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Bioevaluation of Anti-Diabetic Potential of *Jatropha Integremma in* Streptozotocin Induced Diabetic Rats

Dr. Nitin I. Kochar, Miss Aarti N.Dambhe, Dr.Deepak S. Mohale,
Dr. Abhijit V.Shrirao, Dr. Anil V. Chandewar
Department of Pharmacology
Pataldhamal Wadhwani College Of Pharmacy, Yavatmal, India

Abstract: *The global prevalence of diabetes mellitus necessitates the exploration of novel therapeutic agents, particularly from natural sources. This study investigated the anti-diabetic potential of the methanolic leaf extract of Jatropha integerrima in streptozotocin (STZ)-induced diabetic Sprague Dawley rats. Diabetes was induced by a single intravenous injection of STZ (60 mg/kg). Diabetic rats were treated orally with the methanolic extract at doses of 100 mg/kg and 200 mg/kg, and metformin (100 mg/kg) as a standard drug, for 21 days. Blood glucose levels and body weight were monitored at regular intervals. Preliminary phytochemical screening of the extract revealed the presence of alkaloids, flavonoids, carbohydrates, steroids, and tannins. STZ-induced diabetic rats exhibited significant hyperglycemia and weight loss compared to the normal control group ($p<0.01$). Treatment with both doses of Jatropha integerrima extract significantly reduced blood glucose levels ($p<0.05$ for 100 mg/kg and $p<0.01$ for 200 mg/kg) and attenuated weight loss compared to the untreated diabetic control group. The high dose of the extract showed a more pronounced effect, comparable to that of metformin. These findings suggest that the methanolic leaf extract of Jatropha integerrima possesses significant hypoglycemic potential, likely attributed to its phytochemical constituents, particularly flavonoids. Further studies are warranted to isolate and identify the active compounds and elucidate their precise mechanisms of action.*

Keywords: Jatropha integerrima, anti-diabetic, streptozotocin, diabetic rats, flavonoids, blood glucose, body weight

I. INTRODUCTION

1.1) Diabetes Mellitus: A Global Health Challenge Diabetes mellitus represents a cluster of metabolic disorders characterized by chronic elevation of blood glucose levels (hyperglycaemia), often accompanied by the presence of glucose in the urine (glycosuria) and elevated blood lipid levels (hyperlipaemia). Globally, the impact of diabetes is immense, with approximately 177 million individuals affected in the year 2000, a figure projected to reach 300 million by 2025. It is not a singular disease entity but rather a complex syndrome encompassing various underlying causes and significantly increasing the risk of severe cardiovascular complications such as heart attacks, strokes, and peripheral vascular disease. The escalating prevalence of diabetes mellitus poses a substantial burden on healthcare systems worldwide, driven by factors including insufficient insulin production, impaired insulin secretion, defects in insulin receptor function, and increased insulin resistance. Notably, modifiable risk factors like obesity and sedentary lifestyles, alongside urbanization and genetic predispositions, contribute significantly to the rising incidence of this condition.

1.2) The Role of Animal Models in Diabetes Research The study of diabetes and the evaluation of potential therapeutic interventions often rely on the use of animal models, including rodents such as rats, mice, hamsters, guinea pigs, and rabbits. These models allow researchers to investigate the pathophysiological changes associated with the disease and assess the efficacy of novel treatment strategies. Diabetes can be induced in these animals through various methods, including the administration of chemical agents like alloxan and streptozotocin (STZ), viral infections, or the

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use of genetically predisposed diabetic strains. Among the chemical agents employed, alloxan and streptozotocin are the most widely utilized. Alloxan, a urea derivative, selectively destroys pancreatic beta cells, leading to a model resembling type 1 diabetes. However, its use can be associated with high mortality rates. In contrast, streptozotocin, a naturally occurring chemical, is commonly used to induce type 1 diabetes in animal models with a comparatively lower mortality rate and can also induce a model resembling type 2 diabetes with lower, repeated doses. STZ exerts its diabetogenic effect by reducing the levels of nicotinamide-adenine dinucleotide (NAD) in pancreatic beta cells, ultimately leading to cellular damage and the onset of diabetes. A single intravenous injection of STZ at a dose of 60 mg/kg in adult Wistar rats has been shown to induce experimental diabetes mellitus within 2-4 days, characterized by a significant increase in blood glucose levels due to the destruction of beta cells in the islets of Langerhans.

