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Evaluation of antidiabetic activity of ethanolic extract of *Lablab purpureus* leaves in an experimental rat

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Abstract
Previous literature indicates that Lablab purpureus leaves have traditionally been used in the management of diabetes mellitus. The present study was designed to investigate the antidiabetic effect of the ethanolic extract of Lablab purpureus leaves (EELP) in experimental rats. An acute oral toxicity test was carried out on EELP, followed by preliminary phytochemical analysis. Diabetes was induced in Wistar albino rats using alloxan (100 mg/kg, i.p.) and streptozotocin (50 mg/kg, i.p.). Two doses of EELP, 200 mg/kg and 400 mg/kg (p.o.), were administered, while Glibenclamide (5 mg/kg, p.o.) served as the standard reference drug. Antidiabetic activity was assessed by evaluating fasting blood glucose (FBG), serum lipid parameters (cholesterol, triglycerides, HDL, LDL), and pancreatic histopathology. The extract was found to be safe up to 2000 mg/kg in the acute toxicity study. Phytochemical screening confirmed the presence of flavonoids, phenols, alkaloids, and saponins. Both doses of EELP produced a dose-dependent reduction in blood glucose levels in alloxan- and STZ-induced diabetic rats. Histopathological examination of the pancreas revealed partial regeneration of β-cells in extract-treated rats. Overall, the antidiabetic effect of EELP was comparable to that of Glibenclamide.

Keywords: Alloxan, anti-diabetic activity, *Lablab purpureus*, streptozotocin

Introduction
Diabetes mellitus is a metabolic disorder characterized by persistent hyperglycaemia resulting from insufficient insulin secretion, impaired insulin action, or both. It is one of the most widespread metabolic diseases and is associated with serious microvascular and macrovascular complications that significantly contribute to morbidity and mortality [1]. Chronic elevation of blood glucose leads to progressive damage and dysfunction of various organs, particularly the eyes, kidneys, nerves, heart, and blood vessels. Due to inadequate insulin activity on target tissues, disturbances in the metabolism of carbohydrates, fats, and proteins also occur. As the disease advances, these metabolic imbalances can lead to complications such as neuropathy, retinopathy, cardiovascular disorders, and increased susceptibility to infections [2, 3]. If left uncontrolled, diabetes can result in severe outcomes such as stupor, coma, or even death, commonly due to ketoacidosis or, in rare cases, hyperosmolar hyperglycaemic syndrome (HHS) [4].

Diabetes mellitus is broadly classified into three major types: Type 1 diabetes mellitus (T1DM), Type 2 diabetes mellitus (T2DM), and gestational diabetes. T1DM typically develops in children and adolescents, whereas T2DM commonly appears in middle-aged and older adults, often linked to sedentary lifestyle habits and unhealthy dietary patterns [5].

Epidemiological studies show a rapid rise in diabetes worldwide. In 2000, India recorded the highest number of individuals with diabetes (31.7 million), followed by China (20.8 million) and the United States (17.7 million. Global prevalence is projected to increase from 171 million in 2000 to 366 million by 2030, with India contributing the largest share [6]. This growing burden is attributed to rapid urbanization, ageing populations, altered food habits, decreased physical activity, and lifestyle-related stress. Developing countries are expected to account for 77% of diabetes cases in the 21st century [7]. Hypertension also frequently coexists with diabetes, and individuals with diabetes have almost double the risk of developing high blood pressure compared to non-diabetics. The combination of diabetes and hypertension substantially increases the risk of cardiovascular morbidity and mortality [8].

In the present era, diabetes mellitus has emerged as a major global health challenge. Although oral hypoglycaemic agents and insulin are the primary therapeutic options for managing diabetes, their use is often limited by adverse effects, high cost, and issues related to long-term tolerability [9]. These limitations have increased interest in herbal medicines, which are generally considered safer due to their natural origin, better tolerability, and fewer side effects [10]. Herbal remedies not only help in lowering blood glucose levels but also act through multiple mechanisms, including the protection and regeneration of pancreatic β-cells [11].

Traditional plant-based medicines have long played a significant role in the management of diabetes. Reports suggest that more than 1,000 plant species are used worldwide for their antidiabetic properties. Many of these plants contain bioactive constituents such as flavonoids, phenolic compounds, terpenoids, and coumarins, all of which contribute to hypoglycaemic activity [11]. Since oxidative stress is a major factor in the development and progression of diabetes, the antioxidant potential of medicinal plants helps reduce oxidative damage and plays a crucial role in preventing complications such as blindness, nephropathy, and cardiovascular diseases [12, 13].

The use of herbal remedies for diabetes dates back to ancient Ayurvedic texts by Charaka and Sushruta. Recognizing their therapeutic potential, the World Health Organization (WHO) has encouraged the scientific validation of traditional plant-based treatments for diabetes, emphasizing their safety, effectiveness, and suitability for long-term oral use [14].

