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PHYTOPHARMACOLOGICAL INVESTIGATION ON CRUDE DRUG FOR DIABETIC WOUND HEALING ACTIVITY

Bheem Khatarkar[1]*, Dr. Narendra Patel[2]

[1,2]Department of Pharmacology, College of Pharmacy, Sri Satya Sai University of Technology and Medical Sciences, Sehore.

***Corresponding Author: Bheem Khatarkar**
Department of Pharmacology, College of Pharmacy, Sri Satya Sai University of Technology and Medical Sciences, Sehore.

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ABSTRACT
The present study demonstrates that the medicinal plant Lantana camara is a promising source of bioactive compounds with potential preventive roles in the pathogenesis of various diseases. However, the current data are insufficient to propose a definitive mechanism of action. Further phytochemical investigations are warranted to isolate and characterize the active constituents responsible for its antioxidant properties. Additionally, the possibility of synergistic interactions among these compounds merits exploration. Based on blood biochemical parameters, oral administration of Lantana camara at doses of 100 and 200 mg/kg body weight exhibited significant antidiabetic effects in streptozotocin (STZ)- induced diabetic rats. Moreover, the plant demonstrated effective wound healing properties at these doses. These findings suggest that Lantana camara not only possesses antidiabetic potential but also enhances wound healing, indicating dual therapeutic benefits. Nevertheless, further studies are required to validate these effects and elucidate the underlying mechanisms.

1. INTRODUCTION

1.1 Indian medicines

Herbal medicine has a bright future ahead of it, one marked by constant innovation and research. The scientific underpinnings of herbal treatments are being uncovered by biomedical research, which enhances their legitimacy and therapeutic potential. A key component of this future is personalised herbal medicine, which is based on genetics and data- driven methods and enables individualised treatments that take individual variability into account. With genetic modification and plant tissue culture improving the potency and sustainability of medicinal plants, biotechnology is at the forefront of innovation. Novel delivery technologies, such as transdermal patches and nanoparticles, are improving the targeted administration and bioavailability of herbal ingredients. By integrating herbal medicine into global health programmes and practising responsible sourcing, ethical concerns, and sustainability difficulties are being addressed. Herbal medicine is also well-positioned to provide comprehensive and preventive answers for new health concerns, such as mental health problems and antibiotic resistance. In order to guarantee the consistency and safety of herbal products, the area must address issues related to quality control, intellectual property rights protection, and ethical considerations as it develops. Herbal medicine's future ultimately lies in the harmonic fusion of traditional knowledge with cutting-edge scientific research, providing potentially safer, more individualised, sustainable, and globally accessible healthcare choices.[1]

1.2 Wound

When the epithelia line integrity of the skin disrupts or when cellular and anatomical or functional continuity of living tissue breaks or lost the condition is regarded as wound. Wound Healing Society, defines wounds as the physical injuries that result in an opening or break of the skin that cause disturbance in the normal skin anatomyand function. They result in the loss of continuity of epithelium with or without the loss of underlying connective tissue.[2]

Due regards to some world estimations about 6 million people suffer chronic wounds world over. Inflammatory mediators produced at the site of wound results into pain and swelling when the condition of unhealed wound continues for long. Wounds are invitation to many kind of infection and may lead to enhance the 2 recovery of injured patients. Chronic wounds may even lead to multiple organ failure of death of the patients. Thus an appropriate method for healing of wounds is must in restoration of disrupted anatomical continuity and disturbed functional status of the skin which may result into overall health management too.[3]

1.2.1 *Classification of wounds*

Wounds are classified as open and closed wound on the underlying cause of wound creation and acute and chronic wounds on the basis of physiology of wound healing.

1.2.1.1 *Open wounds*

An open wound is described when bleeding is clearly visible after any damage or disruption of tissues and comes out of the body. It is further classified as: Incised wound, Laceration or tear wound, Abrasions or superficial wounds, Puncture wounds, Penetration wounds and gunshot wounds.[4]

1.2.1.2 *Closed wounds*

In closed wounds blood escapes the circulatory system but remains in the body. It includes Contusion or bruises, heamatomas or blood tumor, Crush injury etc.

1.2.1.3 *Acute wounds*

Acute wound is a tissue injury that normally proceeds through an orderly and timely reparative process that results in sustained restoration of anatomic and functional integrity. Acute wounds are usually caused by cuts or surgical incisions and complete the wound healing process within the expected time frame.[5]

1.2.1.4 *Chronic wounds*

Contrary to the acute wounds when wounds fails to pass through the normal stages of healing rather enter a pathological inflammation conditions and persist for long time duration and sometimes shows recurrences, such a situation is known as chronic wounds. Local infection, hypoxia, trauma, foreign bodies and systemic problems such as diabetes mellitus, malnutrition, immunodeficiency or medications 3 are the most frequent causes of chronic wounds.[6]

1.3 Mechanism of wound healing

The response to injury, either surgically or traumatically induced, is immediate and the damaged tissue or wound then passes through three phases in order to affect a final repair:

- The inflammatory phase
- The fibroplastic phase
- The remodelling phase

The inflammatory phase prepares the area for healing and immobilizes the wound by causing it to swell and become painful, so that movement becomes restricted. The fibro plastic phase rebuilds the structure, and then the remodeling phase provides the final form.

1.3.1 *The Inflammatory phase*

The inflammatory phase takes place instantly right after the injury that usually persist between 24 and 48 hrs but may extend upto 2 weeks in some cases. The inflammatory phase launches the haemostatic mechanisms to immediately stop blood loss from the wound site. Consequently clinically identifiable key sign which rubor, calor, tumor, dolor and function appear at inflammation stage. This phase is characterized by vasoconstriction and platelet aggregation to induce blood clotting followed by vasodilatation and phagocytosis to produce inflammation at the site of wound.[7]

1.3.2 *The Fibroplastic phase*

Fibroplastic phase is the second phase of wound healing that remains for upto 2 days to 3 weeks after the inflammatory phase. Fibroplastic phase involves of three steps viz., granulation, contraction and epithelialisation. A bed of collagen is formed and new capillaries are produced in granulation step. Fibroblast produces a variety of substances essential for wound repair including glycosaminoglycans and collagen. In the next step which is contraction, the edges of wound pull together to reduces the defects and in the last third step, epithelial tissues are formed over the wound site.[8]

1.4 Diabetes mellitus

Diabetes mellitus is a amalgamation of diverse disorders generally presenting with episodes of hyperglycaemia and glucose intolerance, due to lack of insulin, defective insulin action, or both (Sicree et al., 2006). Because of the defective insulin availability, regulatory systems for storage and mobilization of metabolic fuels, including the catabolism and anabolism of carbohydrates, lipids and proteins gets affected.[9] Classification of diabetes mellitus is based on its etiology and clinical presentation. There are four types of diabetes mellitus viz; type 1 diabetes, type 2 diabetes, gestational diabetes, and other specific types.[10] Type 1 diabetes represents the lowest percentage out of the total diabetes in a population, though among young age groups it occupy its major prevalence within developed countries. The prevalence of type 1 diabetes is growing in both rich and poor countries. Moreover, a swing to type 1 diabetes is up in children at earlier ages are forthcoming.[11] The type 2 diabetes account about 85 to 95% in high-income countries is of type 2 but also its prevalence is observed in developing countries. Type 2 diabetes if factually associated with inadequate utilization of insulin by target cells and tissues and seems to be a serious global health concern in current scenario .Due to rapid cultural and social dynamics, increasing populations &urbanization, dietary changes, reduced physical activity and other unhealthy lifestyle and behavioral patterns causing the issue of type 2 diabetes to aggravated according to WHO, (1994). Diabetes mellitus and lesser forms of glucose intolerance, particularly impaired 6 glucose tolerance, have become common throughout the world and epidemiological evidences suggest that, it will grow with pace if the steps for control and prevention are not taken (WHO, 1994). In 2010, about 285 million people of 20-79 age group were foreseen to have diabetes worldwide, about 70% of whom live in developing nations. This estimate was expected to increase to about 438 million, by 2030. Further, by 2030, the number of individuals with IGT will be projected to rise up to 472 million, or

8.4% of the adult population.[12] The devastating effects of diabetes mellitus comprising failure of various organs, increasing metabolic problems such as retinopathy, nephropathy, and/or neuropathy . Diabetic's individuals face the challenges of cardiovascular, peripheral vascular and cerebrovascular disease risks. In development of diabetes numerous pathogenic processes are involved, like degeneration of pancreatic β-cells results into insulin sensitivity and action gets lowered.[13]