1.3) Herbal Medicine and the Potential of *Jatropha integerrima* Herbal medicine, or botanical medicine, has a long-standing history of use across various cultures for its therapeutic properties, often utilizing different plant parts such as seeds, roots, leaves, or flowers. With advancements in research and quality control, herbal medicine is increasingly being recognized as a potential source of novel therapeutic agents for various ailments, including diabetes. *Jatropha integerrima*, a medicinal plant belonging to the Euphorbiaceae family and native to the West Indies, has garnered attention for its potential pharmacological activities. Traditionally, the leaves of *J. integerrima* have been used in India and Bangladesh to treat skin conditions, suggesting the presence of bioactive compounds. Phytochemical investigations have revealed the presence of various constituents, including flavonoids. Flavonoids, a class of polyphenolic compounds found in many plants, have demonstrated potential in the prevention and management of diabetes and its complications through various mechanisms, including the regulation of glucose metabolism, liver enzyme activity, and lipid profiles. Given the presence of potentially antidiabetic compounds like flavonoids and the reported antioxidant activity in *Jatropha integerrima*, this study aims to investigate the bioevaluation of the anti-diabetic potential of the methanolic leaf extract of *Jatropha integerrima* in streptozotocin-induced diabetic rats. We hypothesized that the *Jatropha integerrima* leaf extract would exhibit significant hypoglycemic activity in this animal model. To test this hypothesis, we established five experimental groups: a normal control group, a negative diabetic control group, two treatment groups receiving different doses of the *Jatropha integerrima* leaf methanolic extract (100 mg/kg and 200 mg/kg), and a standard drug control group treated with metformin (100 mg/kg). Blood glucose levels and body weight changes were monitored over a 21-day treatment period to assess the potential anti-diabetic effects of the plant extract.

II. PLANT PROFILE

Jatropha integerrima is an evergreen shrub or small tree, also known as Peregrina, Spicy Jatropha, Chaya, Firecracker, Firecracker Jatropha, and Star of Bethlehem. It belongs to the Euphorbiaceae family and is native to the West Indies, particularly Cuba. *Jatropha integerrima*, also known as spicy jatropha, is characterized by its showy bright red flowers and is cultivated worldwide as an ornamental shrub. Its leaves are used in India and Bangladesh as poultices to treat various conditions such as eczema, itch, and skin warts. Phytochemical studies of *J. integerrima* have identified coumarins, cyclic peptides, neolignans, and several new diterpenes with different biological activities. In the past decade alone, more than 16 new compounds have been isolated from *J. integerrima*, indicating a rich metabolome that is still not fully understood. Recent pharmacological studies of this plant have shown promising antibacterial activity of extracts and essential oils obtained from the seeds and leaves, and strong antioxidant activity of flower extracts.

Fig 1. Jatropha integremma

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Domain	Eukaryota
Kingdom	Plantae
Phylum	Spermatophyta
Subphylum	Angiospermae
Class	Dicotyledonae
Order	Euphorbiales
Family	Euphorbiaceae
Genus	*Jatropha*
Species	*Jatropha integerrima*

2.1) Taxonomy and Nomenclature The Euphorbiaceae family is one of the biggest flowering plant families, containing about 300 genera and 7,500 species, with most species characterized by their milky sap and capsular schizocarps. *Jatropha* is regarded as the most primitive genus of the family, with its morphological variety leading to exceptional classifications over the years. About two-thirds of *Jatropha* species are from the Americas. *J. integerrima* is one of the most typically used landscape plant life in the tropics, with a variety of cultivars available for sale. The genus title is derived from the Greek 'iatros' which means ‘physician’ and 'trophe' meaning ‘nutrition’, as some species have medicinal uses. The specific epithet comes from the Latin 'integer' meaning ‘entire’, ‘unbroken’ or ‘untoothed’ and 'rimus', meaning ‘mostly so’ in reference to *J. integerrima* having few lobed or toothed leaves.

