowering of blood sugar levels in both normal and alloxanized rats. The fasting blood sugar in the normoglycaemic rats was reduced from 75.07± 1.54 mg % to 36.65 ± 1.89 mg % in six hours, while in alloxanized rats, blood sugar was reduced from 141.80 ± 2.54 mg % to 70.06 ± 4.23 mg % in six hours. The LD_{50} of the extract in mice was above 5000 mg/ kg body weight when given intraperitoneally. The drug is comparable with tolbutamide in its ability to reduce the blood sugar levels in alloxan induced diabetic rats.

Key words: *Detarium microcarpium* , Hypoglycemic activity, Alloxan.

INTRODUCTION

Many plant-derived preparations are used in folklore medicine in different parts of the world for the management of diabetes [1]. Herbal drugs have won a high acceptance in the management of diabetes mellitus because of its fewer side effects compared to the synthetic agents such as insulin, sulphonylureas, and biguanides. Some of these plants of known antidiabetic activity are *Allum sativum*, [2] *Vernoma amygdalia, [*3] *Dioscorea dumentorum*, [4] *Bridelia feruginea, [*5] *Viscum album, [*6] (*African mistletoe)* and *Anacardium occidentale*, [7] which have been found to lower blood sugar levels in experimental animals.

Detarium microcarpium gum is a naturally occurring gum obtained from the seeds of the tree *Detarium microcarpium* Guill and Perr (Leguminosae). The plant is a resin-yielding savannah tree with sweet edible fruits. [8] It flowers throughout the wet season and fruits between November, January and May every year. The seeds are used traditionally as a food condiment.

Studies have been carried out on the use of the gum as a binding agent in tablet manufacture, [9] and its ability to improve the moisture retention properties of bread and reduce crumb-firming tendency [10]. The aim of the study is to establish the antidiabetic effect of the plant *Detarium microcarpium* in order to establish a basis for its use in Nigerian herbal practice in treatment of diabetes. The effect of the extract was compared with that of tolbutamide, a standard anti-diabetic agent.

EXPERIMENTAL

Plant material. The fresh seeds were collected from plant growing in Nsukka (Enugu State, Nigeria) in January, 2001. Botanical identification was confirmed by Mr. A. O. Ozioko of Department of Botany, University of Nigeria, Nsukka.

Preparation of Gum Extract: The seeds (1 kg) were boiled so as to ease the removal of the tough dry seed coats and also to inactivate any enzymes present. The coats were removed and the cotyledons dried in an oven at 40 °C for 24 hrs and milled using the hammer mill with sieve aperture

3.55 mm. The pulverized gum was sieved through a 0.25 mm aperture sieve. Then 2% w/v of the mucilage, which was found to be most appropriately dispersed in distilled water, was then centrifuged for 30 min. Water was displaced from the water-soluble polysaccharide retained in the supernatant by large volumes of acetone. The precipitated Gum was put inside a bottle containing acetone to prevent oxidation. The freshly prepared gum was chemically tested for the presence of different constituents using standard methods [11].

Animals. White albino mice (25 – 30 g) and rats (75 – 140 g) bred in the animal house of Department of Pharmacology and Toxicology, University of Nigeria, Nsukka were used for the experiments. The animals were kept under standard conditions for 7 days with free access to water and food before the experiments commenced.

Acute toxicity test. The LD_{50} of the extract was determined in the mice intraperitoneally using Lorke's method. [12]

Anti-diabetic evaluation in normoglycaemic rats. The animals were fasted for 12 hours but were allowed access to water before and throughout the duration of experiment. At the end of the fasting period, taken as zero time (0 hr), blood was withdrawn from the marginal ear vein. Blood sugar levels were determined by o-toluidine method [13] and animals having blood sugar concentration of 80 – 120 mg % were used. The animals were divided into 3 groups of five animals each. Groups I and II received the gum at a dose of 200 and 400 mg/kg body weight respectively. Group III received tolbutamide 500 mg/kg body weight, as the standard hypoglycemic agent. All the administrations were through intraperitoneal route.

Anti-diabetic evaluation in hyperglycemic rats. Normal adult rats having blood sugar levels of 70 – 110 mg % after 12 hour fasting were used. The animals were made diabetic by a single intreperitorial injection of 120 mg/kg body weight of alloxan monohydrate (Sigma, USA). The animals were fed for 7 days and on day 8, the survivors fasted for 12 hours and their blood sugar levels were determined as before. The diabetic rats were divided into 3 groups of five animals each and treatment was in the same pattern as normoglycaemic animals on day 9.

Collection of blood and blood glucose estimation. At a fixed time intervals (0, 1, 3, 6, 9h) after treatment, blood sample were withdrawn from the marginal ear vein of the rats and blood sugar levels were determined as previously described [13].

Statistical analysis. Mean blood levels were expressed as mg % ± SEM. The significance of difference between the blood sugar levels at time zero (zero hour) and other time intervals in each treatment group, the extract treated groups and the tolbutamide control group were compared using Students t-test ($p < 0.05$).

RESULTS

Chemical constituents of the gum. The fresh gum gave positive chemical reactions for proteins, fixed oils and fats, starch and reducing sugars.

Acute toxicity test. After intraperitoneal administration of the gum in mice at up to 5000 mg/kg dose, no death was recorded.

Hypoglycemic effect of gum. The result of the anti-diabetic evaluation of the aqueous extract of Detarium microcarpun is shown Tables 1 and 2. A dose dependent reduction in blood sugar levels of the treated rats was observed from different doses of the extract in both normal and alloxanized rats. In normalglycemic rats (table 1) the gum (200 and 400 mg/kg) exhibited 26.20% ($P < 0.05$) and 51.17% ($P < 0.05$) reduction respectively of the blood glucose levels within 6h of administration while tolbutamide (500 mg/kg) showed 63.89% ($P < 0.05$) reduction.

