INTERNATIONAL JOURNAL OF DRUG DISCOVERY AND HERBAL RESEARCH (IJDDHR)
3(1): Jan.-March.: (2013), 601-604
ISSN: 2231-6078

Anti-Diabetic Activity of Ethanolic Extract of *Tinospora Cordifolia* Leaves

Research Article

Chandra Shekhar Singh*[1], Amit Kumar Singh[1], Sonam Khandelwal[1], Ratanlal Vishwkarma[2]
1-Shambhunath Insitute of Pharmacy, Allahabad, Uttar Pradesh, India.
2- Prashad Institute of technology, Jaunpur, Uttar Pradesh, India.

Abstract

For an alternative medicine to treat diabetes mellitus, many herbal drugs are being studied throughout the world. In the present study, an attempt was made to investigate the anti-diabetic activity of *Tinospora cordifolia*. Ethanolic extracts of *Tinospora cordifolia* leaves in different dosages (200 and 400 mg/kg b.w.) administered orally for 10 days and 30 days in streptozotocin diabetic albino rats. The probable mechanism by which TC may act as an anti-hyperglycemic drug is not through insulin secretion like sulfonylureas. It may be through some peripheral mechanisms, such as increasing the glycogen storage in the liver or decreasing the glucose release from the liver. Present study clearly showed that TC has significant anti-diabetic activity in diabetic animals and has an efficacy of 50% to 70% compared to insulin.

Key words: Anti-diabetic activity, *Tinospora cordifolia*, Ethanolic extract

Introduction

There are an estimated 150 million people suffering from diabetes worldwide, which is almost 5 times more than the estimated number 10 years ago[1].

Diabetes mellitus (DM) is a metabolic disorder that affects people of all age groups and from all walks of life. Management of diabetes without any side effects is still a challenge in the medical field, as presently available drugs for diabetes have one or more adverse effects [2]. Since the existing drugs for the treatment of DM do not satisfy our need completely, the search for new drugs continues. In recent years, herbal remedies for the unsolved medical problems have been gaining importance in the research field [3]. Although many researchers have studied the anti-diabetic activity of *Tinospora cordifolia*, no satisfactory study was conducted to investigate its efficacy in streptozotocin induced diabetic rats or to explore how this drug acts as an anti-diabetic agent. Thus, this study was undertaken to explore the efficacy of anti-diabetic activity of *Tinospora cordifolia* in diabetic rats [4].

The possible mechanism by which this drug may act is discussed in this study. *Tinospora cordifolia* belongs to the family Menispermaceae and is known as Gulancha in English, Guduchi in Sanskrit, and Giloya in Hindi. It is a large, glabrous, deciduous climbing succulent shrub, commonly found in hedges.

*** Corresponding Author**
Email:

It has been known for long in the Ayurvedic literature (i.e. the syLeaves of traditional medicine native to India and practiced in other parts of the world as a form of alternative medicine) as a tonic and vitalizer and as a remedy for diabetes and other metabolic disorders [5].

Materials and Methods

Collection, Identification and Extraction of Plant

Tinospora cordifolia Leaves was collected fresh from the forest areas in Jablpur- district, Madhya Pradesh, India, and dried in the shade and then powdered. The plant was identified by Prof. S. C. Dwivedi, Professor and Head of the Department of Botany, Suresh Gyan Vihar University. A specimen (Voucher No. 103) was deposited in the botany department museum. The powdered materials were kept in an air-tight container in a refrigerator until the time of use. Alcoholic extracts of *Tinospora cordifolia* were prepared according to the standard extract procedure [6]. The yield of extracts was approximately 8%.

Animals

Either sex female albino rats of inbred Wistar strain (body wt. 185-200 g) were used in this study. Animal ethical committee clearance was obtained from Institutional Animal Ethics Committee. The animals were fed on a pellet diet and water ad libitum throughout the study period.

Groups

All the experimental animals were divided into 5 groups with each group consisting of 6 animals as follows:

Group 1- Control: This group was used for studying the baseline values of the parameters studied.

Group 2- Diabetic control: This group consisted of streptozotocin induced diabetic rats.

Group 3- Diabetic rats treated with (200 mg/kg. b.w) alcoholic extract of *Tinospora cordifolia*.

Group 4- Diabetic rats treated with (400 mg/kg. b.w.) alcoholic extract of *Tinospora cordifolia*.

Group 5- Diabetic rats treated with insulin.

Diabetes produce

To induce diabetes, the rats were fasted for 16 h and injected with freshly prepared streptozotocin (STZ) at the dose of 50 mg/kg b.w. intravenously in 0.1 M citrate buffer of pH 4.5. Control animals received citrate buffer alone [7].

Diabetes status was confirmed by estimating the fasting blood glucose levels and urine glucose (Benedict's test) after 72 h of STZ injection. Animals showing fasting blood glucose levels above 250 mg/dL were selected for this study [9].

Treatment

Single dosage of alcoholic extract (dissolved in gum acacia) was given orally for 10 days and 30 days to specific groups through oral intubations and the control animals received the vehicle with TC. Lante zinc insulin (6 units/kg. b.w. i.p) was given to the specific group daily [9].

