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Full Length Article

Antidiabetic Efficacy of *Mimosa pudica* (Lajwanti) Root in Albino Rabbits

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Abstract

Antidiabetic effect of Lajwanti (*Mimosa pudica* L.) root was determined in the alloxan induced diabetic adult albino rabbits. After acclimatization, adult albino rabbits (n=6) were divided into six equal groups (I, II, III, IV, V and VI). Group I served as normal control on routine diet, group II was as untreated control on alloxan, group III was treated control on synthetic antidiabetic drug Glimepride, groups IV, V and VI were treated with three graded doses of *M. pudica* root powder. Diabetes was induced in all the adult albino rabbits except group I. Blood samples were drawn at 0, 5, 10, 15 and 20 days of experiement. Blood glucose was determined by the kit method. Results of group IV, V and VI shown that the glucose level decreased in diabetic rabbits at 8th and 12th hour significantly (P<0.05) on 10th, 15th and 20th days of the experiment. Root powder of *M. pudica* at dose rate of 6 mg/kg body weight significantly decreased blood glucose level in the diabetic rabbits at 12th h of the sampling on day 5, 10 and 20. Therefore, it is concluded from the present study that the root powder of *M. pudica* has antidiabetic efficacy at a dose rate of 6 mg/kg body weight.

Keywords: Root powder; Glimepride; *M. pudica*; Alloxan; Antidiabetic activity

Introduction

Diabetes is not a single disease rather is a cluster of metabolic disorders with increase blood glucose level, which occurs due to the defects in the secretion of insulin, its call for action or both. Nowadays, hyperglycemic complications are the major cause of morbidity and mortality in diabetic individuals. Diabetes results in retinopathy, neuropathy and nephropathy (Srivatsan *et al*., 2009; Ahmad *et al.*, 2012).

Elevated serum glucose level was observed in diabetes mellitus, which is either by the lack of insulin, called type I diabetes (or IDDM), or by the development of resistance against insulin, called type II diabetes (NIDDM) (Arulmozhi *et al.*, 2004). It was described that the diabetes is a group of metabolic syndromes which leads to hyperglycemia either due to insulin deficiency (IDDM) or its resistance (NIDDM) or both (Gale and Anderson, 1995).

Diabetes is a complex set of metabolic symptoms, which is diagnosed by chronic hyperglycemia as well as changes in other biomolecules (protein, lipid) metabolism associated with loss of weight, polyuria, polyphagia and polydipsia (Frier *et al*., 1999; Javed *et al.*, 2012).

Patients suffering with this disease are increasing significantly day by day due to the changing life styles like less physical activity (Shaw *et al*., 2010). In 2003, it was estimated that approximately 194 million peoples or 5.1% in the age group of 20-79 years, had diabetes (Ahmed *et al*., 2010). Recently, epidemiological studies estimated that the number of persons suffering from diabetes was 171 million in 2000 and it will be 366 million by the year 2030 (Wild *et al*., 2004).

There are a lot of risks involved in developing diabetes like family history, race, hypertension, sign of insulin resistance, history of vascular disease and inactive life styles etc. So, it can be prevented by the changing the life style including the nutrition therapy, physical activity, behavioral therapy, weight loss and follow up (Anonymous, 2009).

Complications of diabetes are associated with the higher level of free radicals as well as higher level of lipid peroxidation products and decrease levels of antioxidants (Ramakrishna and Rama, 2008). Peroxyl radical formation and increased lipid peroxidation is induced by the dyslipidemia and hyperglycemia in diabetes mellitus, which is a key pathway in genesis of microangiopathy (Kumari *et al*., 2008). It has also been reported that hyperlipidemia is the causative factor for increased lipid peroxidation in diabetes mellitus (Soliman, 2008).

