

Evaluation of Antidiabetic and Anti- Hyperlipidemic Activity of Flower *lantana Camara Linn* Extract in Streptozotocin-Induced Diabetic Rats Model

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ABSTRACT

The present study investigates the antidiabetic and antihyperlipidemic effects of *Lantana camara* flower extract in streptozotocin (STZ)-induced diabetic Wistar rats. A total of 42 rats were allocated into five groups. Diabetes was induced with a single dose of STZ (50 mg/kg, i.p.). Treatment groups received *Lanata*naextract at doses of 200, and 400 mg/kg orally for 21 days. Metformin (100 mg/kg) was used as the standard reference. Blood glucose, lipid profile, and pancreatic histology were analyzed. The extract significantly reduced blood glucose, total cholesterol, triglycerides, LDL, and VLDL levels and improved HDL levels. The 400 mg/kg dose showed comparable results to Metformin. Histological evaluation supported β -cell preservation. The results suggest that *Lantana camara* flower extract possesses promising antidiabetic and antihyperlipidemic potential.

Keywords: *Lantana camara*, STZ, Diabetes, Metformin, Antidiabetic, Antihyperlipidemic, lipid profile

INTRODUCTION

Diabetes mellitus is a chronic disorder of carbohydrate, fat, and protein metabolism, mainly due to insulin deficiency or resistance [1] STZ-induced diabetes in rats mimics human Type 1 diabetes and is commonly used in preclinical studies. Hyperglycemia often leads to hyperlipidemia, increasing the risk of cardiovascular complication [2] **Lipids** - Diabetes mellitus produces abnormal changes in the lipid profile. It will lead the cells to become more susceptible to lipid peroxidation [3]. Experimental studies show that the presence of polyunsaturated fatty acids in cell membrane leads to attack by free radicals due to the presence of multiple bonds [4]. Lipid hyper peroxides (LHP) through intermediate radical reactions produce such fatty acids that generate highly reactive and toxic lipid radicals. They form new lipid hyperperoxides [5]. A critical biomarker of oxidative stress is lipid per oxidation. It is the most explored area of research when it comes to ROS [6] Malondialdehyde (MDA) is formed as a result of lipid peroxidation that can be used to measure lipid peroxides after reaction with thiobarbituric acid. These conditions lead to increased

levels of markers of oxidative stress and dyslipidemia Theories behind elevation in liver function parameters in diabetes state that the liver helps to maintain normal blood glucose concentration during fasting and postprandial states. Loss of insulin effect on the liver leads to glycogenolysis and increase in production of hepatic glucose. Abnormalities of triglyceride storage and lipolysis in insulin-sensitive tissues such as the liver are an early manifestation of conditions characterized by insulin resistance. It can also be detectable earlier than fasting hyperglycaemia, the precise genetic, environmental and metabolic factors and sequence of events that lead to the underlying insulin resistance [7]. The excess in free fatty acids found in the insulin-resistant state is known to be toxic to hepatocytes. Putative mechanisms include high concentration of cell membrane disruption, toxin formation, mitochondrial dysfunction and inhibition and activation of key steps in the regulatory of metabolisms [8]. Other potential explanations for elevated transaminases in insulin-resistant states include peroxisomal beta-oxidation, recruited inflammatory cells and oxidant stress from reactive lipid peroxidation [9].

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.



MATERIALS AND METHODS

Plant Collection- Fresh *Lantana camara* flowers were collected from [local nursery], identified and authenticated by a botanist- Dr. Sandeep K. Verma (Professor and Head of Dept. in Botany) SAGE University Indore (M.P.) [Voucher No. IOS /Bot/SLF-033]. [10]

Extraction -The flowers were shade-dried, powdered, and extracted with hydroalcoholic solvent (ethanol: water, 70:30) using Soxhlet apparatus. The extract was evaporated, dried, and stored at 4°C. Extraction method by Soxhlet apparatus Around 500 gms dried flower of *lantana camara* coarsely powdered weighed and filled in Soxhlet apparatus for extraction. First the powdered drug was defatted with petroleum ether (Pet. Ether) (60°C-80°C); Defatted drug was then dried and again filled in soxhlet apparatus for successively extraction. The extraction was carried out for a period of 72 extract obtained was dried in vacuum to remove excess solvent and were weighed for the determination of % yield¹¹