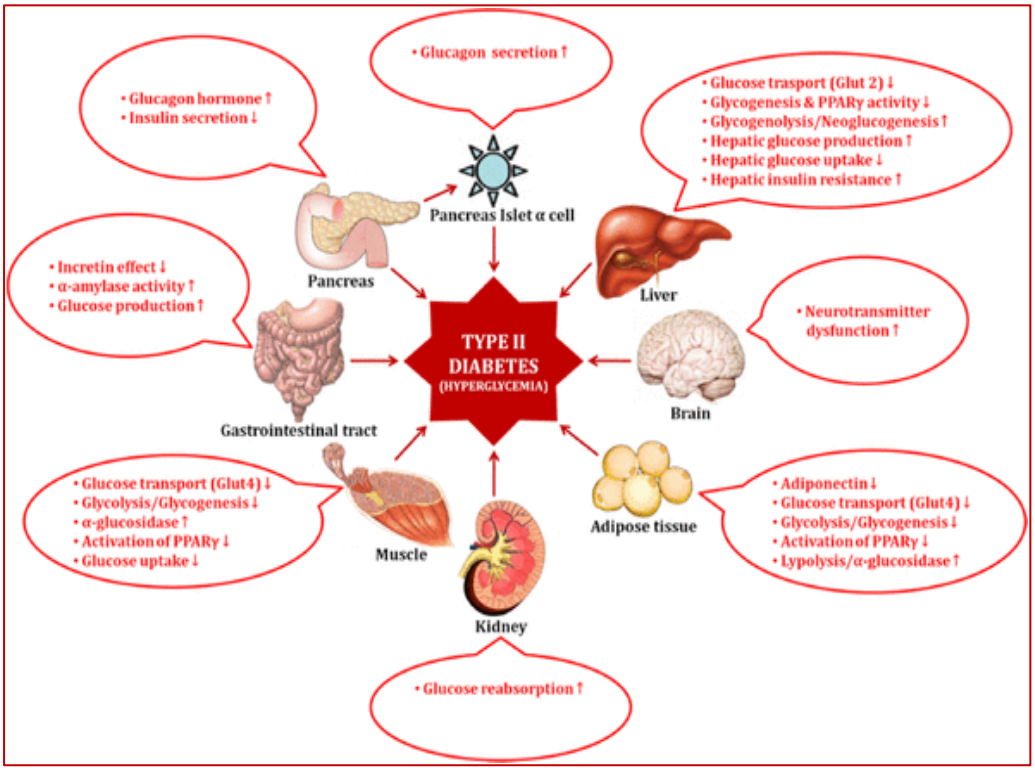


Figure 1.1: Pathophysiology of Type I and Type II diabetes.

1.5 Classification

1.5.1 The Classification of DM Has Undergone the Following Important Changes

1. The designations "type 1 diabetes" and "type 2 diabetes," using Arabic numerals, replace the terms "insulin dependent diabetes mellitus" (IDDM) and "noninsulin dependent diabetes mellitus" (NIDDM).
2. A new term, "IFG" (impaired fasting glucose), defines glucose values that are greater than or equal to 100 mg/dl and up to 125 mg/dl.
3. The revised diagnostic criteria for DM are:

B. Type 2 diabetes mellitus

Throughout the world, Type 2 is most common with increasing prevalence. The reasons of type 2 DM may vary from insulin resistance with relative insulin deficiency to insulin secretory defect with insulin resistance. A huge heterogeneity could be observed in patients with type 2 DM as they initially doesn't require insulin 9 therapy. Out of the 90% of all cases of DM in the United States, type 2 DM is frequent in adults compared to children, and its incidence increases with age, especially after age 40.

However, the prevalence of type 2 DM in children of the age between 10 and 19 years is increasing, especially in the high-risk ethnic groups, such as Native Americans, Hispanic Americans, African Americans, and Asian Americans with symptoms longer, have infrequent or mild diabetic ketoacidosis, are obese, and have a strong family history of diabetes. A characteristic finding is darkening of the skin (acanthuses' nigerians) and there is an increased incidence of insulin resistance.[15]

1.6 Signs and symptoms

1.6.1 Symptoms of Type 1 Diabetes

1. Frequent urination
2. Unusual thirst
3. Extreme hunger
4. Unusual weight loss
5. Extreme fatigue and Irritability

Diabetes is regarded as silent killer. The symptoms are mistakenly sometimes related with either some other disease or considered as an ailment itself. Testing blood for diabetes is best method of diagnosis.

1.6.2 *Symptoms of Type 2 Diabetes*

1. Excessive Urination and Thirst
2. Increased Hunger
3. Unexplained Weight Gain
4. Irritability and Fatigue
5. Blurred Vision

1.6.3 ***Other Symptoms***

1. Sexual Dysfunction in Men
2. Vaginal Infections in Women
3. Numbness/Tingling in hands and feet
4. Itchy or Flaky Skin.

1.7 Treatment of diabetes mellitus

The major components of the treatment of diabetes are:

A) Drug treatment for diabetes
B) Non drug treatment for diabetes
A) Drug Treatment for Diabetes Anti-diabetic drugs treat diabetes mellitus by lowering glucose levels in the blood. With the exceptions of insulin, Exenatide, and Pramlintide, all antidiabetic drugs are orally administered hence they are called oral hypoglycemic agents or oral anti hyperglycemic agents.

There are various classes of anti-diabetic drugs, the choice of which depends on the nature of diabetes, age and condition of the patient, and other factors. Type 1 diabetes mellitus is caused due to insulin deficiency and insulin must be used this either by injected or inhaled. Type 2 diabetes mellitus involves insulin resistance by cells. Thus it requires the use of agents which results into increase in insulin secretion by the pancreas, agents which increase the sensitivity of target organs to insulin and agents which decrease the glucose absorption rate from the gastrointestinal tract.

1.8 Insulin

Insulin is routed subcutaneously, either by injections or by an insulin pump in the patient however other routes of administration are still the matter of research. Insulin may also be given intravenously in critical cares. Several types of insulin available based on the rate at which they are metabolized by the body. For many years it was assumed, as an act of faith, that normalizing plasma glucose would prevent diabetic complications.

The diabetes control and complications trial (American diabetes association, 1998) showed that this faith was well placed: type1 diabetic patients were randomly allocated to intensive or conventional management.

Meglitinides

Meglitinides help the pancreas produce insulin and are often called "short-acting secretagogues." Their mode of action is by closing the potassium channels of the pancreatic β-cells, but opening calcium channels, thereby enhancing the secretion of insulin. Eg: Repaglinide, Nateglinide.

Biguanides

Biguanides reduce hepatic glucose output and increase uptake of glucose by the periphery, including skeletal muscle. Although it must be used with caution in patients with impaired liver or kidney function, motorman has become the most commonly used agent for type 2 diabetes in children and teenagers. Eg: Metformin, Phenformin, Buformin.

B) Non Drug Treatment for Diabetes

1. Life style changes which are used to controlling diabetes Life style change is defined as the way of living which has been altered by variety manner. Life styles have seven principles of good diabetes care: Learn as much as you can about diabetes

- Get regular care for diabetes
- Learn how to control your diabetes
- Take care of your diabetic ABC's

1.13 Herbal treatment of diabetes

Research has been focused in development of eco-friendly, bio-friendly, cost effective and relatively safe, plant-based medicines by last few decades to the main stream with the increased exploration in the field of traditional medicine. The document by Atta-ar-Rahman classified the plants according to their botanical name, country of origin; parts used and nature of active agents. Momordicacharantia is one such plant belongs to the family Cucurbitaceae out of the list with hypoglycemic properties. About 21,000 plants, has been listed WHO which are used for medicinal purposes world over out of which 2500 species are available in India, where 150 species have got a large scale commercial scale. India is the largest producer of medicinal herbs and is called the botanical garden of the world.[16]

2. PLANT PROFILE

Lantana camara

Lantana camara is a thorny shrub upright, half climbing or sometimes more or less hanging, reaching 2-3 m in height. The stems and branches are angular, bearing curved spines, arranged along the edges. The leaves are simple, opposite, decussate with rough lamina, oval, regularly dentate with acute apex.

Scientific Classification

- Kingdom: Plantae
- Division: Magnoliophyta
- Class: Magnoliopsida
- Order: Lamiales
- Family: Verbenaceae
- Genus: *Lantana*

Figure 2: Arial Part of *Lantana camara.*

Medicinal Uses
leaves is mostly used in herbal medicine for wound healing, fever treatment, cough treatment, influenza treatment, stomach ache, malaria, etc. It has also been recorded that can be used for the treatment of cancers, chickenpox, measles rheumatism, and ulcer.

3. MATERIALS AND METHODS

3.1 Plant material collection

The Selected plant *Lantana camara* were collected from Moolchand Phoolchand Store Old Bhopal (M.P) in the month of August, 2024.

Selection
The plant has been selected on the basis of its availability and Folk use of the plant.

Drying
Drying of fresh whole plant parts was carried out in sun but under the shade.

Storage
Dried whole plant part of *Lantana camara* were preserved in plastic bags and closed tightly and powdered as per the requirements.

3.2 Extraction procedure

Following procedure was adopted for the preparation of extracts from the shade dried and powdered herbs*:*

3.2.1 Defatting of plant material

Lantana camara were shade dried at room temperature. The shade dried plant material was coarsely powdered and subjected to extraction with petroleum ether by maceration. The extraction was continued till the defatting of the material had taken place.

Extraction by maceration process
Dried powdered *Lantana camara* has been extracted with different solvent using maceration process for 48 hrs, filtered and dried using vaccum evaporator at 40^0C.

3.3 Determination of percentage yield

The percentage yield of each extract was calculated by using following formula:

3.4 Phytochemical Screening[33]

Phytochemical screening: Phytochemical examinations were carried out for all the extracts as per the standard methods.

3.4.1 Detection of alkaloids: Extracts were dissolved individually in dilute Hydrochloric acid and filtered.

Mayer's Test: Filtrates were treated with Mayer's reagent (Potassium Mercuric Iodide). Formation of a yellow coloured precipitate indicates the presence of alkaloids.

Wagner's Test: Filtrates were treated with Wagner's reagent (Iodine in Potassium Iodide). Formation of brown/reddish precipitate indicates the presence of alkaloids.

