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Comparative Evaluation of Antihyperglycaemic Effect of Various Parts of *Salacia chinensis* L.

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Salacia chinensis L. (Saptrangi) belongs to the family Hippocrateaceae. The plant extracts have been evaluated for number of activities like anti-hyperlipidemic, anti-inflammatory, cardiotonic, sedative and neuromuscular. In traditional medicine, this plant has been used in the treatment of diabetes. In the present study, methanolic extracts of leaf, stem and root of *Salacia chinensis* were tested for antihyperglycaemic activities in alloxan induced diabetic mice. Glibenclamide (500 μg kg^{-1}) was used as the reference drug. Results showed that the methanolic extracts of leaf, stem and root exhibited antihyperglycaemic effect. Methanolic extracts of root exhibited better activity followed by stem and leaf which were equally effective.

Key words: Alloxan, antihyperglycaemic, *Salacia chinensis*, diabetes, glibenclamide

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INTRODUCTION

Diabetes mellitus is a very common disease and giving great threat to developing countries in recent years. There are three main types of diabetes, Type I, Type II and Type III. In Type I diabetes body could not able to produce sufficient amount of insulin and the person requires insulin treatment. In Type II diabetes even enough amount of insulin is produced, the body cells could not able to use it properly and here, drugs which reduce the blood sugar level are needed. The Type III diabetes is called Gestational diabetes, which is present in pregnant women as a transient stage and after child birth, they will recover to normal state (Cooke and Plotnick, 2008). Diabetes mellitus is caused by the abnormality of carbohydrate metabolism which is linked to low blood insulin level or insensitivity of target organs to insulin (Maiti *et al*., 2004). Decreased physical activity, increased obesity, stress and changes in food consumption have been implicated in the prevalence of this disease in the past two decades (Shastri, 1980). For diabetes management insulin injection or oral medication (pills) are given. Diabetes pills are not insulin. People with typeII diabetes will have enough insulin but the body cells fail to take in glucose to meet their requirement and the treatment includes agents which enhance the insulin secretion or decrease the glucose absorption or reduce the insensitivity of organs to insulin (Nathan *et al*., 2005). α-amylase and α- glucosidase are carbohydrate digesting enzymes, inhibitors of these enzymes lower the glucose level and slow down the release of sugar into the blood stream. Different types of oral hypoglycaemic agents such as biguanides and sulphanylurea are available alongside insulin for the treatment of diabetes mellitus but they should not be used in patients with renal disorders (Valiathan, 1998). Because of the side effects of these hypoglycemic agents, people are looking for plant derived antidiabetic agents (Venkatesh *et al*., 2003). *Salacia chinensis* L. (Saptrangi) belongs to the family Hippocrateaceae. The plant extracts have been evaluated for number of activities like anti-inflammatory, cardiotonic, sedative and neuromuscular. The roots are used to treat dysmenorrhoea, amenorrhoea, vineral disease, rheumatism, itch and asthma (Gopalakrishnan *et al*., 1997; Muruganandan *et al*., 2005). Recently, antihyperlipidemic activity from the root extract of this plant has been proven in experimental rats (Deokate and Khadabadi, 2012; Sikarwar and Patil, 2012). The plant has been effectively used in various traditional systems of medicines for the treatment of diabetes (Sikarwar and Patil, 2012). Few practioners used the roots alone and others used whole plant. In this direction our efforts were directed to identify the most effective antidiabetic part of *S. chinensis*.

MATERIALS AND METHODS

Collection and identification of plant material: Leaf, stem and root of *S. chinensis* were collected from Kolli hills, Tamil Nadu, India in the month of June and authenticated by Botanical survey of India, Southern Cirle, Coimbatore, Tamil Nadu, India.

Preparation of plant extract: The collected plant parts (leaf, stem and root) were dried and powdered. The powdered material (500 g) was extracted with methanol for 72 h in soxhlet apparatus. The extract was evaporated under reduced pressure to obtain solid mass.

Animals: After getting approval from the Institutional Animal Ethical Committee, NBRI, Lucknow, Male albino mice, 8-12 weeks old with average weight of 150-200 g were selected. They were housed in polypropylene cages and fed with standard chow diet and water *ad libitum*.

Acute toxicity studies: The acute toxicity test of the extract was determined according to the OECD guidelines No. 420 (Organization for Economic Co-operation and development). Starting dose of 2000 mg kg^{-1} of the extracts was given to 5 animals in each groups. The treated animals were monitored for 14 days for mortality and general behaviour. No death was observed till the end of the study. The extract was found to be safe upto the dose of 5000 mg kg^{-1} so 1/10th of this dose (500 mg kg^{-1}) was chosen for further experiments.