Percentage yield estimation Dried extracts were calculated for percentage yield estimation using formula-

$$\% \text{yield} = \text{Practical yield} / \text{Theoretical yield} \times 100$$

***Lantana Camera linn* Plant (flower) = 36.19 %**

Acute Toxicity Study -The primary goal of the acute toxicity study was to determine the level of negative effects that the extract had on the experimental animal's specific organs at an oral dose of 2000 mg/kg. The extract was safe at 2000 mg/kg, showing no deaths or behavioral changes, and is classified as low toxicity ($LD_{50} > 2000$ mg/kg) under OECD guidelines (2001). Additionally, a negligible variation in the weight of the vital organs of animals from the normal control group and the extract-treated group shows that extract did not produce any sensitivity, change, or acute organ damage. Extracts preparation of flower *Lantanacamera* Linn.¹²

Preliminary phytochemical screening of the extract

S. No	Test	Aqueous	Methylene chloride	Methanol	Ethanol	Petroleum Ether
1	Alkaloids	+	++	++	++	-
2	Steroids	+	++	++	++	++
3	Glycosides	+	++	++	++	+
4	Flavonoids	+	++	+	+	+
5	Tannins and Polyphenols	+	++	+	+	-
6	Triterpenoids	+	++	++	++	-
7	Carbohydrates	+	+	++	++	++
8	Proteins	-	-	-	-	+

Note: (-) Absence, (+) Presence and (++) present with high intensity of the colour.

Selection of animals

Wistar albino rats of either sex between 2 and 3 months of age weighing 150-200 g⁴² rats were used which were procured from the central animal house of College of Pharmacy, Swami Vivekanand College of Pharmacy, Indore (M.P.), India. All animals were housed in an animal room under normal condition of 25±1°C, 12-h light and dark cycle. The animals were allowed free to access commercial rat pallet diet and water. The bedding materials of the cages were

changed every day. All the experimental procedures were carried out in accordance with the Committee for the Purpose of Control and Supervision of Experiments on Animals (IAEC) guidelines. IAEC Registration No. IAEC/SVCP/2025/Feb/01. The study designs were approved by the Institutional Animal Ethical Committee of College of Pharmacy,

Streptozotocin (STZ) induced diabetes in rats

After fasting 18 hours, the rats were injected intraperitoneal injection through tail vein with a single dose of 50 mg/kg Streptozotocin, freshly dissolved in citrate buffer (pH 4.5). After injection, the rats had free access to food and water and were given 5%

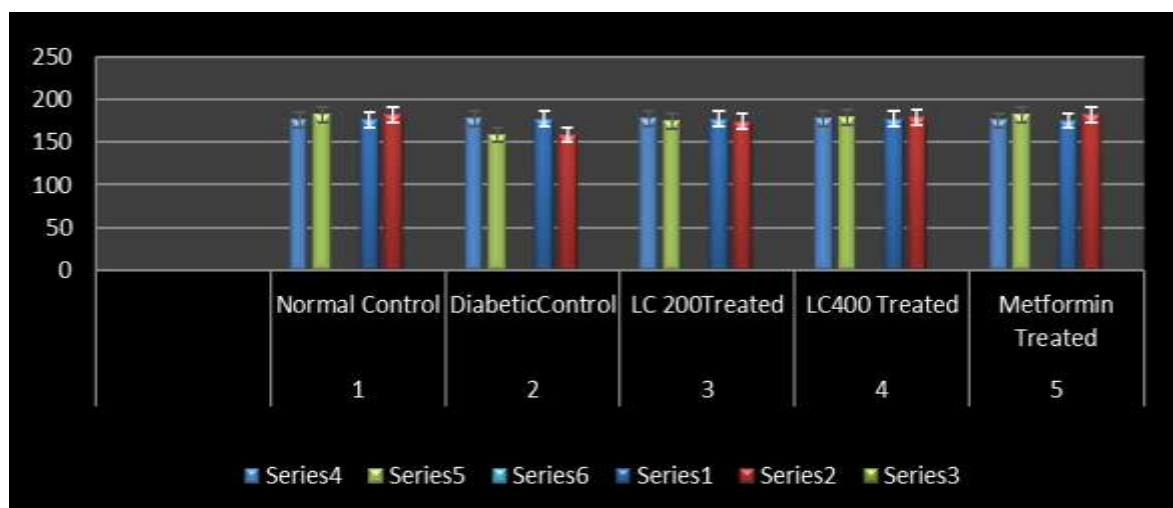
glucose solution to drink overnight to counter hypoglycemic shock²². Diabetes in rats was observed by moderate Polydipsia and marked Polyuria. The diabetes was confirmed by estimating the blood glucose level after 3 days by glucometer based one glucose oxidation method. Rats having blood glucose level more than 250mg/dl were selected for further study.¹³

