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REDUCTION OF HYPERGLYCAEMIA WITH ETHANOLIC EXTRACT OF *SCOPARIA DULCIS* L. IN DOSE DEPENDENT MANNER

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ABSTRACT

Aim: The highest reduction of blood glucose with ethanolic extract of Scoparia dulcis L. at different concentrations (25mg/kg body wt & 50mg/kg body wt) was investigated. **Materials and Methods:** Two doses of ethanolic extract of Scoparia dulcis L. were administered to Swiss Albino Mice at a dose of 25mg/kg body wt and 50mg/kg body wt exhibited significant hypoglycaemic activity compared to Metformin (a commercially available drug). **Conclusion:** Treatment of diabetic mice with Scoparia dulcis ethanolic extract exhibited restoration of biological parameter i.e. antidiabetic activity.

Keywords: Scoparia dulcis L., hypoglycaemia, STZ (Streptozotocin), experimental animal (Swiss albino mice), Metformin.

INTRODUCTION

Scoparia dulcis L. (Sweet Broomweed), Family Scrophulariaceae is a tough, glabrous, multi branched and leafy herbaceous plant upto 90cm high. It bears small white flowers in small 2-4 or 5flowered inflorescences and 3-4mm in diameter.[1,2,3] It is being used in various parts of the world for treating different ailments. It is well known as a folk – medicinal plant for its medico-magic power.[4] Earlier investigations evidenced its use to help with the symptoms of

several diseases such as arterial hypertension and diabetes mellitus.[5] related to inflammation and oxidative stress.

Quite a number of medicinal properties of S.dulcis was previously studied including its antidiabetic, anti-inflammatory and antioxidant capacity in vivo.[6,7] and its impact on lipid peroxidation.[8,9] S.dulcis is medicinally used in Paraguay as crude drug namely "Typycha Kuratu" to improve digestion and protect the stomach. In Taiwan the same plant is used to cure hypertension and in India for toothache, blennorhagia and stomach troubles. An anti-diabetic compound, Amellin, has been reported in the leaf and stem of fresh green plant.[10,11,12,13] A few phenolic and terpenic compounds isolated from S.dulcis were pointed to justify these medicinal properties and various biological activities.[14,15]

Diabetes is old as mankind. Diabetes mellitus is a non-communicable disease. It is mainly of two types: Type I & Type II. [16] Despite the great efforts that have been made in the understanding and management of diabetes, the disease related complications are increasing unabated.[17]The generally agreed treatment goals in type two diabetes mellitus is to maintain near normal levels of glycaemic control in both the fasting and post parandial states. Although diet and exercise are the first step towards achieving this goal, oral antidiabetic pharmacotherapy also plays an important role. [18] The mechanism of action of most of the herbals used to treat diabetes has not been defined.[19] There is an increased demand by patients to use natural products with antidiabetic activity. Herbal medicines are frequently considered to be less toxic and free from side effects. A growing interest is being focussed on natural products that produce specific pharmaceutics for human well being. So, there is a great need for a search for an acceptable and safe glucose lowering agent that would be effective in the treatment of diabetes and easily affordable by the common man.

MATERIALS AND METHODS

Chemicals and Reagents

All the chemicals and reagents were procured from Qualigens Chemicals which were of analytical grade. The kits were purchased from Agappe (Glucose kits).

Plant Material

Plants for the study has been selected based on published as well as unpublished ethno medicinal reports. They have been collected through extensive field work from various areas in and around Assam University Campus. The plant has been authenticated and identified by

Assam University Herbarium Authority. The plant material was air dried for a period of 15-20 days and then milled to fine powder. 500gm of milled material was extracted with petroleum ether and then simultaneously with acetone and ethanol to yield the crude extract. The extraction was done with 10-15 siphoning cycles in the Soxhlet's apparatus. The crude extract was made solvent free using a rotary evaporator. The extract was then collected and stored for further analysis.

Animals and animal treatment

Swiss Albino Mice weighing 25-30gm has been selected as the experimental model. They were kept in spacious well ventilated cages and were fed with standard pellet diet and sterile water. All experiments were conducted according to the guidelines of experimental animal care set up by the ethical committee Streptozotocin (STZ) induced diabetic mice. STZ dissolved in water for injection in the dose of 150mg/kg body wt was administered intraperitoneally.

Induction of diabetes has been ensured by measuring blood glucose level by chemical auto analyser after seven days of induction of diabetes. Mice having glucose level more than 250mg/dl 48 hour after administration of STZ were selected for the study.

Treatment of diabetes was started from 7^{th} day of STZ administration. Treatment was done using commonly available drug in the market (Metformin) and with ethanol plant extract in two different doses. A total of 50 animals were used for the experiment. They were randomly divided into 5 groups with 5 animals in each group. Group I was used as control, Group II, III and IV were made diabetic by single intraperitoneal injection of Streptozotocin (STZ). Periodic blood glucose has been measured to examine the efficacy of both known as well as with herbal plant extract. Blood was collected intraperitoneally from the thigh muscle. It was collected in fresh centrifuge tubes and plasma was separated in an electric centrifuge at 2000rpm for 15 mins. Serum glucose was estimated by commercially available kits. Finally the data collected has been compiled for statistical analysis and comparisons have been done to test their significance.

Statistical Analysis

The statistical analysis of ethanol extract of Scoparia dulcis showed significant activity. The percentage of glucose after hours was calculated and then the average percentage reduced after $\pm$ SEM was calculated to see the efficacy.

