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Antidiabetic Activities of *Ipomoea sepiaria* (Koenig Ex. Roxb) Ethanolic Leaves Extracts in Streptozotocin Induced Diabetic Rats

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A B S T R A C T

Diabetes mellitus (DM) is a chronic metabolic disorder throughout the world which affects human body in terms of physical, psychological and social health. Traditional plants have been used for the treatment of diabetes mellitus. Hypoglycaemic agents from natural and synthetic sources are available for treatment of diabetes. Plants have been an important source of medicine with qualities for thousands of years. They are the basic source of knowledge of modern medicine. Medicinal plants have the capacity to produce a large number of phytochemical constituents with complex structural diversity that is known as secondary metabolites. Due to the traditional acceptability and availability of herbals, the management of type 2 diabetes is convenient with these herbal remedies of low costs and lesser side effects. *Ipomoea* is the largest genus in the flowering plant family Convolvulaceae with over 500 species. The genus occurs throughout the tropical and subtropical regions of the world and comprises annual and perennial herbs. The present study is to evaluate the antidiabetic activity of *I.sepiaria* ethanolic leaves extract against normal and Streptozotocin induced diabetic rats. Significant antidiabetic activity was exhibited by the herbal extract. Treatment with the herbal preparation 100 mg/kg body wt and 200 mg/kg body wt for 14 days in diabetic animals has shown significant decrease in blood glucose levels when compared to standard drug, Glibenclamide.

Keywords: *I.sepiaria*, Type 2 diabetes, Streptozotocin, Glibenclamide, Antidiabetic activity

A R T I C L E I N F O

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1. Introduction

Plants are the basic source of knowledge of modern medicine. Nature has been a source of medicinal agents for thousands of years and a considerable number of modem drugs with quality have been isolated from them, many based on their use in traditional medicine. Over the last 20 years, a large number of secondary metabolites from different plant species have been evaluated for their antimicrobial, anti-inflammatory and anticancer activity. Medicinal plants play a vital role in drug discovery. Medicinal herbs have been source of wide range of biologically active compounds for many centuries and they have been used extensively as crude drugs or as pure components for treating varieties of disease conditions. When compared to synthetic ones, natural remedies have less side effects and toxicity.

India is a varietal emporium of medicinal plants and is one of the richest countries in the world in regard to genetic resources of medicinal plants. The agro-climatic conditions are favourable for introducing new exotic plant varieties [1]. Many infectious diseases are known to be treated with herbal remedies throughout the history of mankind. In India, Herbal medicines have been the basis of treatment and cure for various diseases in traditional methods practiced such as Ayurveda, Unani and Siddha [2]. Plant origin phytochemicals have an enormous therapeutic potential to heal many infectious diseases [3]. At present nearly 80% of the world population rely on plant based drugs for their health care need [4]. Various plants still available in the nature are yet to be explored for their medicinal potential [5].

Diabetes is a group of disorders characterized by hyperglycaemia, altered metabolism of lipids, carbohydrates and proteins [6]. It is becoming the third "killer" of the health of mankind along with cancer, cardiovascular and cerebrovascular diseases [7]. Diabetes is a major worldwide health problem predisposing to markedly increased cardiovascular mortality and serious morbidity related to the development of Nephropathy, Neuropathy and Retinopathy [8]. An extensive literature survey revealed that the plant extract of *Ipomoea sepiaria* was screened for its thrombolytic activity [9], antibacterial activity, anti-fungal activity [10], antipyretic and anti-inflammatory activity. From the review of literature it was identified that less biological activity was examined. So the present study was carried out for the evaluation of antidiabetic activity of *I.sepiaria* leaves extract.

2. Experimental

Identification and authentication of selected plant species

Fresh, healthy and young leaves of *Ipomoea sepiaria* were collected from farm fields of Melattur and Saliyamangalam region of Thanjavur district, Tamilnadu, India and authenticated by professionals in Department of Botany, St. Joseph's College, Tiruchirappalli, India. The herbarium number of the plant is JS 001.