Experimental Data

- **Body Weight (g)**- Body weight is are liable indirect marker of the metabolic state of diabetic rats. Improvement in body weight in treatment groups suggests restoration of insulin action and better glucose utilization.

S. No.	Group	Day0	Day21
1.	Normal Control	176±5	182±3
2.	Diabetic Control	177±4**	158±1*
3.	LC 200 Treated	177±3**	174±3*
4.	LC400 Treated	177±4	179±2
5.	Metformin Treated	175±3	182±4

Statistical significance was evaluated by one-way analysis of variance (ANOVA) and Bonferroni multiple pairwise comparisons between group means by Bio-stat 4.0 version Each Value represent in Mean±SD and n=5. 'a' indicates that the value is compare with negative control groups. 'b' indicate the value is compare with control group and 'c' is indicate the value is compare with standard group. asterisk (*) is represent significant (P<0.05) and double asterisk

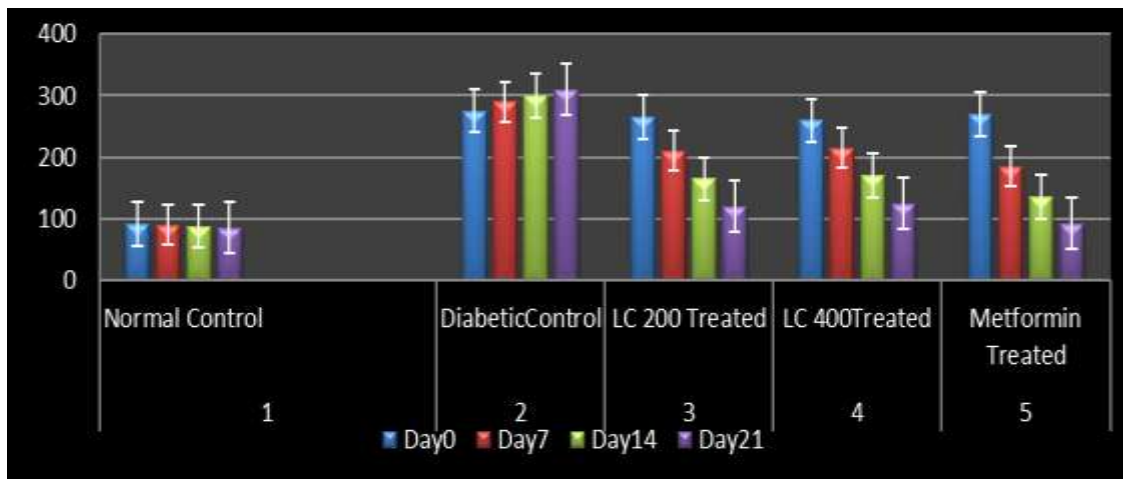


Fasting Blood Glucose (mg/dL) In rat diabetes models, FBG > 200 mg/dL is considered diabetic.

Reduction toward normal values indicates antidiabetic activity of the treatment.