Dragendroff's Test: Filtrates were treated with Dragendroff's reagent (solution of Potassium Bismuth Iodide). Formation of red precipitate indicates the presence of alkaloids.

Hager's Test: Filtrates were treated with Hager's reagent (saturated picric acid solution). Presence of alkaloids confirmed by the formation of yellow coloured precipitate.

3.4.2 Detection of carbohydrates: Extracts were dissolved individually in 5 ml distilled water and filtered. The filtrates were used to test for the presence of carbohydrates.

Molisch's Test: Filtrates were treated with 2 drops of alcoholic α-naphthol solution in a test tube. Formation of the violet ring at the junction indicates the presence of Carbohydrates.

Benedict's Test: Filtrates were treated with Benedict's reagent and heated gently. Orange red precipitate indicates the presence of reducing sugars.

Fehling's Test: Filtrates were hydrolysed with dil. HCl, neutralized with alkali and heated with Fehling's A & B solutions. Formation of red precipitate indicates the presence of reducing sugars.

3.4.3 Detection of glycosides: Extracts were hydrolysed with dil. HCl, and then subjected to test for glycosides.

Modified Borntrager's Test: Extracts were treated with Ferric Chloride solution and immersed in boiling water for about 5 minutes. The mixture was cooled and extracted with equal volumes of benzene. The benzene layer was separated and treated with ammonia solution. Formation of rose-pink colour in the ammonical layer indicates the presence of anthranol glycosides.

Legal's Test: Extracts were treated with sodium nitropruside in pyridine and sodium hydroxide. Formation of pink to blood red colour indicates the presence of cardiac glycosides.

Detection of saponins

Froth Test: Extracts were diluted with distilled water to 20ml and this was shaken in a graduated cylinder for 15 minutes. Formation of 1 cm layer of foam indicates the presence of saponins.

Foam Test: 0.5 gm of extract was shaken with 2 ml of water. If foam produced persists for ten minutes it indicates the presence of saponins.

3.4.4 Detection of phytosterols

Salkowski's Test: Extracts were treated with chloroform and filtered. The filtrates were treated with few drops of Conc. Sulphuric acid, shaken and allowed to stand. Appearance of golden yellow colour indicates the presence of triterpenes.

Libermann Burchard's test: Extracts were treated

with chloroform and filtered. The filtrates were treated with few drops of acetic anhydride, boiled and cooled. Conc. Sulphuric acid was added. Formation of brown ring at the junction indicates the presence of phytosterols.

3.4.5 Detection of phenols

Ferric Chloride Test: Extracts were treated with 3-4 drops of ferric chloride solution. Formation of bluish black colour indicates the presence of phenols.

3.4.6 Detection of tannins

Gelatin Test: To the extract, 1% gelatin solution containing sodium chloride was added. Formation of white precipitate indicates the presence of tannins.

3.4.7 Detection of flavonoids

Alkaline Reagent Test: Extracts were treated with few drops of sodium hydroxide solution. Formation of intense yellow colour, which becomes colourless on addition of dilute acid, indicates the presence of flavonoids.

Lead acetate Test: Extracts were treated with few drops of lead acetate solution. Formation of yellow colour precipitate indicates the presence of flavonoids.

Detection of proteins and aminoacids

Xanthoproteic Test: The extracts were treated with few drops of conc. Nitric acid. Formation of yellow colour indicates the presence of proteins.

Ninhydrin Test: To the extract, 0.25% w/v ninhydrin reagent was added and boiled for few minutes. Formation of blue colour indicates the presence of amino acid.

3.4.8 Detection of diterpenes

Copper acetate Test: Extracts were dissolved in water and treated with 3-4 drops of copper acetate solution. Formation of emerald green colour indicates the presence of diterpenes.[1-3]

3.5 Quantities estimation of bioactive compound

3.5.1 Total flavonoids content estimation[34]

Principle: Determination of total flavonoids content was based on aluminium chloride method.[4]

Preparation of standard: 10 mg quercetin was dissolved in 10 ml methanol, and various aliquots of 5-25µg/ml were prepared in methanol.

Preparation of extract: 10 mg of dried extract was dissolved in 10 ml methanol and filter. Two ml (1mg/ml) of this extract was for the estimation of flavonoids.

Procedure: 1 ml of 2% $AlCl_3$ solution was added to 3 ml of extracts or each standard and allowed to stand for 15min at room temperature; absorbance was measured at 420 nm.

3.6 *In-vivo* Antidiabetic activity[35] Source of data

The standard information was collected from various journals, standard text books available in the library and digital library and from various standard websites.

Screening of Diabetes

3.6.1 Animals

Wistar rats (180–250 g) were group housed (n= 6) under a standard 12 h light/dark cycle and controlled conditions of temperature and humidity (25±2 °C, 55–65%). Rats received standard rodent chow and water *ad libitum*. Rats were acclimatized to laboratory conditions for 7 days before carrying out the experiments. All the experiments were carried in a noise-free room between 08.00 to 15.00 h. Separate group (n=6) of rats was used for each set of experiments. The animal studies were approved by the Institutional Animal Ethics Committee (IAEC) of Oriental college of Pharmacy, Bhopal, (M.P. India)(Registration constituted for the purpose of control and supervision of experimental animals by Ministry of Environment and Forests, Government of India, New Delhi, India.

Toxicity Study: Principle

For the acute oral toxicity and LD50 determination the organization for economic co-operation and development (OECD) guideline 423 was followed. As per OECD guidelines a stepwise procedure with the use of 3 animals of a single sex per step was followed. Absence or presence of compound related mortality of the animal doses at one step will determine the next step i.e.

No further testing needed

Dosing of three additional animals, with the same dose

Dosing of three additional animals at the next higher or the next lower dose levels. Material:

Chemicals: Normal saline and other graded chemicals. Drug solutions were prepared fresh and doses are expressed in terms of their free bases. Metformin was used as standard drugs for comparison with various extracts. Streptozotocin (Sigma-Aldrich), Lipid profile estimation kit (Transasia Bio Medical Limited, Mumbai, India) and other chemicals and solvent obtained from Qualigens, India were used.

Animals: Wistar rats

Other syringes, oral rats feeding needle and weighing balance Tray, marker etc.

Experimental model

3.6.2 Induction of Experimental Diabetes in Rats

Streptozotocin was dissolved in 100 mM citrate buffer (pH 4.5) and calculated amount of the dose (60 mg/kg) of the fresh solution was injected intraperitoneally to overnight fasted rats. Blood glucose was checked 48 h later and animals showing blood glucose value more than 250 mg/dl were included in the experiments and termed as diabetic.

- Group I- Normal

- Group II- Diabetic rats received only distilled water (negative control) Group III- Diabetic rats was treated with Metformin (500mg/kg p.o.)
- Group IV- Diabetic rats received *Lantana camara* (100 mg/kg/day p.o.)
- Group V- Diabetic rats received ***Corchorus olitorius*** (200 mg/kg/day p.o.).

3.6.3 Wound creation[36]

To develop wounds, a single full thickness 1.0 cm diameter superficial excision was made on the mid-dorsum of each diabetic and non-diabetic rats at day 0. The measurement of the wound diameter was taken on 1st, 8th and 21st days by using transparency paper and permanent marker.

- Group I- Normal (normal saline)
- Group II- Diabetic rats received only distilled water (normal saline)
- Group III- Diabetic rats were treated with Framycetin sulphate (1 %w/w) for the infected areas of excision wound healing.
- Group IV- Diabetic rats received *Lantana camara* (100 mg/kg/day p.o.) for the infected areas of excision wound healing.
- Group V- Diabetic rats received *Lantana camara* (200 mg/kg/day p.o.) for the infected areas of excision wound healing.

3.6.4 Antidiabetic screening[37]

3.6.4.1 Blood sampling and glucose estimation

For blood glucose determination, blood was withdrawn by tail snipping technique. For various lipid profile and biochemical parameters estimation, blood was collected from cardiac puncture is a suitable technique. Blood was collected in plain micro centrifuge tube at every second week throughout the study period from all the overnight fasted (16-20 hr.) animals, under anesthesia. Serum was separated from blood sample by centrifugation at 4000 r.p.m. for 10 minutes. Biochemical parameters were studied by using automated biochemistry analyzer Hitachi-902.

3.6.4.2 Estimation of Oral glucose tolerance test

Glucose and the oxygen react in the presence of glucose oxidase producing gluconic acid and hydrogen peroxide subsequently. Hydrogen peroxide oxidizes the dyes in a reaction mediated by peroxidase resulting to a blue colour of the dyes. However instead of conventional and lengthy procedure of other diagnostic kits, the glucometer was found to be suitable diagnostically in term of test accuracy, where a drop of blood is sufficient to get the results and easy to access at ambient temperature >95° F and hence used.

3.6.4.3 Estimation of Total Cholesterol (TC)

Total cholesterol in serum was estimated by using CHOD/PAP methods (Tietz, 1995). Cholesterol is a main component of cell membranes and lipoprotein and it is the precursor for steroid hormones and bile acids synthesizing. Cholesterol is transported in plasma by low-density lipoprotein. The level of the individual's total cholesterol is used in screening early atherosclerosis and monitoring the clinical effect of drugs or low-fat diet.

Test Principle:- By the catalysis of CHE and CHO, Cholesterol ester is catalyzed to of quinoneimine. The absorbency increase is directly proportional to the concentration of cholesterol.