Lajwanti (*Mimosa pudica* L.) is a seasonal plant abundantly found in the hot areas of the world and is commonly used in folk medicine. Phytochemically, it contains phytosterol, amino acids, alkaloids, flavonoids, tannins, glycosides and fatty acids. These chemicals are intrinsically used for medicinal purpose to treat different

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ailments including wound healing, anti-mycotoxic, antidiabetic, antioxidant, anticonvulsant, antiulcer, antimicrobial and antiasthmatic activity (Pande and Anupam, 2010; Azmi *et al*., 2011).

M. pudica, a common herb, grows everywhere in the southern regions of the country. Traditionally, it is used for the treatment of diabetes in the Indian culture. Stem bark extract had already reported for the antidiabetic activity while the other parts, which are still not reported for this activity, include pods and roots. Moreover ethanol and petroleum ether extracts of *M. pudica* leaves showed antidiabetic effect (Sutar *et al.,* 2009). Leaves are the most abundantly used following the bark, root, whole plant, fruit, seeds, flowers, rhizomes, sap and nuts (Banik *et al.,* 2010).

This study was carried out to evaluate the antidiabetic effect of root of *M. pudica* dried powder on the alloxan induced diabetes in albino rabbits after its oral administration.

Materials and Methods

The antidiabetic effect of Lajwanti (*Mimosa pudica* L.) root was investigated in diabetic adult albino rabbits. The experiment protocols were as follows.

Plant Material

The *M. pudica* plants were sowed in the botanical garden of Department of Botany, University of Agriculture Faisalabad, Pakistan. Plants were allowed to grow for about three months. Then the plant was uprooted from the soil and root was collected. The plant root was washed with plain water, air dried and grinded into fine powder with the help of an electrical grinder. After grinding, the root powder was stored in well closed cellophane bags at 4ºC in a refrigerator.

Chemicals and Drugs

Alloxan-monohydrate (B.D.H. Laboratories, Poole, England), Standard Glucose (Randox Lab. Ltd. Ardmore, Diamond Road, United kingdom), GOD-PAP Reagent (Randox Lab. Ltd. Ardmore, Diamond Road, United kingdom), Glimepiride (Shifa Pharmacy, Susan road, Faisalabad), Gum tragacanth (Bara Dawakhana, Karkhana Bazar, Faisalabad, Pakistan).

Experimental Animal Used

Thirty six (36) healthy adult albino rabbits were taken and randomly divided into six equal groups (n=6). The average body weight of each group ranged from 1.5–2 kg. The rabbits were acclimatized for one week before the initiation of experiment. The animals were fed with routine seasonal fodder. Water was supplied to the adult albino rabbits round the clock.

Preparation of Drug Suspension

The amount of *M. pudica* root powder for each adult albino rabbit was calculated on weight basis and the required amount of powder was weighed on the electric balance. Drug suspension was made by suspending the root powder in 5 mL of 2% gum tragacanth suspension. Glimepiride was also administered after suspending in 5 mL of 2% gum tragacanth suspension.

Induction of Diabetes

All groups, except Group I, were made diabetic by injecting 150 mg/kg body weight of alloxan intravenously (Akthar *et al*., 2011). After injecting the aloxan, blood glucose level of all the surviving rabbits were determined by using the blood glucose testing kit, glucose GOD-PAP reagent commercially available (Randox Lab. Ltd. Ardmore, Diamond Road, United kingdom). Adult albino rabbits had the blood glucose level of about 250-300 mg/dL were considered as diabetic and were used for further experimental studies.

Grouping of Rabbits

Group I served as normal control fed with normal routine green fodder throughout the experimental schedule. Group II served as the untreated control as it received normal green fodder as well as it was administered intravenously with the 150 mg/kg body weight alloxan. Group III served as treated control. It received normal green fodder and 150 mg/kg body weight aloxan intravenously as well as Glimepiride in 5 mL of 2% gum tragacanth suspension orally (Sumon *et al*., 2008). Group IV, V and VI served as treated groups. They received normal routine green fodder and 150 mg/kg body weight alloxan intravenously to make them diabetic. As well as, to evaluate the antidiabetic effects of *M. pudica* root powder, 2, 4 and 6 mg/ kg body weight of *M. pudica* root powder were also administered orally in 5 mL of 2% gum tragacanth suspension, respectively.

