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Research Article

EVALUATION OF THE ANTI-DIABETIC EFFECTS OF *TINOSPORA CORDIFOLIA* LEAF EXTRACT ON DIABETIC RATS INDUCED BY STREPTOZOTOCIN

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ABSTRACT

This paper was designed to conduct a review of *Tinospora* as an anti-diabetic. The Streptozotocin made the rats become diabetic and *Cordifolia* leaf extract was used. Diabetes mellitus is a polygenic and multifaceted disorder of metabolism. Unconditional insulin deficiency condition, insulin insensitivity or insulin insensitivity. either of them which leads to homeostasis of glucose being disarmed and hyperglycemia ensues. This is attributed to the leaf *Tinospora cordifolia* extract having a good anti-diabetic effect, which is likely as it has a high anti-diabetic potential. In this study, one intraperitoneal was used to induce Wistar rats to diabetes. Streptozotocin (55mg/kg) injection, followed by 28 days oral (50 per cent). Test group which had ethanolic cordifolia leaf extract (300 mg/kg). The efficacy of the extract and the standard was compared using a four-group design 6-design. Glibenclamide (10 mg/kg) by following the variation in the fasting blood glucose and body weight after a week. The phytochemical characterization of the 50 percent ethanol extract revealed the existence of tannins, flavonoids and alkaloids. The result was obtained with the 300mg/kg at 28 days. Important decrease of level of blood glucose by 58.2% ($P < 0.01$). The extract has a significant restoration of body weight and normalization of metabolic in the group treated as well. Parameters, which prove the efficiency similar to the conventional medicine Glibenclamide. The paper concurs with this fact that the 50 percent ethanol extract of *Tinospora cordifolia* leaves have immense anti-diabetic effects and prevent loss of weight in STZ-induced. diabetic rats, which it has over its traditional use as a natural therapeutic agent in the management of diabetes.

Keywords: Diabetes mellitus, *Tinospora cordifolia*, Streptozotocin, Antidiabetic activity, Blood glucose, Lipid profile.

INTRODUCTION

Diabetes mellitus is a long-term metabolic disorder in which the amount of blood sugar rises is high in an abnormal manner due to failure to produce insulin, reduction in tissue sensitivity. to insulin or a combination of the two processes. Cases of the condition have been increasing. of concern on a global scale, and therefore, it is one of the most pressing health issues of the population of this century. Constant hyperglycemia is one of the causes of progressive structural and functional damage to more than a single organ particularly the retina, kidney, peripheral nerve etcetera cardiovascular system (Akbarzadeh *et al*., 2007). The traditional approach of management of diabetes is based on dietary control, regular physical activity, physical activity, and medication, oral antidiabetic drugs or insulin treatment. Even though these methods are appropriate in a clinical context, their application in the prolonged perspective can give rise to have side effects and may not fully avoid development of secondary complications. As a result of this, an increased attention has been paid to medicinal plants and naturally derived. compounds as being supportive or alternative form of therapy, largely due to being well-known in regards to safety. profile and pharmacological potential (Pari and Uma Maheswari, 2000).

Tinospora cordifolia or Guduchi or Giloy is a commonly known medicine. Climber has been utilized in the Ayurved-based medicine in a broad variety of treatments applications. Phytochemical studies have depicted that the plant has high antioxidant, anti-inflammatory,

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immunoregulatory and anti-inflammatory. Several research studies are also experimental indicate that maybe *Tinospora cordifolia* extracts are antihyperglycemic by stimulating the release of insulin and raising the uptake of glucose in the periphery (Kamala Kannan & Prince, 2006). In order to establish the efficacy of insulin in diabetes, experimental model Streptozotocin (STZ)-induced diabetes is widely used. STZ selectively kills insulin 0 -producing pancreatic cells and is referred to as antidiabetic agents and therefore brings about an insulin deficit situation (Katisart, 2011). The implementation of this is well developed. model, the current study was to be designed to look into the effects of *Tinospora* as an antihyperglycemic agent. *cordifolia* leaf extract and to lend it scientific validation of its historical use in the Management of diabetes.

