



Research Article

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HYPOGLYCEMIC AND ANTI DIABETIC EFFECT OF *ALTERNANTHERA SESSILIS* IN NORMAL AND STREPTOZOTOCIN (STZ)-INDUCED RAT

**K.V.Raghavender Rao^{1*}, K.R.S.Sambasiva Rao², R.Nelson³, K.Nagaiah⁴,
V.Jaya sankar Reddy^{5*},**

1. J & J Dechane Laboratories Pvt Ltd, 4-1-324, Residency Road, Abids, Hyderabad. A. P.
2. Professor and Coordinator, Center for Biotechnology, Acharya Nagarjuna University, Guntur, A.P, India.
3. Department of Gene Technology, J.J College of Arts & Science, Pudukottai, T.N.
4. Scientist-EII, Fine Chemicals Laboratory, ICT, Tarnaka, Hyderabad, A.P.
5. Department of Pharmacology, Krishana Teja Pharmacy College, Tirupati, A.P.

*Corresponding author E-mail:kumardornala@gmail.com

ABSTRACT

Various herbs have been found beneficial in the management of NIDDM and are gaining considerable recognition in the management of NIDDM worldwide. The present study was planned to search, standardize, and evaluate the efficacy of indigenous herbal ingredient *Alternanthera sessilis* which is used in some areas for the treatment of Diabetes mellitus and whose hypoglycemic effects have not yet been scientifically studied. The whole of *Alternanther sessilis* collected, shade dried and ground to get powder and extracted with ethanol and water in soxhlet extractor and concentrated in rotary flash evaporator under vacuum. Quantitative and qualitative analysis carried out on both the extracts. Studies were undertaken to evaluate the hypoglycemic and anti diabetic activity of both the extracts of *Alternanthera sessilis* on both normal and streptozotocin induced rats.

Keywords: *Alternanthera sessilis*, Hypoglycemic activity, Anti diabetic activity, Amaranthecea.

INTRODUCTION:

The prevalence of Diabetes Mellitus is increasing globally day by day. The past two decades have seen an explosive global increase in the number of people diagnosed as non-insulin dependent diabetics. In India it is estimated that 19.4 million individuals are affected by non-insulin dependent diabetes mellitus, which is likely to go up to 57.2 million by the year 2025. It was observed that in urban India, prevalence of diabetes has risen to 12.1 percent and there was an equally large pool of individuals with Impaired Glucose Tolerance (IGT), many of them will eventually develop NIDDM in the coming future.¹

Alternanthera sessilis is a species belongs to the plant family Amarantaceae very widespread throughout the tropics and subtropics: and occurs throughout the hotter parts of India, ascending to an altitude of 1200 m in the Himalayas, cultivated as a pot

herb. It is a prostrate herb much branched and rooting at the lower nodes. Leaves simple, opposite, fleshy, lanceolate, oblanceolate or linear oblong, sub acute. Flowers are small, white, shining, in small axillary sessile clusters. Fruits compressed, obcordate utricles with suborbicular seeds. The leaves are widely used as vegetable. Majorly the whole plant is used for medicinal purpose. The Wealth of India says young shoots are nutritious and contain protein 5% and iron 16.7 mg\100 gms. The young shoots are nutritious and contain carotenoids, triterpene², saponins³, flavonoids, steroids, stigmasterol, β -sitosterol⁴. It is accredited with galactogogue properties and antibacterial properties⁵ useful in night blindness due to its high carotene content. Siddha literature mentioned *Alternanthera sessilis* as Kaya Kalpa drug (i.e. drug which prevents and cures chronic diseases and rejuvenates the body) and as compatible diet. The

antioxidant carotene is found in large amounts in *Alternanthera sessilis*.^{6,7} It is used for the treatment of biliousness, dyspepsia, sluggish liver in Sri Lanka ⁸. The plant is also used traditionally as cooling, digestive, intellect promoting, in burning sensation, liver disorders, skin diseases, as antipyretic ⁹ and in children for overall development. Ayurveda and Siddha medical systems consider *Alternanthera sessilis* as Rasayana drug.

