

Hypoglycaemic effect of Maryadavalli [*Ipomoea pes-caprae* (Linn.) R. Br.] in alloxan induced diabetic rabbits

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Abstract

Introduction: Non communicable diseases these days are causing a havoc in the overall development of humanity. Of all non-communicable diseases, Diabetes Mellitus is playing a notorious role in the devastating phase of public health.. Ayurveda, the life science provides astonishing results in such life style disorders. Vriddhadaru an excellent Ayurvedic drug and *Ipomoea pes-caprae* has been traditionally used as Vriddhadaru, effective in diabetic management with promising results. But, the anti-diabetic effect of the drug has not been scientifically appreciated. This study ascertains the hypoglycaemic effect of the drug in a pre-clinical model.

Methodology: In the present study, alloxan induced 18 diabetic albino rabbits were divided into 3 groups with 6 rabbits in each group. On the day of experiment, after assessing the fasting blood sugar levels in all 18 rabbits, root powder of the test drug as CMC suspension in the dose of 0.56 g/kg body weight and the standard drug, metformin; in the dose of 0.024 mg/kg body weight were administered to the first group and second group respectively. The third group was kept as control and administered with distilled water alone. Later, the blood glucose values were taken at 1st, 3rd and 5th hour and the obtained values were compared with in the group and between the groups.

Observations and Results: The blood glucose levels were compared using paired t test for within the group analysis and by student t test for between the group analysis. Within the group comparison of blood sugar level in group 1 showed significant decrease in the level at 1st hour, 3rd hour and 5th hour from the corresponding fasting blood sugar levels. In group 2, significant decrease of blood sugar level was seen between fasting blood sugar level and 1st hour value and also in fasting blood sugar value and 5th hour value. Between group comparison of group 1 and group 2 showed no significant difference in the change of the blood sugar level at different time intervals

Discussion: Ayurvedic literature proposes Pramehaghna property to the drug Vriddhadaru which is substantiated through this pre-clinical trial. Further, hypoglycaemic action of *Ipomoea pes-caprae* (Linn.) R. Br. is mainly attributable to the chemical constituents which have proven anti-oxidant and α -glucosidase inhibitory activity.

Conclusion: From the above study, it is inferred that *Ipomoea pes-caprae* (Linn.) R. Br. is equally effective in reducing blood sugar levels in Alloxan induced diabetic rabbits against the standard drug Metformin.

Keywords: Hypoglycaemia, Alloxan monohydrate, Vriddhadaru, *Ipomoea pes-caprae*

Introduction

Rise of this era witnesses conquer of non-communicable diseases over the communicable ones in causing life distress, melancholy and untimely death. Drastic changes in our life styles and food habits are the major culprit behind this devastating scenario. Among all non-communicable diseases, Metabolic syndrome stands apart and is of quite a concern. This condition mainly includes dyslipidemia and diabetes mellitus type II. The latter is characterised by chronic hyperglycaemia with disturbances of carbohydrate, fat and protein metabolism resulting from defects in insulin secretion, insulin action, or both. It occurs when the pancreas does not produce enough insulin, or when the body cannot effectively use the insulin it produces¹.

Diabetes is in the top 10, and perhaps the top 5, of the most significant diseases in the developed world, and is gaining significance elsewhere. In 2006, according to the WHO, at least 171 million people worldwide suffer from diabetes. Its incidence is increasing rapidly, and it is estimated that by the year 2030, this number will double². The effects of diabetes mellitus include long-term damage, dysfunction and failure of various organs. In its most severe forms, ketoacidosis or a non-ketotic hyperosmolar state may develop and lead to stupor, coma and, in absence of effective treatment, death. Even though a large number of drugs are available for this condition, none ensure complete cure, especially in preventing complications³.

Ipomoea pes-caprae, used as 'Vriddhadaru'⁴ or Maryadavalli⁵ in Ayurvedic literature and 'Adambu valli' in Malayalam⁶ is a common drug very often seen at sea shores and alongside railway tracks⁷. Ayurvedic

classics like Ashtangasamgraha⁸ and Raajanighantu⁹, describes it as a Rasayana and Pramehahara drug. Numerous studies have been conducted till date regarding its liver protective¹⁰, anti-inflammatory¹¹ and antioxidant effects¹². Also, traditionally; many physicians are thoroughly using this drug in diabetic patients. Yet, very less number of studies are available regarding its anti-diabetic effect¹³. Moreover, search for new effective drugs are very much essential now a days as genuine Ayurvedic drugs in this picture are facing radical scarcity. In this study, the hypoglycaemic activity of root powder of the plant *Ipomoea pes-caprae* (Linn.) R. Br. was assessed in alloxan induced diabetic albino rabbits against the standard drug- Metformin.

