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*Original Research Article*

# Evaluation of Costus Igneus on Lipid Profile Status and Anti-Hyperglycemic Activity in Alloxan Induced Diabetic Rats

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## ABSTRACT

The present study was made to investigate an anti-hyperglycemic effect of Costus igneus in alloxan induced diabetic mellitus. Diabetes was induced by alloxan (150mg/kg i.p.) into rats. Crude extract of leaves of Costus igneus was used in alloxan induced diabetic rats. Glibenclamide used as a standard antidiabetic drug in one group to compare the effect with test drug. Blood glucose level was estimated and pancreas was sent to study histopathology in rats. All groups show significant results after giving costus igneus. It has been concluded that the leaves of costus igneus having good hypoglycemic activity.

***Keywords:*** Costus igneus, Alloxan, Glibenclamide, Diabetes mellitus, anti-hyperglycemic effect.

## INTRODUCTION

Diabetes mellitus considered as a chronic metabolic disorder occurs due to insulin deficiency, characterized by hyperglycemia and alteration in metabolism of carbohydrates, protein and lipids with an increased risk of vascular complication. [1] Among several metabolic disorders, insulin deficiency has been known to stimulate lipolysis in the adipose tissue and give rise to hyperlipidemia and fatty liver. [2]

Today India is known to most important country for the diabetes in the world with over 20 million diabetics and this number is going to increase to 57 million by 2025. Diabetes mellitus is ranked seventh among the leading cause of death and is considered third when it's fatal complications are taken into account [3] like renal failure, coronary artery disorder, cerebro-vascular disease, neurological complications, blindness, limb amputation, long term damage, dysfunctions and failure of various organs and eventually premature death are associated with chronic hyperglycemia. [4] In conventional therapy, type I is managed with exogenous insulin and type II with antidiabetes agents [5] but the blood glucose level is not effectively controlled, it has lot of side effects, developments of resistance and gives economic burden to the patients, so there has been increasing need for the newer antidiabetic with less cost, availability of product easily and reduced side effects. The increase in the incidence of diabetes in developing countries follows the trend of urbanization and life style changes, most importantly eastern style diet. [10] Based on the WHO recommendations hypoglycemic activity of plant origin used in traditional medicine are important (WHO 1980). Therefore, plant materials are continuously scrutinized and explored for their effect as hypoglycemic action.

*Costus igneus*, commonly known as insulin plant in India, belongs to family Costaceae. The family Costaceae consists of

four genera and approximately 200 species. The genus Costus known as the largest in the family with about 150 species that are mainly tropical in distribution. It is believed that consumption of the leaves helps lower the blood glucose levels, and diabetics who consumed the leaves of this plant report a fall in their blood glucose levels. The costus igneus shows various pharmacological activities like diuretic, antioxidant, anti-microbial, anti-cancerous. [7]

This study is planned to evaluate effect of crude extract of costus igneus on alloxan induced diabetes and biochemical parameters like cholesterol, triglyceride, HDL were investigated. Changes in body weight were measured and histological examination was also carried out on pancreas tissue of experimental animals.

## MATERIALS AND METHODS

### Plant material

The leaves of costus igneus were collected from the plants grown in ayurvedic garden from Mahatma Gandhi ayurvedic college, hospital and research centre Salod (Hirapur) Wardha, Maharashtra. Prior to use, the leaves were verified as belonging to the insulin plant (*Costus igneus*) by an Ayurvedic practitioner and dispenser in Mahatma Gandhi Ayurvedic College, hospital and research centre Wardha, India. The leaves were dried in shade and was coarsely powdered with the help of mechanical grinder and passed through sieve no.40. The powder was stored in an airtight container for further use.

**Animal-** Male albino rats with weight ranging from 150-250g were used in the present study and were kept at room temperature of 22-25°C in the animal house. Internationally accepted ethical guidelines were followed in all the animals for the care of laboratory animals. Animals were kept in laboratory for one week to adapt the environment before to start the experiments and fed with rodent pellet diet. Ethical clearance for performing the experiments on animals was obtained from Institutional Animal Ethics Committee (IAEC).

