ANTIDIABETIC ACTIVITY OF CAESALPINIA BONDUCELLA LEAVESs OF HYDRO ALCOHOLIC EXTRACTS IN ALBINO RATS

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Abstract

The anti-diabetic effect of Caesalpinia bonducella leaf extracts was tested in streptozotocin-induced hyperglycemia. Significant antihyperglycemic effect was generated by oral treatment of the extracts (400 mg/kg). The same study examined the effects of the extracts on diabetes-induced hyperlipidemia, finding that they dramatically reduced both the raised cholesterol and LDL levels. The extracts' antihyperglycemic effects may be brought about by their ability to prevent glucose absorption. The medicine may have both antidiabetic and antihyperlipidemic effects.

Keywords: *- Caesalpinia bonducella, antihyperglycemic, antidiabetic, antihyperlipidemic, diabetes, cholesterol.*

1. Introduction

A sizable portion of the population has been impacted by diabetes mellitus, and in the future it will be a serious condition that affects individuals everywhere in the world, regardless of sex, age, or socioeconomic level. Although insulin has shown to be somewhat beneficial in lengthening diabetes patients' lives, there are still numerous problems with this treatment; therefore it is not a long-term fix. Additionally, the treatment with oral hypoglycemia medications is ineffective. So it would be interesting to look for novel therapeutic agents derived from plants utilized in conventional treatment that have no negative side effects.

In the southern regions of India and Sri Lanka, Caesalpinia bonducella Roxb. (Fabaceae) is a huge, dense, thorny shrub that is frequently planted as a hedge plant.(1) It has been shown to have anti-inflammatory(2) and antimalarial properties.(3) It is said to be an aphrodisiac and all-purpose tonic that aids in physical regeneration.(4)

Since, in previous studies the anti-diabetic activity of seeds extracts were reported. Hence, it is intended that this study establish scientific evidence for the Caesalpinia bonducella leaf extract for the anti-diabetic activity.(5)

2. Experimental

2.1. Plant material

The plant's fresh leaves were procured in Sambhal, Uttar Pradesh, India, during the month of July, and Dr. Sunita Garg, director of the Raw Materials Herbarium & Museum (RMHD), Delhi, validated them. The plant specimen was donated to the National Institute of Science Communication and Information Resources (CSIR-NISCAIR), Raw Materials Herbarium & Museum (RHMD), New Delhi. At the same institution, a voucher specimen number (ARFC/SOP/IAEC/01/18) was given. To eliminate the surface impurities, the gathered leaves were washed under running water from the faucet. Under shade, the plant materials were air dried.

2.2. Preparation of the extracts

The dried leaves were ground into a powder and extracted using a Soxhlet device in ethanol at 600–800°C. Finally, a rotating vacuum evaporator was used to evaporate the extracted samples. The sequential solvent extraction procedure produced the extract yield. The yield was discovered to be (12%) for ethanol. For additional research, dried extracts were employed.

2.3. Animals

Albino Wistar rats (weighing between 125 and 150g) were purchased and brought to the Animal Research Facility Center of the School of Pharmacy at Monad University in Hapur. The IAEC of the School of Pharmacy at Monad University in Hapur approved the experimental protocol. (Reference number: ARFC/SOP/IAEC/01/18) Rats were kept in polypropylene cages lined with husk under typical ambient conditions (25 5 °C, 55 10% relative humidity). The rats were provided with free access to water and were fed on a typical pellet diet.

2.4. Oral glucose tolerance test

Normal mice that had been fasted overnight (18 hours) underwent the oral glucose tolerance test.(6) The next eight groups—groups I, II, III, IV, and V—were created using rats. Every group contained six animals. Rats from Group I served as the standard (administered only normal saline). Rats from groups II to IV received varying doses of C. bonducella ethanolic seed extract (200, 300, and 400 mg/kg, orally), whereas rats from group V received glibenclamide (0.5 mg/kg b.w. per day p.o.) treatment. 30 minutes following extract administration, the animals from all groups were loaded with 60 percent glucose (3 g/kg p.o.). Before administering the medication, blood was taken from the tail at 0, 30, 60, 90, 120, and 150 minutes after glucose loading. An electronic glucometer was used to estimate the blood glucose levels (Gluco-one, Dr. Morepen).