Serum, heparin or EDTA plasma is suitable for samples. Whole blood, hemolysis is not recommended for use as a sample. Freshly drawn serum is the preferred specimen.

Use the suitable tubes or collection containers and follow the instruction of the manufacturer; avoid effect of the materials of the tubes or other collection containers.

Centrifuge samples containing precipitate before performing the assay. Stability:
5-7 days at 2–8 ℃
3 months at -20

3.6.4.4 Estimation of Triglycerides (TG)

Triglycerides are the main constituent of vegetable oil, animal fat, LDL and VLDL, and play an important role as transporters of fatty acids as well as serving as an energy source. Triglycerides are broken down into fatty acids and glycerol, after which both can serve as substrates for energy producing and metabolic pathways. High blood levels of triglycerides are implicated in atherosclerosis, heart disease and stroke as well as in pancreatitis. The Triglyceride Quantification Kit provides a sensitive, easy assay to measure triglyceride concentration in variety of samples. In the assay, triglycerides are converted to free fatty acids and glycerol. The glycerol is then oxidized to generate a product which reacts with the probe to generate colorimetric (spectrophotometry at λ = 570 nm) and fluorometric (Ex/Em = 535/587 nm) methods. The kit can detect 2 pmol-10 nmol (or 2~10000 µM range) of triglyceride in various samples.

Storage and Handling: Store kit at –20oC, protect from light. Warm Triglyceride Assay Buffer to room temperature before use. Briefly centrifuge all small vials prior to opening.

Reagents Preparation

Triglyceride Probe: Dissolve in 220 µl anhydrous DMSO (provided) before use. Store at – 20°C, protect from light and moisture. Use within two months.
Triglyceride Enzyme Mix: Dissolve in 220 µl Triglyceride Assay Buffer. Aliquot and store at – 20°C. Use within two months.
Lipase: Dissolve in 220 µl Triglyceride Assay Buffer. Aliquot and store at -20°C. Use within two months.

Triglyceride Assay Protocol
Standard Curve Preparation
For the colorimetric assay, add 0, 2, 4, 6, 8, 10 µl of the 1 mM Triglyceride Standard into wells individually. Adjust volume to 50 µl/well with Triglyceride Assay Buffer to generate 0, 2, 4, 6, 8, 10 nmol/well of Triglyceride Standard.For the fluorometric assay, dilute the Triglyceride Standard to 0.01- 0.1 mM with the Triglyceride Assay Buffer (Detection sensitivity is 10-100 fold higher for a fluorometric than a colorimetric assay). Follow the procedure as the colorimetric assay.

Sample Preparation:* Prepare test samples to a final volume of 50 µl/well with Triglyceride Assay Buffer in a 96-well plate. We suggest testing several dilutions of your sample to make sure the readings are within the standard curve range.
***Notes:** Serum samples can be tested directly. For tissues (100 mg) or cells (10 millions) or other non-aqueous samples, homogenize samples in 1 ml solution containing 5% `
C = Ts / Sv nmol/µl or µmol/ml or mM
Where: **Ts** is triglyceride amount from standard curve (nmol).
Sv is the sample volume (before dilution) added in sample wells (µl).

3.6.4.5 Estimation of High Density Lipoproteins-Cholesterol (HDL-C)
HDL-cholesterol in serum was estimated by using PEG method.
Lipoproteins are the proteins, which mainly transport fats in the blood stream. They can be grouped into chylomicrons, very low density lipoproteins (VLDL), low density lipoproteins (LDL) and high density lipoproteins (HDL). Chylomicrons and VLDL transport mainly triglycerides, though VLDLs also transport some amount of cholesterol. LDL carries cholesterol to the peripheral tissues where it can be deposited and increase the risk of arteriosclerotic heart and peripheral vascular disease. Hence high levels of LDL are atherogenic. HDL transports cholesterol from the peripheral tissues to the liver for excretion, hence HDL has a protective effect. The measurement of total and HDL cholesterol and triglycerides provide valuable information for the risk assessment of coronary heart diseases.

Test Principle
When the serum is reacted with the Polyethylene Glycol contained in the precipitating reagent, all the VLDL and LDL are precipitated. The HDL remains in the supernatant and is then assayed as a sample for cholesterol using the Cholesterol (CHOD/PAP) reagent.

Classification	Cholesterol	HDL	Triglyceride	LDL
Desirable	<200	>60	<150	<130
Borderline	200-239	35-59	200-399	130-159
High	>240	-	>399	>160
Low	-	<35	-	-

It is recommended that each laboratory establish its own normal range representing its patients population.
Contents 75 ml

L1: Enzyme Reagent 1	60 ml
L2: Enzyme Reagent 2	15 ml
L3: Precipitating Reagent	2.5 ml
S: HDL Cholesterol Standards (25 mg/dl)	5 ml

Storage / Stability
Contents are stable at 2-80C till the expiry mentioned on the label.

Reagent Preparation
Reagents are ready to use.
Working Reagent: Pour the contents of 1 bottle of L2 (Enzyme Reagent 2) into 1 bottle of L1 (Enzyme Reagent 1). This working reagent is stable for at least 8 weeks when stored at 2-80 C. Upon storage the working reagent may develop a slight pink colour however this does not affect the performance of the reagent. Alternatively, for flexibility as much of working reagent may be made as and when desired by mixing together 4 parts of L1 (Enzyme Reagent 1) and 1 part of L2 (Enzyme Reagent 2). Alternatively, 0.8 ml of L1 and 0.2 ml of L2 may also be used instead of 1 ml of the working reagent directly during the assay.

Sample Material
Serum, EDTA plasma, HDL Cholesterol is reported to be stable in serum for 7 days when stored at 2-80C. The sample should preferably be of 12 to 14 hours fasting.

Estimation of Total Protein (TP) PRINCIPLE
Proteins are present in all body fluids but show very high concentration (> 3 g/dl) in plasma, lymphatic fluids, and some exudates. The amount of total proteins in serum decreases in the third trimester of pregnancy. The measurement of total proteins in serum is useful to assess the conditions related to changes in plasma or fluid volumes, such as shock and dehydration. A total serum protein test measures the total amount of proteins in the blood. Serum proteins mainly consist of albumin but few globulins (such as α1-globulin) also may be measured.

Procedure
Pipette into three test tubes: Sample, standard, physiological solution and biuret reagent (ml)
Mix properly and allow to stand for 30 min at room temperature.
Measure the absorbances of the sample and the standard at 546 nm against the blank.

3.6.4.6 Estimation of SGPT

The enzyme alanine aminotransferase is widely reported in a variety of tissue sources. The major source of ALT is of hepatic origin and has led to the application of ALT determinations in the study of hepatic diseases. Elevated serum levels are found in hepatitis, cirrhosis, and obstructive jaundice. Levels of ALT are only slightly elevated in patients following a myocardial infarction. UV methods for ALT determination were first developed by Wroblewski and LaDue in 1956.2 The method was based on the oxidation of NADH by lactate dehydrogenase (LDH). In 1980, the International Federation of Clinical Chemistry recommended a reference procedure for the measurements of ALT based on the Wroblewski and LaDue procedure.

The pyruvate formed in the first reaction is reduced to lactate in the presence of lactate dehydrogenase and NADH. The activity of ALT is determined by measuring the rate of oxidation of NADH at 340 nm. Endogenous sample pyruvate is converted to lactate by LDH during the lag phase prior to measurement.

Storage And Stability

Store dry reagent at 2 - 8°C (refrigerated).
The reconstituted reagent is stable for thirty days (30) if immediately refrigerated and for twenty-four (24) hours at room temperature.

Reagent Deterioration The reagent should be discarded if: Turbidity has occurred; turbidity may be a sign of contamination.
Moisture has penetrated the vial and caking has occurred.
The reagent fails to meet linearity claims or fails to recover control values in the stated range.
The reconstituted reagent has a reagent blank absorbance less than 0.8 at 340 nm.

Specimen Collection

This assay is intended for use with serum. Reports indicate that ALT in serum remains stable at 4 - 8°C for a minimum of seven days.4 Hemolyzed specimens should not be used as erythrocytes contain seven times the ALT activity of serum.

Interfering Substances

Pyridoxal phosphate can elevate ALT values by activating the apoenzyme form of the transaminase.5 Pyridoxal phosphate may be found in water contaminated with microbial growth. High levels of serum pyruvate may also interfere with assay performance. Young, et al., give a list of drugs and other substances that interfere with the determination of ALT activity.

3.6.4.7 Estimation of SGOT

CLINICAL SIGNIFICANCE: SGOT is an enzyme found mainly in heart muscle, liver cells, skeletal muscle and kidneys. Injury to these tissues results in the release of the enzyme in blood.

Methodology: Mod. Ifcc Metho.

Principle

SGOT (AST) catalyzes the transfer of amino group between L-Aspartate and a- Ketoglutarate to form Oxaloacetate and Glutamate. The Oxaloacetate formed reacts with NADH in the presence of Malate Dehydrogenase to form NAD.
The rate of oxidation of NADH to NAD is measured as a decrease in absorbance which is proportional to the SGOT (AST) activity in the sample.

Storage And Stability

Reconstitute one vial of Enzyme Reagent (A1) with 10ml of SGOT
Diluent for 6 x 10 ml and 20 ml for 5 x 20 ml. Mix gently to allow dissolution. Working reagent: This working reagent is stable for at least 4 weeks when stored at 2- 8ºC.

Sample Material

Serum. Free from hemolysis. SGOT (AST) is report to be stable in serum for 3 days at 2-80C.