Preparation of Plant Extract

The powdered sample was successively extracted with ethanol by hot continuous percolation method in Soxhlet apparatus [11] for 24 hrs. The extract was concentrated by using a rotary evaporator and subjected to freeze drying in a lyophilizer till dry powder was obtained.

Animals

Healthy, matured male albino wistar rats weighing 170-210g were used for the present study. They were kept in plastic animal cages at animal house maintained at standard temperature and humidity with 12 h light and dark cycle. The animals were fed with standard pellet diet and water. The animals are handled according to Good Laboratory Practice (GLP). After one week of acclimatization, the animals were used for further research experiments. The ethical clearance was obtained from institutional animal ethical committee as per the Indian CPCSEA guidelines.

Chemicals

Streptozotocin (STZ), Glibenclamide, all other chemicals and solvents used in the experiment were of high quality and purchased from Sigma Aldrich, E-Merck and HiMedia.

Acute Toxicity Study

This study was carried out by using Acute Toxic Class Method as per Guidelines of OECD-423 [12]. The ethanol extract of *I.sepiaria* were administered orally to 4 male rats (starting dose of 500 mg/kg to 2000 mg/kg b.wt). The mortality and behavioural changes were observed in these rats during 48 hours.

Induction of Diabetes

0.1M Citrate buffer of pH 4.5 is used to dissolve STZ and injected intraperitoneal (i.p) at a dose of 40 mg/kg b.wt to a group of rats after an overnight fast to induce diabetes. To overcome the drug induced hypoglycaemia, the STZ treated rats were orally administered 5% glucose solution overnight. These STZ treated animals with the blood glucose ranging from 200-300 mg/dl was considered as diabetic rats and used for further research purpose.

Animal studies

Animals were divided into five groups (6 animals in each group)

Group 1: Normal rats

Group 2: Streptozotocin (STZ) induced rats-40mg/kg b.wt.

Group 3: STZ + Ethanolic leaf extract of *I. sepiaria* (100 mg/kg b.wt)

Group 4: STZ + Ethanolic leaf extract of *I. sepiaria* (200 mg/kg b.wt)

Group 5: STZ + Glibenclamide (5 mg/kg b.wt)

Estimation of body weight

The body weight of rats from all the groups was measured on 0^{th} day and 14^{th} day. The digital weighing balance was used to measure the weight of rats in all groups.

Determination of Blood Glucose and Plasma Insulin

Blood glucose was estimated by the standard method [13]. Glucose concentration was expressed as mg/dl of blood. Plasma insulin was assayed by the standard method [14]. The insulin concentration was expressed as µU/ml of plasma.

Statistical Analysis

The values were analyzed by ANOVA and followed by DMRT. All the results were expressed as Mean ± SD and the p values ($P<0.05$) were considered as significant [15].

3. Results and Discussion

Results

Acute Toxicity Study: It revealed the non toxic nature of the ethanol extracts at the tested concentrations. No lethal toxic reactions were observed.

Estimation of body weight

The body weight of the normal animals, STZ treated animals, diabetic animals treated with 100 mg/kg of ethanol leaf extract, diabetic animals treated with 200 mg/kg of ethanol leaf extract and diabetic animals treated with standard drug Glibenclamide on 0^{th} day was 201 g, 182 g, 201.1 g, 197.3 g, 192.2 g respectively and on 14^{th} day was 205g, 178g, 204.3g, 202.4g, 195.10g respectively (Table 1).

Changes in level of Blood glucose and Plasma insulin

The biochemical parameters were recorded and tabulated. The blood glucose level of the normal animals were 88.12 mg/dl on the 0^{th} day and 89.14 mg/dl on the 14^{th} day. The Streptozotocin treated control showed 88.36 mg/dl on the 0^{th} day and 332.8 mg/dl on the 14^{th} day. Diabetic animals treated with 100 mg/kg of ethanol leaf extract showed 90.40 mg/dl on the 0^{th} day and 91.52 mg/dl on the 14^{th} day. Diabetic animals treated with 200 mg/kg of ethanol leaf extract showed 90.61 mg/dl on the 0^{th} day and 90.58 mg/dl on the 14^{th} day. Diabetic animals treated with standard drug, Glibenclamide exhibited 87.25 mg/dl on the 0^{th} day and 202.15 mg/dl on the 14^{th} day (Table 2). The plasma insulin levels in normal animals, STZ treated animals, diabetic animals treated with 100 mg/kg of ethanol leaf extract, diabetic animals treated with 200 mg/kg of ethanol leaf extract and diabetic animals treated with standard drug Glibenclamide were 18.35 µU/ml, 8.53 µU/ml, 20.88 µU/ml, 22.15 µU/ml, 13.72 µU/ml respectively (Table 2).