TABLE 1: Effects of *D. microcarpium* gum and tolbutamide on mean blood fasting blood glucose of normal rats.

Drug dose (mg/kg)	Fasting blood sugar (mg %)					Percentage maximum reduction
	0 h	1 h	3 h	6 h	9h	
Gum 200	72.39.7 ± 2.35	72.04 ± 4.35	*62.61 ± 3.46	*53.42 ± 2.38	58.49 ± 3.38	26.2
Gum 400	75.07 ± 1.54	70.97± 6.00	*59.62 ± 4.89	*3.65 ± 1.89	43.26 ± 1.41	51.17
Tolbutamide 500	87.51± 1.31	*79.32 ± 1.18	51.60 ± 2.26	*31.60 ± 2.30	33.50 ± 2.40	63.89

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

TABLE 2: Effects of *D. microcarpium* gum and tolbutamide on mean blood fasting glucose of alloxanized rats.

Drug dose (mg/kg)	Fasting blood sugar (mg %)					Percentage maximum reduction
	0 h	1 h	3 h	6h	9h	
Gum 200	140.13 ± 3.46	*130.46 ± 1.07	127.643 ± 1.46	*103.15 ± 2.00	113.08 ± 1.14	26.39
Gum 400	142.80 ± 2.54	142.51± 3.49	*121.36 ± 2.84	*70.06 ± 7.61	98.08 ± 4.23	50.58
Tolbutamide 500	138.10 ± 5.78	*131.30 ± 8.67	*95.83 ± 10.81	*47.05 ± 8.15	56.24 ± 8.21	66.91

Values are expressed as mean ± SEM; *p < 0.05; n = 5

In alloxanized rats, 200 and 400 mg/kg doses of extract lowered the mean fasting blood glucose levels from 140.13 ± 3.46 mg % at an 0 hr to 103.15 ± 1.14 mg % and 141.80 ± 2.54 mg % to 70.06 ± 4.23 mg % respectively at six hours (table 2). The effect of tolbutamide as the control followed the same sequence. The percentage maximum reduction in blood sugar levels produced by extract at the doses of 200 and 400 mg/kg in the fasted normal and alloxan treated rats were 26.39 % and 50.58 % respectively.

DISCUSSION

The investigations on the gum of *Detarium microcarpium* showed that the gum caused significant reductions ($P < 0.05$) in the blood sugar level in hyperglycaemic rats. In the alloxan-induced diabetic rats, the extract produced a marked reduction in blood sugar level, which became significant within 1 hr post administration and peaked at the sixth hour post administration. The acute toxicity test, which was found to be above 5000 mg/kg, implies that the extract is relatively safe with low risk of acute intoxication [12].

When compared with tolbutamide treated animals, the gum produced a comparable percentage maximal reduction in the mean fasting blood sugar level in normoglycaemic and hyperglycaemic rats. The mechanism of action of the extract is unclear but it could be possible that it exerts its hypoglyemic action by either increasing the peripheral utilization of glucose or by stimulating the secretion of insulin by the remaining intact β-cell that may likely be present.

The results of the study provide supportive scientific evidence in favour of the view that gum of *Detarium microcarpum* does posses significant hypoglycemic effect on alloxan-induced diabetic rats.

REFERENCES

1. Wambebe C. O, Ogoazi N. O., (1991) Hypoglycemic effect of some tropical medicinal plants. *West Afr. J. Pharmacol. Drug Res.* **9/10**: 124.
2. Reiter H. D., (1985) Blood sugar lowering effect of ally polysulphide from Allium sativum, *Phytomed.* **2:** 78-91.
3. Akah P. A., Okafor C. L. (1992) Blood sugar lowering Effects of *Veronica Amydalina Del* in an experimental Rabbit model, *Phytother. Res.* **6**: 171-173.
4. Undie A. S., Akubue P. I. (1986) Hypoglycemic effect of *Dioscorea dumentorum* on blood sugar level of diabetic rats, *J. Ethnopharmacol.* **15**: 133-144.
5. Iwu M. M., (1980) Anti diabetic properties of *Bridelia ferrugriea* Leaves. *Planta Med.* **39**: 1980, 247.
6. Obatami, D. K., Biokomo E. O., Tempu V. J. (1994) Antidiabetic properties of African mistletoe in streptozocin-induced diabetic rat. *Journal Pharmacol.*, **43**: 13, 17.
7. Ezugwu C. O., Okonta J. M., Esimone C. O., (2001) Blood Sugar lowering effect of *Anacardium occidentale* leaf extract in an experimental rat model. *J. Nat. Remed.* **1**: 60-63.
8. Keay R.W.J., (1989) Trees of Nigeria, Claredon Press Oxford: London, 204-207.
9. Chukwu A. (1992) studies on *d. microcarpium* gum Comparative evaluation as a binder in tablets containing Tartrazine Dye. *S.T.P. Pharm. Sc.* **2**: 463-468.
10. Onweluzo, J. C., Leelavathi K., Rao P. H., (1999) Effect of *Detarium microcarpium* and *Mucuna flagillipes* gums on the quality of white bread, *Plant Hum. Nutri.* **54**: 173-182.
11. Trease G. E., Evans W. C. (1994) Pharmacognosy, 13th edn. Balliere Tindall: London, 167-197, 286.
12. Lorke D. (1983) A New approach to practical Acute Toxicity Testing. Arch. Toxicol **54**: 275-287.
13. Stroev E. A., Makarowa V. G., Laboratory Manual in Biochemistry Mir Publishers: Moscow, 1989, p. 143.