Procedure Assay

Pipette into a clean dry test tube labelled as Test (T):

Addition Sequence	Test (T) 37°C
Working Reagent	1.0 ml
Sample	0.1 ml

Mix well and read the initial absorbance A0 after 1 min. and repeat the absorbance reading after 1, 2 & 3 minutes. Calculate the mean absorbance change per min.

3.7 Statistical analysis

Statistical analysis was performed using Microsoft Excel spreadsheet (version 2007, Microsoft Corp, Seattle, Washington). Variables of interest were entered and all data analyzed using Graph Pad Instant. All statistical analysis is expressed as mean ± standard error of the mean (SEM). Data were analyzed by one way ANOVA, where applicable $p<0.05$ was considered statistically significant, compared with vehicle.

4. RESULTS

4.1 Determination of Percentage Yield

The crude extract obtained through the maceration process was further concentrated using a water bath to completely evaporate the solvent, yielding the final extract. Calculating the percentage yield of extraction is a crucial aspect of phytochemical research, as it helps determine the efficiency of extraction for a specific plant, its different parts, or various solvents used. This evaluation aids in optimizing extraction methods and standardizing procedures for reproducibility. The yield of extracts obtained from different plant samples using solvents such as petroleum ether, chloroform, ethyl acetate, methanol, and water is presented in Table 4.1.

Table 4.1: % Yield of plant material.

S. No.	Solvents	*Lantana camara*
1	Pet ether	1.1%
2.	Chloroform	392%
3.	Ethyl acetate	4.6%
4.	Methanol	8.9%
5.	Aqueous	7.4%

4.2 Phytochemical screening of extracts

A small portion of the dried extracts was subjected to preliminary phytochemical screening following the methods described by Kokate (1994). The tests were performed to detect the presence of various phytoconstituents, including alkaloids, glycosides, tannins, saponins, flavonoids, and steroids, in each of the extracts. For this purpose, a small quantity of each extract was reconstituted in sterile distilled water to achieve a concentration of 1 mg/mL.

The results of the phytochemical analysis for each sample are summarized and discussed in Table 4.2.

Table 4.2: Phytochemical screening of extracts *Lantana camara.*

S. No.	Constituents	Chloroform	Ethyl acetate	Methanol	aqueous
1.	**Alkaloids** Dragendroff's test Hager's test	 -ve -ve	 -ve -ve	 -ve -ve	 -ve -ve
2.	**Glycosides** Legal's test	 -ve	 -ve	 -ve	 -ve
3.	**Flavonoids** Lead acetate Alkaline test	 +ve +ve	 +ve +ve	 +ve +ve	 +ve -ve
4.	**Phenolics** $FeCl_3$	 -ve	 -ve	 +ve	 +ve
5.	**Proteins And Amino acids** Xanthoproteic test	 +ve	 +ve	 +ve	 +ve
6.	**Carbohydrates** Fehling's test	 -ve	 -ve	 +ve	 +ve
7.	**Saponins** Foam test	 -ve	 -ve	 +ve	 +ve
8.	**Diterpins** Copper acetate test	 +ve	 +ve	 +ve	 +ve

Results of estimation of total flavonoid content of *Lantana camara*

Total flavonoids content was calculated as quercetin equivalent (mg/100mg) using the equation based on the calibration curve: **$Y=0.040X + 0.009$, $R^2=0.999$**, where X is the quercetin equivalent (QE) and Y is the absorbance.

Table 4.3: Preparation of calibration curve of quercetin.

S. No.	Concentration (µg/ml)	Absorbance
0	0	0
1	5	0.216
2	10	0.425
3	15	0.625
4	20	0.815
5	25	1.021

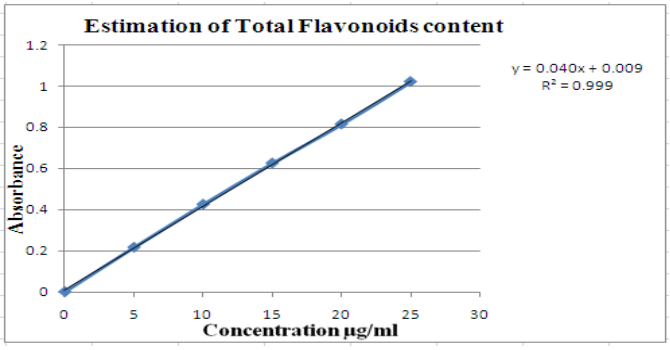


Figure 5.1: Graph of estimation of total flavonoids content.

Table 4.4: Estimation of total flavonoids content of *Lantana amara.*

S. No.	Extracts	Total flavonoids content (mg/ 100 mg of dried extract)
1	Chloroform	0.505
2	Ethyl acetate	1.300
3	Methanol	2.050
4	Aqueous	1.785

4.3 Results of Anti-diabetic activity

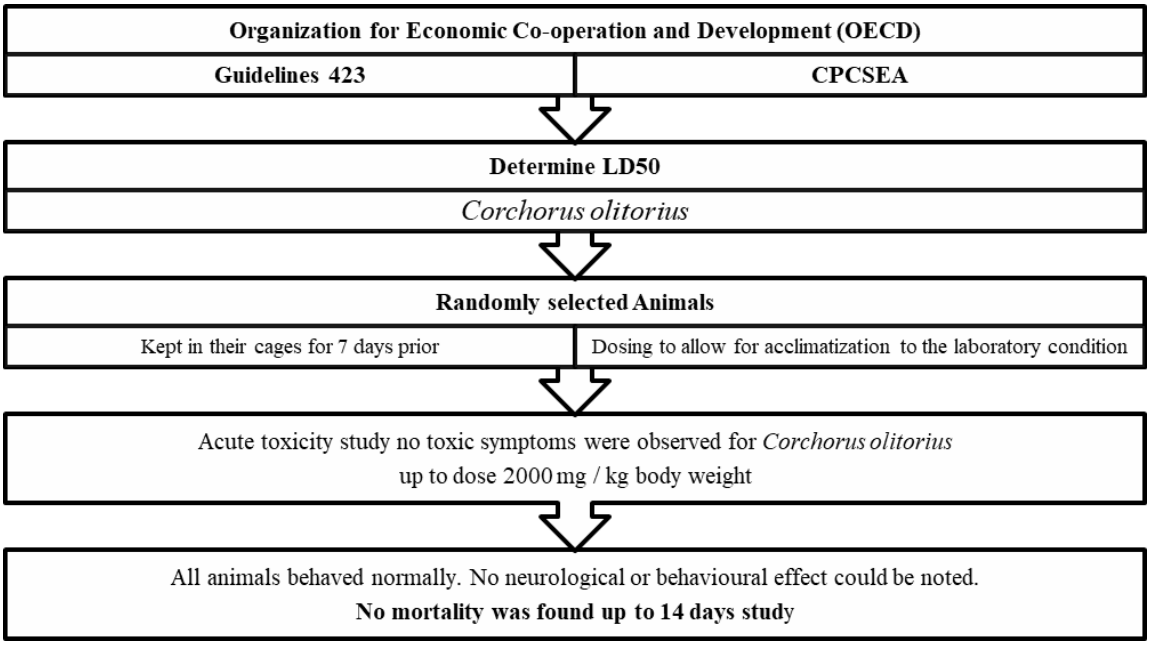
The various results obtained from different experiments carried out were compiled here under.

4.4 Acute toxicity studies

The acute oral toxicity study and dose selection were conducted in accordance with the guidelines of the Organization for Economic Co-operation and Development (OECD), specifically Draft Guideline 423, as recommended by the Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA), Ministry of Social Justice and Empowerment, Government of India.

Healthy Wistar rats of either sex, weighing between 180–250 g, were used for the study to determine the LD_{50} of *Lantana camara*. The animals were randomly selected, individually marked for identification, and housed in laboratory conditions for a 7-day acclimatization period prior to dosing.

During the acute toxicity assessment, no toxic symptoms were observed in animals administered *Lantana camara* extract at doses up to 2000 mg/kg body weight. All animals exhibited normal behavior, with no observable neurological or behavioral abnormalities. No mortality was recorded throughout the 14-day observation period, indicating that the extract is relatively safe at the tested dose.



As represented in Table and Figure 5.5, 5.2, body weights of animals in all groups were performed at the initial and end of the study. Body weight of animals was significantly ($p<0.05$) maintained in all treatment groups (Metformin 500 mg/kgp.o., *Corchorus olitorius* 100 and 200 mg/kg/p.o., 190.40±8.26; 199.00±5.50 and 196.00 ± 9.70) during study as compared to control group (190.00±10.00).

Table 4.5: Mean Body Weight Change.

Group	Drug	Dose	Body weight (g)	
			Onset of study	End of study
I	Normal	Normal saline	198.15±5.83	214.16±4.83
II	Control	Normal saline	211.10± 9.00	191.00±10.00
III	Metformin	500 mg/kg p.o.	221.32± 7.26	191.40±8.26*
IV	*Lantana camara*	100 mg/kg p.o.	232.10± 3.50	200.00±3.50
V	*Lantana camara*	200 mg/kg p.o.	228.44± 3.10	197.00 ± 8.70*

Values are expressed as mean ± S.E.M. (*n* = 6).Values are statistically significant at p<0.05 vs. control group respectively (One-way ANOVA followed by Dunnett's test).

