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Antidiabetic Effect of Ethanolic Extract of Caesalpinia Bonduc Seeds in Streptozotocin-Induced Diabetic Rats

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KEYWORDS
Diabetes, Anti-diabetic, Streptozotocin, *Caesalpinia bonduc* etc.

ABSTRACT:
Purpose: A study of historical literature reveals that diabetes was widely recognized and understood in India. Herbal medicines have long been used to treat a range of diseases. Nature has provided an extensive number of medicinal plants that are useful to all living things. While the fundamental merits of many plants have long been recognized, many others remain to be fully researched. Therefore, it is necessary to look into their uses and conduct pharmacognostic and pharmacological research in order to determine their therapeutic characteristics. Actually, diabetes is becoming a global problem. Thus, the purpose of this research is to open up new avenues for improving the medicinal uses of *Caesalpinia bonduc* for the specific ailment of diabetes. Method: The goal of the current study is to assess the anti-diabetic effects of *Caesalpinia bonduc* seeds against STZ-induced diabetics. Result: The body weight and blood glucose level of the seed extract of *Caesalpinia bonduc* was found to be significantly lower and comparable to that of a standard anti-diabetic medicine (Metformin). Conclusion: In the current study, albino wistar rats were used as test subjects to evaluate the anti-diabetic activities of a methanolic seeds extract of *Caesalpinia bonduc*.

1. INTRODUCTION

Diabetes mellitus, a metabolic disorder characterized by a continuously elevated blood sugar level, is an important health issue worldwide. It typically comes on by insufficient insulin secretion or insulin sensitivity. Diabetes mellitus has been extensively investigated because of its rapid increase and associated issues1. Worldwide, the affected population is estimated to be around 230 million. Only half of those who suffer from its worldwide receive proper care, and most are ignorant of the illness. It occurs when brought on by either an insulin shortage, an insulin resistance, or both. The pancreatic β-cells release insulin to regulate blood glucose levels. Some of the symptoms that diabetic

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people frequently experience include blurred vision, excessive thirst, exhaustion, frequent urination, hunger, and weight loss2 As normal human consumes primarily carbohydrates, it is increasing. There is currently no synthetic medication that can permanently treat diabetes3. Thus, we need to explore the world of herbs in search of a new, more effective drug. Significant progress has been accomplished when managing diabetes mellitus with insulin therapy, oral hypoglycemic medications, a restricted diet, and exercise, either in isolation or in combination. However, the hunt for native antidiabetic medicines is still underway. This is because accounts of actually favorable results from conventional medical treatments have come out4.

Caesalpinia bonduc (C. bonducella) is a huge ascendant prickly shrub found throughout the coastal part of India. It is common in southern parts of India and is frequently grown as a border plant5. It has been used as a medicinal plant since ancient times. In siddha medicine it is considered as a tonic and analgesic and is believed to help heal broken bones. It is said to have antibacterial, antifungal, antioxidant, anthelmintic, antihemorrhoidal and analgesic activities. Analgesic and anti-inflammatory, anthelmintic and antimalarial, Antitumor activity and antioxidant, Adaptogenic activity 6,7. The purpose of this work was to investigate the potential of Antidiabetic Effect of Ethanolic Extract of Caesalpinia bonduc seeds in Streptozotocine induced Diabetic Rats.

MATERIALS AND METHOD

Caesalpinia bonduc seeds were purchased from a local market nearby in Dhule, Maharashtra, and were authenticated by Dr. D.A. Dhale (Professor, PG and Research Department of Botany, SSVPS's L.K. Dr. P. R. Ghogrey Science College, Dhule). After collecting the seeds, washing them thoroughly to get free of any debris, breaking the seed coat, and drying them for four to five days there were about 4 kg of seeds. The seeds were subsequently allowed to dry before the hulls were removed and ground up. An electric grinder is used to ground the seeds into powder. To get the fine powder, the obtained powder is sieved and dried again.

