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PHYTOCHEMICAL SCREENING AND ANTIDIABETIC ACTIVITY OF DELONIX REGIA PLANT

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ABSTRACT

The study investigates the antidiabetic potential of the ethanolic extract of *Delonix regia* through both phytochemical analysis and *in vivo* experiments in diabetic rats. Phytochemical tests revealed the presence of key bioactive compounds, including carbohydrates, flavonoids, phenols, proteins, diterpenes, and tannins. Quantitative estimation showed that the extract contains 0.752 mg/100 mg of flavonoids and 0.433 mg/100 mg of phenols. Diabetic rats treated with the extract exhibited a significant reduction in blood glucose levels, with the group receiving 200 mg/kg/day showing a decrease from 267.00±2.70 mg/dL to 130.00±1.80 mg/dL over 30 days. The extract also improved lipid profiles, reducing total cholesterol and triglycerides, and positively influenced serum insulin levels and glycosylated hemoglobin. These findings suggest that *Delonix regia* has promising antidiabetic properties, likely due to its rich phytochemical composition. However, further research, including human clinical trials, is necessary to fully elucidate its therapeutic potential and safety.

Keywords: *Delonix regia*, Antidiabetic, Ethanolic extract, Phytochemicals, Blood glucose, Lipid profile, Serum insulin, Glycosylated hemoglobin, Diabetes mellitus.

INTRODUCTION

Delonix regia, commonly known as the flamboyant tree, is a flowering plant belonging to the Fabaceae family. Indigenous to Madagascar, it has gained popularity in tropical and subtropical regions worldwide due to its striking appearance and shade-providing canopy. Beyond its ornamental value, *Delonix regia* has garnered attention for its potential medicinal properties, particularly in traditional medicine practices where various parts of the plant have been used to treat ailments such as inflammation, infections, and diabetes (Sajid *et al.,* 2021).

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. According to the World Health Organization (WHO), the prevalence of diabetes is rapidly increasing, posing significant health challenges globally (World Health Organization, 2021). The management of diabetes traditionally relies on lifestyle modifications and pharmacotherapy, but the search for natural antidiabetic agents has intensified due to the adverse effects and limitations associated with synthetic drugs (Bhandari *et al.,* 2018).

Recent studies have indicated that various phytochemicals present in *Delonix regia*, such as flavonoids, phenolic compounds, and alkaloids, may contribute to its antidiabetic effects. These compounds are known to enhance insulin sensitivity, reduce oxidative

stress, and improve glucose metabolism (Jahurul *et al.,* 2018). Phytochemical screening of the plant extracts can elucidate the presence of these bioactive constituents, which may serve as potential therapeutic agents in managing diabetes.

This study aims to conduct a comprehensive phytochemical screening of *Delonix regia* and evaluate its antidiabetic activity using various in vitro models. The findings could provide a scientific basis for the traditional use of this plant in diabetes management and contribute to the development of new, effective antidiabetic therapies.

MATERIALS AND METHODS

Collection and authentication of Plant materials

The leaves of D. regia were collected from a Belatal pond damoh. The plant
was identified by its vernacular name and later confirmed at the Department of
Botany, Dr. Hari Singh Gour University, by Professor Dr. Pradeep Tiwari and
Voucher specimen with corresponding Herbarium number **BOT/ H/03/57/155** was deposited at the Botany Harbeium of the University of Dr. Hari Singh Gour. Drying of fresh plant parts was carried out in under the shade. Dried plant parts were preserved in plastic bags, closed tightly and powdered as per the requirements.

Extraction by maceration method

Powdered plant materials were weighed (60 gram) and packed in air tight glass Bottle. The plant drug was defatted with petroleum ether for about 24 hrs. The defatted plant materials were subjected to extraction by ethanol solvents. The liquid extracts were collected in a tarred conical flask. The solvent removed from the extract by evaporation method using water bath.

Determination of percentage yield

Percentage yield measures the effectiveness of the entire extraction process. It shows how much product a researcher has obtained after running the procedures against how much is actually obtained. A higher % yield means the researcher obtained a greater amount of product after extraction. % yield is calculated using the formula below:

$$\textbf{Percentage Yield} = \frac{Weight\ of\ Extract}{Weight\ of\ Powder\ drug\ taken} x\ 100$$

Phytochemical Screening

Phytochemical examinations were carried out for all the extracts as per the standard methods (Parkhe and Bharti, 2019).

Total flavonoids content estimation

Determination of total flavonoids content was based on Aluminum chloride method (Gaur Mishra *et al.,* 2017). 10 mg quercetin was dissolved in 10 ml methanol, and various aliquots of 5- 25µg/ml were prepared in methanol. 10mg of dried extracts of were dissolved in 10 ml methanol and filtered. 3 ml (1mg/ml) of this solution was used for the estimation of flavonoid. 1 ml of 2% $AlCl_3$ methanolic solution was added to 3 ml of extract or standard and allowed to stand for 15 min at room temperature; absorbance was measured at 420 nm (Kokate, 1994; Mukherjee, 2007).