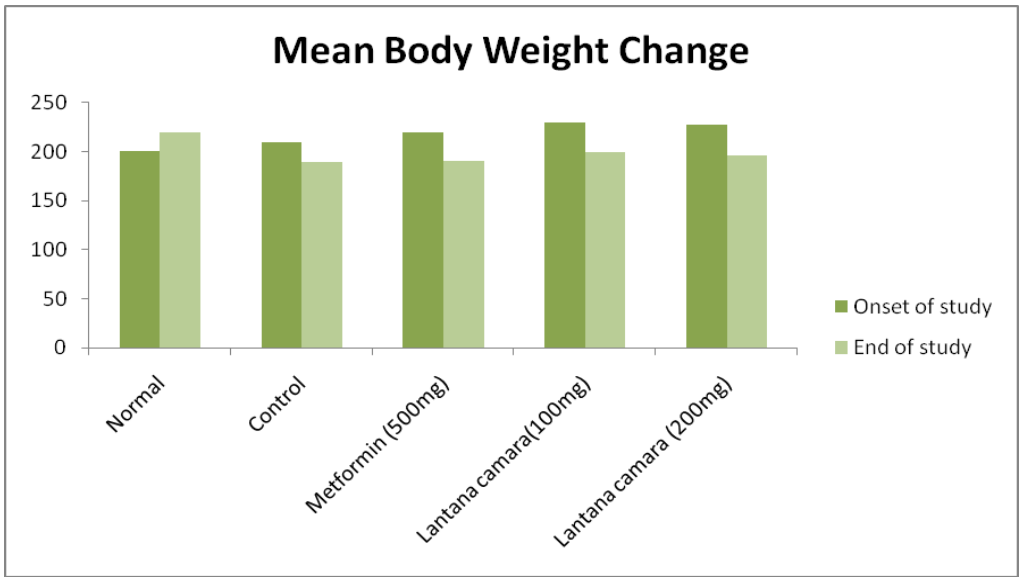


Figure 4.2: Mean Body Weight Change.

As shown in Table and Figure 4.6, 5.3, Blood glucose level of animals in all groups was recorded at 0, 8th and 21th day. Progressive decrease in blood glucose level was found in all treatment groups during study. At the end of experiment Metformin 500 mg/kgp.o., *Lantana camara* 100 and 200 mg/kg/p.o. (112.00 ± 6.50; 118.00 ± 6.00 and 120.00 ± 5.50) treated group blood glucose level was decrease significantly (p<0.05) at 21st days, respectively.

Table 4.6: Antidiabetic activity of *Lantana camara* on blood glucose level in STZ- induced diabetic rats

Groups	Treatment	Dose	Blood glucose (mg/dl)		
			Days 0	Days 8	Days 21
I	Normal	Normal	80.00 ± 4.00	85.00 ± 4.00	92.00 ± 4.00
II	Control	Normal saline	299.00± 7.00	380.00 ± 7.00# 7.00#	97.00±
III	Metformin	500 mg/kg p.o.	250.00± 6.50	140.00 ± 6.50** 6.50**	112.00 ±
IV	*Lantana camara*	100 mg/kg p.o.	265.00± 6.00	155.10 ± 6.00*	118.00 ± 6.00**
V	*Lantana camara*	200 mg/kg p.o.	270.00± 5.50	157.00 ± 5.50 *	120.00 ± 5.50*

Values are expressed as mean ± S.E.M. (*n* = 6).Values are statistically significant at p<0.05 vs. negative control group respectively (One-way ANOVA followed by Dunnett's test).

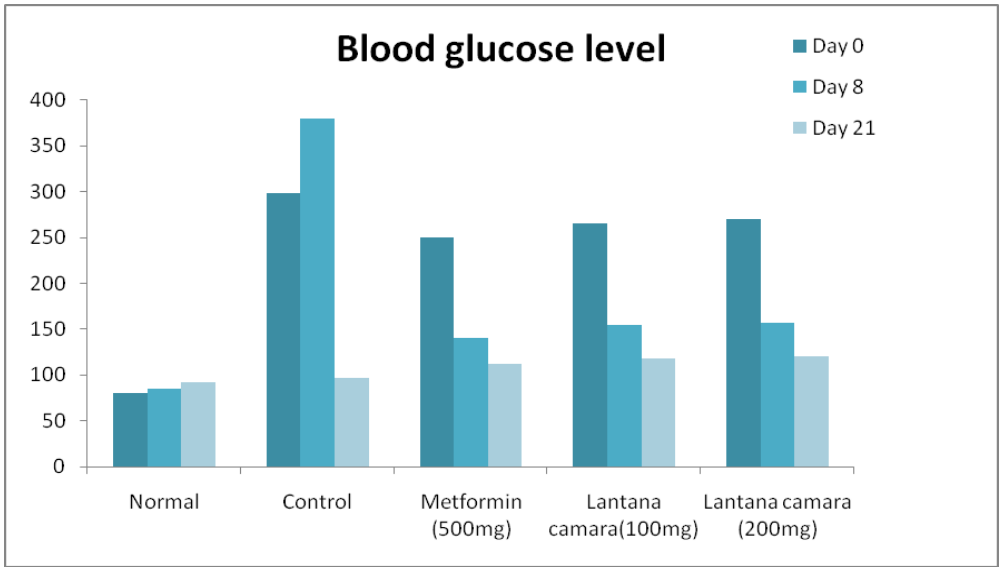


Figure 4.3: Antidiabetic activity of *Lantana camara* on blood glucose level in STZ- induced diabetic rats.

In *Lantana camara* 100 and 200 mg/kg/p.o. (138.0 ± 6.00; 125.0 ± 5.00) treated group total cholesterol decreased significantly ($p < 0.05$). In 500 mg/kg metformin (110.0 ± 5.00) treated group total cholesterol decreased significantly ($p < 0.05$), respectively as compared with control group (210.0 ± 5.00), as shown in Table and Figure 4.7, 4.4.

Table 4.7: Effect of *Lantana camara* on total cholesterol level in STZ- induced diabetic rats.

Groups	Drug	Dose	Total Cholesterol (mg/dl)
I	Normal	Normal saline	80.00 ± 6.00
II	Control	Normal saline	210.0 ± 5.00
III	Metformin	500 mg/kg p.o.	110.0 ± 5.00***
IV	*Lantana camara*	100 mg/kg p.o.	138.0 ± 6.00
V	*Lantana camara*	200 mg/kg p.o.	125.0 ± 5.00**

Values are expressed as mean ± S.E.M. ($n = 6$).Values are statistically significant at $p<0.05$ (One-way ANOVA followed by Dunnett's test).

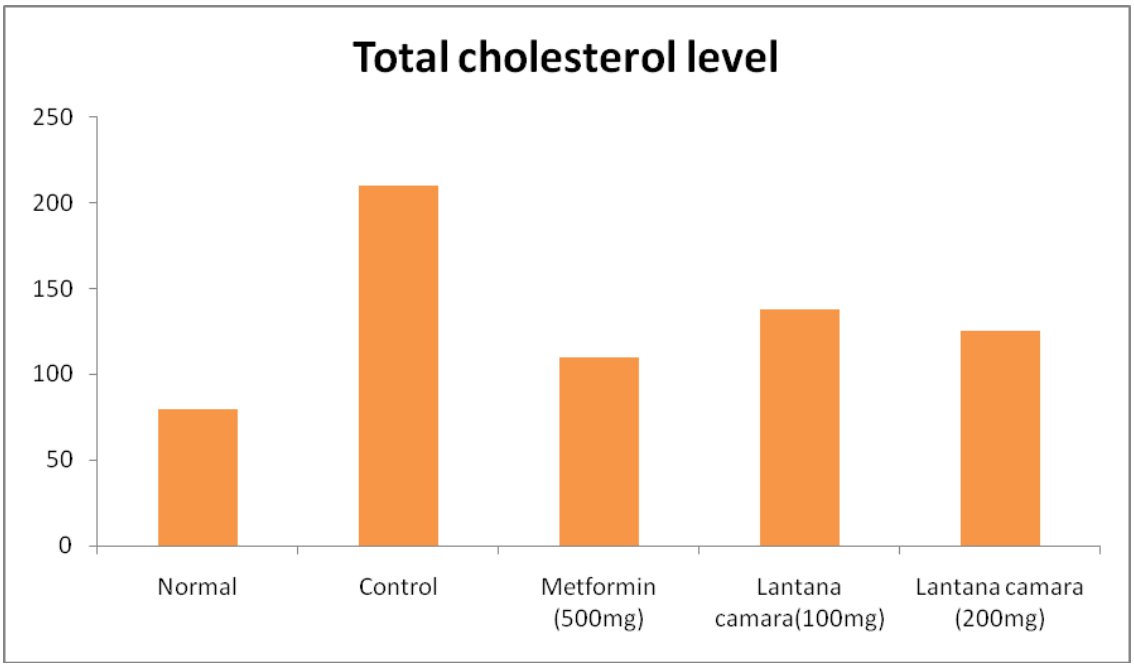


Figure 4.4: Effect of *Lantana camara* on total cholesterol level in STZ-induced diabetic rats.

In *Lantana camara* 100 and 200 mg/kg/p.o. (96.00 ± 7.00; 86.50 ± 5.00) treated group triglyceride decreased significantly ($p < 0.05$). In 500 mg/kg metformin (82.00 ± 5.00) treated group triglyceride decreased significantly ($p < 0.05$), respectively as compared with control group (150.5 ± 6.00), as shown in Table and Figure 5.8, 5.5.