Materials and Methods

Collection and authentication of plant material

The leaves of the Lablab purpureus were collected from the local area and authenticated by Taxonomist.

Plant Material and Extraction

Fresh leaves of Lablab purpureus were collected, thoroughly washed with tap water and then with distilled water to remove impurities. The cleaned leaves were shade-dried at room temperature for several days, after which they were ground into a fine powder using a mechanical blender and stored in an airtight container. For extraction, 60g of the powdered material was macerated in 300 mL of ethanol and kept on an orbital shaker for 48 hours. The mixture was then filtered, and the filtrate was concentrated under reduced pressure to obtain the extract. The resulting ethanolic extract was stored at 4°C until further use [15].

Preliminary phytochemical evaluation

The ethanolic extract of Lablab purpureus leaves (EELP) was subjected to qualitative phytochemical screening to identify major phytoconstituents. For this purpose, the extract was dissolved in distilled water using a small amount of acacia as a suspending agent. Standard phytochemical tests were performed to detect the presence of various classes of compounds [16].

Experimental Animals

Wistar albino rats (150-250 g) of either sex were used for the study. The animals were maintained under standard laboratory conditions, including a temperature of 22±2 °C, relative humidity of 60±5%, and a 12-hour light/dark cycle. They were provided with a conventional pellet diet and water ad libitum. Rats were housed in sterile polypropylene cages containing clean paddy husk bedding. The experimental protocol was reviewed and approved by the Institutional Animal Ethics Committee (Approval No. SCP/IAEC/F150/P177/2021), and all procedures were carried out in accordance with CPCSEA guidelines for the care and use of laboratory animals.

Experimental methods

Acute oral toxicity evaluation

The acute toxicity study of the extract was performed using three female Wistar rats following OECD Guideline 423. After an overnight fast, the extract was administered orally at a limit dose of 2000 mg/kg body weight. The animals were closely monitored for the first three hours to observe any immediate toxic effects and were further observed for 14 days for mortality, behavioural abnormalities, discomfort, or neurological symptoms [17].

Alloxan induced diabetic activity in rats [18]:

Wistar Albino rats (150-250g) of both sexes were randomly selected and divide into five groups, each including six animals. The groups were allotted as follows:

- **Group I:** Normal control (Vehicle)
- **Group II:** Diabetic control (Alloxan 100 mg/kg, i.p.)
- **Group III:** Diabetic animals (Alloxan 100 mg/kg, i.p. + Glibenclamide 5 mg/kg, p.o.)
- **Group IV:** Diabetic animals (Alloxan 100 mg/kg, i.p.) + EELP (low dose p.o.)
- **Group V:** Diabetic animals (Alloxan 100 mg/kg, i.p.) + EELP (high dose p.o.)

All the animals except group I was made diabetic by a single intraperitoneal injection of Alloxan monohydrate (100 mg/kg body weight) in normal saline. After two days of alloxan injection, the blood glucose level was assessed using glucometer and the animals having a blood sugar level >200mg/dL were selected for the study. Ethanolic extract of Lablab purpureus were administered orally.

Streptozotocin induced diabetic activity in rats [19]

Experimental Design

Wistar Albino rats (150-250g) of both sexes were randomly selected and divide into five groups, each including six animals. The groups were allotted as follows:

- **Group I:** Normal control (Vehicle)
- **Group II:** Diabetic control (STZ 50mg/kg, i.p.)
- **Group III:** Diabetic animals (STZ 50mg/kg, i.p.) + Glibenclamide (5mg/kg, p.o.)
- **Group IV:** Diabetic animals (STZ 50mg/kg, i.p.) + EELP (low dose p.o.)
- **Group V:** Diabetic animals (STZ 50mg/kg, i.p.) + EELP (high dose p.o.)

All the animals except Group I was made diabetic by a single intraperitoneal injection of Streptozotocin (50 mg/kg body weight) in normal saline. After two days of streptozotocin injection, the blood glucose level was assessed and the animal having a blood sugar level >200 mg/dL were selected for the study. Ethanolic extract of Lablab purpureus were administered orally.

Evaluation
Blood samples were collected from the tail vein on days 7, 14, 21, and 30 of treatment to determine fasting blood glucose levels using a single-touch glucometer. Body weight, food intake, and water intake were recorded weekly throughout the experimental period. On day 30, terminal blood collection was performed via cardiac puncture under light anaesthesia. Serum was separated and analysed for biochemical parameters including fasting glucose, total cholesterol, triglycerides, HDL-cholesterol, and LDL-cholesterol using a semi-auto analyser.