S. No.	Group	Day 0	Day 7	Day 14
1.	Normal Control	92±1.25	90±2.15	88±0.21
2.	Negative Control	275±1.23**	290±0.12**	300±2.15**
3.	Metformin Treated	270±1.62**	185±0.51**	135±3.81**
4.	LC 200 Treated	265±2.65	210±2.61	165±2.37
5.	LC 400Treated	260±2.05	215±0.58	170±1.57**

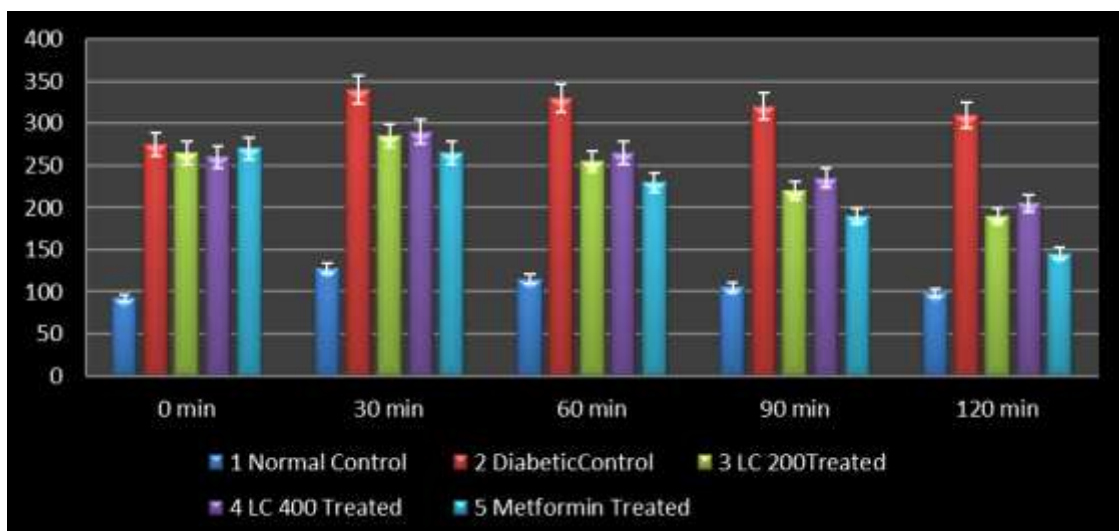
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- **OGTT (mg/dL)** OGTT in rats is an essential parameter to evaluate glucose tolerance and antidiabetic potential of drugs or plant extracts

S. No.	Group	0 min	30 min	60 min	90 min	120 min
1.	Normal Control	92±2.4	128±2.9	115±3.6	105±0.9	98±3.4
2.	Diabetic Control	275±3.2	340±2.5	330±2.6	320±3.2**	310±3.2
3.	LC 200 Treated	265±3.8	285±2.0**	255±1.9	220±0.7	190±3.4
4.	LC 400 Treated	260±3.7	290±2.2**	265±1.7	235±2.6**	205±2.4
5.	Metformin Treated	270±1.8	265±3.1	230±2.4	190±2.9	145±3.2

Statistical significance was evaluated by one-way analysis of variance (ANOVA) and Bonferroni multiple pairwise comparisons between group means by Bio-stat 4.0 version. Each Value represent in Mean±SD and n=5. 'a' indicates that the value is compare with negative control groups. 'b' indicate the value is compare with control group and 'c' is indicate the value is compare with standard group. asterisk (*) is represent significant (P<0.05) and double asterisk, (**) High Significance (p < 0.001).