Materials and methods

Selection of animals

25 healthy albino rabbits of either sexes weighing 1500-2000gm were collected from the animal house of Agadatantra department, Government Ayurveda College, Thiruvananthapuram.

Preparation of Alloxan solution

Alloxan monohydrate was obtained from Laboratory supplies Thiruvananthapuram, batch no: 43256. Using normal saline 0.5%, the solution was prepared.

Standard drug – Metformin

A stock solution was prepared with 0.5 mg of metformin in 50 ml distilled water so that 1 ml contained 0.02 ml of metformin¹⁴

Preparation of test drugs

Form of preparation: Powder

Route of administration: Oral

Drug: Root of *Ipomoea pes-caprae*.

A Carboxymethylcellulose stock solution of strength 0.01g% of the test drug was prepared in distilled water.

Dose

The dose of the test drug was calculated from Sarnghdharma samhitha; the dose being the common dose for choorna¹⁵. Effective dose for rabbit was calculated by using the table constructed by Paget G.E. and Barnes T.M. in the evaluation of drug activities. Based on this; corresponding doses were calculated.

Setting

Animal house working under the Drug Standardization Unit, Govt. Ayurveda College, Trivandrum, Kerala

Procedure¹⁶

25 albino rabbits of either sex (weighing 1500-2000gm) were used in the present study. The animals were kept under observation for one week. Normal fasting blood sugar values were noted before administration of alloxan. All rabbits were fasted for 18 hours and the samples were collected from marginal ear vein. Blood sugar was calculated by glucose peroxidase (GOD-POD) method. After that, normal rabbit feed was given. Alloxan monohydrate (150 mg/kg body weight) dissolved in normal saline was injected via intra peritoneal route in 18 h previously fasted animal to induce diabetes. After one hour of alloxan administration, the animals were fed with standard pellets and water at libitum. After 72 hours, the blood glucose levels were estimated, applying the glucose oxidase method and rabbits having blood glucose level more than double were selected for the study¹⁷.

18 healthy diabetic rabbits were taken for the study. They were grouped into three, with each group containing 6 animals which were caged separately. Animals of each group were marked for individual identification. First group (G1) was treated with test drug i.e. 0.56 g/kg body weight of root powder of *Ipomoea pes-caprae*, second (G2) group was administered with standard drug metformin at the dose of 0.024 mg/kg and the third group (G3) was kept as control and treated with distilled water alone.

On the day of the experimental study, fasting blood samples were taken from all the rabbits and then; the drugs were administered orally using feeding cannula. After 1 hour blood samples were collected and all the animals were fed. Blood samples for glucose assessment were again collected from all animals at 3rd and 5th hours after the drug administration. The values were subjected to statistical analysis.

Observations and Results

The blood glucose levels were compared using paired t test for within the group analysis and by student t test for between the group analysis using the programme WinPepi version 11. While comparing the blood sugar values in G1, using paired t, the following data were obtained (table 1).

Table 1

	Mean	SD	Mean diff	p – Value
FBS and 1 st hour	232.0 147.5	31.4 19.1	84.4	< 0.01
FBS and 3 rd hour	232.0 202.6	31.4 28.0	29.4	< 0.05
FBS and 5 th hour	232.0 153.3	31.4 16.2	78.7	< 0.01
1 st hour and 3 rd hour	147.5 202.6	19.1 28.0	55.0	< 0.05
1 st hour and 5 th hour	147.5 153.3	19.1 16.2	5.8	> 0.05
3 rd hour and 5 th hour	202.6 153.3	28.0 16.2	7.93	< 0.01

The comparison of the blood sugar level at different time of G2, using paired t test is given below (table 2).

Table 2

	Mean	SD	Mean diff	p – Value
FBS and 1 st hour	246.6 161.4	34.1 37.9	85.2	< 0.01
FBS and 3 rd hour	246.6 212.4	34.1 31.0	34.1	> 0.05
FBS and 5 th hour	246.6 150.2	34.1 34.3	96.4	< 0.01
1 st hour and 3 rd hour	161.4 212.4	37.9 31.0	51.0	< 0.01
1 st hour and 5 th hour	161.4 150.2	37.9 34.3	11.2	> 0.05
3 rd hour and 5 th hour	212.4 150.2	31.0 34.3	62.3	< 0.01

The comparison of the blood sugar level at different time of G3, using paired t test is given below (table 3).