2.2) Description
Size: Shrub, 2.5–5 meters tall.
Stems: Upright, dark brown, smooth, with clear latex in young shoots.
Leaves: Oval or slightly lobed, 7.5–15.3 cm long, smooth, and somewhat leathery.
Flowers:
Male: Bright red to pink petals, 10 stamens.
Female: Similar to male, but slightly larger.
Fruit: Ovoid capsule, 1–1.3 cm long, splits open explosively.
Seeds: Cream-colored with red and black spots, 7–10 mm long.

2.3) Distribution *Jatropha integerrima* is a shrub to small tree native to Cuba. It is additionally listed as native to Hispaniola by USDA-ARS (2020). It is used during its range as an ornamental, and can be observed in North America, Central America, the Caribbean, Asia, Europe, Africa, and Oceania.

2.4) Habitat *Jatropha integerrima* is a shrub to small tree which is broadly used as an decorative. It has been recorded in sandy semi-arid areas, near swampy areas, on disturbed soils, limestone cliffs and humus pockets in woodland, and is cultivated in urban areas.

2.5) Chemical Constituents The chemical constituents of the tissue/parts analyzed. The leaf has pent decanal (32.4%), 1,8-cineole (11.2%), and β-ionone (10.8%) as the major components. On the other hand, the seed oil is comprised mainly of aliphatic hydrocarbons represented by pentacosane (13.6%), hexacosane (13.3%), octacosane (12.3%), and heptacosane (10.1%). However, the defatted seed oil was predominantly made up of the monoterpenes 1,8-cineole (35.5%), p-cymene (20.5%), and α-pinene (16.5%).

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2.6) Uses

Anti-inflammatory Properties
Hepatoprotective
Antioxidant
Skin Conditions: In India and subtropical Africa, the leaves are used as poultices to treat various skin conditions such as eczema, pruritus (itching), and skin warts.

III. MATERIALS AND METHODS

3.1) Material

3.1.1) Chemical & reagents

Table no.1: List of chemical & reagent used during study

Sr. No.	Name of Chemical	Company
1)	Petroleum ether	Thermo Scientific Chemicals
2)	Methanol	OAISIS Alchol India Pvt Ltd
3)	Chloroform	ACME
4)	Streptozotocine(STZ)	MP Biomedica
5)	Molish's Reagent	SD Fine Chem Ltd.
6)	Mayers Reagent	SD Fine Chem Ltd.
7)	Sulphuric acid	SD Fine Chem Ltd.
8)	Lead Acetate	ACME
9)	Ferric Chloride	SD Fine Chem Ltd.
10)	Sodium Hydroxide	ACME
11)	Zinc	SD Fine Chem Ltd.
12)	Hydrochloride Acid	SD Fine Chem Ltd.
13)	Citric Acid	SD Fine Chem Ltd.
14)	Glucose diagnostic kit	Ambica Diagnostic

3.1.2) Experimental Animals

Healthy Sprague Dawley rats (8 weeks of age) weighing 150-250 gm were selected for the study. The animals were housed in polypropylene cages with wire mesh and husk bedding and maintained under standard environmental conditions (temperature 22 ± 2°C, relative humidity 55-60%, 12-hour light/dark cycle). Rats were fed with standard pellet diet (Amrut Feeds, Sangli) and water was provided *ad libitum* throughout the course of the study. The animals were housed and treated according to the rules and regulations of CPCSEA and IAEC. The protocol for the study was approved by the Institutional Animal Ethical Committee (IAEC) with reference no. 650/PO/Re/S-2002/2025/CPCSEA/02.