MATERIALS AND METHODS

Selection of Plant material

Tinospora cordifolia Fresh leaves were bought at Guntur region of Andhra Pradesh, India. A taxonomic validation was achieved on the plant specimens collected. Qualified botanist, to certify their authenticity, till they may be applied in experiments. Accurate Phytopharmacological studies demand identification, which is essential in the botanical. consistency and reproducibility of experimental finding (Sharma *et al*., 2015).

Preparation of plant extract

The harvested leaves were washed to get rid of the impurities that were attaching to the leaves in the shade at room temperature dried in air. The content was dried to the maximum extent and refined into an extraction powder. The powdered sample was ethanolized. the extracting solvent. The solution was filtered and then the solvent was taken after a sufficient extraction. The crude ethanolic was obtained through the use of a rotary evaporator, which was used to distill at low pressure to extract the crude ethanol. extract that was subjected to refrigeration condition until the next experiment use (Khandelwal *et al*., 2013).

Experiment in Animals

The adult Wistar albino rats weighing 150 200 g were used as the experimental subject. The they held animals in polypropylene cages under controlled conditions, at 25 -2 o C and a 12-hour light dark cycle at controlled conditions. Standard laboratory. Enough feed and water were provided freely throughout the period of the study. All experimental Under the guidelines and the authority of the, tests were conducted. The institute is the Animal Ethics Committee (Akbarzadeh *et al*., 2007).

Drugs and Vehicle

The antidiabetic medication that formed the major one in this study was Glibenclamide. The ethanolic EETC was extracted in an appropriate medium in the form of extract of *Tinospora cordifolia*. For oral the extract, and the standard drug were suspended in 0.5percent Carboxy Methyl. One of such ingredients is cellulose (CMC) that can also be utilized as a stabilizing vehicle that will allow keeping the dosage constant (Kamala Kannan N, Prince PSM, 2006).

Chemical uses

Streptozotocin (STZ), which was obtained at Sigma-Aldrich, was used as the primary chemical to cause diabetes. Other chemicals were of analytical grade such as Ethanol, CMC, and different diagnostic kits used in estimating blood glucose and lipid profiles. STZ is particularly selected due to its capacity to kill insulin producing cells in the pancreas the beta cells (Teeraporn Katisart, 2011).

Drug Treatment

Animals were separated into various groups (Control, Diabetic Control, Standard and Test groups). A single intraperitoneal injection of STZ (55mg/kg) induced diabetes. Rats that had a blood glucose level of more than $250 mg/dl were taken as diabetic after 72 hours. *Tinospora cordifolia* extract was given to the test groups in the required doses orally over a duration of 21 days to determine the long-term hypoglycemic effect (Pari L, Uma Maheswari J, 2000).

Assessment of Parameters

In keeping with the methodology used by similar pharmacological studies, the following parameters were observed: Fasting Blood Glucose: The test was done on day 0, 7, 14, 21 and 28 by taking blood through the tail vein. Body Weight: Measured every week to measure the effect of the metabolism and prevention of diabetic muscle wasting.

Experiment Methodology

Diabetes Rats were starved overnight to normalize metabolic conditions. A single intraperitoneal injection of Streptozotocin (STZ) (55mg/kg) dissolved freshly in 0.1M citrate buffer induced diabetes. STZ is able to destroy insulin-producing beta -cells via inhibition of the Krebs cycle and ATP depletion in mitochondria causing the damage to DNA (Szkudelski, T. 2001). Blood samples were taken at the end of 72 hours after injection of the STZ in the tail-vein. Digital glucometer was used to measure the fasting blood glucose (FBG). The test groups comprised of only those animals that exhibited sustained hyperglycemia (FBG > 250 mg/dL) as a reliable diabetic model (Harjeet Singh, Meenu Mehta *et al*., 2019).

