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Investigation Of The Antidiabetic Effects Of Some Medicinal Herbs In A Streptozotocin-Induced Rat Model

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Background: Diabetes mellitus is a group of diseases that affects how fats, proteins, and carbs are used in the body. A number of diabetes researchers have recently looked into the health benefits of a number of plant products.
Methods: Three medicinal plants were tested to see which one was best at keeping rats from getting diabetes using a streptozotocin-induced model. Barleria Montana, Rotula aquatica, and Schrebera swietenoids are plants that have strong methanolic products that can help lower blood sugar.
Results: We showed in this study that the methanol extract of Barleria montana helps with insulin withdrawal by lowering blood sugar levels in diabetes rats that were given STZ.

Conclusions: More research needs to be done to figure out how the bioactive compounds in the unclear extracts work at the molecular level to give them their antiseptic and anti-inflammatory qualities.

Keywords: Antidiabetic activity, medicinal plants, streptozotocin, comparative study.

INTRODUCTION:

A collection of disorders known collectively as diabetes mellitus impact the body's utilization of lipids, proteins, and carbohydrates. This becomes an issue when insulin production is inadequate or when insulin action falls short of expectations. People with diabetes mellitus now have access to a plethora of medications that can reduce hyperglycemia [1-3]. These include biguanides and sulfonylureas. To solve the problems caused by diabetes, we need to find a new group of chemicals, because the drugs we already have have bad side effects. The medical society is still having a hard time controlling diabetes effectively without any bad effects. People are always looking for different ways to treat illnesses. It's a good idea to look into herbal treatments for diabetes. For a long time, though, plant medicines have been used to treat illnesses in Asian cultures as well as around the world [2-4].

Most of the time, plant treatments don't have a clear explanation for how they work. A number of ancient herbal treatments are often used to help people with diabetes. Still, anecdotal proof is the most reliable way to show that they are good for you. Traditional herbs used to treat diabetes may be able to make new oral hypoglycemic compounds [3-5]. These could help many rural communities in poor countries deal with the fact that current drugs are expensive and hard to get. India is known for having a lot of herbs. Schrebera swietenoids live on the slopes of dry deciduous woods between 600 and 1000 meters above sea level. The root of the plant is used to treat diabetes and leprosy [5-7]. If your nose is blocked, applying a paste made from the roots to your throat and chest can help clear things up. Barleria montana is a plant in the Acanthaceae family that is known for being the same as Barleria purprea. Plains with rocks along the edges, hillsides with steep slopes, and higher levels are where it is most common. A substance taken from the plant's leaf has become famous for its ability to heal cuts, burns, and diabetes when things are tough [6-8].

Diabetes mellitus is a common problem with the hormones that affects about 10 percent of people around the world. Both people and animals die more often when they have diabetes. About 0.2% of dogs have this problem, making them the most common animal affected by it. In traditional Indian medicine, many plants are known to have properties that could help people with diabetes [7-9]. Some of these plants have even been studied by scientists, and their active ingredients have been found. The World Health Organization has also suggested that plants should be tested to see how well they work in situations where safe modern medicines are not available. According to studies based on ethnobotanical knowledge, about 800 plants have been shown to keep diabetes from happening. Researchers in the field of diabetes have recently looked into how different plant products can be used as medicine [8-10]. A rat model of diabetes caused by streptozotocin was used in this study to compare the anti-diabetic effects of three medicinal plants.

MATERIAL AND METHODS:

Materials:

Plant Materials:
We collected roots of Barleria montana, aerial parts of Schrebera swietenodes, and aerial parts of Rotula aquatica from different places in India during the winter. The raw forms of the drugs were ground up in a Wilay mill, and then they were extracted using a Soxhlet device and methanol as the solvent.

Plant extracts:
A combination of plant-derived substances combined with methanol was administered to diabetic rats previously treated with STZ in order to investigate their potential in reducing blood glucose levels. Individuals were administered doses of the products at 100, 200, or 400 mg/kg of body weight. The test subjects in the animal studies that looked at how well the treatment worked had to go without food for 12 hours so that the amount of drug in their blood could be measured. The animals could get as much food and raw materials as they wanted. The Glibenclamide and alcohol groups were both treated in the same way and at the same time on the day of treatment. It was possible to connect the blood samples of brothers by using the retroorbital plexus of rats [10-12].

Animals:
This study utilized adult albino rats weighing between 100 and 150g. Prior to the commencement of the trial, a 15-day acclimatization period was provided for all the rats. Each day, they were provided with an unrestricted quantity of the standard chow meal and water. Animals classified as fasting abstained from eating for a minimum of sixteen hours, however they were still able to consume water [11-13].