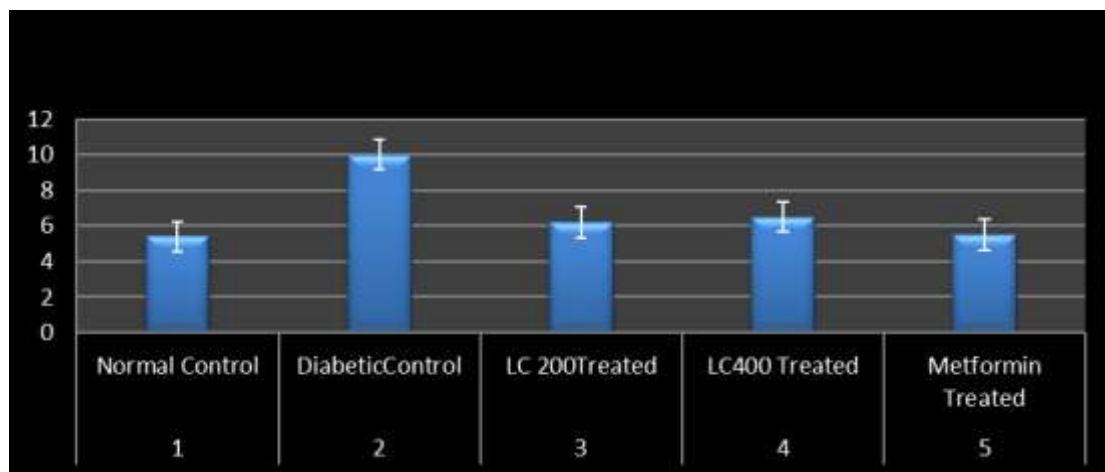


- **HbA1c (%) at Day 21-** Diabetes in rats, HbA1c increases significantly due to chronic hyperglycemia. Reduction in HbA1c after

treatment confirms sustained antihyperglycemic activity. HbA1c is often measured at the end of the study (e.g., 21 or 28 days)

S. No.	Group	HbA1c (%)
1.	Normal Control	5.4 ± 0.2
2.	Diabetic Control	10.0 ± 0.6
3.	LC 200Treated	6.2 ± 0.3
4.	LC400 Treated	6.5± 0.3
5.	Metformin Treated	6.4± 0.2

The values are expressed in mean ± SEM. The results were analyzed by using one way analysis of variance (ANOVA) followed by Dunnet's "t" test to determine the statistical significance. $p < 0.05$ was chosen as the level of significance. Statistical analysis was performed using Graph Pad Prism Software 5.0 version

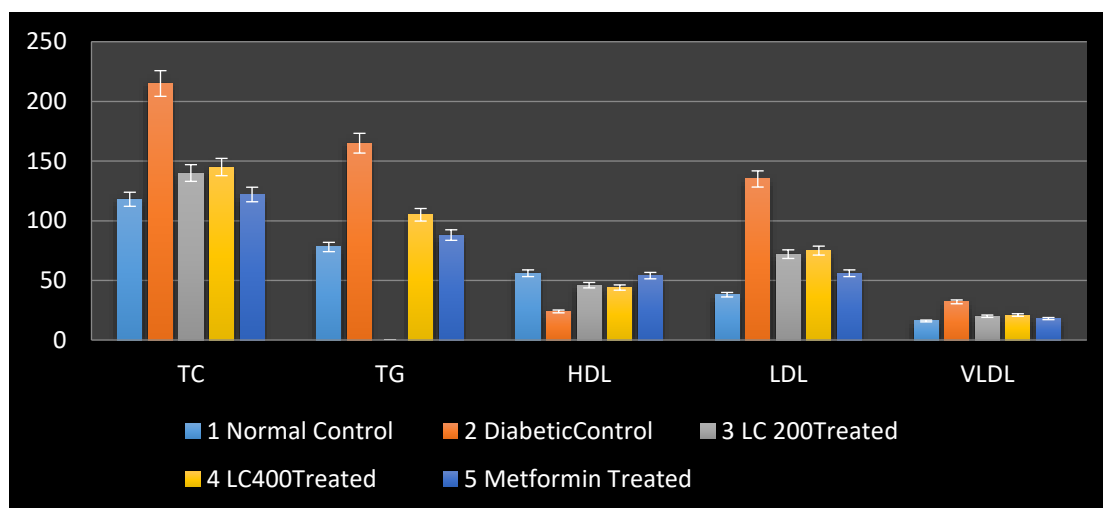


➤ **Lipid Profile(mg/dL)-** Lipid profile in diabetic rats is an essential parameter to assess antidiabetic and antihyperlipidemic

activity of drugs plant extracts. Restoration toward normal values suggests cardioprotective potential.