Histopathological Studies
Pancreatic tissues were fixed in 10% formalin and subsequently washed under running water. The samples were dehydrated using graded concentrations of isopropyl alcohol and embedded in paraffin wax. Thin tissue sections were prepared using a microtome, followed by staining with eosin. The stained sections were examined microscopically to assess various histopathological features [20].

Methods for Estimation of Biomarkers
Serum biochemical parameters were determined using standard procedures described in the instruction manuals of the respective commercial diagnostic kits. All measurements were carried out using a semi-auto analyser in accordance with the manufacturer's guidelines [21].

Statistical Analysis
The experimental data were provided as mean ± SEM. Statistical comparisons between groups were carried out using one-way analysis of variance (ANOVA), followed by Tukey's multiple comparison test to determine significance levels.

Result

Preliminary phytochemical screening:
The preliminary phytochemical screening of ethanolic extract of Lablab purpureus was performed as per standard procedure and revealed the presence of Alkaloids, Phenols, Saponins and Flavonoids.

Acute oral toxicity study
EELP was studied for oral acute toxicity at dose 2000mg/kg of bodyweight p.o. route according to OECD guideline no.423. Animals were administered with single dose of 2000mg/kg and observed for its behavioural, neurological and mortality profile for the first 4 hours after dosing followed by 14 days study period. There was no mortality amongst the dosed groups of animals and did not show any toxicity or behavioural changes and the extract found to be safe or non-toxic in rats.

Alloxan induced antidiabetic activity
The Fasting blood glucose (FBG) level was within the range of 70-100 mg/dL in all the groups at day 0. The animals treated with alloxan in normal saline (100 mg/kg. i.p.) had shown an increased FBG level, which is more than 200 mg/dL after 48 hours. Changes in the FBG level after repeated dose administration in different groups are tabulated in Table no. 01 and represented in Fig. no. 01.

Table 1: Effect of EELP on blood glucose level in alloxan induced diabetic rats

Groups	Blood glucose level (mg/dL)				
	Initial	Day 7	Day 14	Day 21	Day 30
Normal control	90.50±1.65	91.00±0.73	91.00±1.75	90.17±1.10	90.83±0.60
Diabetic control	292.0± 4.38$^{\#}$	294.5±2.377$^{\#}$	299.2± 4.79$^{\#}$	301.3± 1.14$^{\#}$	303.5±0.88$^{\#}$
Glibenclamide (5 mg/kg)	284.2±6.19 ^{ns}	208.5±3.85 ***	184.0± 1.63 ***	169.0±4.69 ***	130.8±1.77 ***
EELP (200 mg/kg)	287.3±4.55 ^{ns}	283.3± 3.85^{ns}	277.5± 3.99*	258.5±2.51*	197.8±1.42**
EELP (400 mg/kg)	288.0±5.41 ^{ns}	279.3± 3.80*	266.8± 4.43**	246.7±5.22 **	183.3± 1.25***

Values are expressed as Mean± S.E.M, n=6 in all group except in diabetic control, n=4 on 30th day (1 animals died on 21st day, and 1 died on 25th day). One way ANOVA followed by Tukey's multiple comparison tests. *p<0.05, ** P<0.01, *** P<0.001 when compared to diabetic control group and $^{\#}$ p<0.001 compare to normal control group. Ns denotes non-significant.

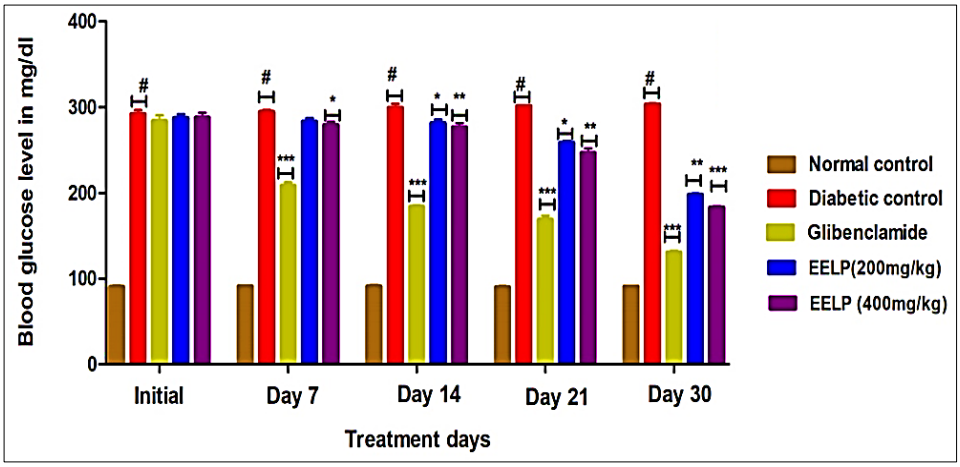

Fig 1: Effect of EELP on blood glucose level in Alloxan induced diabetic rats.