METHODOLOGY:

The whole plant of *Alternanthera sessilis* was collected from local areas of Mahaboobnagar district of Andhra Pradesh, India and the same was authenticated by Pharmacognosy Department of J & J Dechane Laboratories Pvt. Ltd., Hyderabad, India. The plants were shade dried and ground to get coarse powder of 40-mesh size and extracted with ethanol in soxhlet extractor. The extract was concentrated under reduced pressure and it was dissolved

in a minimum amount of ethanol and adsorbed on already extracted plant material. The material air-dried successively extracted in a soxhlet extractor with ethanol and water. After each extraction the solvents were evaporated and concentrated under reduced pressure. The different extracts so obtained were subjected to qualitative and quantitative chemical analysis and subjected to pharmacological studies.

Hypoglycemic activity of various extracts on rats:

Dose of extracts was fixed 200-mg/kg concentrations considering the results of the toxicity and behavioral study as suitable for hypoglycemic activity. The male Albino wistar rats weighing between 100-150 g were divided into three groups each group having 6 animals. These were housed under standard environmental conditions. Prior to experiment carried out, the animals were fasted for 18 h and water *ad libitum*. First group of animals received

average 0.2 ml volume of Tween-20 and other groups of animals received 200 mg/kg body weight of extract and 90 µg/kg body weight Glibenclamide mixed with Tween-20 by single oral administration. And 0 h blood samples were collected from tail vein before drug administration to estimate fasting blood glucose. Blood samples were collected at 0.5, 1, 2, 4, 8, 12, 18 and 24th h after administration of extract, Glibenclamide, solvent and glucose is estimated.

ANTI-DIABETIC ACTIVITY:

The animals were kept fasting overnight and Diabetes was induced by a single intraperitoneal injection of freshly prepared solution of streptozotocin (STZ) (70 mg/kg body weight) in 0.1 M citrate buffer (pH 4.5).⁶. In order to avoid the streptozotocin induced hypoglycemic mortality, 5% glucose solution was given for 24 h to streptozotocin treated animals. The control rats received the control vehicle in amounts equivalent to the drug treated

group. A rest period 2 days was allowed for the blood glucose levels to stabilize. During this period the animals used to have free access to both food and water. The animals having blood glucose values above 250 mg/dl on the 3rd day after STZ injection were considered as Diabetic. The various extracts were given on the 4th day after STZ injection and it was considered as first day of treatment.

The blood glucose lowering activity of alcoholic and aqueous extracts were determined in STZ – induced Diabetic rats, after oral administration at the dose of 200 mg/kg body weight in comparison to glibenclamide and control. The blood samples were collected from the tail vein of rats before and also at 0.5, 1, 2, 4, 8, 12, 18 and 24th h after drug administration and the samples were analyzed for blood glucose by using glucose-oxidase/peroxidase method.

EXPERIMENTAL DESIGN:

The rats were divided into three groups comprising of six animals each group as follows:

Group I: Diabetic controls + Tween-20.

Group II: Diabetic rats given 200-mg/kg body weight of extract orally.

Group III: Diabetic rats given 90µg/kg body weight of Glibenclamide orally.

RESULTS:

Results of various phytochemical parameters of the plant summarized in table-1 and the quantitative data in table-2. The results indicate the presence of active constituents in the solvents extracted from medicinal plants material. The water-soluble ash value, acid insoluble ash value, the total ash value were reported in table-2. Ash values measures the residue of the extraneous matter (e.g. Sand and soil) adhering to the plant surface. The acid

insoluble ash value measures the amount of silica present especially as sand and siliceous earth. Their results were given in NMT limit as quality control parameters of crude drugs. . The hypoglycemic activity results of the alcoholic extract of *A. sessilis* shown in Fig. 1. and the results of the water extract of *A. sessilis* in Fig 2.

The study on STZ induced diabetic rats of alcoholic extract of *Alternanthera sessilis* is shown in Fig. 3 Similarly, of the water extract of *A. sessilis* in Fig. 4.

