Experimental Evalution of Antidiabetic Activity of Swertia Chirata – Aqueous Extract

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Abstract:
Diabetes is a metabolic desease and plant derived products are used to combate this deadly disease. Leaves of *Swertia chirata* (Faimily; Gentianaceae) is one of the illustrious leafy vetetable that is used for this purpose traditionally. It has been used against diabetes for a long while. The alcoholic extract of Swertia chirayita extract was treated for its biochemical and pathomorphological effect in streptozotocin induced diabeted in rats. To study the antidiabetic activity of aqueous extract of Swertia chirata in streptozotocin induced diabetes in albino rats. To campare the antidiabetic activity of Swertia chirata extracts with that of standard drug glibenclamide used in treatment of type2 diabetes mellitus. In this present study 24 male albino wistar rats divided into 4 groups with 6 animals were taken. One groupas control was given normal salin for 21days daily. Other3 groups were induced diabetes. Standard and test groups were fed with glibenclamide (0.5mg/kg) and aqueous extract (200mg/kg) daily respectively. The result were analysed with ANOVA (Analysis of variance) and comparison with standard, test and control groups done by post hoc tukeys test. $p>0.001$ was considered highly significant.
Keywords: Antidiabetic Activity; Swertia Chirata; Aqueous Extract

1. Introduction

Diabetes mellitus(DM) refers to a group of common metabolic disorder that share the phenotype of hyperglycemias Depending on the aetiology of the DM, factors contributing to hyperglycemia include reduced insulin secretion , Decreased glucose utilization ,increased glucose production . DM is the leading cause of end – stage renal disease, non-traumatic lower extremity amputation and adult blindness and predisposes to cardiovascular diseases. Currently the number of case of diabetes worldwide is estimated to be around 150 million. This number of cases being expected in china and India. India has now been declared by WHO as the diabetes capital of the word. The currently used hypoglycemic drugs in the treatment of diabetes are not completely effective and are associated with adverse effects both in the short and long run. The antihyperglycemic effects of the antidiabetic plants are attributed to their ability to increase insulin output fron the pancreas or inhibit intestinal absorption of glucose or some other process.

Several herbs have been tried in various studies to prevent or delay type2 diabetes. *Aegle marmelose, Aloe vera, Artemisia pallens ,Coccinia indica, Swertia chirata* and many others have been shown to have antidiabetic activity .Among the different specias of swertia , Swertia chirata is considered for its medicinal properties as antihelminthisi , antipyretic, hypoglycemic and antifungal property.So this study is undertaken to evaluate the antidiabetic activity of aqueous extract *Swertia chirata* in streptozotocin induced diabetes in rats.

Epidemiology

Diabetes mellutus is pandemic in both developed and developing countries. Worldwide the prevalence of diabetes mellitus is estimated to be 2.8% and is set to rise to 4.4% by 2030. In India alone the prevalence of diabetes is expected to increase from 42 millon to 69.9 millon by 2025. Type1 diabetes due to beta cell destruction , usually leads to absolute insulin deficiency. Type2 diabetes may range from predominantly insulin resistance with relative insulin deficiency to a predominantly insulin secretory defect with insulin resistance.

Swertia chirata

This plant belong to Gentiannaceae family. Swertia chirata, also known as chirayita, is a plant with a long history of medicinal use, including traditional use as an antimicrobial agent. While it is not antibiotic, some studies suggest it possesses antimicrobial activity against certain bacteria and viruses. The genus Swertia consists of annual and perennial herbs. Its medicinal properties, antihelminthic , hypoglycemic and antipyretic , are attributed to its active principles amarogentin , swerchirin and swertiamarin . Its secondary metabolites xanthones, secoridoin glycoside, triterpenoid alkaloid and hexane fraction also contribute to its medicinal properties. It's also used in the dyspensia and diarrhoea. Three main phytochemicals mangiferin, amarogentin, and swertiamarin were identified in aqueous and 12% ethanolic extracts of all plant parts. Mangiferin is reported to possess considerable hypoglycemic property and also also shows suppressive effects on blood lipid profiles in diabetes.

2. Materials and Methods

This study was conducted at the Department of pharmacology, Bharti viswavidhalaya Durg Chhattisgarh, after approval from Institutional Animal Ethics Committee.

Maintaince of Animal;

Animal

The animal used in the present experimental work were healthy albino rats of wistar strain of male sex weighing between 150-250 g. The animals were maintained under standard laboratory conditions with free access to food and water . Each group consisted of randomly selected six animals.