Discussion

Medicinal plants are the potential sources of bioactive compounds and they are used in treatment of diabetes all over the world [16]. Safe, effective and inexpensive remedies are gaining popularity equally among the people of both the urban and rural areas especially in developing countries like India [17]. Many of the oral antidiabetic agents have a number of serious side effects and still there is a challenge in managing diabetes without any side effects [18]. Medicinal plants with the anti-hyperglycemic effects has the ability to withstand the function of pancreatic tissues so that there is an increase in insulin output or decrease in the intestinal absorption of glucose. Hence the treatment with these herbal drugs of medicinal plants has an effect of protecting cells and smoothing out fluctuation in glucose levels [19].

Streptozotocin at high doses selectively destroys the pancreatic β cells which results in diabetes mellitus [20]. In most of the experimental studies, hyperglycemia was induced by streptozotocin or alloxan [21]. Methanolic extract (51%) of *P.guajava* leaves showed hypoglycemic effect in type 2 diabetes [22]. Aqueous extract of *A.squamosa* root (at a dose of 250 mg/kg and 500 mg/kg b.wt) when given to STZ- induced diabetic rats reduced the blood glucose level from 285.52 to 208.81 mg/dl, 6 hours after oral administration of extract [23]. In the present study, the daily oral administration of ethanolic leaves extract of *I.sepiaria* results in decrease in blood glucose levels in STZ induced diabetic rats. It is proved to be effective and satisfactory. These extracts proved to restore the glucose levels to near normal level.

4. Conclusion

From the investigation, the ethanolic extract of *I.sepiaria* leaves exhibited significant hypoglycemic activity in STZ induced diabetic rats.

Table 1

S.No	Groups	Body weight (gm)	
		Initial (0^{th} day)	Final (14^{th} day)
1.	Normal	201 ± 18.31	205 ± 3.2
2.	Diabetic (STZ)	182 ± 6.14	178 ± 2.6
3.	Diabetic (STZ) + *I.sepiaria* ethanolic extract (100 mg/kg b.wt)	201.1 ± 10.56	204.3 ± 1.81
4.	Diabetic (STZ) + *I.sepiaria* ethanolic extract (200 mg/kg b.wt)	197.3 ± 14.24	202.4 ± 8.54
5.	Diabetic (STZ) + Glibenclamide (5 mg/kg b.wt)	192.2 ± 6.42	195.10 ± 9.82

Values are expressed as Mean ± SD (n=6)

Values are statistically significant at $P < 0.05$

Table 2

S.No	Groups	Blood Glucose (mg/dl)		Plasma Insulin (µU/ml)
		Initial (0^{th} DAY)	Final (14^{th} DAY)	
1.	Normal	88.12 ± 3.06	89.14 ± 2.04	18.35 ± 2.5
2.	Diabetic (STZ)	88.36 ± 4.12	332.8 ± 3.50	8.53 ± 1.77
3.	Diabetic (STZ) + *I.sepiaria* ethanolic extract (100 mg/kg b.wt)	90.40 ± 4.01	91.52 ± 3.29	20.88 ± 2.60

4.	Diabetic (STZ) + *I.sepiaria* ethanolic extract (200 mg/kg b.wt)	90.61 ± 8.52	90.58 ± 6.36	22.15 ± 2.50
5.	Diabetic (STZ) + Glibenclamide (5 mg/kg b.wt)	87.25 ± 2.03	202.15 ± 3.47	13.72 ± 0.49

Values are expressed as Mean ± SD (n=6)
Values are statistically significant at $P < 0.05$

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