Collection of Blood Samples

Blood samples were drawn from jugular vein of individual animal after 0, 5^{th}, 10^{th}, 15^{th} and 20^{th} days. In addition to these sampling days, samples were collected aseptically on 0, 2, 4, 8, 12 and 24 h of each sampling day. After clotting the blood samples, serum was separated by centrifugation and stored at 4ºC in a refrigerator.

Determination of Blood Glucose

Glucose level in the blood samples was determined by using kit method (glucose GOD-PAP, UK) (Gupta *et al*., 2011). Accurate results were obtained by using glucose oxidase method.

Statistical Analysis

Results were assessed by using the Analysis of Variance techniques. Statistical difference between groups was assessed by Duncan's Multiple Range test using 5% level of significance (Steel *et al.,* 1997).

Results

Antidiabetic effects of *M. pudica* root powder, after its administration at different doses like 2, 4 and 6 mg/kg body weight started at the 4th h and it reached at its maximum value at the 12th h after its administration.

Day 10: Blood glucose level start decreasing at 4th hour and it was lowest at 12th h in group IV, V and VI, at day 10 (Table 1). Significant ($P<0.05$) decrease in blood glucose level was found in group VI at 12th h i.e.147.23 mg/100 mL. Group V and VI showed the significant ($P<0.05$) result at 8th h. Blood glucose value of group V and VI at 8th h was 186.29 and 192.96 mg/100 mL, respectively as shown in Table 1. Both these groups are non-significant ($P>0.05$) with each other at 8th h.

Day 15: Blood glucose level start decreasing at 4th hour and it was lowest at 12th h in group IV, V and VI, at day 15 (Table 2). Significant ($P<0.05$) decrease in blood glucose level was found in group VI at 12th h i.e., 147.67 mg/100 mL. Group V and VI showed the significant ($P<0.05$) result at 8th h. Blood glucose level of group V and VI at 8th h was 185.07 and 188.57 mg/100 mL, respectively as shown in Table 2. Both these groups are non-significant ($P>0.05$) with each other at 8th h.

Day 20: Blood glucose level start decreasing at 4th hour and it was lowest at 12th h in group IV, V and VI, at day 20 (Table 3). Significant ($P<0.05$) decrease in blood glucose level was found in group VI at 12th h i.e., 144.44 mg/100 mL. Group V and VI showed the significant ($P<0.05$) result at 8th h. Blood glucose level of group V and VI at 8th h was 186.29 and 189.50 mg/100 mL, respectively as shown in Table 3. Both these groups are non-significant ($P>0.05$) with each other at 8th h.

A similarity in the results was found at different days. At the start of the day, there was a high blood glucose level and after the effect of root powder diminished it again raised at high value at the next morning.

Discussion

Antidiabetic effects of *Mimosa pudica* root powder, after its administration at different doses like 2, 4 and 6 mg/kg body weight, started at the 4th h and it reached at its maximum value at 12th h. It showed the persistent antidiabetic effect and after the increase in the blood glucose levels it again become non-significant ($P>0.05$) at 24th h. One thing was common in all graded doses of the *M. pudica* root powder. It showed the same pattern of increasing and decreasing blood glucose levels at any dose i.e., 2, 4 and 6 mg/kg body weight. On the other hand, Glimepride could not produce any significant ($P<0.05$) antidiabetic effect in the diabetic rabbits.