Table 4.8: Effect of *Lantana camara* on triglyceride level in STZ -induced diabetic rats.

Group	Drug	Dose	Triglyceride (mg/dl)
I	Normal	Normal saline	72.00 ± 5.00
II	Control	Normal saline	150.5 ± 6.00
III	Metformin	500 mg/kg p.o.	82.00 ± 5.00**
IV	*Lantana camara*	100 mg/kg p.o.	96.00 ± 7.00*
V	*Lantana camara*	200 mg/kg p.o.	86.50 ± 5.00*

Values are expressed as mean ± S.E.M. (n = 6).Values are statistically significant at $p<0.05$ (One-way ANOVA followed by Dunnett's test).

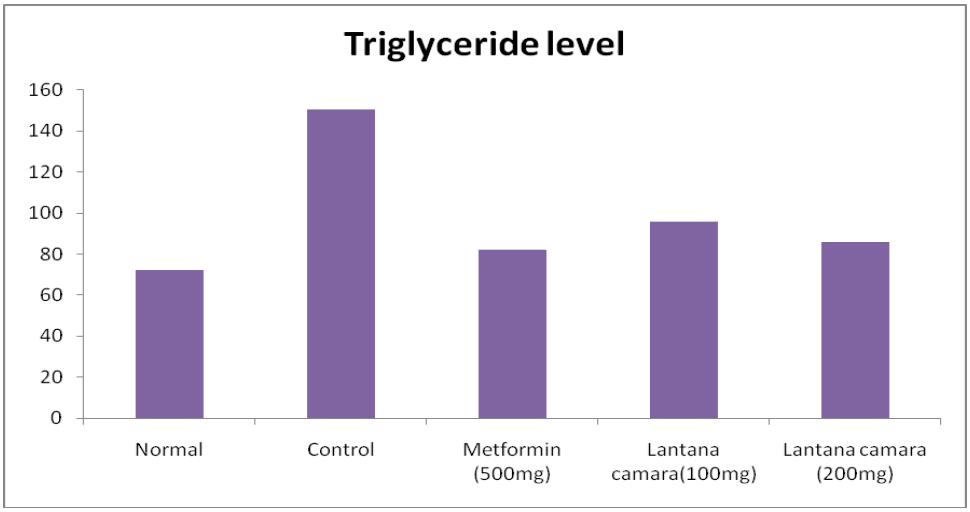


Figure 4.5: Effect of *Lantana camara* on triglyceride level in STZ-induced diabetic rats.

As shown in Table and Figure 4.5, in *Lantana camara* 100 mg/kg (35.00±1.80) treated group high density lipoprotein (HDL) increased significantly ($p < 0.05$), and *Lantana camara* 200 mg/kg (46.00±1.90) treated group HDL also increased significantly ($p < 0.001$). In 500 mg/kg p.o. metformin (50.50±2.00) treated group HDL increased significantly ($p<0.001$), respectively as compared with control group (28.40±2.70).

Table 4.9: Effect of *Lantana camara* on HDL in STZ-induced diabetic rats.

Group	Drug	Dose	HDL (mg/dl)
I	Normal	Normal saline	51.80±1.10
II	Control	Normal saline	28.40±2.70
III	Metformin	500 mg/kg p.o.	50.50±2.00***
IV	*Lantana camara*	100 mg/kg p.o.	35.00±1.80*
V	*Lantana camara*	200 mg/kg p.o.	46.00±1.90**

Values are expressed as mean ± S.E.M. (n = 6).Values are statistically significant at $p<0.05$ (One-way ANOVA followed by Dunnett's test).

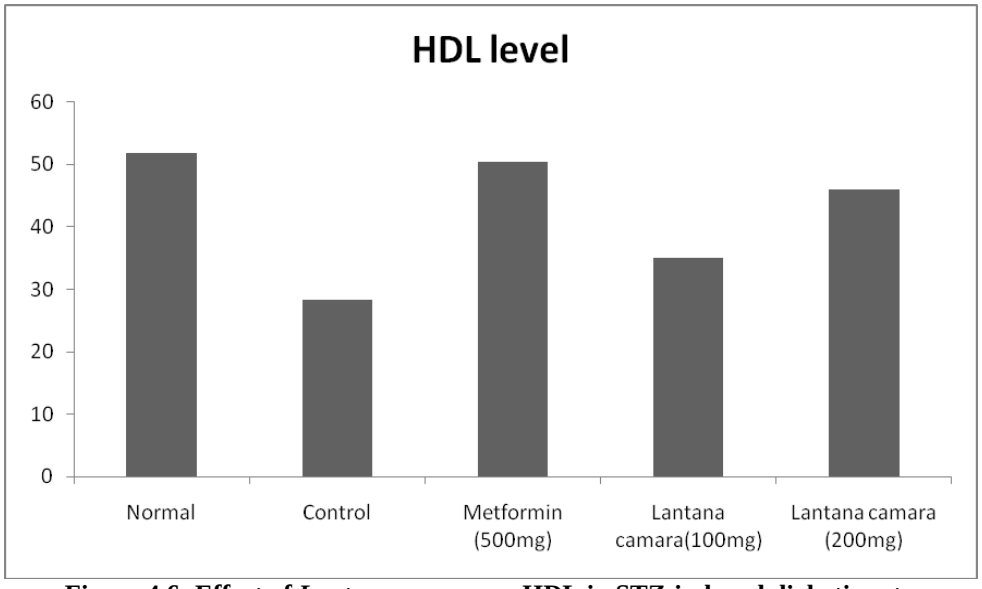


Figure 4.6: Effect of *Lantana camara* on HDL in STZ-induced diabetic rats.

As shown in Table and Figure 4.6, in *Lantana camara* 100 mg/kg (98.00 ± 5.00) treated group total protein (TP) significantly decreased, and *Lantana camara* 200 mg/kg (85.00 ± 5.00) treated group TP also decreased significantly (p<0.01). In 500 mg/kg p.o. metformin (85.00 ± 7.00) treated group TP was significantly decreased (p<0.001), respectively as compared with control group (140.00± 6.00).

Table 4.10: Antidiabetic effect of *Lantana camara* on serum lipid profile i.e. total protein (TP) level in STZ-induced diabetic rats.

Group	Drug	Dose	TP (g/dl)
I	Normal	Normal saline	76.00± 5.00
II	Control	Normal saline	140.00± 6.00
III	Metformin	500 mg/kg p.o.	85.00 ± 7.00***
IV	*Lantana camara*	100 mg/kg p.o.	98.00 ± 5.00
V	*Lantana camara*	200 mg/kg p.o.	85.00 ± 5.00**

Values are expressed as mean ± S.E.M. (n = 6).Values are statistically significant at p<0.05 (One-way ANOVA followed by Dunnett's test).

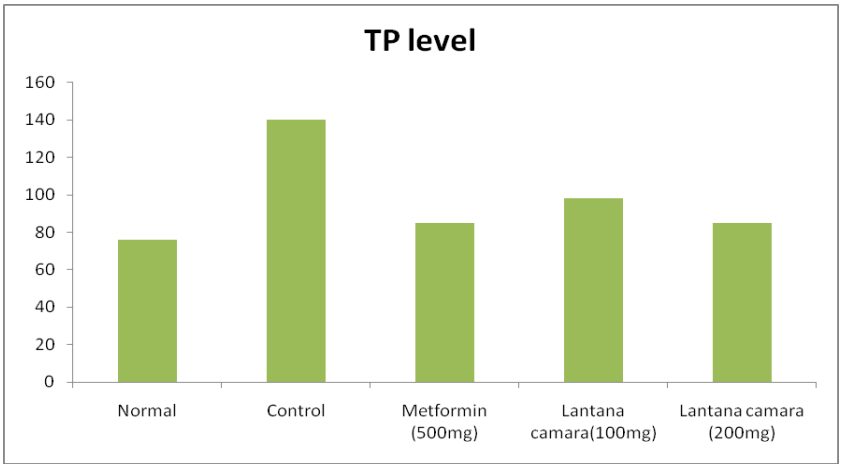


Figure 4.7: Effect of *Lantana camara* on TP in STZ-induced diabetic rats.

After end days of experiment, serum transaminase such as SGOT level was significantly (p < 0.001) elevated in diabetic control group. As shown in Table and Figure 4.11, 4.8, in *Lantana camara* 100 mg/kg (77.50 ± 5.50) treated group SGOT significantly decreased, and *Lantana camara* 200 mg/kg (71.00 ± 5.00) treated group SGOT also decreased significantly (p<0.01). In 500 mg/kg p.o. metformin (67.00 ± 4.00) treated group SGOT was significantly decreased (p<0.001), respectively as compared with control group (122.0± 7.00).

Table 4.11: Effect of *Lantana camara* on SGOT in STZ-induced diabetic rats.

Group	Drug	Dose	SGOT (IU/L)
I	Normal	Normal saline	58.00 ± 5.00
II	Control	Normal saline	122.0± 7.00
III	Metformin	500 mg/kg p.o.	67.00 ± 4.00**
IV	*Lantana camara*	100 mg/kg p.o.	77.50 ± 5.50*
V	*Lantana camara*	200 mg/kg p.o.	71.00 ± 5.00*

Values are expressed as mean ± S.E.M. (*n* = 6).Values are statistically significant at p<0.05 (One-way ANOVA followed by Dunnett's test).