2.5. Streptozotocin induced hyperglycemia

In overnight fasting albino wistar rats, a single dosage of streptozotocin (60 mg/kg, i.p.) reconstituted in normal saline caused hyperglycemia. On the fifth day of STZ treatment, blood was drawn by a tail vein puncture, and one-touch Glucometer (Gluco-one, Dr. Morepen) strips were used to test blood glucose levels. Rats having a fasting blood sugar level of 250 were deemed to have hyperglycemia.(7) Rats were put into six groups at random (six animals in each group). Only normal saline was given to group (I), the normal control, and 0.25 percent CMC was given to group (II), the diabetic control. Diabetes group (III) rats were given Ceasalpinia bonducella etholic extract (200 mg/kg, p.o) (EECB). Diabetic rats in group (IV) were given (400 mg/kg, p.o.) EECB Diabetic rats in group (V) got the conventional medication glibenclamide (10 mg/kg, p.o.). Body weight and blood glucose were monitored using strips on the first, third, fifth, seventh, ninth, eleventh, fifteenth, seventeenth, and twenty-first days of therapy for EECB.

At the conclusion of the experiment, blood was drawn for additional biochemical analysis, starved animals were decapitated at the cervical spine, and organs like the pancreas were taken out, cleaned with ice cold saline, and preserved for additional analysis.

Several biochemical markers, including blood glucose level, lipid profile, and oxidative profile, were estimated using serum.

2.6. Statistical analysis

The mean SD is used to express all findings. Graph Pad Prism 5.0 version software was used for the statistical analysis, which was done using the ANOVA (Bonferroni multiple comparison test) method. A result of p 0.05 or above was deemed significant.

3. Results

3.1. Glucose tolerance test

In the glucose tolerance test, the ethanolic leaves extract of C. bonducella significantly lowered blood glucose levels. This finding suggests that the extracts have the ability to effectively prevent the absorption of glucose.

3.2. Anti-hyperglycemic effect

In line with expectations, the diabetic control group's severe hyperglycemia was higher than that of the healthy animals. Following the STZ injection, the blood glucose levels of the STZ-treated group alone dramatically rose from 76.4 to 290.40 mg/dl. From the first day of therapy through day 21, blood glucose levels were substantially lower in the extract-treated groups. When compared to the STZ-treated control group, all extract-treated groups shown a significant lowering impact (p 0.05) on blood glucose levels. According to Table 1, the greatest concentration of C. bounducella's ethanolic leaf extract (400 mg/kg) was shown to be more efficient than the lower concentration (200 mg/kg) at lowering blood glucose levels. The high dose (400 mg/kg of body weight) of the ethanolic leaves extract of C. bounducella has blood glucose lowering properties that were comparable to those of the medication Glibenclamide. On day 21, an ANOVA comparison indicated that the high dosage (400 mg/kg) of C. bounducella ethanolic leaves extract had a very significant effect compared to the low dose (200 mg/kg) of the extract. When compared to the diabetic control group, oral treatment of EECB (200, 400 mg/kg) significantly (p0.001, n=6, one-way ANOVA with Bonferroni multiple comparison test) decreased blood glucose levels. Maximum antihyperglycemic action was shown by EECB (400mg/kg). The blood glucose level was significantly reduced in the group receiving the standard treatment (Glibenclamide, 10mg/kg, p.o.) from 289.603.11 to 160.23.0 (p0.001, n=6).

However, leaf extracts from the studied groups demonstrated following antidiabetic efficacy.

S. No.	Treatment	Blood Glucose Level (mg/dl)					
		1st day	3rd day	7th day	9th day	14th day	21st day
1	Normal control(10 ml/kg vehicle control)	89.75± 6.3	92.75±3.8	94±3.44	94.5±2.38	96.5±4.18	99.5±2.9
2	Diabetic control(60 mg/kg STZ control)	290.4 ± 2.9	298.6 ± 3.1	302.8 ± 2.9	309.8 ± 2.8	312.2 ± 4.6	321.8 ±2.4
3	STZ+EECB leaves (200 mg/kg)	270.5 ± 6.4	254.5 ± 5.2	240.3 ± 3.6	218.9 ± 3.6	200.3 ± 5.1	189.2 ± 3.8
4	STZ+EECB leaves (400 mg/kg)	260.5 ± 2.4	242.8 ± 4.3	222.1 ±4.1*	211.6 ±2.9*	193.4 ±3.1*	152.8 ±1.9

5	STZ + Glibenclamide (0.5 mg/kg b.w per day p.o)	289.6 ± 3.1	279.6 ± 2.5	251.4 ± 2.0	232.1 ± 3.3	198.5 ± 1.9	160.2 ±3.0

Table 1:- Effect of EECB on Streptozotocin-Induced Diabetic Rats' Blood Glucose Level (mg/dl).