3.1.3) Apparatus and Instruments

Water bath, micropipette, digital weighing balance, glass wares, glucometer.

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3.2) Method

3.2.1) Procurement and Authentication of Plant Materials

Jatropha integerrima plants were collected from the local area of Yavatmal, Vidharbha region, Maharashtra (India). The plant material was identified and authenticated by Mrs. A. M. Gaharwar, Assistant Professor of Vasantrao Naik College of Agricultural Biotechnology, Yavatmal (Reference No. VNCABT/Ytl/Hort/1698/2024) on 11/12/2024.

3.2.2) Extraction of *Jatropha integerrima* Leaves Leaves of *Jatropha integerrima* plant were dried in the shade and coarsely powdered. The powdered material (3000 gm) was subjected to defatting in a glass jar with petroleum ether. The defatted powder was then extracted with methanol using a Soxhlet apparatus. The methanol extract was concentrated by evaporation in a water bath at 40°C. The weight of the empty pouch was 0.61 gm, and the weight of the methanolic extract of *Jatropha integerrima* obtained was 31.51 gm (32.12 gm - 0.61 gm). The percentage yield of the methanolic extract of leaves of *Jatropha integerrima* was calculated as:

% Yield = Weight of initial plant materialWeight of extract×100

% Yield = 3000 gm31.51 gm×100=1.050% w/w

3.2.3) Phytochemical Screening Freshly prepared methanolic extract was subjected to preliminary phytochemical screening for the detection of various phytochemical active constituents using standard methods.

Test for Alkaloids: 3 ml of dilute hydrochloric acid was added to a small amount of extract and filtered. The filtrate was mixed with 2 ml of Hager's reagent. Formation of a yellow precipitate was regarded as positive for the presence of alkaloids. Meyer's and Dragendorff's tests were also performed similarly.

Test for Flavonoids:

Lead acetate test: The lead acetate test for flavonoids involves adding a few drops of 10% lead acetate solution to a plant extract.The formation of yellow or cream precipitate confirms the presence of flavonoids.

Ferric chloride test: add a few drop of 5% ferric chloride to the extract, green or blue colour indicates flavonoids.

Test for Carbohydrates: Extract was dissolved individually in 5 ml distilled water and filtered. The filtrate was used for the following tests:

Molisch's test: 2-3 ml of test solution, a few drops of alcoholic alpha-naphthol solution were added, shaken, and concentrated H2SO4 was carefully added from the sides of the test tube. Violet ring formation at the junction of the two liquids indicated the presence of carbohydrates.

Fehling's test: Filtrate was heated with Fehling's A and B solutions. A brick-red precipitate indicated the presence of reducing sugars.

Benedict's test: Filtrate was heated with Benedict's reagent. A colored precipitate (green, yellow, or brick-red) indicated the presence of reducing sugars.

Test for Proteins: 5 ml of extract was treated with a small amount of copper sulfate solution, followed by the addition of NaOH solution. Appearance of a violet color suggested the presence of proteins (Biuret test). Xanthoprotein test was also performed.

Test for Saponins: A small quantity of the extract was shaken vigorously with 2 ml of water. Persistence of foam produced for 10 minutes indicated the presence of saponins.

Test for Tannins:

Lead Acetate test: A few drops of extract were treated with basic lead acetate. A white precipitate indicated the presence of tannins.

Gelatin Test: A few drops of gelatin solution were added to the extract. A white precipitate indicated the presence of phenolic compounds, including tannins.

Test for Phenolic Compounds: To 2-3 ml of methanolic extract, a few drops of gelatin solution were added. A white precipitate indicated the presence of phenolic compounds.

Test for Triterpenoids: A small amount of extract was heated with tin and thionyl chloride. Formation of a pink color was an indication of the presence of triterpenoids (Noller's test).