Experimental design: The diabetic mice were divided into different groups containing at least five animals in each group:

Group I: Normal
Group II: Diabetic control
Group III: Received standard drug, Glibenclamide
Group IV, V and VI: Received leaf, stem and root extracts

Diabetes induction: The mice except normal group were administered with alloxan monohydrate (Sigma Chemicals, Bangalore, India) dissolved in sterile normal saline at the dose of 150 mg kg^{-1} b.wt. i.p (intra peritoneally). After a fortnight, alloxan monohydrate treated mice having hyperglycemia (evidenced by blood glucose range of 300-350 mg 100 mL^{-1}) were selected for the experiment, normal control group was given food and water, group II (diabetic mice) was given 0.5 mL of 5% Tween, group III

Table 1: Oral glucose tolerance test

Treatment	Blood glucose levels (mg dL^{-1}) 0 min	30 min	60 min	90 min	120 min
Normal control	92.4±2.4	96.3±5.2	93.6±2.3	91.4±3.6	90.0±2.6
Diabetic control	142.4±7.2	152.2±6.8	158.6±7.2	152.3±6.0	147.0±7.0
Glibenclamide (500 μg kg^{-1})	112.2±5.6**	126.2±6.4**	120.3±4.8**	118.3±3.3**	116.8±4.6**
Leaf extract (500 mg kg^{-1})	130.6±5.8*	142.6±5.2*	144.8±5.2*	140.3±7.5*	136.2±3.5*
Stem extract (500 mg kg^{-1})	120.8±5.4*	136.6±5.4*	132.2±4.6*	129.2±3.2*	126.2±6.2*
Root extract (500 mg kg^{-1})	120.2±2.4**	132.5±3.5**	130.6±7.1**	122.4±4.3**	120.4±7.6**

Values are Mean±SE, (One way ANOVA followed by Dunnette multiple comparison test). ***Statistically significance of $p<0.05$, $p<0.01$, when compared with respective control

diabetic mice were given 0.5 mL of tween 80 containing glibenclamide (500 μg kg^{-1}), group IV, V and VI diabetic mice were treated with *S. chinensis* leaf, stem and root extracts at a dose of 500 mg kg^{-1} b.wt., respectively. The dose of standard drug glibenclamide (500 μg kg^{-1}) was selected based on previous report (Augusti, 1996). From overnight fasted animals after 30 min of the drug administration every half an hour for a period of 3 h blood glucose level was estimated by glucose oxidase method using a commercial glucometer.

Statistical analysis: The values are expressed as Mean±SE. The results were analyzed for statistical significance using one way ANOVA followed by Dunnette's test.

RESULTS AND DISCUSSION

In order to find out the active antihyperglycaemic part, the methanolic extracts of various parts of *S. chinensis* were studied for their antihyperglycaemic activity using alloxan induced hyperglycaemic model. The different methanolic extracts of the plant parts of *S. chinensis* were studied at a dosage of 500 mg kg^{-1} b.wt. on alloxan induced diabetic mice. The results of the experiment indicated that all the extracts of different parts prevented the rise of blood glucose level. Comparatively the methanolic extracts of root showed maximum activity at a dose of 500 mg kg^{-1} (Table 1). Sumana and Suryawanshi (2001) reported the antidiabetic effects of flowers and leaves of *Vinca rosea*. The activity of leaves and flowers was found to be more or less same in their studies. Contradictory to this, in the present study the methanolic extracts of the root was found to exhibit better activity. Leaf and stem were found to be more or less equally effective. In order to find out the mechanism of action cell line studies were carried out. Morphological changes were observed daily throughout the culture. The results revealed that the plant extract did not show positive effects in the rejuvenation of islet cells. Diabetes mellitus Type I is a disease caused by the lack of insulin. Insulin must be used in Type I diabetes. Diabetes mellitus Type II is a disease of insulin resistance by cells. Treatments to control Type II diabetes include, agents which increase the amount of insulin secreted by the pancreas and agents which decrease the rate at which glucose is absorbed from the gastrointestinal tract (Valiathan, 1998). The mode of action of the plant extract is not very clear but it was not through enhancing insulin secretion (observations are not given here) but might be through slowing down the digestion of carbohydrates. Similar observations had been made with *Anacardium occidentale* (Kamtchouing *et al*., 1998) and *Punica granatum* (Li *et al*., 2005) where the extracts exhibited inhibitory action on α-amylase and α-glucosidase enzymes which are involved in the digestion of carbohydrates.

CONCLUSION

In conclusion, the findings described in the present study provide further evidence in support of the folkloric claim of traditional practioners on *S. chinensis* for the regulation of blood sugar and using the roots alone in herbal preparations may provide better therapeutic effects to minimize the complications of diabetes.

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