

REVIEW ARTICLE

PHARMACOLOGY

**“A COMPARATIVE STUDY ON THE ANTIDIABETIC EFFECT OF NELUMBO NUCIFERA AND GLIMEPIRIDE IN STREPTOZOTOCIN INDUCED DIABETIC RATS”**

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**ABSTRACT**

The present study is aimed to evaluate the anti diabetic effect of *Nelumbo nucifera* rhizome and flower extracts on serum glucose level in normal and streptozotocin induced diabetic rats. The various extracts was prepared and screened for their effects on serum glucose level in rats. In streptozotocin induced animals the various extracts showed significant anti diabetic property. From the result of these studies, we can conclude that the *Nelumbo nucifera* rhizome and flower extract is a promising anti diabetic agent.

## KEYWORDS

Nelumbo nucifera, anti diabetic activity, streptozotocin induced diabetic rats.

## INTRODUCTION

Medicinal plants play a paramount role in the new era of modern medicine. Numerous medicine plants and their formulations are used for various disorders in ethno medical practices as well as in the traditional systems of medicine. Diabetes mellitus is a chronic metabolic disease caused by a variable combination of two pathogenic factors: insulin deficiency and insulin resistance. The result is disordered utilization and storage of the proximate nutrients (carbohydrates, proteins and fats) and reduced production of energy in the form of ATP. Hyperglycemia is the most easily measured laboratory marker and the liability of chronic degenerative disease is almost all body tissues.

## MATERIALS AND METHODS

Soxhlet apparatus, distilled rhizome and flower powder of *Nelumbo nucifera*, The plant was collected in and around salem and Dharmपुरi District, in the month of march, which was identified by Pharmacognosy Department and authenticated by Department of Botany, Pee Gee College of Arts And Sciences.

### Extraction

The collected, cleaned and powdered rhizome and flower of *Nelumbo nucifera* was used for the extraction process. 500 gm of powdered leaf material was evenly packed in the soxhlet apparatus it was then extracted with mineral water and ethyl alcohol. The solvent used was purified before use. After extraction the mixture was filtered and the filtrate was collected and concentrated. The residue was collected. Then the dried extract was used for the animal studies and phyto chemical screening.

### Animals

Male albino rats of (Wistars) strain weighing around. 160-180 gm were taken for the study.

The animals were allowed to acclimatize to laboratory condition for 10 days after their arrival. The animals were housed into group of four under standard housing conditions and maintained in a 12h/12h light/dark cycle.

### Induction of diabetes

The rats were fasted for 16 hours before inducing diabetes with streptozotocin. Animals were injected intraperitoneal with streptozotocin of 80mg/kg body weight in 0.9 % freshly prepared streptozotocin solution which was autoclaved before use. Control animals received saline solution alone.

Streptozotocin induced animals were allowed to drink 5% glucose solution to overcome drug induced hypoglycemia for 2 days. Streptozotocin treated rats were divided into 4 groups. The treatment was started on the 8<sup>th</sup> day after Streptozotocin injection and this is considered as the first day of treatment.

### EXPERIMENTAL DESIGN

The rats were divided into four groups comprising of six animals in each group.

GROUP I : Normal control rats received saline (0.1 M cold citrate Buffer pH 4.5 orally for 30 days)

GROUP II : Diabetic control rats (streptozotocin induced diabetic rats without treatment).

GROUP III : Diabetic rats treated with *Nelumbo nucifera* (150 mg/kg body weight/day) in aqueous solution orally for 30 days.

GROUP IV : Diabetic rats treated with glimipride (400 mg/kg body weight/day) in aqueous solution orally for 30 days.