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Test for Gums/Mucilage: The extract was mixed with water. Absence of thickening of the substance indicated the absence of gums.

Test for Fixed oils & Fats: A small quantity of extract was pressed between filter papers. Absence of an oil spot indicated the absence of fixed oils and fats.

Test for Steroids:

Salkowski's Test: Extract was treated with concentrated sulfuric acid, and a reddish-brown color in the lower layer indicated the presence of steroids.

Liebermann-Burchard Test: Extract was treated with acetic anhydride and sulfuric acid. Formation of a bluish-green color indicated the presence of steroids.

Test for Glycosides: Keller-Killiani test was performed.

3.3) Experimental Design For this study, rats were randomly divided into the following five groups (n=4 per group):

Group 1 (Vehicle Control): Rats received only normal saline solution orally for 21 days.

Group 2 (Negative Control): Diabetes was induced in rats by a single intravenous injection of streptozotocin (STZ) at a dose of 60 mg/kg body weight, freshly prepared in sterile citrate buffer (pH 4.5) after overnight fasting. Diabetes was confirmed by measuring fasting blood glucose levels ≥ 250 mg/dL 72 hours after STZ injection. These rats received normal saline orally for 21 days.

Group 3 (Low Dose of Methanolic Extract of *Jatropha integerrima*): Diabetic rats were treated orally with the methanolic extract of *Jatropha integerrima* at a dose of 100 mg/kg body weight once daily for 21 days. The extract was dissolved in normal saline for administration.

Group 4 (High Dose of Methanolic Extract of *Jatropha integerrima*): Diabetic rats were treated orally with the methanolic extract of *Jatropha integerrima* at a dose of 200 mg/kg body weight once daily for 21 days. The extract was dissolved in normal saline for administration.

Group 5 (Standard): Diabetic rats were treated orally with metformin at a dose of 100 mg/kg body weight once daily for 21 days. Metformin was dissolved in normal saline for administration.

3.4) Measurement of Blood Glucose Levels Fasting blood glucose levels were measured using a glucometer (Roche Diagnostics) from tail vein blood samples. Measurements were taken at baseline (Day 0, before STZ injection), after diabetes induction (Day 3), and then at regular intervals during the 21-day treatment period (Days 5, 10, 15, and 20). Rats were fasted for at least 6 hours prior to each blood glucose measurement.

3.5) Measurement of Body Weight The body weight of each rat in all groups was recorded using a digital weighing balance at baseline (Day 0) and at regular intervals during the treatment period (Days 5, 10, 15, and 20).

3.6) Statistical Analysis All data were expressed as mean ± standard deviation (SD). Statistical analysis was performed using one-way analysis of variance (ANOVA) followed by dunnett compare all vs control test for multiple comparisons using instat software .

IV. RESULTS

4.1) Results of Preliminary Phytochemical Studies

Table no.2 presents the results of the preliminary phytochemical screening of the methanolic leaf extract of *Jatropha integerrima*. The analysis revealed the presence of alkaloids, flavonoids, carbohydrates, steroids, and tannins. Glycosides were found to be absent in the extract.

Table no.2 Results of phytoconstituents in *Jatropha integerrima* leaves extract

Sr.No	Phytoconstituents	Test	Hydro Alcoholic extract
1	Alkaloid	Mayer's Test	+

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		Dragendroff's Test	+
2	Flavonoids	Ferric Chloride Test	+
		Lead Acetate Test	+
3	Carbohydrates	Molisch Test	+
		Fehling Test	+
		Benedict's Test	+
4	Steroid	Salkowski's Test	+
		Liebermann-Burchard test	+
5	Tannins	Lead Acetate Test	+
		Gelatin Test	+
6	Proteins	Xanthoprotein test	+
		Biuret Test	+
		Lead Acetate Test	+
7	Glycoside	Keller Kiliam Test	-