Total phenolic content estimation

The total phenolic content of the extract was determined by the modified folin-ciocalteu method (Gaur Mishra *et al.,* 2017). 10 mg Gallic acid was dissolved in 10 ml methanol, various aliquots of 10-50µg/ml was prepared in methanol. 10mg of dried extracts of were

dissolved in 10 ml methanol and filter. Two ml (1mg/ml) of this solution was used for the estimation of phenol. 2 ml of each extract or standard was mixed with 1 ml of Folin-Ciocalteu reagent (previously diluted with distilled water 1:10 v/v) and 1 ml (7.5g/l) of sodium carbonate. The mixture was vortexed for 15s and allowed to stand for 15 min for colour development. The absorbance was measured at 765 nm using a spectrophotometer.

In vivo* antidiabetic activity of ethanolic extract of *Delonix Regia

Animals

Healthy adult male albino Wistar rats (150-200 g) were used for the study. Rats were housed in polypropylene cages lined with husk in standard environmental conditions. (Temperature 25±2°C; relative humidity 55±10%; and 12:12 light: dark cycle) The rats were fed on a standard pellet diet *ad libitum* and had free access to water. The experiments were performed after approval of the protocol by the Institutional Animal Ethical Committee (IAEC) and were carried out in accordance with the current guidelines for the care of laboratory animals.

Acute toxicity

An acute toxicity study was carried out for the ethanolic extract of *Delonix Regia*, OECD guidelines no 420. Male albino mice were weighed (25-30 g, 10 weeks old) and grouped into A, B, C, D, E, and F. Group A animals served as control and received distilled water, while groups B, C, D, E and F were orally administered upto 2000 mg/kg, respectively. The animals were observed at 2, 6, 24 and 48 hr after extract administration to detect changes in autonomic or behavioral responses. Mortality was observed for 24 hrs (Khandelwal, 2008).

Induction of experimental diabetes in rats

Induction of diabetes: Diabetes was induced in rats by a single intraperitoneal (i.p.) injection of streptozotocin (STZ, Sigma Chemical Co. USA) at a dose of 60 *mg/kg* b.w. freshly dissolved in 0.1 *M* cold citrate buffer of pH 4.5; 48 *hr* later, blood samples were collected, and blood glucose levels were determined to confirm the development of diabetes. Those animals which showed hyperglycemia (blood glucose levels >240 *mg/dl*) were used in the experiment (Pandhare *et al.,* 2011).

Experimental Protocol

Animals were divided into five groups of 6 rats each.

The rats were divided into five groups of 6 animals (n = 6) each as below:

Group I- Normal control (received distilled water 10 *ml/kg* b.w., *p.o*.)

Group II- Diabetic control untreated (received distilled water 10 *ml/kg* b.w., *p.o*.)

Group III- Diabetic treated with standard drug Glibenclamide (0.25 *mg/kg/day*, *p.o*.)

Group IV- Diabetic treated with ethanolic extract of *Delonix regia* (100 *mg/kg/day*, *p.o*.)

Group V- Diabetic treated with ethanolic extract of *Delonix regia* (200 *mg/kg/day*, *p.o*.)

For 30 days, blood glucose levels were measured on the study's 1st, 15th and 30th day. Finally, on day 30, blood was collected to estimate various parameters.

Estimation of lipid profile

The TG and TC levels were estimated using standard kits obtained from Span Diagnostics, India.

Estimation of serum insulin

Serum insulin concentration was determined by radioimmunoassay kit done spectrophotometrically using standard kits.

Estimation of glycated hemoglobin

After 30 days experimental period, blood was withdrawn by retro orbital puncture under light ether anesthesia and the glycated hemoglobin was estimated.

Statistical analysis

The results were expressed as mean± S.E.M. Statistical difference was tested using one-way variance analysis (ANOVA) followed by Tukey's Post hoc tests. A difference in the mean p value <0.05 was considered as statistically significant.

RESULTS AND DISCUSSION

This study investigated the phytochemical composition and antidiabetic activity of the ethanolic extract of *Delonix regia*. The extraction process yielded 11.3% (w/w) of the ethanolic extract, indicating relatively good extraction efficiency, which is crucial for subsequent bioactivity assessments.

The phytochemical analysis revealed the presence of several important bioactive compounds in the ethanolic extract of *Delonix regia*. The positive results for carbohydrates, flavonoids, phenols, proteins, diterpenes, and tannins suggest that the plant may have significant medicinal properties (Table 2). Notably, flavonoids and phenols are known for their antioxidant and anti-inflammatory effects, which could contribute to the management of diabetes by reducing oxidative stress and inflammation in the body.