M. pudica root powder showed the maximum efficacy at the dose of 6 mg/kg body weight at the 12th h. Therefore, a significant result was found with estimated high dose of *M. pudica* root powder at 12th h on each sampling day as shown in the Tables 1, 2 and 3. On the other hand, Glimepride did not show the comparative results at a dose of 800 µg/kg body weight at any hour after its administration. Glimepride either decreased the glucose level either by direct stimulation of the beta cells or by the extra pancreatic mechanisms (Lemke *et al*., 2008).

Alloxan cause the beta cell destruction and showed the same effects as human diabetic patient experienced in diabetes like glycosuria, hyperglycemia, polyuria, acidosis, polyphagia, polydipsia and loss of body weight. It has already been reported that a single intravenous injection (150 mg/kg body weight) was sufficient in developing diabetes by killing the beta cells. This would lead to increase the glucose level up to 3-4 times the normal value (Mahmood, 2006).

It was revealed with the help of phytochemical analysis that the chloroform extract of the root of *M. pudica* contains steroids, alkaloids, glycosides flavonoids and phenolic compounds. This was further elaborated with high performance thin layer chromatography (HPTLC) and thin layer chromatography (TLC) (Rajendran and Krishnakumar, 2010).

Ascorbic acid, crocetin, D-glucoronic acid, linoleic acid, linolenic acid, palmitic and stearic acids, mimosine, D-xylose and b-sitosterols were found in phytochemical analysis of *M. pudica* root (Mahanta and Ashis, 2001).

It has been reported that glycosyl flavones in *Enicostemma hyssopifolium* could decrease the level of glucose in the blood in type II diabetic patients by inhibiting the enzyme α-glucosidase in the intestinal brush borders (Patel and Mishra, 2011). Therefore, it is concluded that there might be another chemical, which have the potential to reverse the effects of alloxan on the beta cells. Further study should be investigated to separate the active substance which could have the potential to reverse the effects of alloxan in albino rabits. Therefore, antidiabetic effect of *M. pudica* root powder could be the combined effect of an active chemical that could reverse the effect of alloxan as well as glycosyl flavones in alloxan diabetic rabbits.

In conclusion, antidiabetic efficacy of *M. pudica* root powder was tested in alloxan induced diabetes in albino rabbits and it is concluded that the decrease in blood glucose level started at 4th h and it was at lowest level at 12th h after its administration. Therefore, it is documented that *M. pudica* root powder proved efficacious in lowering the blood glucose level in alloxan induced diabetes in the albino rabbits.

Furthermore, chemical characterization and pharmacological evaluation should be made to separate and

Table 1: Levels of blood glucose expressed in mg/100 mL at various time intervals at day 10

Group	Hours												Total
	0	2	4	8	12	24	
I	96.08 ± 3.48o	92.71 ± 3.29o	92.38 ± 2.61o	93.94 ± 3.97o	94.24 ± 3.82o	92.31 ± 3.20o	93.61 ± 1.31F
II	294.32 ± 2.54ab	298.47 ± 3.77a	294.86 ± 3.98ab	296.62 ± 4.18ab	294.68 ± 3.57ab	295.37 ± 4.03ab	295.72 ± 1.43A
III	276.06 ± 1.66cd	266.36 ± 1.62de	255.94 ± 1.54ef	246.03 ± 1.54fg	256.82 ± 1.25e	274.29 ± 2.21d	262.58 ± 1.91B
IV	285.82 ± 3.77bc	261.53 ± 2.71e	233.15 ± 5.15hi	206.74 ± 4.35l	214.93 ± 3.94kl	290.17 ± 4.71ab	248.72 ± 5.74C
V	265.27 ± 3.66de	231.19 ± 3.31ij	204.99 ± 3.95l	186.29 ± 4.36m	221.36 ± 5.83jk	276.22 ± 4.08cd	230.89 ± 5.58D
VI	243.11 ± 4.60gh	221.88 ± 3.72jk	206.71 ± 4.10l	192.96 ± 3.28m	147.23 ± 3.75n	257.55 ± 4.17e	211.57 ± 6.25E
Total	243.44 ± 11.54B	228.69 ± 11.17C	214.67 ± 10.69D	203.76 ± 10.54E	204.88 ± 11.37E	247.65 ± 12.01A	

