ORIGINAL RESEARCH PAPER
Volume - 10 | Issue - 08 | August - 2021 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

HYPOGLYCEMIC ACTIVITY OF METHANOL EXTRACTS OF SOME MEDICINAL PLANTS ON STREPTOZOTOCIN INDUCED ALBINO MICE DIABETIC MODELS

Biological Science

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ABSTRACT

BACKGROUND: Medicinal plants are sources of potent and powerful drugs[1], and the different parts of medicinal plants are being used as raw drugs and thus herbal drugs constitute a major part in all traditional medicines.
AIM: To study the hypoglycemic activity of ten medicinal plants.
OBJECTIVES: To know about the hypoglycemic activity of medicinal plants to be used as herbal drugs to cure diabetes mellitus.
METHODS: Methanol extracts of leaves of *Catharanthus roseus,* seeds of *Trigonella foenum-graceum,* phylloclade of *Opuntia ficus-indica,* bulb of *Allium sativum,* rhizome of *Costus igneus,* leaves of *Aconitum napellus,* leaves of *Adhatoda vasika,* root tubers of *Panax ginsang,* floral buds of *Withania somnifera* and leaves of *Stropanthus hispidus* was used for assaying hypoglycemic activities in Streptozotocin induced albino mice diabetic models.
RESULTS: The methanol extract of leaves of *Catharanthus roseus*, seeds of *Trigonella foenum-graceum*, phylloclade of *Opuntia ficus-indica*, bulbs of *Allium sativum*, rhizome of *Costus igneus*, leaves of *Aconitum napallus*, *Adhatoda vasika*, root tubers of *Panax ginsang*, floral buds of *Withania somnifera* and leaves of *Stropanthus hispidus* were found to be effective in alleviating diabetes mellitus through its insulin-sensitizing activities.
CONCLUSIONS: The methanol extracts of these medicinal plants can play a promising role to cure diabetes mellitus.

KEYWORDS

Medicinal plants, Methanol extract, Streptozotocin, Albino mice

INTRODUCTION

Medicinal plants are sources of potent and powerful drugs[1]. Therefore use of medicinal plants has become an important part of daily life[2]. The different parts of medicinal plants are being used as raw drugs and thus herbal drugs constitute a major part in all traditional medicines[3]. World Health Organization has made an attempt to identify about 25000 medicinal plants globally[4,5]. The present investigation is aimed to study the hypoglycemic activity of some important medicinal plants collected from Gaya.

MATERIALS AND METHODS

Methanol extracts of leaves of *Catharanthus roseus,* seeds of *Trigonella foenum-graceum,* phylloclade of *Opuntia ficus-indica,* bulb of *Allium sativum,* rhizome of *Costus igneus,* leaves of *Aconitum napellus,* leaves of *Adhatoda vasika,* root tubers of *Panax ginsang,* floral buds of *Withania somnifera* and leaves of *Stropanthus hispidus* was used for assaying hypoglycemic activities in Streptozotocin induced mice diabetic models. Plant samples were washed under running tap water blotted with filter paper and was dried in the shade at room temperature. The dried plant sample (2.6 kg) was then soaked with absolute methanol under reflux condition for the methanolic extract preparation. The sample was then homogenized with extraction buffer and the supernatant collected after three rounds of extraction. The solvent was evaporated under reduced pressure in a rotary evaporator at 40 ^{0}C. To this thick paste colloidal silicon dioxide was added and dried in vacuum tube dryer. The obtained methanol extract was stored in deep freezer at -20^0 C until further test.

Adult albino mice weighing around 18–25 gram with 6.5 ± 0.5 cm length were selected for experiments allowed to acclimatize for 15 days in an environmentally controlled room under standard environmental conditions (21±2°C, 55±5%Relative humidity, 12 hr Light: Dark cycle).

The mice were fed on diet consisted of wheat grains, Choker wheat, Gram grains, Maize grains, Soybean grains, Sun drop oil, Milk powder and Jaggery. This diet provided carbohydrate, crude protein, fat, ash and fiber 3.9%. Pellet of these ingredients were prepared, and one pellet of feed per mouse was given.

Diabetes in mice was induced by multiple intra-peritoneal injection of freshly prepared streptozotocin solution in 0.05 M sodium citrate (pH 4.5) at the dose of 35 mg/kg body weight followed by an hour of fasting. The mice were then allowed to access the respective food and water *ad libitum*. Mice with fasting blood glucose level of 200 mg/dl (7.8 mmol/l) or higher were considered to be diabetic and were used in the study. A parallel set of control mice (non-diabetic) were injected with citrate buffer only.