+ Present, - Absent

4.2) Body Weight of Rats

Table No.3 and Figure No.2 illustrate the impact of *Jatropha integerrima* treatment on the body weight of streptozotocin-induced diabetic rats. A significant ($p<0.01$) decrease in body weight was observed in the Negative control group compared to the Normal control group from Day 5 to Day 20, indicating diabetes-associated weight loss. After confirmation of diabetes, rats were treated with the methanolic extract of *Jatropha integerrima* for 20 days. Rats receiving the low dose (100 mg/kg) of the extract exhibited a moderate reduction in weight, although this was not statistically significant compared to the negative control. However, rats treated with the high dose (200 mg/kg) of *Jatropha integerrima* extract showed a significant ($p<0.01$) attenuation of weight loss compared to the untreated diabetic group. The standard drug (metformin, 100 mg/kg) also significantly ($p<0.01$) attenuated weight loss in the diabetic rats.

Table No.3: Evaluation of body weight of rats (gm)

Groups	**Weight of rats on day 0 (gm)**	**Weight of rats on day 5 (gm)**	**Weight of rats on day 10 (gm)**	**Weight of rats on day 15 (gm)**	**Weight of rats on day 20 (gm)**
Normal control	203 ± 18.98	205 ± 10.80	209.2 ± 11.61	207.5 ± 14.54	215 ± 11.44
Negative control	214.5 ± 15.15	191.5 ± 6.60	167.75 ± 8.85	152.75 ± 4.92	147 ± 7.83
Low dose (100mg/kg)	213.25 ± 14.99	201.5 ± 6.60	179.75 ± 8.85	165.75 ± 7.63	160 ± 5.71
High dose (200mg/kg)	221.5 ± 19.29	210 ± 7.75	189.5 ± 9.14	175 ± 6.16	173.75 ± 10.53
Standard drug	215 ± 14.65	219.75 ± 5.18	201.5 ± 5.06	195.75 ± 6.80	194 ± 5.29

Results are expressed as Mean ± SD (n=4)
@$p< 0.01$ compared with corresponding normal control group
**$p < 0.01$ compared with Negative control group
*$p < 0.05$ compared with Negative control group
ns $p >0.05$ compared with Negative control group

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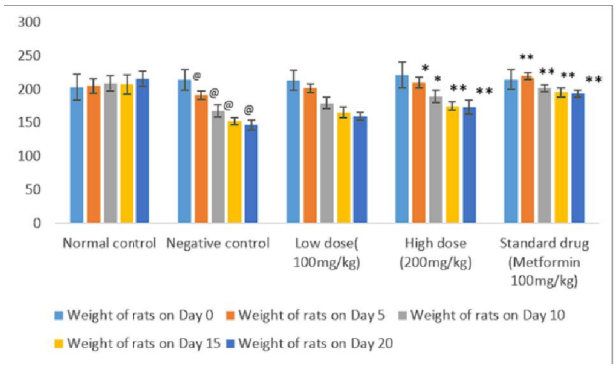

Fig No.2: Evaluation of body weight of rats

4.3) Blood Glucose Level Table no.4 and Figure no. 3 show the effect of *Jatropha integerrima* on the blood glucose level of streptozotocin-induced diabetic rats. There was a significant ($p<0.01$) increase in the blood glucose level in all STZ-induced groups (Negative control, Low dose, High dose, and Standard drug) compared to the Normal control group from Day 5 to Day 20, confirming the induction of diabetes.

After the confirmation of diabetes, treatment with the methanolic extract of *Jatropha integerrima* for 20 days resulted in a significant reduction in blood glucose levels in both treatment groups. The low dose (100 mg/kg) showed a significant ($p<0.05$) reduction from Day 5 onwards, while the high dose (200 mg/kg) exhibited a more pronounced and significant ($p<0.01$) reduction in blood glucose levels from Day 5 onwards. The standard drug (metformin, 100 mg/kg) also significantly ($p<0.01$) reduced blood glucose levels in the diabetic rats.