Induction of diabetes:
The individuals in the experimental group received a dosage of 50 mg/kg of their body weight of freshly prepared streptozotocin in a 0.1 M citrate buffer. The individuals in the control group were administered citrate buffer. Intraperitoneally, 0.4 mL of a solution and a 24-gauge needle attached to a tuberculin syringe were employed to administer the streptozotocin within a time frame of 15 minutes after its dissolution. On the third day following the administration of streptozotocin, fasting glucose levels were utilized to verify the presence of diabetes in the animals [12-14].

Serum Glucose Estimation:
At the beginning, the subject's blood sugar level was measured using an advanced glucometer, and a small amount of 0.5 milliliters of blood was collected from their tail. A glucometer was employed to assess the levels on a solitary application strip, and the outcomes were recorded. Blood samples were collected at specific time intervals of 0, 2, 4, 8, 12, 18, and 24 hours and stored in 1 ml Eppendorf tubes. The serum was centrifuged at a speed of 5000 revolutions per minute (rpm) for a duration of 10 minutes in order to separate the various components. A basic and efficient test tube was utilized to cultivate 30 µl of serum sample and 3 ml of active glucose reagent at a temperature of 37 °C for a duration of 10 minutes [13-15].

Results:
Body weight:

The study supported the idea that weight loss is a common phenomenon in people with diabetes. When streptozotocin was given to rats, their body weight dropped noticeably. Using statistics, it was clear that this drop was important compared to the normal control group. When compared to the diabetes control group, the rats that were given the extract had a statistically significant increase in body weight. It looks like these two plants worked even better than glibenclamide at helping people gain or keep off weight. This makes them the most promising in terms of how well they work. The group that was given Psidium guajava had a smaller percentage increase in body weight than the group that was given glibenclamide [13-15].

Blood glucose:

The selective death of pancreatic islet cells by streptozotocin causes blood sugar levels to rise. This study clearly shows that giving albino rats 50 mg/kg of streptozotocin causes a very diabetogenic response. The diabetic rats that were given Schrebera swietenodes, Barleria montana, Rotula aquatica, and glibenclamide had blood glucose levels that were about 3.5 times higher after fifteen days of treatment than the normal control group rats. It was found that the diabetic control groups had significantly higher glucose levels compared to the normal control groups of the same size. This difference was statistically significant. The diabetic rats' high blood sugar levels went down a lot after being given an oral solution of a liquid extract of the leaves of Schrebera swietenodes, Barleria montana, Rotula aquatica, and Glibenclamide. When the prescription drug Glibenclamide was given on the fifteenth day, blood glucose levels went down. The groups that were given the drugs had significantly lower blood sugar levels than the diabetes control group that was the same except for the drugs [14-16].

Urine glucose and ketone:

Only the normal control group exhibited urine samples devoid of ketones or glucose on day 0. On the fifteenth day, the groups administered with glibenclamide and plant medicine exhibited the presence of glucose and ketones, although the diabetic control group did not (Table 1 and Table 2) [15-17].

Table 1: In STZ-induced diabetic rats, methanol extracts of plants affect blood glucose

Group	Treatment	0	2	4	12	18	24
1	Glibenclamide	352.12±11.2	342.52±13.3	342.01±9.14	334.15±10.21	340.13±12.12	340.98±11.14
2	Control	351.35±13.2	260.21±9.46	200.45±7.14	301.33 ±14.55	322.78± 6.12	332.75± 8.14
3	100 (RA)	340.2± 11.3	332.74± 8.20	320.88 ± 6.60	303.45± 8.61	310.70± 8.46	312.56± 6.88
4	200 (RA)	342.33± 12.12	332.49± 6.09	322.13± 6.50	281.14 ±8.65	308.55± 6.47	323.14± 11.47
5	100 (SS)	341.90±	326.62±	321.32 ±	321.69±	319.14±	317.41± 9.23

		8.2	8.60	6.33	8.16	14.87	
6	200 (SS)	356.25± 14.1	343.40± 12.48	316.89± 8.62	279.72 ±8.14	291.48± 6.88	319.82± 8.90
7	100 (BM)	344.15± 10.3	320.52± 10.80	300.92 ± 10.64	313.22± 8.14	321.77± 8.66	340.12±4.12
8	200 (BM)	340.78± 6.12	311.79± 7.12	293.41± 16.14	262.89 ±41.14	284.78± 15.88	281.50±20.14

Table 2: Methanol extracts of medicinal plants reduce glucose in STZ-induced diabetic rats