DISCUSSION:

The data in table-1 reveal the results of the preliminary identification tests for the phytoconstituents of ethanolic and aqueous extracts of the plants. Alcoholic and water extracts of *Alternanthera sessilis* on silica gel G plate in different mobile phases showed different bands at various Rf values indicating the presence of different chemical constituents like glycosides, triterpenes, saponins, protein and amino acids

,which may serve as responsible constituents for the management of diabetes. In the present study the alcoholic and aqueous extracts of the plant were used for screening of Antidiabetic activity in rats. The role of flavonoids, polyphenols, triterpenoids, saponins and glycosides as Antidiabetic agents was well established.^{11, 12, and 13}

The pure alcoholic and aqueous extracts of *Alternanthera sessilis* were used for screening Antidiabetic and hypoglycemic activities in rats. The hypoglycemic activity results of the extracts revealed that, the alcoholic extract of *A. sessilis* reduced sugar levels from 109.32 to 71.67 (12 h) and the significant effect of the extract started from 4 h and the activity was increased further and sustained till 12 h.

The extract shown significant hypoglycemic activity in comparison to control and standard. The water extract of *A. sessilis* reduced the sugar levels from 108.70 to 77.30 (12 h), and the significant effect of

the extract started from 4 h and the activity was increased and sustained till 12 h. the extract shown significant hypoglycemic activity in comparison to control and standard.

The statistical analysis revealed that all the values were significant at 5% significance level ($P < 0.05$). The results further indicate the efficacy of alcoholic and aqueous extracts of the plant. The study on STZ induced diabetic rats showed that the alcoholic extract of *Alternanthera sessilis* reduced the blood glucose levels from 323.35 to 111.05 (8 h), significant effect of the extract started from 4 h and effect was increased and sustained till 8 h. Similarly, the water extract of *A. sessilis* reduced the blood glucose levels from 365.92 to 123.96 (8 h), and this significant effect of the extract was started from 4 h and the effect was increased and sustained till 8h. The extracts shown significant hypoglycemic

activity in comparison to control and standard.

CONCLUSION:

The study clearly demonstrated that the alcoholic and aqueous extracts of *Alternanthera sessilis* showed significant reduction in blood glucose levels of STZ-induced diabetic rats and the activity of both

the extracts was quite significant and encouraging. The Antidiabetic activity of *A. sessilis* can be attributed to the presence of triterpenoids, phytosterols and glycosides. The results also further revealed that the aqueous extract is slightly less effective when compared with alcoholic extract.

Table-1: Studies on Phytochemical constituents

Phytoconstituent	<i>Alternanthera sessilis</i> (Water extract)	<i>Alternanthera sessilis</i> (Ethanol extract)
Alkaloids	–	-
Flavonoids	+	+
Saponins	+	+
Steroids	+	+
Tannins	-	-
Coumarins	-	-
Phenols	-	-
Glycosides	+	+
Proteins	+	+
Triterpenoids	+	+
Amino acids	+	+
Carbohydrates	+	+

Table-2: Studies on quantitative parameters of selected parameters:

Parameters	<i>Alternanthera sessilis</i> (Water Extract)	<i>Alternanthera sessilis</i> (Alcohol Extract)
Total ash (NMT)	5%	5%
Water soluble ash (NMT)	0.7%	0.8%

Acid insoluble ash (NMT)	0.4%	0.6%
Water soluble extractive (NLT)	35%	20%
Ethaol soluble extractive (NLT)	18%	26 %

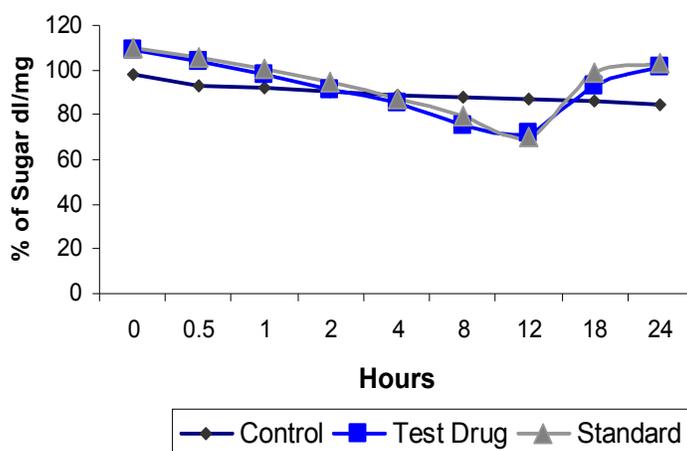


Figure 1: Hypoglycemic Effect of Alcohol Extract of Alternanther sessilis.