Effect on body weight
The bodyweight of animals was assessed because bodyweight found to be declined during diabetes. In order to detect whether the ethanolic extract of *Lablab purpureus* has the ability to restore weight loss during disease progression, body weight changes of the animals were determined. Changes in body weight are tabulated in Table no.07 and represented in Fig. no.13.

Table 2: Bodyweight in Alloxan induced diabetic rats.

Groups	BODY WEIGHT (Grams)				
	Initial	Day 7	Day 14	Day 21	Day 30
Normal control	207.5±4.61	210.0±3.6	212.5±4.61	213.0±3.07	214.2±3.00
Diabetic control	209.2±4.72	199.2±5.06	188.33±4.21	184.2±4.36	182.5±3.59
Glibenclamide (5 mg/kg)	205.00±7.63	202.5±7.38	204.2±7.23	205.8±6.50	207.5±5.73
EELP (200 mg/kg)	208.3±8.81	203.3±8.23	204.2±7.89	204.2±6.76	205.0±6.19
EELP (400 mg/kg)	205.0±4.28	202.5±4.03	202.5±5.88	203.3±5.11	204.2±4.54

Values are expressed as Mean± S.E.M, n=6 in all group except in diabetic control, n=4 on 30th day (1 animals died on 21st day, and 1 died on 25th day). One way ANOVA followed by Tukey's multiple comparison tests.

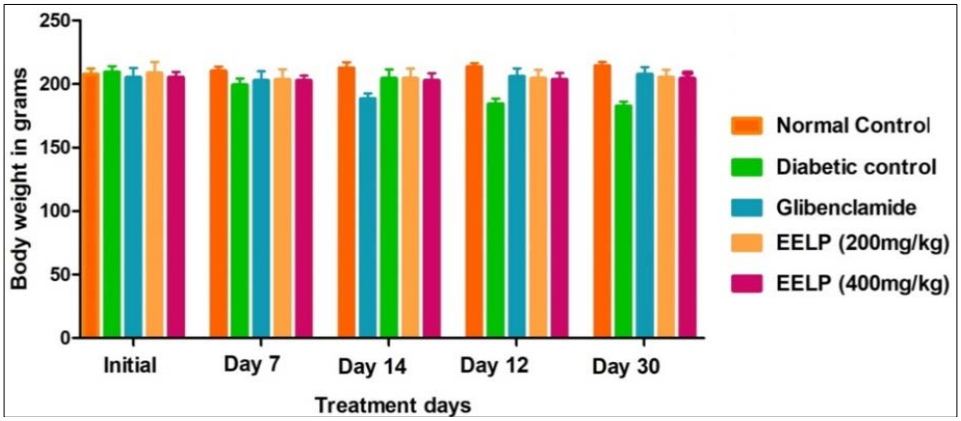

Fig 13: Effect of EELP on animal body weight in Alloxan induced diabetic rats

Streptozotocin induces anti-diabetic activity

The Fasting blood glucose (FBG) level was within the range of 70-100 mg/dL in all the groups at day 0. Treatment with STZ in normal saline (50 mg/kg, i.p.) had increased the FBG level more than 200 mg/dL after 48 hours. Changes in FBG levels in different groups after repeated dose of drug administration are tabulated in Table no. 03 and represented in Fig. no. 03.

Table 3: Effect of EELP on blood glucose level in STZ induced diabetic rats

Groups	Blood glucose level (mg/dL)				
	Initial	Day 7	Day 14	Day 21	Day 30
Normal control	91.33±1.40	90.00±2.03	90.17±1.49	90.33±1.05	91.50±0.76
Diabetic control	254.5±7.23 #	260.2±7.29 #	262.8±7.06 #	265.2±5.87 #	281.0±2.88 #
Glibenclamide (5 mg/kg)	257.8±7.55 ns	222.7±4.31 ***	193.8±8.86 ***	162.7±6.22 ***	128.7±1.45 ***
EELP (200 mg/kg)	267.2±8.02ns	251.8±4.12ns	243.0±4.87 ns	237.7±5.32 *	190.8±3.84 **
EELP (400 mg/kg)	277.7±2.95 ns	261.8±4.46 ns	239.5±3.84*	214.2±5.09 **	182.0±3.04 ***

Values are expressed as Mean± S.E.M, n=6 in all group except in diabetic control, n=5 on 30th day (1 animals died on 22nd day). One way ANOVA followed by Tukey's multiple comparison tests. *p<0.05, ** P<0.01, *** P<0.001 when compared to diabetic control group and # p<0.001 compare to normal control group. Ns denotes non-significant.