On Day 20, the percentage reduction in blood glucose levels compared to the negative control group was approximately 29.07% for the low dose (100 mg/kg) of *Jatropha integerrima* extract and 30.80% for the high dose (200 mg/kg) of *Jatropha integerrima* extract. The standard drug (metformin, 100 mg/kg) showed a reduction of approximately 34.36% on Day 20.

Table no.4 Effect of *Jatropha integerrima* on blood glucose level of Streptozotocin induced diabetic rats (mg/dl)

Groups	0 Day	5 days	10 days	15 days	20 days
Normal control	103.75 ± 2.217	104.5 ± 2.38	104.5 ± 2.38	103.75 ± 2.217	104.5 ± 2.358
Negative control	105.25 ± 4.113	228.5 ± 4.655	235 ± 4.203	249.25 ± 4.573	259.75 ± 4.646
Low dose (100mg/kg)	105.5 ± 4.203	216.25 ± 5.679	214.25 ± 5.909	195.25 ± 4.349	184.25 ± 3.304
High dose (200mg/kg)	105.25 ± 3.096	219.25 ± 4.349	211.5 ± 4.041	192.25 ± 4.349	179.75 ± 4.646
Standard drug	104.75 ± 2.63	212.75 ± 3.403	195.5 ± 4.359	183.5 ± 4.655	170.5 ± 4.856

Results are expressed as Mean ± SD (n=4)
@p< 0.01 compared with corresponding normal control group
**p < 0.01 compared with Negative control group
*p < 0.05 compared with Negative control group
ns p >0.05 compared with Negative control group

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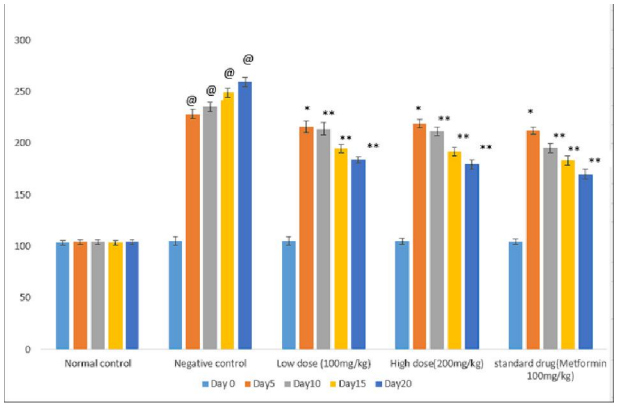

Fig no.3 Effect of Jatropha integremma on blood glucose level of Streptozotocin induced diabetic rats.

V. DISCUSSION

Diabetes mellitus encompasses a spectrum of metabolic disorders characterized by persistent hyperglycaemia, often accompanied by glycosuria and hyperlipaemia. The escalating global prevalence of this condition underscores the urgent need for effective therapeutic strategies. In this study, we investigated the anti-diabetic potential of the methanolic leaf extract of *Jatropha integerrima* in streptozotocin (STZ)-induced diabetic rats, a well-established animal model for studying the disease. STZ selectively damages pancreatic beta cells, leading to insulin deficiency and subsequent hyperglycaemia, mimicking key features of type 1 diabetes.

The successful induction of diabetes in our study was confirmed by the significant ($p<0.01$) increase in blood glucose levels observed in the negative control group compared to the normal control group from Day 5 onwards. This hyperglycaemia was accompanied by a significant ($p<0.01$) decrease in body weight in the diabetic control group, a common consequence of insulin deficiency leading to increased muscle wasting and fat breakdown.

Treatment with the methanolic leaf extract of *Jatropha integerrima* demonstrated significant hypoglycemic activity. Both the low (100 mg/kg) and high (200 mg/kg) doses of the extract resulted in a significant reduction in blood glucose levels compared to the untreated diabetic control group. Notably, the higher dose (200 mg/kg) exhibited a more pronounced effect (30.80% reduction on Day 20), which was comparable to the effect observed with the standard anti-diabetic drug, metformin (34.36% reduction on Day 20). This suggests that the *Jatropha integerrima* leaf extract possesses potent blood glucose-lowering properties.