Statistical analysis

Statistical significance between the different groups was determined using one way analysis of variance (ANOVA) followed by Tukey's multiple comparisons by fixing the P value as <0.05[10].

Results and Discussion

Anti-diabetic activity *Tinospora cordifolia* has significant ($P < 0.05$) in diabetic animals and has an efficacy of 50% to 70% compared to insulin. *Tinospora cordifolia* administration in diabetic animals did not show any increase in serum insulin levels or regeneration of pancreatic β cells but showed increased hepatic glycogen synthase and decreased glycogen phosphorylase activity.

In this study, the streptozotocin induced diabetic animals showed elevated fasting blood glucose levels (Table 1).

In this study, the liver glycogen synthase activity decreased and phosphorylase activity increased substantially in untreated diabetic rats during the study period (Table 2).

In this study, the serum insulin levels also decreased drastically in untreated diabetic rats. Treatment with *Tinospora cordifolia* by administration of a single dosage of extract or for 10 and 30 days did not increase the serum insulin levels in diabetic animals (Table 3).

In addition, the histological examination of endocrine pancreas in *Tinospora cordifolia* treated diabetic rats (Figure) did not reveal any evidence of regeneration of beta cells of islets of Langerhans. Moreover, in the present study, treatment with 400 mg of extracts of *Tinospora cordifolia* in control rats for 30 days did not show any adverse effects on the normal histology of the pancreas. Since the present study has some limitations by having limited experimental sample size and methodology, this observation may be suggestive of a need for further research in the future to examine the adverse effects of this drug.

Conclusion

The anti-diabetic activity of *Tinospora cordifolia* is not through the insulin secretion by pancreatic beta cells. It may be due to the increased entry of glucose into the peripheral tissues and organs like the liver.

Tinospora cordifolia is an effective anti hyperglycemic drug that can be used in the treatment of Diabetes mellitus. Although its activity is feeble compared to insulin, it can be used as a supportive drug in the treatment of Diabetes mellitus.

Since *Tinospora cordifolia* increased the activity of glycogen synthase in the liver, it may increase the storage of glucose in hepatocytes. It also decreased the activity of phosphorylase in the liver; thereby it may prevent the release of glucose into the blood. These observations strongly suggest that *Tinospora cordifolia* may not act like sulfonylureas, but like other oral anti-hyperglycemic drugs. This study indicates that treatment with *Tinospora cordifolia* may be an alternative to some of the presently available drugs.

Table1. Effect of *Tinospora cordifolia* extracts on fasting blood glucose and comparison of efficacy of *Tinospora cordifolia* extracts with insulin.

	Days	**Control**	**Diabetic Control**	**Diabetic +Et 200**	**Diabetic +Et 400**	**Diabetic +Insulin**
Fasting blood glucose (mg/dL)	11th day	88.71 ± 4.1*	349.44 ± 4.2*z	194.55 ± 4.5*z	216.76 ± 4.4*	128.28 ± 3.7
	31st day	89.76 ± 3.6*	347.77 ± 4.6*a	227.19 ± 3.2*z	215.277 ± 3.9*	137.72 ± 3.1
Efficacy (%)	11th day	-	-	57.73	53.33	83.87
	31st day	-	-	46.67	50.66	80.21

Data expressed as mean ± SD (n = 6) P < 0. 05

* Control vs. other groups

z Diabetic control vs. *Tinospora cordifolia* treated diabetic groups.

Table2. Effect of *Tinospora cordifolia* extracts on hepatic glycogen phosphorylase, glycogen synthase activities, and comparison of efficacy of *Tinospora cordifolia* extracts with insulin.

	Days	Control	Diabetic	Diabetic +Et 200	Diabetic +Et 400	Diabetic +Insulin
Glycogen synthase activity (µmol of UDP formed/mg protein/h).	11th day	658.76 ± 5.08*	695.22 ± 3.66	743.55 ± 4.45*z	740.48 ± 3.66*z	743.52 ±3.41*
	31st day	660.12 ± 3.87*	700.07 ± 3.86	736.87 ±3.59*z	740.88 ± 3.78*z	738.77 ± 3.46*
Efficacy (%)	11th day	-	85.67	67.78	67.45	66.33
	31st day	-	83.77	69.71	65.67	67.27
Glycogen synthase activity (µmol of UDP formed/mg protein/h).	11th day	180.75 ± 5.1*	176.23 ±5.4	79.45 ±3.3*z	89.33 ± 3.4*z	82.45 ± 2.8
	31st day	176.34 ± 4.12*	178.77 ±4.22	79.86 ± 4.3*z	90.12 ± 3.6*z	86.42 ± 3.1
Efficacy (%)	11th day	-	96.75	23.41	30.68	25.25
	31st day	-	97.67	22.22	30.90	25.38

Data expressed as mean ± SD (n = 6) P < 0. 05
* Control vs. other groups
z Diabetic control vs. *Tinospora cordifolia* treated diabetic groups.

Table3. Effect of *Tinospora cordifolia* extract on serum insulin levels (pmol/L).