Table 3

	Mean	SD	Mean diff	p – Value
FBS and 1 st hour	252.6 233.1	26.0 21.7	19.5	< 0.05
FBS and 3 rd hour	252.6 291.2	26.0 21.0	38.6	< 0.05
FBS and 5 th hour	252.6 273.4	26.0 18.5	20.8	> 0.05
1 st hour and 3 rd hour	233.1 291.2	21.7 21.0	58.1	< 0.01
1 st hour and 5 th hour	233.1 273.4	21.7 18.5	40.3	< 0.05
3 rd hour and 5 th hour	291.2 273.4	21.0 18.5	17.8	< 0.01

Comparison of average changes in blood sugar level between group 1 and group 2 was done using unpaired t test and the results were given in the table number 4.

Table 4

Duration	Group 1		Group 2		p - value
	Mean	SD	Mean	SD	
FBS & 1 st hour	35.11	13.02	34.45	12.83	> 0.05
FBS & 3 rd hour	12.22	9.97	13.07	13.54	> 0.05
FBS & 5 th hour	33.19	9.07	38.38	14.98	> 0.05
1 st hour & 3 rd hour	40.58	36.90	33.86	12.84	> 0.05
1 st hour & 5 th hour	5.98	23.26	5.92	16.09	> 0.05
3 rd hour & 5 th hour	23.94	5.06	29.45	11.98	> 0.05

Within the group comparison of blood sugar level in group 1 showed significant decrease in the level at 1st hour ($p < 0.01$), 3rd hour ($p < 0.05$) and 5th hour ($p < 0.01$) from the corresponding fasting blood sugar levels. Significant increase in the blood sugar level was noted while comparing the value of 3rd hour ($p < 0.05$) with that of 1st hour. But no significant change was observed in the 5th hour value when compared with that of 1st hour value. While comparing 5th hour of blood sugar level with that of 3rd hour value a significant decrease at $p < 0.01$ was observed. Hence, initially there was a significant decrease in the blood sugar at 1st hour. Then in 3rd hour there was a moderate increase of value than that of 1st hour followed by a gradual decrease in 5th hour. In group 2, significant decrease of blood sugar level was seen between fasting blood sugar level & 1st hour value ($p < 0.01$) and fasting blood sugar value & 5th hour value ($p < 0.01$). No significant change was observed between fasting blood sugar level and 3rd hour value ($P > 0.05$). Significant increase in the blood sugar level was noted

between 1st and 3rd hour value ($p < 0.01$) but no difference was observed between 1st and 5th hour value ($p > 0.05$). But 3rd and 5th values are different significantly ($p < 0.01$).

In group 3, the blood sugar levels increased significantly ($p < 0.05, 0.01$) in most of the cases and in few cases there was no statistical difference ($p > 0.05$)

Between group comparison of group 1 and group 2 showed no significant difference in the change of the blood sugar level at different time intervals.

Hence, it can be concluded that *Ipomoea pes-caprae* can significantly reduce the blood glucose level. While comparing with the standard drug metformin, no significant therapeutic difference was noted.

Discussion

Statistical evaluation shows that the blood glucose level in group 1, treated with *Ipomea pes-caprae* shows a gradual decrease similar to that of standard drug metformin. Almost all values are similar to that of standard drug.

Previous studies show that *Ipomoea pes-caprae* contains mainly four active constituents namely 2-hydroxy-4,4,7-trimethyl-1(4H)-naphthalenone, (-)-mellein, eugenol (3), and 4-vinyl-guaiacol (Pongprayoon U et al.1991) and most of them are having high anti-oxidant properties (Agoramoorthy et al., 2008). Other chemicals isolated from this plant are glochidone, betulinic acid, alpha- and beta-amyrin acetate and isoquercitrin (Krogh R et al., 1999). Among these betulic acid and beta amyrin acetate are having both insulinomimetic and antioxidant activity (Agoramoorthy et al., 2008). This plant also shows potent α -glucosidase inhibitory activity of 67.9 ± 0.11 (Selvaraj et al., 2012) which is a key element in reducing the glucose level. These studies altogether appreciate the hypoglycaemic effect of this plant.

Conclusion

From the above study, it is inferred that *Ipomoea pes-caprae* (Linn.) R. Br. is equally effective in reducing blood sugar levels in Alloxan induced diabetic rabbits against the standard drug Metformin. Effectiveness of the plant and advantages if any over the existing therapy can only be assessed by a long term study in more than one type of rodents. Clinical efficacy in human subjects should also need to be proved for establishing it as an effective single drug therapy in Diabetes mellitus.

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