Extraction methodology 8,9

The Caesalpinia bonduc seeds powder were extracted using the Soxhlet technique in petroleum ether (60–80°C) and ethanol. To achieve thick sticky extract, the extracts were finally evaporated and dried to use a vacuum and tray dryer.

Animals

Healthy adult swiss albino wistar rats of either sex weighing between 160 to 180 gm were used for acute toxicity study and antidibetic activity.

Toxicity study: (OECD 423). 10

According to Organization for Economic Cooperation and Development recommendations No. 423, an acute toxicity study was conducted. Six groups of six albino wistar rats, one of each sex, were created. Rats received single oral doses of seed extract at various dose levels of 50, 250, 500, 1000, 1500, and 2000 mg/kg b.w. Animals were individually observed for the first 30 minutes, then occasionally over the next 24 hours, paying extra close attention to the first four hours and then every day after that for a total of 14 days.

Experimental procedure.

Induction of Experimental Diabetes:11,12

An intraperitoneal injection of 60 mg/kg of streptozotocin (STZ) dissolved in 50 mM citrate buffer causes diabetes, and a control animal administered an identical volume of solution in the same ways.

Experimental Procedure: 13, 14, 15

Wister Rats were divided into six groups, each consisting of six animals. The seed extract of Caesalpinia bonduc was dissolved in water and administered orally. Saline solution and metformin at 500mg/kg were administered orally. Rats were divided into fallowing groups.

Group 1 –Normal

Group 2 - Diabetic treated. (Streptozotocin 60 mg/kg)

Group 3 - Diabetic treated with 500mg/kg of metformin

Group 4 - Diabetic treated with 100mg/Kg Caesalpinia bonduc seed extract for 21 days.

Group 5 - Diabetic treated with 200mg/Kg Caesalpinia bonduc seed extract for 21 days.

Group 6 - Diabetic treated with 400mg/Kg Caesalpinia bonduc seed extract for 21 days

Statistical analysis

The data represent mean S.E.M. Result were statistically by one-way ANOVA followed by dunnet’s test. The minimum level of significance was set at $p<0.005$.

RESULTS

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Body weight: The results of this study confirmed the belief that weight loss is a sign of diabetes. Rats showed an important reduction in body weight when given streptozotocin. This reduction has been shown to be statistically significant (P<0.05) when compared to the normal group. These lowered body weights were observed to grow in comparison to the comparable diabetes control group, and in rats treated with Caesalpinia bonduc seed extract (p<0.05) and metformin (p<0.001), the increase was found to be statistically significant. (Tab. 1).

Table 1. Body weight Effect of Caesalpinia bonduc seed extract on body weight in Streptozotocin induced diabetic rat.

Group	Body weight (gm)			
	Initial	7th day	14th day	21th day
Normal	160±6.23	161±5.54*	164.23±4.23*	165.54±8.67*
Diabetic treated (Streptozotocin 60mg/kg)	195±9.56	199.45±5.65**	201±8.95**	210.56±6.56**
STD (Metformin 500mg/kg) + Diabetic treated	180±4.23	187.23±10.4*	184±5.7*	185±6.52*
100mg/Kg *Caesalpinia bonduc* seed extract + Diabetic treated	172.56±7.54	180.52±5.56*	187±8.99*	192.87±8.87*
200mg/Kg *Caesalpinia bonduc* seed extract + Diabetic treated	188±8.98	193.52±7.6*	200.14±7.8**	214.56±7.89*
400mg/Kg *Caesalpinia bonduc* seed extract + Diabetic treated	180±7.56	200.23±47**	193.25±5.56**	191.45±5.56**

Values are expressed as mean S.E.M. (n=6)
*P<0.05, **P<0.01, when compared with the Streptozotocin treated group

Blood glucose level: Blood glucose levels increase as a result of streptozotocin selective death of pancreatic islet cells. According to the results of the current study, albino rats exposed to streptozotocin at a level of 60 mg/kg body weight indicate a strong diabetogenic response. On the 7th ,14th ,21th day blood sample collected and check blood glucose level, blood glucose levels in diabetic control rats treated with Caesalpinia bonduc seed extract and metformin were about three times greater than those of the rats in their respective normal control group. It's remarkable to notice that the increase in blood glucose levels in the control groups of diabetics was found to be it to be very statistically significant (p<0.05). In assessment to the respective normal control groups. After oral administration of Caesalpinia bonduc seed extract and metformin, these elevated blood glucose levels in diabetic rats were reduced. When diabetic and drug-treated animals were compared, when compared to the corresponding diabetic control group, this decrease in blood glucose levels in the drug-treated groups was found to be highly statistically significant (p< 0.01). (Tab. 2).