Furthermore, the treatment with *Jatropha integerrima* extract, particularly at the higher dose, attenuated the diabetes-induced weight loss in the experimental animals. This could be attributed to the improved glycaemic control observed in these groups, as better regulation of blood glucose can help mitigate the catabolic state associated with insulin deficiency.

The preliminary phytochemical screening of the methanolic leaf extract revealed the presence of several bioactive constituents, including alkaloids, flavonoids, carbohydrates, steroids, and tannins. Among these, flavonoids are particularly noteworthy for their known anti-diabetic potential. Flavonoids have been reported to exert hypoglycemic effects through various mechanisms, including enhancing insulin secretion from pancreatic beta cells, improving insulin sensitivity in peripheral tissues, inhibiting carbohydrate-digesting enzymes like alpha-glucosidase, and exhibiting antioxidant activity, which can protect beta cells from oxidative damage often associated with diabetes. The strong antioxidant activity previously reported in flower extracts of *Jatropha integerrima* further supports the potential role of its constituents in mitigating the oxidative stress prevalent in diabetes.

While our study provides compelling evidence for the anti-diabetic potential of *Jatropha integerrima* leaf extract, it is important to acknowledge certain limitations. Firstly, this study was conducted on an animal model, and the results may not directly translate to human physiology. Secondly, although we identified the presence of flavonoids, we did not isolate and identify the specific active compound(s) responsible for the observed effects. Further research is needed to

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pinpoint the exact bioactive molecules within the extract. Thirdly, the precise mechanisms of action underlying the hypoglycemic effects were not fully elucidated in this study.

Future research directions should focus on isolating and characterizing the specific bioactive compounds present in the *Jatropha integerrima* leaf extract. In vitro studies investigating the potential mechanisms of action, such as effects on insulin secretion, glucose uptake, and enzyme inhibition, are warranted. Long-term studies assessing the chronic effects and potential toxicity of the extract are also crucial. Furthermore, comparative studies with other *Jatropha* species or other medicinal plants with known anti-diabetic properties could provide valuable insights. Ultimately, preclinical and clinical trials will be necessary to evaluate the efficacy and safety of *Jatropha integerrima*-based interventions in humans with diabetes.

VI. SUMMARY

This study investigated the anti-diabetic potential of the methanolic leaf extract of *Jatropha integerrima* in streptozotocin (STZ)-induced diabetic Sprague Dawley rats. Diabetes was successfully induced, leading to significant hyperglycaemia and weight loss. Oral administration of the *Jatropha integerrima* leaf extract at both low (100 mg/kg) and high (200 mg/kg) doses for 21 days resulted in a significant reduction in blood glucose levels and an attenuation of weight loss compared to the untreated diabetic control group. The high dose of the extract exhibited a more pronounced hypoglycemic effect, comparable to that of the standard drug, metformin. Phytochemical screening of the extract revealed the presence of alkaloids, flavonoids, carbohydrates, steroids, and tannins, suggesting that these constituents, particularly flavonoids with their known anti-diabetic properties, may contribute to the observed effects. The findings of this study indicate that the methanolic leaf extract of *Jatropha integerrima* possesses significant anti-diabetic potential in this animal model, warranting further research to identify the specific bioactive compounds and elucidate their mechanisms of action for potential development as a novel therapeutic agent for diabetes.

VII. CONCLUSION

In conclusion, our findings demonstrate that the methanolic leaf extract of *Jatropha integerrima* possesses significant hypoglycemic potential in streptozotocin-induced diabetic rats, likely attributed to its rich phytochemical profile, particularly the presence of flavonoids. These results warrant further investigation into the specific bioactive compounds and their mechanisms of action, suggesting that *Jatropha integerrima* could be a promising source for the development of novel herbal-based treatments for diabetes.

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