Group	Treatment	2	4	8	16	24
1	Control	2.41±3.14	2.78±3.45	3.84±9.78	3.47±3.89	2.30±3.78
2	Glibenclamide	26.50±5.3	39.50±3.8	22.14±7.13	12.90±2.5	5.80±5.25
3	100 (RA)	5.40±2.7	5.40±2.4	49.7±3.14	5.13±2.40	5.78±4.13
4	200 (RA)	3.52±1.2	11.14±3.3	17.53±4.82	21.4±3.19	9.74±5.14
5	100 (SS)	8.48±4.5	15.40±4.5	38.50±7.4	19.14±3.17	10.13±3.6
6	200 (SS)	8.28±5.41	10.80±2.10	17.58±5.6	9.35±5.36	10.11±2.14
7	100 (BM)	9.40±3.72	12.11±2.4	12.47±2.10	21.16±3.20	15.14±8.9
8	200 (BM)	11.25±4.6	19.12±3.9	33.24±2.4	16.46±5.8	8.14±5.4

Discussion:

The drug-treated and control groups' average blood glucose levels were checked after they were given different amounts of methanolic extracts from the stems and leaves of Rotula aquatica, Barleria montana roots, and Schrebera swietenoides at different times. Using the starting blood glucose levels, the statistical significance of the drop in blood glucose levels was found [15-17]. There was no change in the rats' blood sugar levels when they were given a gastric suspension of 1% Sodium CMC. The diabetes rats' blood glucose levels dropped significantly after being given Glibenclamide. The drop was statistically significant at two hours and large at four hours. At 18 or 24 hours, however, there was no clear drop in the normal blood glucose level. The average amount of glucose in the blood after taking a common medicine by mouth [16-18].

The study looked at how much lower blood sugar levels were after different amounts of methanolic extracts from the roots of Barleria montana, Rotula aquatica, and Schrebera swietenoides were taken by mouth. After 24 hours, there was no statistically significant drop in blood glucose levels after Glibenclamide was given. Giving 400 mg/kg b.w. of a methanolic extract from the above-ground parts of Schrebera swietenoides for eight hours lowered blood sugar levels by a large amount. The methanolic extract of Schrebera swietenoides was given at a dose of 400 mg/kg body weight [17-19].

The biggest drop in blood sugar levels was seen 12 and 8 hours after 200 and 400 mg/kg b.w. of the methanolic extract of Schrebera swietenoides plant parts were given. At two, twelve,

and eighteen hours after an oral dose of 400 mg/kg b.w. of a methanolic extract from the roots of Barleria montana, blood glucose levels dropped noticeably. In addition, there was a very noticeable drop at 4 and 8 hours [18-20]. The average percentage drop in blood sugar levels caused by 400 mg/kg of body weight of Barleria montana methanolic extract. Giving 400 mg/kg b.w. of a methanolic extract of Rotula aquatica aerial parts by mouth and comparing it to a control group at the same times showed a big drop in blood sugar levels after 4, 8, 12, and 18 hours. The average percentage drop in blood sugar levels that happened after 400 mg/kg body weight of a methanolic extract from the aerial parts of Rotula aquatica was given [21-23].

Streptozotocin (STZ) is often used in computer-assisted training for people with type I diabetes. It helps keep nitric oxide levels steady while damaging only pancreas islet β-cells. Unfortunately, this causes β-cells to die quickly and makes it much harder for the pancreatic islets to make pyridine nucleotides [24-26]. The presence of superoxide anions (SOD) caused by the effects of streptozotocin (STZ) on mitochondria speeds up the development of diabetes. In our gold mine study, we found that diabetic rats that were given Barleria montana methanol reliably had lower levels of insulin in their blood and lower levels of glucose in their meat compared to rats that were given the other two extracts [27-31]. This effect might be caused by the pancreas making insulin, which affects the growth of new β-cells, or it could be caused by ATP-unofficial K+ channel inhibitors, such as Glibenclamide, making new β-cells produce insulin more quickly. Researchers have already found that phenolic compounds only change the amounts of ATP to keep blood sugar levels steady. They don't change any other potassium ion channels in the ears [32-38].

CONCLUSION:

In conclusion, our research showed that the methanolic extracts from Schrebera swietenoids, Barleria Montana, and Rotula aquatica plants were very good at lowering blood sugar. We showed that the methanol extract of Barleria montana helped diabetic rats that were made diabetic with STZ by lowering the levels of insulin in their blood. More research needs to be done to figure out how the bioactive compounds in the ambiguous extracts work at the molecular level to give them their antiseptic and anti-inflammatory qualities.

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Nil

Conflict of Interest:
None

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