3.3. Effect of EECB Leaves on Diabetic Rats' Lipid Profile.

In table 2, the outcomes of the lipid profile of the diabetes control and treatment groups are shown. EECB (200, 400 mg/kg, p.o.) administration resulted in a substantial (p0.05, p0.001, n=6, one way ANOVA with Bonferroni multiple comparison test) decrease in TC, TG, LDL, and VLDL when compared to diabetes control. Additionally, one way ANOVA with Bonferroni multiple comparison test revealed that EECB (400 mg/kg) and Glibenclamide (10 mg/kg, p.o.) significantly improved HDL levels (p0.05, p0.001 n=6).

S. No.	Treatment	Total Cholesterol	Triglyceride	HDL	LDL	VLDL
1.	Normal control(10 ml/kg vehicle control)	79.65±5.12	61.5±6.55	39.85±3.30	30.1±1.36	10.3±0.29
2.	Diabetic control(60 mg/kg STZ control)	196±12.05	164.5±6.75	27.65±3.5	138.15±2.19	31.1±1.08
3.	STZ+EECB leaves (200 mg/kg)	168±8.97***	149±4.98 ***	29.55±2.37	119.45±1.39** *	34±1.73
4.	STZ+EECB leaves (400 mg/kg)	147.33±2.43** *	130.66±3.35** *	33.11±2.55*	87.29±1.06***	24.6±1.18***
5.	STZ + Glibenclamide (0.5 mg/kg b.w per day p.o)	133.5 ±4.20 ***	121.25±4.75** *	36.75±2.21** *	77.5±2.08***	20.25±1.96***

Table 2 :- Ceasalpinia bounducella Dose Effect on Lipid Profile in Streptozotocin-Induced Diabetic Rats.

3.4. Effect of EECB on SOD and TBARS in Diabetic Rats.

SOD levels in the diabetic control group dropped, as seen in Table 3. Treatment with EECB (200, 400 mg/kg, p.o.) significantly increased antioxidant parameters (p0.05, p0.001, n=6, one way ANOVA with Bonferroni multiple comparison test) (SOD). When compared to the diabetic control group, the treated group's TBARS levels were considerably (p 0.001) lower. Data are shown as meanSD. Diabetes control and Glibenclamide/EECB (200 and 400 mg/kg) showed statistically significant differences [one way-ANOVA followed by Bonferroni multiple comparison test; ***p0.001, **p0.01, *p0.05].

S. No.	Group	TBARS (µM/gm)	SOD (U/mg Protein)
1	Normal control(10 ml/kg vehicle control)	0.33±0.07	6.87±1.09
2	Diabetic control(60 mg/kg STZ control)	0.98±0.11	4.54±1.42
3	STZ+EECB leaves (200 mg/kg)	0.84±0.06	5.76±0.65
4	STZ+EECB leaves (400 mg/kg)	0.53±0.03***	6.38±0.48**
5	STZ + Glibenclamide (0.5 mg/kg b.w per day p.o)	0.42±0.04***	8.73±0.87***

4. Discussion

Long-term diabetes mellitus is linked to a number of problems, including atherosclerosis, myocardial infarction, neuropathy, and nephropathy. Long-standing theories link these consequences to persistently high glucose levels and the oxidative damage that follows. Previous research conducted in our lab demonstrated that Ceasalpinia bounducella leaf extracts may produce strong in vivo antioxidant activity.(8,9) Other researchers assessed various plants for their anti-diabetic properties as well as their relationship to antioxidant activity.(10) In the current investigation, larger dosages (200 and 400 mg/kg) of Ceasalpinia bounducella ethanolic leaf extracts were able to significantly lower blood glucose levels in diabetic rats after 2 hours of therapy, with no discernible changes in body weight. Other researchers noticed related results.(11) Therefore, unlike insulin and other manufactured medicines, ethanolic leaf extracts from Ceasalpinia bounducella may be deemed to have good antidiabetic principles.

In the current investigation, Ceasalpinia bounducella leaf extracts were shown to be as efficacious equally glibenclamide at lowering blood glucose levels in STZ-induced diabetic rats. However, the Ceasalpinia bounducella plant's mechanism has been precisely identified. By increasing the production of free radicals by glucose auto-oxidation, hyperglycemia raises the risk of cell damage. The actions of the diabetogenic drug STZ and the rise in blood glucose levels may both contribute to the increase in oxygen free radicals in diabetes.(12) Since Ceasalpinia bounducella is an active antioxidant (8) and was discovered to be the most effective antidiabetic medication to lower blood glucose levels, Ceasalpinia bounducella leaf extract exhibited considerable suppression of STZ induced diabetes in experimental mice.

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