The mice were grouped into five categories viz., Normal control (NC), Diabetic Control (DC), Diabetic Treated (DT_{150}), Diabetic Treated (DT_{250}), and Diabetic Treated (DT_{RZG}). NC received only citrate buffer solution. DC group was STZ induced which received citrate buffer only. DT_{150} and DT250 received 150mg/Kg and 250mg/Kg of body weight of methanol extract respectively. DT_{RGZ} received Rosiglitazone at a dose of 2mg/Kg of body weight.

For the experiment, the mice were divided into five groups having six mice in each group: DC group (diabetic control mice), NC group (non-diabetic control mice) and three DT group (diabetic mice treated with two different doses of extract as well as Rosiglitazone 2mg/ kg body weight). Treatment with extracts was started after one week of STZ treatment, which was considered as the 1st day of treatment. The fasting blood glucose levels of animals were analyzed aseptically by puncturing their tail veins and blood glucose recorded with the help of Glucometer.

All experiments were carried out in replicates of five and results were statically analyzed by mean ± S.E and by one-way ANOVA. The levels of significance was fixed between $P<0.05$ – $P<0.001$. The results obtained have been presented in Table-1.

Table-1: Blood Glucose Level (mmol/L) In Mice Diabetic Model During And Fourth Weeks After Treatment With Methanol Extract Of Medicinal Plants

Mice group	Methanol extract of medicinal plant parts																			
	1		2		3		4		5		6		7		8		9		10	
	Weeks of treatment																			
	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4	0	4
NC	4.25 ±0.25	4.42 ±1.25	4.35 ±1.31	4.45 ±1.32	4.38 ±1.15	4.65 ±1.42	4.40 ±1.42	4.37 ±1.40	4.42 ±1.41	4.45 ±1.41	4.25 ±1.25	4.65 ±1.24	4.37 ±1.41	4.42 ±1.43	4.32 ±1.24	4.61 ±1.23	4.41 ±1.41	4.67 ±1.22	4.35 ±1.25	4.47 ±1.23
DC	14.75 ±1.15	14.97 ±1.16	14.65 ±1.18	14.85 ±1.12	14.15 ±1.15	14.25 ±1.14	14.35 ±1.17	14.37 ±1.16	14.40 ±1.15	14.47 ±1.25	14.42 ±1.17	14.48 ±1.18	14.37 ±1.14	14.45 ±1.15	14.65 ±1.18	14.80 ±1.19	14.67 ±1.16	14.85 ±1.12	14.41 ±1.13	14.55 ±1.14

DT_{150}	14.85 ±1.25	9.18 ±1.27	14.75 ±1.26	8.17 ±1.33	14.87 ±1.34	11.45 ±1.45	14.86 ±1.47	9.18 ±1.46	14.87 ±1.51	8.25 ±1.18	14.87 ±1.27	10.85 ±1.26	14.76 ±1.18	9.17 ±1.13	14.85 ±1.18	7.85 ±1.35	14.75 ±1.45	7.75 ±1.17	14.86 ±1.28	11.47 ±1.27
Dt_{250}	15.15 ±1.16	5.65 ±0.18	15.17 ±0.16	5.15 ±1.16	15.25 ±0.19	10.15 ±1.17	15.35 ±1.14	6.76 ±1.24	15.85 ±1.15	5.15 ±1.12	15.75 ±1.15	10.25 ±2.14	15.65 ±1.16	5.25 ±1.17	15.84 ±0.18	5.17 ±0.19	15.76 ±1.16	6.85 ±1.26	15.85 ±1.27	10.35 ±1.17
DT_{RGZ}	15.18 ±1.18	6.95 ±1.15	15.19 ±1.25	7.10 ±1.24	15.35 ±1.17	6.96 ±1.15	15.25 ±1.27	6.75 ±1.16	15.37 ±1.14	6.67 ±1.19	15.28 ±1.27	6.94 ±1.13	15.38 ±1.23	6.97 ±1.35	15.45 ±1.44	6.85 ±1.29	15.42 ±1.28	6.67 ±1.24	15.35 ±1.16	6.85 ±1.18

Values are significant at p<0.05 as compared with normal control; n = 6 in each group
0 = Pretreatment; 4 = after fourth weeks of treatment