S. No.	Group	TC	TG	HDL	LDL	VLDL
1.	Normal Control	118±3.21	78±2.03	56±0.23	38±3.23	16±0.12
2.	Diabetic Control	215±2.03**	165±4.02	24±0.25	135±0.12	32±1.15**
3.	LC 200 Treated	140±1.05	100±2.13**	46±1.25**	72±1.21	20±2.15
4.	LC400Treated	145±1.23*	105±2.78**	44±0.59**	75±0.45	21±0.25**
5.	Metformin Treated	122±1.54	88±0.22	54±0.21	56±0.54	18±1.65

The values are expressed in mean ± SEM. The results were analyzed by using one way analysis of variance (ANOVA) followed by Dunnet's "t" test to determine the statistical significance. $p < 0.05$ was chosen as the level of significance. Statistical analysis was performed using Graph Pad Prism Software 5.0 version



RESULTS

Blood Glucose Levels

L. camara- treated groups showed significant reductions in glucose levels over 21 days. The 400 mg/kg dose group showed effects comparable to Metformin.

Blood Glucose Levels - The *Lantana camara*-treated groups demonstrated a progressive and significant reduction in fasting blood glucose levels over the 21-day experimental period compared to the diabetic control group.

- Dose-dependent effect: The antihyperglycemic activity increased with the dose. Among the tested doses, the 400 mg/kg group exhibited the most pronounced reduction in glucose levels.
- Comparison with standard drug: The effect of the 400 mg/kg *L. camara* extract was found to be comparable to that of Metformin (a standard oral hypoglycemic agent), indicating potent glucose-lowering potential

Lipid Profile

Marked TC, TG, LDL, and VLDL reductions were observed, especially at 400 mg/kg. HDL levels improved significantly.

Lipid Profile - Treatment with *L. camara* extract produced a marked improvement in lipid profile parameters, particularly at the higher dose (400 mg/kg).

- Total Cholesterol (TC): Significant reductions were noted, indicating a hypocholesterolemic effect of the extract.
- Triglycerides (TG): A substantial decrease in TG levels was observed, suggesting improved lipid metabolism and reduced hepatic triglyceride synthesis.
- Low-Density Lipoprotein (LDL) and Very Low-Density Lipoprotein (VLDL): Both LDL and VLDL levels were significantly lowered, reflecting a reduction in atherogenic lipoproteins and potential cardiovascular protection.

DISCUSSION

The *Lantana camara* extract demonstrated significant glucose-lowering and lipid-normalizing effects. The observed activities may be attributed to flavonoids and other phytochemicals with antioxidant and insulin-sensitizing properties. Metformin, the standard reference drug, acts via AMP-activated protein kinase (AMPK) activation, reducing hepatic glucose output. *L. camara* extract produced similar outcomes, especially at higher doses. Histopathological examination of pancreatic tissues further supported the extract's protective role in preserving islet cell architecture, indicating a potential insulinotropic or β -cell regenerative mechanism. The observed effects may be attributed to the presence of bioactive phytochemicals such as flavonoids, saponins, and tannins, known for their antihyperlipidemic and antidiabetic properties. In conclusion, the findings support the traditional use of *Lantana camara* in managing diabetes and lipid disorders. Further studies are recommended to isolate and characterize the active constituents.

CONCLUSION

Lantana camara flower extract possesses significant antidiabetic and antihyperlipidemic activity in STZ-induced diabetic rats. The 400 mg/kg dose was most effective and comparable to Metformin. This supports the traditional use of *L. camara* in diabetes and provides a basis for further phytochemical and clinical studies. The present study demonstrated that the hydroalcoholic extract of *Lantana camara* flowers exhibits significant antidiabetic and antihyperlipidemic activity in streptozotocin-induced diabetic rats. The extract effectively reduced fasting blood glucose, total cholesterol, triglycerides, LDL, and VLDL levels, while increasing HDL cholesterol dose-dependently. Among the tested doses, 400 mg/kg showed the most potent effect, comparable to the standard drug Metformin (100 mg/kg).

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