Male albino rats of wistars train weighing around, 160-180 gm were taken for the study. The rats were treated with graded doses of *Nelumbo nucifera* rhizome & flower extract. The doses grading from 50 mg/kg, 100mg/kg, 150mg/kg & 200mg/kg were orally administered to the rats. The standard Glimepramide was also administered orally at a dose 400 mg/kg for the

IV group i.e. diabetic rat treated with Glimepramide. The treatment was carried out for 30 days and the blood samples were collected. A normal group is also maintained by providing with normal saline (Group I). In the 8<sup>th</sup> day in fasting condition blood samples were collected from the tail vein and centrifuged at 2000 rpm at 4°C for 10 minutes to separate serum and plasma for the estimation of the various bio chemical parameters.

## RESULTS

### PRELIMINARY PHYTOCHEMICAL SCREENING OF AQUEOUS FLOWER AND RHIZOME EXTRACT

TEST FOR EXTRACT	INFERENCE
Alkaloid	+
Carbohydrate	+
Glycoside	-
Steroids	-
Flavonoids	+
Fixed oils and fats	-
Saponins	-
Tannins	-
Phenolic Compounds	-
Quinone	-
Terpenoids	+
Proteins and free amino acids	+

+ = PRESENCE  
- = ABSENCE

**LEVELS OF BLOOD GLUCOSE, PROTEIN, UREA, URIC ACID, CREATINE AND URINE SUGAR OF NORMAL CONTROL AND EXPERIMENTAL GROUPS OF RATS.**

Parameters	Normal control	Diabetic Control	Diabetes induced + Nelumbo Nucifera treated	Diabetes induced + Glimpiride treated
Blood Glucose mg/dl	83.12 ± 4.76	282.78 ± 21.63	111.16 ± 5.00	124.32 ± 6.08
Plasma Protein mg/dl	7.11± 0.2	5.7 ± 0.4	7.5 ± 0.5	6.9 ± 0.3
Blood Urea mg/dl	23.981 ± 2.48	54.18 ± 6.95	33.27 ± 2.97	36.1 ± 2.45
Serum Uric Acid mg/dl	2.84 ± 0.16	4.33 ± 0.32	3.49 ± 0.18	3.43 ± 0.21
Serum Creatinine mg/dl	0.92 ± 0.08	2.6 ± 0.2	1.23± 0.06	1.40 ± 0.07
Urine Sugar	Nil	+++	Nil	Nil

± - Standard Deviation  
 +++ - More than 2 % Sugar

**LEVELS OF HEMATOLOGICAL PARAMETERS (HEAMOGLOBIN, GLYCOSILATED HEAMOGLOBIN, RBC, WBC, PLATELETS) IN NORMAL CONTROL AND EXPERIMENTAL GROUPS OF RATS**

GROUPS		HEMOGLOBIN	GLYCOSILATED HEAMOGLOBIN	RBC	WBC	PLATELET S
NORMAL CONTROL		11.7 g/dl	0.28 mg/gHb	7.4×10 <sup>6</sup> mm <sup>-3</sup>	12.5×10 <sup>3</sup> m <sup>-3</sup>	4.8×10 <sup>5</sup> m <sup>-3</sup>
DIABETIC CONTROL		7.6g/dl	0.88 mg/gHb	3.6×10 <sup>6</sup> mm <sup>-3</sup>	8.1×10 <sup>3</sup> m <sup>-3</sup>	8.0×10 <sup>5</sup> m <sup>-3</sup>
DIABETES+ <i>Nelumbo nucifera</i>		9.12g/dl	0.32 mg/gHb	6.5×10 <sup>6</sup> mm <sup>-3</sup>	11.12×10 <sup>3</sup> m <sup>-3</sup>	5.5×10 <sup>5</sup> m <sup>-3</sup>
DIABETES+DRUG(Glimepiride)		11.23g/dl	0.45 mg/gHb	6.2×10 <sup>6</sup> mm <sup>-3</sup>	10.8×10 <sup>3</sup> m <sup>-3</sup>	7.5×10 <sup>5</sup> m <sup>-3</sup>