Methanol extract of 1. *Catharanthus roseus* (leaves) 2. *Trigonella foenum-graceum* (seeds) 3. *Opuntia ficus-indica* (phylloclade) 4. *Allium sativum* (bulbs) 5. *Costus igneus* (rhizome) 6. *Aconitum napellus* (leaves) 7. *Adhatoda vasika* (leaves) 8. *Panax ginsang* (root tubers) 9. *Withania somnifera* (floral buds) 10. *Stropanthus hispidus* (leaves)

RESULTS AND DISCUSSION

The methanol extract of leaves of *Catharanthus roseus*, seeds of *Trigonella foenum-graceum*, phylloclade of *Opuntia ficus-indica*, bulbs of *Allium sativum*, rhizome of *Costus igneus*, leaves of *Aconitum napallus*, *Adhatoda vasika*, root tubers of *Panax ginsang*, floral buds of *Withania somnifera* and leaves of *Stropanthus hispidus* has been reported to be effective in alleviating diabetes mellitus through its antioxidant and insulin-sensitizing activities.

The changes in the blood glucose levels before and after receiving the treatment in normal and diabetic mice have been presented in Table-1. The DC mice showed a significantly (p<0.001) higher level of glucose (+279%), when compared with their normal control counterparts. Diabetic mice of all the three groups (DT_{150}, DT_{250} and DT_{RGZ}) showed a reduction in glucose levels, when compared to the DC ones; nevertheless, the reduction was particularly evident in the DT_{250} and DT_{RGZ} mice (−44%; p<0.001). When compared, the glucose levels of the DT_{250} and DT_{RGZ} versus the DC group mice during the 4th week of treatment program, a significant lower value in the first was also found (−45% and -70%; p<0.001) respectively. Nevertheless, this decline in the glucose levels was less evident in the DT_{150}mice (−38%) than in the DT_{250} and DT_{RGZ} mice. The decline in the level of blood glucose to normal level was significantly observed when mice were treated with methanol extract of leaves of *Catharanthus roseus*, seeds of *Trigonella foenum-graceum*, bulbs of *Allium sativum*, rhizome of *Costus igneus*, leaves of *Adhatoda vasika*, root tubers of *Panax ginsang* and floral buds of *Withania somnifera*. The methanol extract of these plant parts caused decline in the level of blood glucose to 5.65 mmol/L, 5.15 mmol/L, 6.75 mmol/L, 5.15 mmol/L, 5.25 mmol/L, 5.17 mmol/L and 6.85 mmol/L respectively. The results revealed that the values are significant at P<0.05 as compared with normal control (Table-1).

The pharmacological properties of active phytochemicals including antidiabetic activities have been studied by vander Heijden *et al*[6] in *Catharanthus roseus*, Mandegary *et al*[7] and Bukhari *et al*[8] in *Trigonella foenum-graceum*, Yang *et al*[9] in *Opuntia ficus-indica*, Zhau *et al*[10] and Wang *et al*[11] in *Allium sativum*, Jothivel *et al*[12] and Gireesh *et al*[13] in *Costus igneus*, Dall Acqua *et al*[14] and Gao *et al*[15] in *Aconitum napellus*, Ilango *et al*[16] and Ahmad *et al*[17] in *Adhatoda vasika*, Panda *et al*[18] and Bouic[19] in *Panax ginsang*, Singh[20] , Abou-Douh[21], Dhuley[22], Wagner *et al*[23], and Panda and Kar[24] in *Withania somnifera*, Kresner *et al*[25], Agyare *et al*[26] and Ayola *et al*[27] in *Stropanthus hispidus*.

CONCLUSIONS:

The methanol extract of leaves of *Catharanthus roseus*, seeds of *Trogonella foenum-graceum*, phylloclade of *Opuntia ficus-indica*, bulbs of *Allium sativum*, rhizome of *Costus igneus*, leaves of *Aconitum napallus*, *Adhatoda vasika*, root tubers of *Panax ginsang*, floral buds of *Withania somnifera* and leaves of *Stropanthus hispidus* exhibited good anti diabetic property. The existing anti-diabetic molecules of these plants possesses better anti hyperglycemic activity. Therefore, the herbal extracts like extract of these medicinal plants can play a promising role by its anti diabetic and anti oxidant properties.

Acknowledgements: Authors are thankful to Dr. D. K. Yadav for providing necessary suggestions and support.

Conflict of interest: Authors declare no conflict of interest directly and indirectly.

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