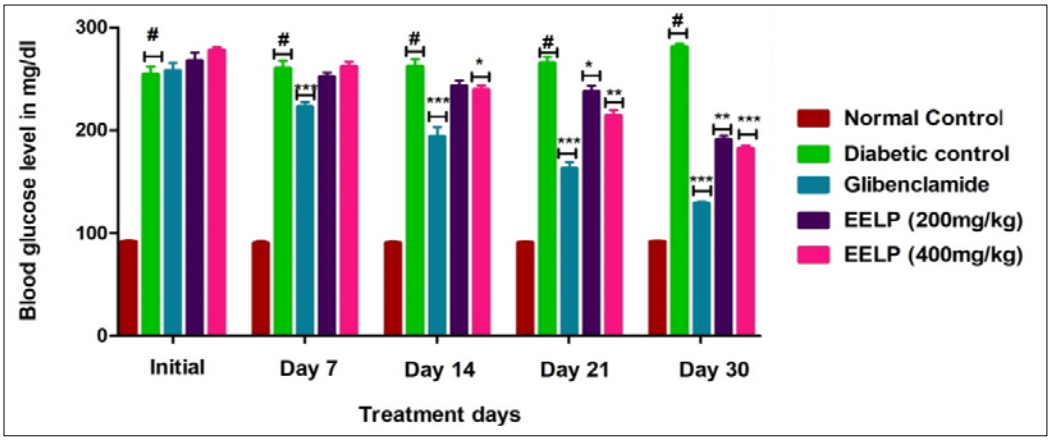

Fig 3: Effect of EELP on blood glucose level in STZ induced diabetic rats.

Effect on bodyweight:

The bodyweight of animals was assessed because bodyweight found to be declined during diabetes. In order to detect whether the ethanolic extract of *Lablab purpureus* has the ability to restore weight loss during disease progression, body weight changes of the animals were determined. Changes in body weight are tabulated in Table no. 04 and represented in Fig. no.04.

Table 4: Body weight in STZ induced diabetic rats.

Groups	BODY WEIGHT (Grams)				
	Initial	Day 7	Day 14	Day 21	Day 30
Normal control	200.8 ±1.53	203.3 ±1.66	205.8 ±1.53	207.5 ±1.11	208.3 ±1.05
Diabetic control	200.0 ±1.82	190.0 ±2.58	185.0 ±2.58	180.0 ±2.58	178.3 ±2.10
Glibenclamide (5 mg/kg)	200.0 ±1.29	201.7 ±1.66	202.5 ±2.14	203.3 ±2.10	204.2 ±1.53
EELP (200 mg/kg)	196.7 ±4.01	192.5 ±3.81	192.0 ±3.60	193.3 ±4.41	194.2 ±3.96
EELP (400 mg/kg)	195.8 ±3.00	193.3 ±2.47	193.1 ±3.27	194.2 ±2.71	195.0 ±3.16

Values are expressed as Mean± S.E.M, n=6 in all group except in diabetic control, n=5 on 30th day (1 animals died on 22nd day). One way ANOVA followed by Tukey's multiple comparison tests.

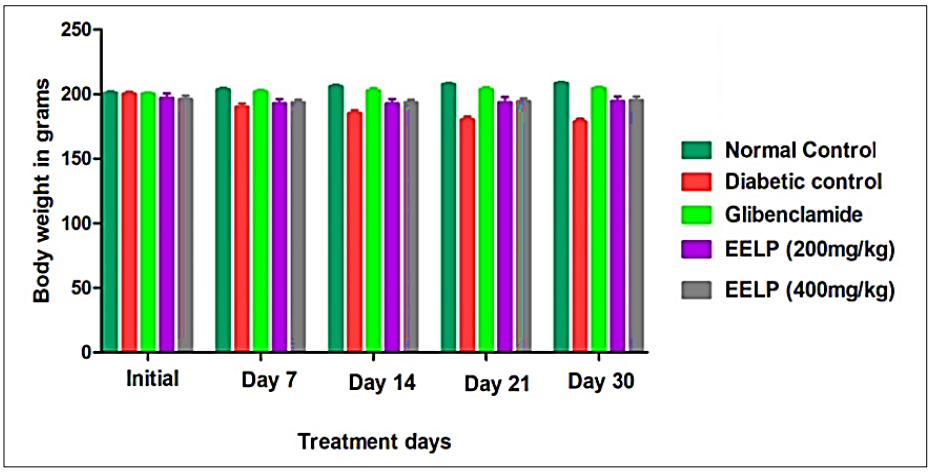

Fig 4: Effect of EELP on animal body weight in STZ induced diabetic rats

Serum lipid profile: Hyperglycemia and hypercholesterolemia are the two major problems associated with diabetes and are responsible for vascular complications. It was known that the increase in glycaemia in Alloxan and STZ induced diabetic rats is associated with dyslipidemia characterized by elevated serum triglycerides and total cholesterol levels. The dyslipidemia profile of diabetic rats is characterized by an increase in total cholesterol, LDL, TG, and a decreased level of HDL.