Table 2: Levels of blood glucose expressed in mg/100 mL at various time intervals at day 15

Group	Hours												Total
	0	2	4	8	12	24	
I	95.30 ± 3.60p	92.65 ± 4.21p	95.09 ± 3.40p	95.25 ± 3.14p	96.47 ± 2.96p	92.82 ± 2.47p	94.60 ± 1.29F
II	330.29 ± 4.18a	321.62 ± 4.61a	325.94 ± 4.66a	327.00 ± 4.76a	332.70 ± 2.74a	327.01 ± 4.23a	327.43 ± 1.71A
III	304.67 ± 1.66b	295.43 ± 1.55bc	285.77 ± 1.60cd	286.15 ± 1.33cd	297.04 ± 0.86b	305.27 ± 1.57b	295.72 ± 1.43B
IV	285.72 ± 4.03cd	260.39 ± 3.05fg	238.19 ± 3.59ij	204.78 ± 3.70m	217.22 ± 3.62l	284.01 ± 3.51d	248.38 ± 5.42C
V	266.92 ± 3.87ef	231.88 ± 2.77jk	206.31 ± 4.89m	185.07 ± 4.62n	224.11 ± 5.95kl	271.95 ± 3.50e	231.04 ± 5.48D
VI	246.21 ± 4.36hi	219.08 ± 2.55l	214.95 ± 5.03lm	188.57 ± 2.68n	147.67 ± 4.04o	256.29 ± 3.89gh	212.13 ± 6.30E
Total	254.85 ± 12.95A	236.84 ± 12.47B	227.71 ± 12.31C	214.47 ± 12.73E	219.20 ± 13.72D	256.23 ± 13.00A	

Table 3: Levels of blood glucose expressed in mg/100 ml at various time intervals at day 20

Group	Hours												Total
	0	2	4	8	12	24	
I	93.65 ± 2.26o	92.33 ± 3.48o	92.62 ± 4.21o	91.47 ± 3.90o	96.45 ± 3.12o	95.34 ± 3.52o	93.64 ± 1.34F
II	354.60 ± 4.12a	354.12 ± 4.09a	354.87 ± 4.21a	354.27 ± 2.99a	354.55 ± 5.21a	356.18 ± 4.37a	354.76 ± 1.60A
III	336.27 ± 1.48b	325.37 ± 1.27c	312.84 ± 0.71d	314.25 ± 1.39d	324.71 ± 1.17c	337.34 ± 0.94b	325.13 ± 1.67B
IV	287.92 ± 4.61e	259.33 ± 2.84gh	235.20 ± 4.48j	204.67 ± 3.91l	217.70 ± 4.43k	286.65 ± 5.14e	248.58 ± 5.66C
V	266.07 ± 4.87fg	228.54 ± 2.48jk	201.39 ± 4.54l	186.29 ± 4.32m	224.94 ± 5.84jk	273.47 ± 3.74f	230.12 ± 5.58D
VI	246.43 ± 4.17i	220.44 ± 2.75k	205.43 ± 4.79l	189.50 ± 2.34m	144.44 ± 3.96n	254.99 ± 4.36hi	210.20 ± 6.41E
Total	264.16 ± 14.44A	246.69 ± 14.31B	233.72 ± 14.34C	223.41 ± 14.80D	227.13 ± 15.48D	267.33 ± 14.38A	

Mean± SEM. Values sharing similar letter in a row or in a column are statistically non-significant (P>0.05). Small letters represent comparison among interaction means and capital letters are used for overall mean

analysis the newer more active constituents that could sufficiently aid in lowering serum glucose level in humans. Besides this, their medicinal importance as a whole should be investigated and their activity should be developed as antidiabetic agents.

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