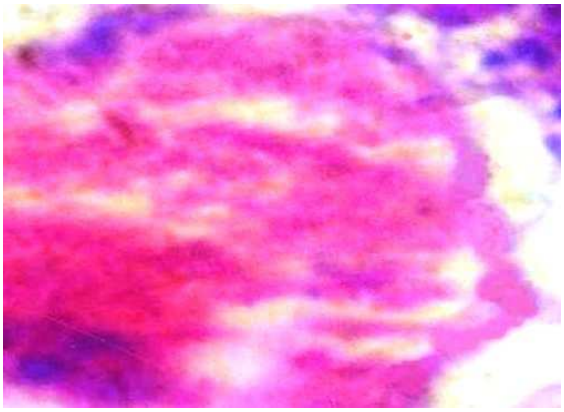
	Control	Diabetic Control	Diabetic +Eth.200	Diabetic +Eth.200
Fasting	473.11 ± 12.6	135.98 ± 13.08*	151.95 ±6.68*	150.48 ± 10.68
1 h after giving TC	470.56± 16.78*	142.83 ± 6.7*	146.16 ± 8.8*	148.33 ± 12.7
On 11th day	473.32 ± 13.2*	135.98 ± 10.40*	151.95 ± 12.91*	150.48 ± 7.00
On 31st day	460.08 ± 9.66*	147.50 ± 7.89*	160.89 ± 12.02*	159.65 ± 9.54

Data expressed as mean ± SD (n = 6) P < 0. 05
* Control vs. other groups
z Diabetic control vs. *Tinospora cordifolia* treated diabetic groups.
Untreated diabetic control Diabetic animal treated with *Tinospora cordifolia*

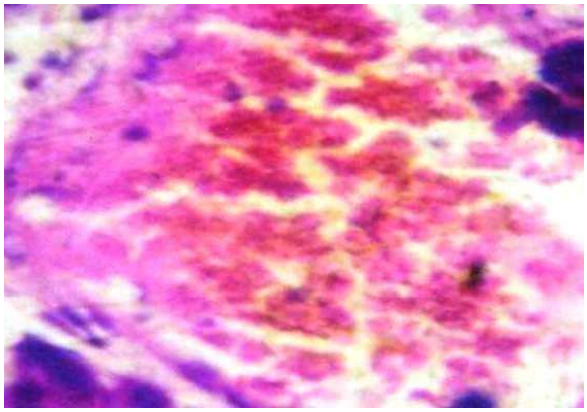
References

1) Girendra Kumar Gautam, S C Dwivedi, and G Vidyasagar, Different pharmacological activity of indian Medicinal plants "abutilon" in http://www.pharmatutor.org/articles?page=1
2) Marx j. Unraveling the causes of diabetes. Science 2002; 296: 686-9.
3) Bohannon NJV. Treating dual defects in diabetes: Insulin resistance and insulin secretion. Am J Health Syst Pharm 2002; 59, Suppl 9: s 9-s13.
4) Stanely P, Prince M, Menon VP. Hypoglycemic and other related actions of *Tinospora cordifolia* roots in alloxan induced diabetic rats. J Ethnopharmacology 2000; 70: 9-15.
5) Singh SS, Pandey SC, Srivastava S, Gupta VS, Patro B, Ghosh AC. Chemistry and medicinal properties of *Tinospora*m *cordifolia* (Guduchi). Indian Journal of Pharmacology 2003; 35: 83-91.
6) Gupta SS, Verma CL, Verma SC, Garg VP, Mahesh Rai. Anti-diabetic effects of *Tinospora cordifolia*. Effect on fasting blood sugar level, glucose tolerance and adrenaline-induced hyperglycemia. Ind Jour Med Res 1967; 55: 733-45.
7) Chattopadhyay SM, Ramanathan R, Ramanathan M, Das J, Bhattacharya SK. Animal models in experimental diabetes mellitus. Indian Journal of Experimental Biology 1997; 35: 1141-5.
8) Mitra SK, Gopumadhavan S, Muralidhar TS, Anturlikar SD, Sujatha MB. Effect of a herbomineral preparation D-400 in streptozotocin induced diabetic rats. Journal of Ethnopharmacol 1996; 54: 41-6.
9) Stanely P, Prince M, Venugopal PM, Gunasekaran G. Hypolipidaemic action of *Tinospora cordifolia* roots in alloxan diabetic rats. Journal of Ethnopharmacol 1999; 64: 53-7.
10) Trinder P. Determination of blood glucose using an oxidaseperoxidase syLeaves with a non-carcinogenic chromogen. J Clin Pathol 1969; 22: 158-61.
11) Wi JK, Kim JK, Youn JH. Reduced glucose clearance as the major determinant of postabsorptive hyperglycemia in diabetic rats. Am J Physiol Endocrinol Metab 1998; 274: E257-E64.
12) Shanmugasundaram KR, Pannerselvam P, Samudram E, Shanmugasundaram RB. Enzyme changes and glucose utilization in diabetic rabbits: the effect of Gymnema sylvestre.Journal of Ethnopharmacol 1983; 7: 205-35.

Figure 1.



Untreated diabetic control



Diabetic animal treated with *Tinospora cordifolia*