Drugs

Streptozotocin (STZ) After weighing the required quantity of STZ powder fresh STZ solution was prepared in 0.1M solution citrate buffer of 4.5 .STZ was administered at a dosee of 50-60 mg/kg by intraperitoneal route. STZ was purchased from Sisco Research Lab, Ahemedabad.

Sodium citrate buffer; composition of 100 ml of 0.1M citrate buffer of pH 4.5.

Glibenclamide

In this study glibenclamide was taken as the standard drug at a dose of 0.5 mg/kg b.w. by oral route and results ere comapared with test drug. Glibenclamide powder dosage form was purchased from banglore (Aventis Pharma).

Test drug (Swertia Chirata)

Swertia chirata extracts-aqueous extract at a dose of 200mg/kg b.w. by oral administration was used. *Swertia chirata extract* was procured from Department of Rasayanshastra, Ayurveda Bharti Vishwavidyalaya Durg Chhattishgarh.

Glucometer

The glucometer used was Accu-check- Active for measuring blood glucose.

Methods

Inclusion Criteria; weighing 150-250 g and healthy male rate with normal behavior and activity. Exclusion Criteria: Animals weighing<150 g and >250 g and female rats. In the present study, diabetes was chemically induced by streptozotocin (stz) which produced permanent hyperglycaemia in rats. Blood glucose levels wre measured by glucometer. Atotal of 24 animals wre used for the study. They were divided into 4 groups of 6 animals each. Out of 24 rats, only 18 rats were incluced diabetes.

Induction of Diabetes

After an 18hrs fasting , diabetes was induced in 18 rats by intra-peritonial (i.p.) injection of streptozotocin (STZ) dissolved in 0.1 M sodium citrate buffer (pH 4.5) at a dose of 50-60 mg/kg b.w. . Animals were observed for first 24 hrs following the injection of STZ for any evidence of allergic reactions, behavioural changes and convulsions. Animal were fed with 5% glucose solution to overcome the STZ induced hypoglycaemia. No untoward reaction was observed in any animal. After 72 hrs of STZ induction , blood glucose levels were recorded. Only those animal blood glucose level were between 200-300 mg/dl with glycosuria were selected for the study and wre divided into 6 groups as non-diabetic or normal control group.

Swertia Chirata Aqueous extract

Normal control group (a-1)

This group of animal received 0.5 ml of normal saline daily for 21 days by oral route. Blood glucose levels were recorded before the administration of normal salin on day 0 at 9 am , then on 3rd , 7th , 14th and 21st days at 9 a.m.

Diabetic control group (A-2)

The blood glucose levels of this group werw recorded at 9am on day 0 before administering normal saline. Later the animals wre fed with 0.5 ml of normal saline daily orally for 21 days. The animals were observed for evidence of any behavioural changes, hyperglycaemia and convulsions.

Aqueous extract test group (A-3)

The blood glucose levels of this group were recoded at 9 am on day 0 before the administration of test drug. Then the aqueous extract at a dose of 200 mg/kg b.w. were fed to all animals were observed for any evidence if hypoglycaemia and convulsions.

Glibenclamide standard group (A-4)

The blood glucose levels of this group were recorded at 9 am on day 0 before the administration of glibenclamide. Later the animals were fed with glibenclamide. Later the animals were the fed with glibenclamide at a dose of 0.5 mg/kg b.w. daily orally in the morning for 21 days. Their bold glucose levels were recorded on 3rd, 7th, 14th and 21st day. They were observed carefully for evidence of hypoglycaemia and convulsions.

Statistical Analysis:

The results have been stastically analyzed for significance by using one way analysis of variance (ANOVA) for multiple group comparasons followed by post Hoc Tukeys test. $p<0.001$ was considered highly significant.

3. Results

The results were analysed with Anova (Analysis of variance) **and** comparison with standard , test and control groups done by post hoc tukeys tesr. $p<0.001$ was considered highly significant.

Table -1: Mean +- SD values of blood glucose levels in different groups of rats treated with Aqueous Extract of Swertia chirata 0n days 0,3,7,14,21.