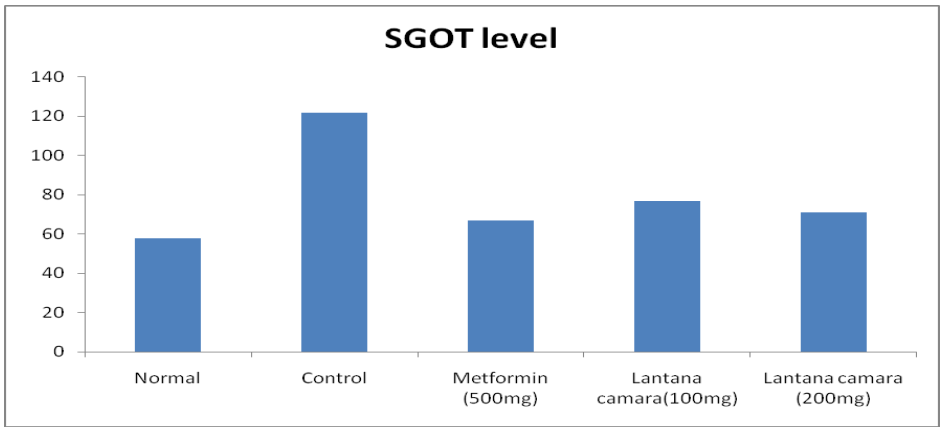


Figure 4.8: Effect of *Lantana camara* on SGOT in STZ-induced diabetic rats.

Similarly, at the end days of experiment the serum transaminase such as SGPT level was significantly ($p < 0.001$) elevated in diabetic control group. As shown in Table and Figure 4.8, in *Lantana camara* 100 mg/kg (71.00 ± 5.00) treated group SGPT significantly decreased, and *Lantana camara* 200 mg/kg (60.00 ± 5.00) treated group SGPT also decreased significantly ($p<0.01$). In 500 mg/kg p.o. metformin (58.00 ± 5.00) treated group SGPT was significantly decreased ($p<0.001$), respectively as compared with control group (117.0 ± 6.00).

Table 4.12: Effect of *Lantana camara* on SGPT in STZ-induced diabetic rats.

Grou p	Drug	Dose	SGPT (IU/L)
I	Normal	Normal saline	47.00 ± 5.00
II	Control	Normal saline	117.0 ± 6.00
III	Metformin	500 mg/kg p.o.	58.00 ± 5.00**
IV	*Lantana camara*	100 mg/kg p.o.	71.00 ± 5.00*
V	*Lantana camara*	200 mg/kg p.o.	60.00 ± 5.00**

Values are expressed as mean ± S.E.M. (*n* = 6).Values are statistically significant at p<0.05 (One-way ANOVA followed by Dunnett's test).

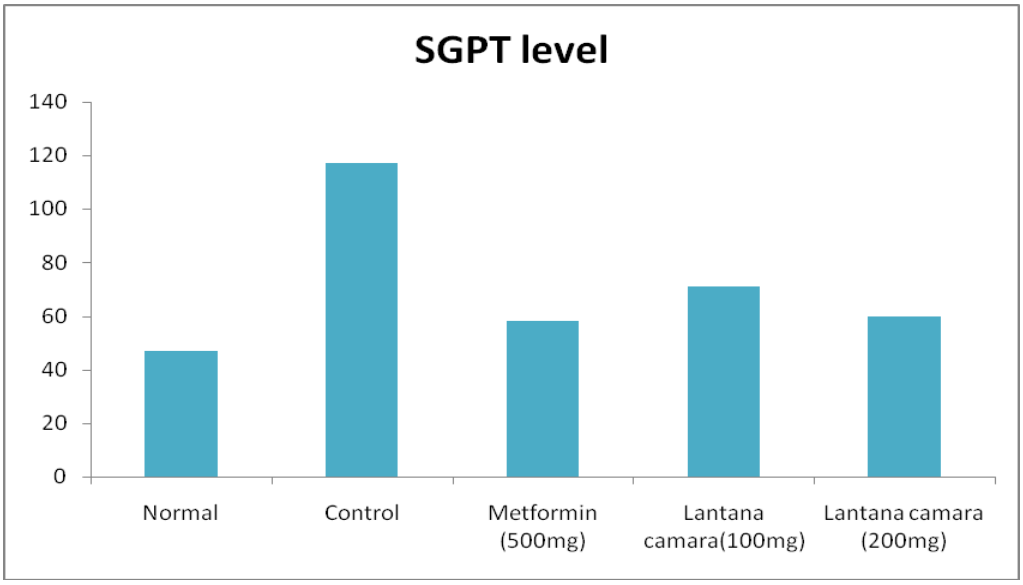


Figure 4.9: Effect of *Lantana camara* on SGPT in STZ-induced diabetic rats

4.5 Results of wound healing activity

The measurement of the wound areas were taken on the day 1st, 8th and 21th day using transparency paper and a permanent marker. The wound areas were recorded and measured on graph paper. *Lantana camara* 100 and 200 mg/kg/p.o. (118±3.41; 112±3.78) increased the rate of wound healing in the diabetic rats (Figure 4.10). The wound closure was optimal in the diabetic group. The results are summarized in Table- 4.13.

Table 4.13: Effect of *Lantana camara* treatment on Excision Wound [Wound Area (mm^2)].

Groups	Treatment	Dose	Wound Area (mm2)		
			Days 1	Days 8	Days 21
I	Normal	Normal	103±3.10	98±3.14	93±3.45
II	Control	Normal	222±4.86	236±3.97#	264±3.61#
III	Framycetin	1 %w/w	247.00±6.00	130.00 ± 6.50**	115.00 ± 5.00**
IV	*Lantana camara*	100 mg/kg p.o.	219±3.36	142±3.34*	118±3.41*
V	*Lantana camara*	200 mg/kg p.o.	216±2.87	138±3.98*	112±3.78*

Values are expressed as mean ± S.E.M. (n = 6).Values are statistically significant at $p<0.05$ vs. control group respectively (One-way ANOVA followed by Dunnett's test).

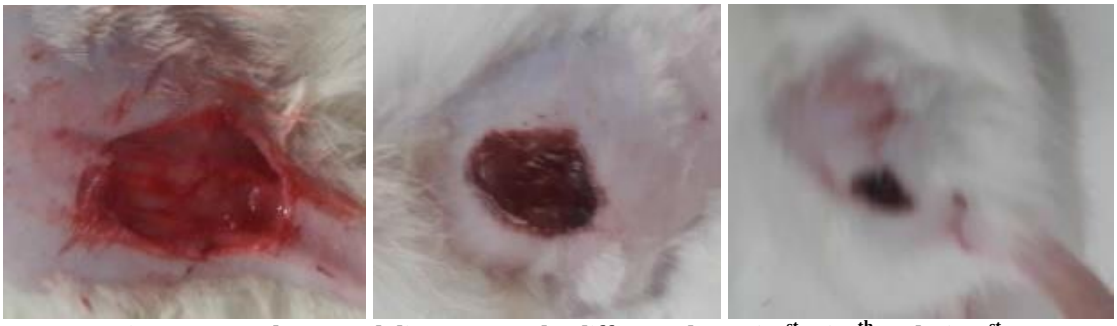


Figure 4.10: The wound diameter on the different days A) 1st, B) 8th and C) 21st.

5. SUMMARY

The present study concludes that *Lantana camara* is a promising medicinal plant with potential therapeutic applications. It demonstrates significant antidiabetic and wound- healing activities, particularly at doses of 100 and 200 mg/kg body weight (B.W.) in streptozotocin (STZ)-induced diabetic rats. Based on blood biochemical parameters, *Lantana camara* at these dosages not only exhibited antihyperglycemic effects but also promoted effective wound healing.

Despite these encouraging results, the current data is not sufficient to determine the exact mechanisms of action. Further phytochemical investigations are required to isolate and characterize the bioactive constituents responsible for the observed pharmacological effects. Additionally, studies exploring potential synergistic interactions among the plant's compounds may provide further insight into its efficacy.

Diabetes mellitus (DM) is a chronic metabolic disorder

characterized by abnormal glucose homeostasis due to defects in insulin secretion or action. It poses a significant global health burden due to its high prevalence and associated complications. Animal models, such as STZ-induced diabetic rats, play a critical role in studying the disease and evaluating new therapeutic agents. STZ is a well-established chemical agent used to induce diabetes in experimental animals, mimicking many clinical and pathological features of human DM.

The findings of this study also suggest that *Lantana camara* may be beneficial in managing diabetes-related complications and improving wound healing in diabetic conditions. However, further research and clinical validation are necessary to substantiate these findings and explore the full therapeutic potential of this plant.

6. CONCLUSION

Our study suggests that *Lantana camara* exhibits dose-dependent antidiabetic activity. These findings may contribute to a better understanding of the potential role of *Lantana camara* in the clinical management of diabetes mellitus. Additionally, the plant appears to possess significant hypolipidemic effects, as evidenced by a reduction in cholesterol, triglycerides, and total protein levels, along with an increase in high-density lipoprotein (HDL) levels. The proposed mechanism underlying these effects may involve the inhibition of cholesterol and triglyceride synthesis.

Furthermore, the study highlights the antioxidant properties of *Lantana camara*, which may play a vital role in preventing diabetic complications. The wound healing potential of *Lantana camara* was also evident, with the 200 mg/kg dose showing greater efficacy than the 100 mg/kg dose, indicating a clear dose- dependent response.

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