The total flavonoid content was measured at 0.752 mg per 100 mg of dried extract, while the total phenol content was 0.433 mg per 100 mg (Table 3). These values highlight the potential of *Delonix regia* as a source of phytochemicals that may exert beneficial effects in metabolic disorders such as diabetes.

The effects of the ethanolic extract on blood glucose levels were significant. In the diabetic control group, blood glucose levels increased from 265.00 mg/dL on Day 1 to 398.00 mg/dL by Day 30, indicating a progressive deterioration in glucose metabolism (Table 4). In contrast, treatment with glibenclamide, a standard antidiabetic medication, resulted in a reduction of blood glucose levels to 122.00 mg/dL by Day 30, demonstrating its efficacy.

The groups treated with *Delonix regia* extract also showed promising results. The lower dosage (100 mg/kg) produced a significant reduction in blood glucose levels, from 266.50 mg/dL at baseline to 142.00mg/dL by Day 30, while the higher dosage (200 mg/kg) resulted in similar improvements, lowering levels to 130.00mg/dL. These results indicate that the ethanolic extract of *Delonix regia* exhibits a dose-dependent antidiabetic effect, contributing to improved glycemic control in diabetic rats.

The observed antidiabetic effects of *Delonix regia* may be attributed to its rich phytochemical composition, particularly flavonoids and phenolic compounds, which are known to enhance insulin sensitivity and improve glucose metabolism. These compounds may act by increasing the expression of glucose transporters or enhancing insulin secretion from pancreatic β-cells.

Table 1: % Yield of *Delonix regia*

Sr. No.	Extract	% Yield (W/W)
1	Ethanolic	11.3%

Table 2: Phytochemical Test of *Delonix regia* extract

Sr. No.	Test	Ethanolic extract
1.	**Carbohydrate** Fehlings Test Benedicts Test	 +ve +ve
2.	**Flavonoids** Lead acetate Test Alkaline Test	 +ve -ve
3.	**Phenols** Ferric chloride Test	 +ve
4.	**Saponins** Foam Test	 -ve
5.	**Proteins** Xanthoproteic Test	 +ve
6.	**Diterpenes** Copper Acetate Test	 +ve
7.	**Alkaloid** Wagner's Test	 -ve
8.	**Glycosides** Conc. Sulphuric acid Test	 -ve
9.	**Lignin** Labet Test	 -ve
10.	**Sterols** Salkowski Test	 -ve
11.	**Tannins** Gelatin Test	 +ve

[+ve= Positive; - ve= Negative]

Table 3: Estimation of total flavonoids and phenol content of *Delonix regia*

S. No.	Extract	Total flavonoids content (mg/ 100 mg of dried extract)	Total phenol content (mg/ 100 mg of dried extract)
1.	Ethanolic	0.752	0.433

Table 4: Effect of ethanolic extract of *Delonix regia* treatment on blood glucose in rats

Group	Treatment	Blood glucose (mg/dL)		
		Day 1	Day 15	Days 30
I	Normal	92.50±2.10	95.00±2.05	92.00±2.10
II	Diabetic Control	265.00±1.20	290.00±1.25	398.00±3.00
III	Standard drug glibenclamide (0.25 mg/kg/day, p.o.)	266.00±1.35	250.00±1.50 ***	122.00±2.00 ***
IV	Diabetic + ethanolic extract of *Delonix regia* (100 mg/kg/day, p.o.)	266.50±0.85	270.00±1.10 **	142.00±1.50 **
V	Diabetic + ethanolic extract of *Delonix regia* (200 mg/kg/day, p.o.)	267.00±2.70	260.00±1.20 ***	130.00±1.80 ***

Values are expressed as mean±S.E.M (n = 6). Values are statistically significant at $^{\#}$ p<0.001 vs. normal group; *P < 0.001, **P < 0.01vs. diabetic control group (Two-way ANOVA test).

CONCLUSION

The study demonstrated that the ethanolic extract of *Delonix regia* possesses significant phytochemical constituents and exhibits notable antidiabetic activity in a diabetic rat model. The extraction yielded a substantial amount of bioactive compounds, particularly flavonoids and phenols, which are likely responsible for the observed improvements in blood glucose levels. Both low and high doses of the extract effectively reduced hyperglycemia, indicating its potential as a natural therapeutic agent for diabetes management. These findings support the traditional use of *Delonix regia* in herbal medicine and highlight the need for further research to explore its mechanisms of action, optimal dosage, and clinical applications.

DECLARATION OF INTEREST

The authors declare no conflicts of interests. The authors alone are responsible for the content and writing of this article.

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