Effect of EELP on serum lipid profile in alloxan induced diabetic rats

The serum lipid profile in alloxan induced diabetic rats is tabulated in Table no. 05 and represented in Fig. no. 05.

Table 5: Effect of EELP on serum lipid profile in Alloxan induced diabetic rat.

Groups	Parameters (mg/dL)			
	Total Cholesterol	Triglyceride	HDL	LDL
Normal control	133.3±1.52	80.83±2.72	37.17±1.40	97.67±3.33
Diabetic control	205.7±1.38 #	203.0±5.40 #	29.33±0.88 #	149.67±2.55 #
Glibenclamide (5 mg/kg)	135.2±2.27 ***	94.33±2.55 ***	35.50±0.76 **	111.5±2.44 ***
EELP (200 mg/kg)	178.3±4.89 ***	181.5±2.21 **	31.00±0.85 *	138.8±0.60ns
EELP (400 mg/kg)	162.5±1.38 ***	152.7±2.84 ***	32.17±1.49 **	122.5±1.47*

Values are expressed as Mean±S.E.M, n=6 in all group except in diabetic control, n=4 on 30th day (1 animals died on 21st day, and 1 died on 25th day). One way ANOVA followed by Tukey's multiple comparison tests. *p<0.05, ** P<0.01, *** P<0.001 when compared to diabetic control group and # p<0.001 compare to normal control group. Ns denotes non-significant.

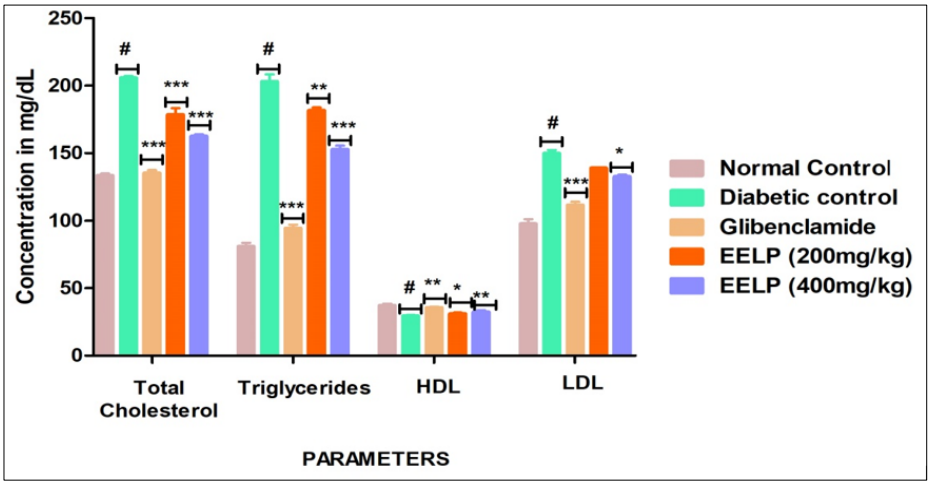

Fig 5: Effect of EELP on serum cholesterol, triglycerides, HDL, and LDL in alloxan induced diabetic rat.

Effect of EELP on serum lipid profile in STZ induced diabetic rats: The serum lipid profile in STZ induced diabetic rats is tabulated in Table no. 06 and represented in Fig. no. 06.

Table 6: Effect of EELP on Serum lipid profile in STZ induced diabetic rat.

Groups	Parameters (mg/dL)			
	Total Cholesterol	Triglyceride	HDL	LDL
Normal control	130.5±1.89	80.50±1.68	38.67±0.88	99.00±1.34
Diabetic control	186.5±2.17 #	206.7±2.15 #	28.83±0.70 #	103.0±1.48 #
Glibenclamide (5 mg/kg)	129.8±1.24 ***	97.83±2.54 ***	36.67±1.05 ***	108.5±1.70 ***
EELP (200 mg/kg)	175.7±1.78 **	195.0±1.52 **	32.00±1.88 ns	125.5±1.44 ns
EELP (400 mg/kg)	162.0±1.03 ***	164.8±1.99 ***	36.17±1.13 **	123.7±1.14 *

Values are expressed as Mean± S.E.M, n=6 in all group except in diabetic control, n=5 on 30th day (1 animals died on 22nd day). One way ANOVA followed by Tukey's multiple comparison tests. *p<0.05, ** P<0.01, *** P<0.001 when compared to diabetic control group and # p<0.001 compare to normal control group. Ns denotes non-significant.