Groups	Days0	Day3	Day7	Day14	Day21
A1	66.33 +_ 7.50	72.33 +_4.13	67.50 +_5.36	69.00 +_8.833	60.00 +_5.18

A2	285.17 +-12.75	285.83 +-7.17	294.50 +-14.61	296.17 +- 10.80	296.17 +_12.11
A3	264.67 +-24.43	163.70 +-31.80	105.67 +-8.57	78.20 +-25.50	85.80 +_31.70
A4	246.50 +-20.83	142.00 +-14.21	109.83 +-12.91	89.33 +-11.86	73.17 +_8.01
ANOVA	P<0.001	P<0.001	P<0.001	p>0.05	p>0.05

Shows comparison of mean blood glucose levels between normal control, diabetic control, standard and test groups in aqueous extract treates rats which are recorded in the fixed intervals as detailed in . It indicates that the test drug (A3) has antidiabetic activity but less when compared to the standard group (A4).Thus an analysis of results shows that aqueous extract group (A3) of *Swertia chirata* have significant antidiabetic activity in camparison to respective control groups (A1,A2), but less marked antidiabetic activity when comared to the respective standard glibenclamide groups (A4).

4. Discussion

In this study, the hypoglycaemic (antidiabetic) activity of aqueous extract of *Swertia chirata* has been evaluated and its efficay had beed campared with that of standard oral hypoglycaemic drug glibenclamide. Study done by susanna phoboo had shown that aqueous extract of *Swerta chirata* has antidiabetic activity and is probably due to the active principle mangiferin , present in the stem of the plant. Mangiferin has several modes of action viz. Direct stimulation of beta cell to release insulin. May be due to reduced intestinal absorption of glucose. Enhance glycolytic enzymes which stimulates glycogenesis in the liver and thereby contributes to reduction of blood glucose. Inhibiting alfa glucosidase and aldose reductase. Enhance glycolytic enzymes which stimulates glycogenesis in the liver and thereby contributes to reduction of blood glucose. Increase hepatic and muscle glycogen content, promotes beta cell repair and regeneration. Exerts insulin like action by reducing the glycated haemoglobin levels. Also inhibits dipeptidyl peptidase IV medicated degradation of glucagon like peptide-1(GLP-1) and increase GLP-1. Swertiamarin found in roots, inflorescence and leaf mixture accounts for antidiabetic activity of aqueous extract of *Swertia chirata.* Amarogentin present in all plant parts also contributes to the antidiabetic activity. Study done by joshi and Dhawan had also showed the antidiabetic activity of *Swertia chirata* . Studies done by singh AP had shown that swerchirin , xanthone of Sertia chirata had antidiabetic activity. Saxena et al had demonstrated the blood sugar lowering effect of swerchirin found in aqueous extract of swertia chirsts extract in streotozotocin treated rats. Swerchirin acts by stimulating insulin releasevfrome islets of Langerhans. Arya Renu et al have demonstrated the antidiabetic activity of its hexane fraction of swertia chirata which has active principle swerchirin. Sekar et al had shown that the main principle

swerchirin of swertia chirata induced a significant fall in blood sugar in albino rats and more effective in regulating blood sugar levels when campared to the regular drug tolbutamide. Grover J.K., Yadav S. , Vats V. had shown that swerchirin (a xanthone isolated from hexane fraction of the plant) showed significant blood sugar lowering efffect in fasted , glucose loaded and tolbutamide pre-treated albino rats. Studies done by bajpai et al has confirmed observation that swerchirin from hexan fraction of swertia chirata had antidiabetic activity. The present study has several limitations. The study has been carried out only in one specias of animal i.e. rats and needs to be extended to other animals as well. Only the fasting blood glucose was estimates in this study which does not give a clear picture about the effect of Swertia chirata on other parameters of diabetes mellitus .NO attempt has been made to establish exact mechanism of antidiabetic activity and beta cell pathology . In order to establish the exact mechanism of antidiabetic activity further investigations are also requred to standardize the composition of extracts of swetia chirata.

5. Conclution

At the end of the study it can be concluded that Swertia chirata extract – aqueous extract at a dose of 200mg/kg body weight, has exhibited antidiabetic activity in streptozotocin induced d diabetes in rets. These extracts exhibited less marked antidiabetic activity when compared to standard drug glibenclamide in streptozotocin induced diabetes in rats. However extensive studies have to be undertaken to establish this activity in animal models as well as human subjects. Further investigations are also required to standardize the composition of extracts. Results have shown that *Swertia chirata* has significant antidiabetic activity which is statically significant as compared to control groups but has less marked antidiabetic activity when compared to the standard drug glibenclamide.

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