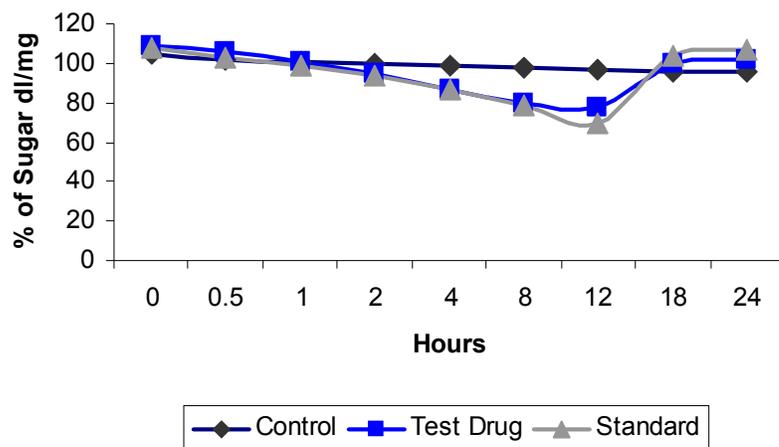


Figure 2: Hypoglycemic Effect of Water Extract of Alternanther sessilis

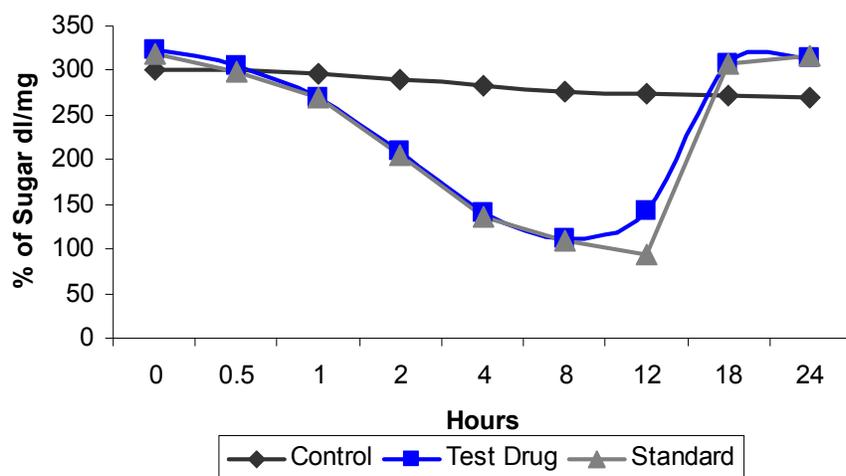


Figure 3: Anti Diabetic Effect of Alcohol Extract of *Alternanthera sessilis*

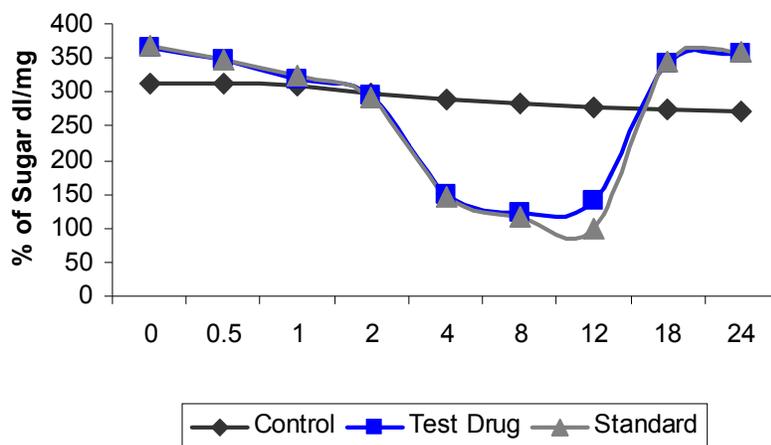


Figure 4: Anti Diabetic Effect of Water Extract of *Alternanthera sessilis*

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