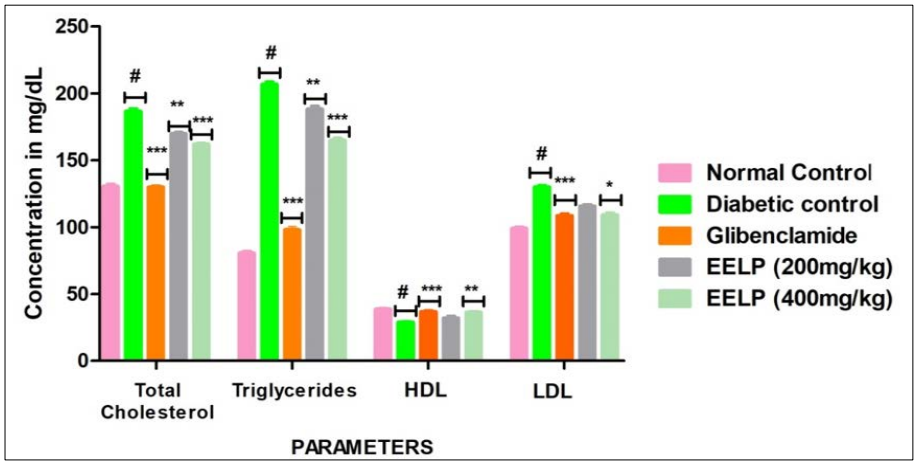

Fig 6: Effect of EELP on serum cholesterol, triglycerides, HDL, and LDL in STZ induced diabetic rat.

Histopathology Studies

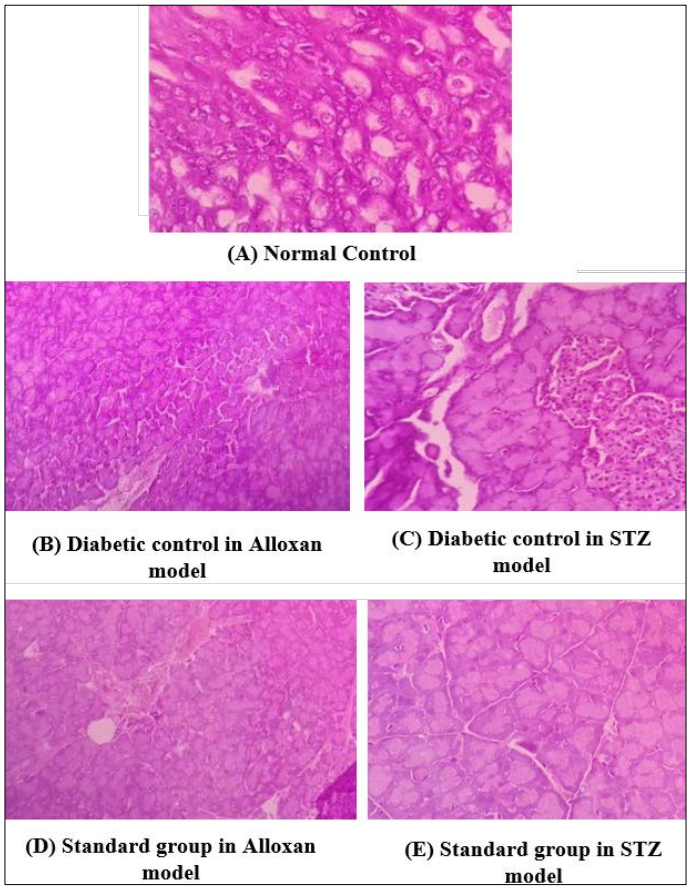

Fig 7: Histopathology studies of pancreas

The histological structure of the control group pancreas consisted of closely packed lobules of pancreatic acini (Fig.no.07.A). Pancreatic tissues of diabetic control animals showed decreased islets size, decreased β- cells number, and irregular islet shapes with degenerated connective tissue sheet (Fig.no.07.B and 17.C). Glibenclamide treated group pancreatic tissues showed marked improvement with restored size of islets of Langerhans, regular and increased number of islets cells, and restored islets shape and size. (Fig.no.07.D and 07.E). EELP 400 mg/kg (high dose) treated group showed moderate improvement in pancreatic islets size, increased number of β- cells with the presence of many vacuoles in between the interstitial loose connective tissue, and relatively restored islets covering connective tissue sheet. (Fig.no.07.F and 07.G).

Discussion

Diabetes mellitus is a metabolic disorder of multiple etiologies, characterized by persistent hyperglycaemia and disturbances in carbohydrate, lipid, and protein metabolism resulting from impaired insulin secretion, deficient insulin action, or both. Although synthetic antidiabetic drugs remain a major therapeutic approach, their use is often associated with limitations such as adverse effects, high cost, and reduced long-term tolerability. Consequently, many patients turn to herbal remedies, which have been used since ancient times for the management of diabetes. Numerous studies have demonstrated that many medicinal plants exhibit hypoglycaemic activity due to the presence of bioactive phytochemicals with antidiabetic potential. These plant-based therapies are preferred for their lower toxicity, minimal side effects, affordability, and wide availability compared to conventional medicines [22]. The present study investigates the antidiabetic activity of the ethanolic extract of Lablab purpureus leaves in alloxan- and streptozotocin-induced diabetic rat models.