## CHANGES IN BODY WEIGHT GAIN OF NORMAL CONTROL AND EXPERIMENTAL GROUPS OF RATS

GROUPS	0	10	20	30
	DAYS	DAYS	DAYS	DAYS
NORMAL CONTROL	150 gm	193 gm	156 gm	160 gm
DIABETIC CONTROL	160 gm	157 gm	160 gm	168 gm
DIABETIC+ <i>Nelumbo nucifera</i>	180 gm	162 gm	172 gm	179 gm
DIABETIC + Glimpiride	190 gm	151 gm	183 gm	175 gm

### Statistical analysis

The values are expressed as mean +SD for six rats in each group. Data's were analyzed with SPSS/10.0 student software. Hypothesis testing method included one way analysis of variance (ANOVA) following by post hoc testing performed with least significant difference (LSD) test. The 'p' value of less than 0.05, 0.01, and 0.001 were considered to indicate statistical significance.

## DISCUSSION

**BLOOD GLUCOSE:** Blood glucose is an index for the diagnosis of diabetes mellitus. During diabetes the blood glucose levels are drastically increased. Which results from reduced glucose utilization by various tissues. Streptozotocin induced diabetes which results in damage of islet of beta cells and causes increase in the concentration of glucose in blood. Administration of *Nelumbo nucifera* Rhizome and flower extract to streptozotocin induced diabetic rats shows reduction in blood glucose level in diabetic rats.

**PLASMA PROTEIN:** A significant decrease in the levels of total protein was observed in plasma of streptozotocin induced diabetic control rats. The decreased levels of protein were

reverted back to near normal by the extract and glimepiride treated diabetic rats.

**UREA, CREATININE AND URIC ACID:** The significant increase in the level of urea and Creatinine in the diabetic group. Which were brought back near to normally upon the treatment with the extract and Uric acid level also restores to near normal level.

**URINE SUGAR:** Excessive and frequent urination is one of the main symptoms of diabetes. The diabetic control rats shows presence of sugar in the urine.

**HEMATOLOGICAL PARAMETERS:** The levels of RBC, WBC, and Platelets & Hemoglobin in control and experimental groups of rats are estimated. A significant decrease in the content of RBC, WBC, Hemoglobin and a significant increase in the platelets were observed in diabetic rats were compared to control rats.

Administration of *Nelumbo nucifera* and Glimpiride to diabetic rats resulted in the restoration of hemoglobin levels to near normal. During diabetes the excess of glucose present in blood reacts with hemoglobin to form glycosylated hemoglobin. So the total hemoglobin level is decreased in diabetic



rats. The increased glycosylated Hemoglobin is associated with loss of beta cells function and has been implicated in the complication of diabetes mellitus. Anemia resulting from increased cell lysis and glycosylation of hemoglobin resulting from severe hyperglycemia, during diabetes is the contributing factors for reduced hemoglobin and the observed decreases in the RBC count in diabetic rats.

*Nelumbo Nucifera* and glimepiride treatment restores the normal levels of Hb, HbA<sub>1c</sub>, RBC, WBC and Platelets in diabetic rats due to its normoglycemic effect.

**BODY WEIGHT:** The changes in body weight of control and experimental group of rats are estimated. The body weight of control rats show a normal growth pattern where as in Streptozotocin induced diabetic rats decrease significantly when compared with control rats. Decrease in body weight is due to derangement of metabolic pathways and our study correlates with this statement.

The enhancement of body weight in *Nelumbo nucifera* treated diabetic rats may be due to improvement in metabolic activity of the system and to maintain glucose homeostasis.

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## CONCLUSION

The presence of various medicinally active chemicals such as alkaloids, carbohydrates, flavanoids. The biological activity of aqueous extract was effective against diabetics, the plant could be subjected to further studies, which may lead to possibility of isolating the active principle from the plant. The above results due to the presence of biologically active compounds along with trace elements of *Nelumbo nucifera* extract exhibit better hypoglycemic properties than the standard drug Glimepiride.

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