Phytochemical Screening

To determine the chemical fingerprint of ethanolic leaf extract, it was put through qualitative tests. The tests were aimed at identifying alkaloids, flavonoids, and phenolic compounds as these secondary metabolites are the main sources of antioxidant and anti-diabetic effects of the plant (Laxmikant H Kamble, 2015).

RESULTS AND DISCUSSION

The results show that the *Tinospora cordifolia* leaf extract

is highly effective in inverting hyperglycemia in diabetic rats and its effect is as effective as the conventional clinical therapies (Anu Chaudhary, Rina Das, *et al*., 2024). Such a strong anti-diabetic activity is explained by the fact that bioactive alkaloids and flavonoids are present that facilitate glucose homeostasis (Laxmikant H Kamble, 2015). In contrast to most synthetic drugs, the extract is assumed to act in peripheral actions like enhancing glycogen production within the liver and skeletal muscles (Sonam Khandelwal, Ratanlal, *et al*., 2013). Moreover, the extract showed the ability to inhibit the breakdown of tissue proteins as demonstrated by the fact that the body weight was significantly preserved in the groups treated with the extract (Harjeet Singh, Meenu Mehta *et al*., 2019). These findings are highly scientific to justify the usage of *Tinospora cordifolia* as a safe and natural substitute in the long-term handling of chronic diabetes (Rohit Sharma, Hetal Amin, *et al*., 2015). The data obtained were presented in the form of Mean -SEM. The evaluation of the significance was made using One-way ANOVA, and then using Dunnett multiple comparison test. The statistical method helps to be sure that the amount of blood glucose reduction observed is considerably larger than the changes observed in the diabetic control group (Prashant Tiwari, Puravi Nayak, *et al*., 2018).

Table 1. The Effect of Ethanolic Extract on the OGTT Model Level of Serum Glucose in normal Rats.

S. No	Durg/Control	Body Weight	Blood glucose level (mg/dl)				
			0 hour	1 hour	2 hours	3 hours	4 hours
1	Group-1 control (distilled water)	180.0 ± 2.0	92.0 ± 2.5	132.0±3.5	117.0±0	119.0±1.0	100.5±1.5
2	Group 2 extract (200mg/kg)	164.1±27	102.0±1.0	123±0 **	107.0±2.0 **	101.0±3.0 *	98.0±2.0 *
3	Group 3 extract (400 g/kg)	152.6±3.4	99.0±1.5 **	120.0±1.5 **	100.0±2.5 **	96.0±3.0 *	88.5±1.5 *
4	Group 4 extract (20 mg/kg)	151.3±2.3	111.0±4.5 **	121.0±31 **	117.0±3.6**	114.0±2.6 *	112.5±1.2*

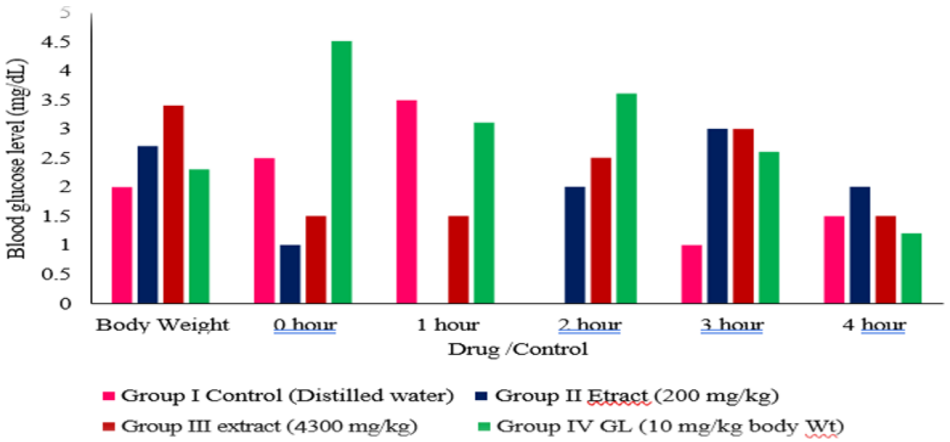


Figure 1. The influence of ethanolic extract on the serum glucose Levels in the OGTT model of normal rats.