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Table 2. Blood glucose level Effect of Caesalpinia bonduc seed extract on Blood glucose level in Streptozotocin induced diabetic rat.

Group	**Blood glucose level** (mg/dl)			
	Initial	7th day	14th day	21th day
Normal	115±19.89	118.89±22.6*	119.56±18.56*	122.23±17.89*
Diabetic treated (Streptozotocin 60mg/kg)	591.45±75.56	599.78±47.89*	613.25±43.12**	623.56±48.56**
STD (metformin 500mg/kg) + Diabetic treated	602.23±41.23	612.23±40.23*	450.23±45.23**	250±25.56**
100mg/Kg *Caesalpinia bonduc* seed extract + Diabetic treated	645±56	600.25±45.56*	565.85±32.56**	421±32.56**
200mg/Kg *Caesalpinia bonduc* seed extract + Diabetic treated	652±45.56	535.56±25.36*	499.56±27.45**	401.23±26**
400mg/Kg *Caesalpinia bonduc* seed extract + Diabetic treated	658±96.56	502.36±45.69*	476.56±21.56**	265.55±21.36**

Values are expressed as mean S.E.M. (n=6)
*P<0.05, **P<0.01, when compared with the Paracetamol treated group (one-way ANOVA followed by Dunnett test)

DISCUSSION

Streptozotocin (STZ) was initially isolated from Streptomyces a chromogenes in 1960, with its diabetogenic properties not described until 1963. This activity was described based on previous research demonstrating that the loss of pancreatic islet β-cells selectively causes the diabetogenic effects. This activity causes the animals to exhibit symptoms similar to type 1 diabetes in humans, including insulin insufficiency, hyperglycemia, polydipsia, and polyuria. A number of animal species are susceptible to the cytotoxic effects of STZ on pancreatic β-cells, with the rabbit being less so than the mouse, rat, and monkey16.

Streptozotocin (60 mg/kg) administered intraperitoneally efficiently caused diabetes in normal rats as shown by body weight loss, glycosuria, hyperglycemia, polyphagia and polydipsia

In our present study we have found that standard drug Metformin and 400mg/Kg Caesalpinia bonduc seed extract can inverse diabetic effects. The possible mechanism of study plant about its antidiabetic action may be by potentiation of pancreatic secretion of insulin from β-cell of islets or due to improved transport of blood glucose to peripheral tissue17. This was clearly showed by the improved level of insulin due to decrease hepatic glucose production and falls intestinal absorptionin diabetic rats treated with standard drug metformin and Caesalpinia bonduc seed extract. Animals given a dose of streptozotocin also received a seed extract from Caesalpinia bonduc, which stopped the weight loss. The antidiabetic function of Caesalpinia bonduc seed extract look like to be responsible for its capacity to regain body weight loss. The most significant results of the current study are that, in streptozotocin-induced diabetic rats, a 400 mg/kg body weight dose of a seed extract from Caesalpinia bonduc for 21 days had a positive effect on body weight as well as blood glucose levels. Results obtained from the present study are very much positive and similar with metformin, a standard drug used to treat diabetes mellitus. Similar to our observations,

CONCLUSION

Based on the above results, it can be established that the active principles present in Caesalpinia bonduc seed extract for better antidiabetic activity as compared to the

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Streptozotocin induced diabetic effect. However, more rich work is required to establish the efficacy of seed extract by isolating and identifying the active constituents present in the seed extracts which are responsible for the antidiabetic effect.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest.

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