The preliminary phytochemical evaluation of the EELP had shown the presence of chemical constituents such as alkaloids, flavonoids, phenols, and saponins. Even though several synthetic medications have been produced to treat diabetes, there are still very few pharmaceuticals accessible for the treatment of diabetes. Several literature surveys revealed that the chemical compounds such as alkaloids, flavonoids, polysaccharides, saponins, carbohydrates, glycosides, steroids, terpenoids, peptides and amino acids, lipids, phenols are reported to show blood glucose lowering effect [23].

The acute oral toxicity study of Lablab purpureus extract was carried out in three female Wistar albino rats, following OECD Guideline 423. A single oral dose of EELP was administered, and the animals were observed for 14 days to monitor any behavioural abnormalities, toxicity symptoms, or mortality. Throughout the observation period, no adverse effects were noted, indicating that the extract was safe up to 2000 mg/kg body weight. As body weight loss is a sensitive marker of toxicity, the stable body weight and normal food intake of the treated animals further confirmed the safety of the extract. Based on these findings, doses of 200 mg/kg and 400 mg/kg were selected for the pharmacological investigation. In this study, alloxan and streptozotocin were used to induce diabetes in rats, while Glibenclamide served as the standard reference drug.

The normoglycemic group of rats had shown a stable blood glucose level throughout the study period. The diabetic control group rats showed an elevated blood glucose level compared to normal control group rats. This is an indication of the disease. Reduction in blood glucose levels were observed in all the treated groups during the study period. The group of animals treated with a standard drug and 400 mg/kg of *Lablab purpureus* shown significant hypoglycaemia compared to diabetic control group. Whereas 200mg/kg *Lablab purpureus* also shown reduced blood glucose level in diabetic rats, but 400 mg/kg has more efficient action as reduction in blood glucose levels were statistically highly significant. The results suggest that EELP (400mg/kg) has significant glucose lowering activity which is comparable with standard drug, Glibenclamide. The elevated level of glucose due to the progression of the disease was restored to normal by *Lablab purpureus* in a dose-dependent manner. The results in the present study indicate that the leaf extract of *Lablab purpureus* were found to be effective against both alloxan and streptozotocin induced diabetes.

Changes in the bodyweight of the rats were recorded on the initial, 7th, 14th, 21st and 30th days of treatment. All groups of animals except the normal control group showed an initial decrease in body weight. The diabetic control group showed the significantly reduced body weight throughout the study, which is an indication of the disease progression. The standard group, EELP 200mg/kg, and EELP 400mg/kg group showed a significant increase in body weight when compared with the diabetic control group. The animals treated with a standard and two doses of test drugs significantly retained their body weight to normal condition from alloxan and streptozotocin action in the pancreas. The results suggest the effectiveness of the EELP to restore the body weight in experimental animals which are comparable with that of the standard drug Glibenclamide.

Hyperglycaemia and hypercholesterolemia are the two major problems associated with diabetes and is responsible for vascular complications. It was known that the increase in glycaemia in Alloxan and STZ induced diabetic rats is associated with dyslipidaemia characterized by elevated serum triglycerides and total cholesterol levels. The dyslipidemic profile of diabetic rats are characterized by increase in total cholesterol, LDL, VLDL, TG and a decreased level of HDL [24].

The EELP and Glibenclamide treated groups significantly reduced total cholesterol and triglycerides levels compared to diabetic control. It also shown reduction in elevated LDL level and found to increase in HDL level in both the alloxan and STZ induced diabetic models. These improvements in lipid profile of test treated groups were comparable to standard treated groups and explored the protective activity of *Lablab purpureus* in diabetic hypercholesterolemia. The results suggest that administration of EELP (400mg/kg) significantly restored TC, TG, LDL, and HDL levels to their normal values indicating treatment efficiency and it might be due to its lipid lowering activity.

Histopathological examination of the pancreas indicated that the diabetic animal's pancreatic islets were deteriorated, with shrinking cell size and fewer pancreatic islets. In the normal control group animals, the cells appeared normal and being proliferated. Glibenclamide treated group suggest complete restoration of normal cellular size of islet of Langerhans and absence of islet damage. And the diabetic treated with both doses of EELP shows partly restoration of normal cellular population size of the islets of Langerhans and absence of

islet damage. Thus, the histopathological findings showed marked improvement after 30 days. The activity of EELP has triggered the β cells to increase insulin production which promotes glucose uptake and utilization by other tissues.

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