Table 2. The influence of 27 days management with ethanolic extract to serum glucose levels of rats with diabetic condition induced by STZ.

S. No	Treatment	Initial	7th day	14th day	21st day	28th day
1	Normal control	89.3±3.8	91.0±1.5	95.0±1.0	92.8±2.1	89.0±1.7
2	Diabetic control	221.5±3.2	267.3±3.5	310.3±2.2	383.0±2.8	405.3±3.2
3	Diabetic + Gliben Clamide (10 mg/kg)	281.0±1.9 ***	261.0±3.6 **	153±3.8 ***	140.1±3.1 ***	129.5±2.7 ***
4	Diabetic + extract (400 mg/kg)	240.1±2.2 ***	210.6±3.3 **	160.3±3.7 ***	121.3±1.4 ***	96.8±1.7 ***

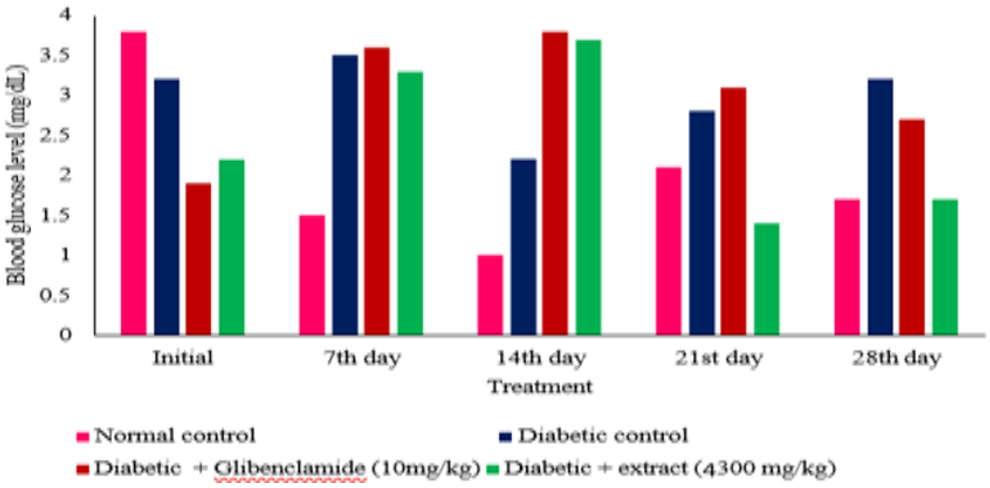


Figure 2. The effect of 27 days of treatment with the ethanolic extract on serum glucose levels in STZ induced diabetic rats.

CONCLUSION

The researchers come to the conclusion that *Tinospora cordifolia* leaf extract has a high anti-diabetic effect and is able to reduce hyperglycemia and prevent weight loss in diabetic models (Anu Chaudhary, Rina Das, *et al*., 2024). These pharmacological effects probably occur via peripheral action, including increased glycogen storage in the liver and enhanced glucose absorption made possible by its high level of alkaloid and flavonoids (Sonam Khandelwal, Ratanlal, *et al*., 2013). In sum, the study is scientifically justified and justifies the use of this plant as a safe and effective natural alternative of diabetes management in the long term (Pari L, Uma Maheswari J, 2000).

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CONFLICT OF INTERESTS

The authors declare no conflict of interest

ETHICS APPROVAL

Not applicable

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AI TOOL DECLARATION

The authors declare that no AI and related tools are used to write the scientific content of this manuscript.

DATA AVAILABILITY

Data will be available on request

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