RESULTS

The p-value of ethanol extract of Scoparia dulcis L. is significant (with p-value less than 0.05). So, we can say that, there is a significant difference between normal and diabetic, between normal and plant extract in different doses (25mg/kg body wt and 50 mg/kg body wt). Table 1 to 6 shows the activity of the extracts administered in different doses intraperitoneally and their p-value calculated.

Table -1

Normal vs Diabetic

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Treatment	580762	9	64529.11	3293.678	1.03E-49
Days	1891.727	4	472.9317	24.13925	9.12E-10
Error	705.3052	36	19.59181		
Total	583359	49			

From the above table we can see that the p value corresponding to treatment and days are 0.000 (i.e. less than 0.05). Therefore we can say that there is a significant difference between normal and diabetic and among the different days (i.e. 1^{st}, 7^{th}, etc).

Table -2

Normal vs Plant extract 25 mg/dl

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Treatment	163147.1	9	18127.45	22.06891	4.11E-12
Days	23968.46	4	5992.114	7.294982	0.000207
Error	29570.48	36	821.4021		
Total	216686	49			

From the above table we can see that the p value corresponding to treatment and days are 0.000 and 0.0002 respectively (i.e. less than 0.05). Therefore we can say that there is a significant difference between normal and plant extract (25 mg/dl) and among the different days (i.e. 1^{st}, 7^{th}, etc).

Table -3

Normal vs Plant extract 50 mg/dl

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Treatment	76367.55	9	8485.284	7.105644	7.75E-06
Days	36311.68	4	9077.92	7.601923	0.000151
Error	42989.8	36	1194.161		
Total	155669	49			

From the above table we can see that the p value corresponding to treatment and days are 0.000 and 0.0001 respectively (i.e. less than 0.05). Therefore we can say that there is a significant difference between normal and plant extract (50 mg/dl) and among the different days (i.e. 1st, 7th, etc).

Table -4

Normal vs Metformin

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Treatment	151919	9	16879.89	8.844505	7.16E-07
Days	60291.75	4	15072.94	7.897723	0.000112
Error	68706.6	36	1908.517		
Total	280917.3	49			

From the above table we can see that the p value corresponding to treatment and days are 0.000 and 0.0001 respectively (i.e. less than 0.05). Therefore we can say that there is a significant difference between normal and metformin and among the different days (i.e. 1st, 7th, etc).

Table -5

Plant extracts 25 mg/dl vs Metformin

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Treatment	220.5888	9	24.50987	0.074552	0.99985
Days	170404.2	4	42601.04	129.5799	7.53E-21
Error	11835.46	36	328.7627		
Total	182460.2	49			

From the above table we can see that the p value corresponding to treatment and days are 0.99985 (i.e. greater than 0.05) and 0.000 (i.e. less than 0.05) respectively. Therefore we can say that there is no significant difference between plant extract (50mg/dl) and metformin but there is a significant difference among the different days (i.e. 1st, 7th, etc).

Table -6

Plant extracts 50 mg/dl vs Metformin

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*
Treatment	12884.96	9	1431.663	5.278869	0.000136
Days	198238.7	4	49559.68	182.7379	2.22E-23
Error	9763.429	36	271.2064		
Total	220887.1	49			

From the above table we can see that the p value corresponding to treatment and days are 0.0001 and 0.000 respectively (i.e. less than 0.05). Therefore we can say that there is a significant difference between plant extract (50mg/dl) and metformin and among the different days (i.e. 1st, 7th, etc).

In the above analysis Treatment means the factors (i.e. Normal control, Diabetic, Plant extract, etc.)

DISCUSSION

The present study supports the traditional claim that the ethanol extract of this plant could be added in the traditional preparation for the ailment of various diabetes associated complications. Various works has been done with the crude extract of this plant till date but no such work has been done so far in Assam.

Firstly, a comparison was done to see the significant difference between normal and diabetic mice. The p-value corresponding to treatment and days (was less than 0.05). So, we can infer that there is a significant difference between normal and diabetic mice.

Secondly, a comparison between normal and plant extract 25mg/kg body wt showed a p-value of 0.0002 (i.e. < 0.05) from which we can conclude that there is a significant difference between and plant extract at a dose of 25mg/kg body wt. Thirdly, plant extract at a dose of

50mg/kg body wt when compared with normal mice showed a p value of< 0.05 i.e. that is a significant difference between normal and plant extract (50mg/kg body wt).

Normal mice when compared with commercially available drug Metformin showed a significant p-value (0.05). Again, plant extract (25mg/kg) and metformin (1ml/kg body wt) showed a p-value of 0.99985 which is less than 0.05. From this we can infer that there is a significant difference among the different days (1^{st}, 7^{th}, etc).

Similarly, plant extract at a dose of 50mg/kg body wt, when compared with Metformin, showed a significant difference i.e. p- value < 0.05, among the different days (i.e. 1^{st}, 7^{th} , etc). All the above comparisons indicate that, Scoparia dulcis is a very promising antidiabetic plant which can be used to cure various diabetes and its related complications and Scoparia dulcis at a dose of 50mg/kg body wt showed higher efficacy than commercially available drug metformin. So, further study can be done keeping into the knowledge about its efficacy and active compounds can be isolated which can be used to treat diabetes that will prove to be a boon to mankind since diabetes is increasing at an alarming rate.

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