### Oral toxicity studies [5,8]

Organization for Economic Co-operation and Development (OECD) guidelines (revised draft 425; Fixed Dose Procedure) was followed for acute oral toxicity test to plant extract. Before experimentation rats were divided into four groups of three animals each for toxicity test, were fasted overnight with water *ad libitum* and were orally administered with fixed extracts dose of 100,250,500,1000 mg/kg body weight respectively. The rats were observed continuously for 2 hr for behavioral, neurological changes and after 24 hr and 72 hr for any lethality. No death was found on administered dose and it was tolerable. Therefore, two dose levels of 250 and 500mg/kg body weight were selected for antidiabetic activity.

### Induction of diabetes

150mg/kg of alloxan monohydrate was used to produced diabetes in rats by injecting intra-peritoneal in 0.9% w/v Nacl to over-night fasted rats. The rats were then kept for next 24hr on 10% glucose solution bottles, in their cases to prevent hypoglycemia. After 72 hr of injection, rats with marked hyperglycemia (blood glucose>250mg/dl) were selected and used for the study. The selected diabetic rats were divided into four group (n=6). One more group of normal non-alloxanized animals (n=6) was also added in study as normal control group The blood glucose levels were estimated on 0,7,14,21,27$^{th}$ day. [4,5]

### Experimental Design

Group I (NC) - Control vehicle only (1 ml of 2 % gum acacia).
Group II (DC) - Diabetic control alloxan (150 mg/kg body wt) treated only once
Group III (DG) - Diabetic + Glibenclamide (5 mg/kg body wt).
Group IV (DE1) -Diabetic + Costus igneus (250 mg/kg body wt) extract treated
Group IV (DE2) - Diabetic + Costus igneus (500 mg/kg body wt) extract treated

**Collection of the blood and estimation of serum glucose:**

Blood was withdrawn from the retro-orbital sinus under ether inhalation anesthesia and glucose levels were estimated at an interval of 0th,7th, 14th, and 28th day.

Changes in body weight were measured before and after giving test drug.

**Histopathological Studies:**

On day 28, pancreatic tissues from all groups were subjected to histopathological studies. The whole pancreas from each animal was removed after sacrificing the animal under anesthesia and was collected in 10% formalin solution and send immediately in pathology department for getting report.

**Statistical Analysis:**

All the values of body weight, blood sugar level were expressed as mean ± standard error of mean (SEM). The results are analyzed for statistical significance using one way ANNOVA followed by P-value using GraphPad (software). p-value <0.0001 considered significant.

## RESULTS

Changes in body weight after giving Costus igneus in Diabetic rats-Normal control animals were found to be stable in their body weight but diabetic rats shown significant reduction in body weight during $28^{th}$ day despite the increased in food and fluid intake in animals. But in group III, IV and V after receiving standard drug and extract, rats showed increased in body weight when compared to group II.

**Table 1: Changes in body weight after giving Costus igneus in Diabetic rats.**

| Groups | B.W.initial | After 24hrs | $7^{th}$ day | $14^{th}$ day | $21^{st}$ day | $28^{th}$ day |
|---|---|---|---|---|---|---|
| Group-I Normal (1ml 2% gum acasia) | 168.33±9.31 | 168.33±9.31 | 169.83±8.87 | 171.5±9.14 | 173.17±9.06* | 174±8.60* |
| Group-II diabetic, (alloxan 150mg/kg b.w.) | 166.67±7.52 | 162±7.85 | 155.5±6.76 | 149.83±5.91 | 144.5±5.17 | 137.5±4.59 |
| Group-III Standard (glibenclamide 5mg/kg b.w.) | 165.83±10.21 | 161.83±10.76 | 165±10.79 | 168±9.98 | 170.67±10.01* | 173.17±9.93* |
| Group-IV (extract C.I.250mg/kg b.w) | 167.67±6.07 | 164±5.83 | 166.5±6.02 | 168.67±5.81 | 171±5.55* | 174±5.55* |
| Group-V (extract C.I.500mg/kg b.w) | 170.83±8.01 | 167.17±7.03 | 170±7.16 | 172.5±7.34 | 175±7.56* | 177.5±7.66* |

Values are Mean ± S.E.M; n=6 and p-value <0.0001* when compared group II with groupI, III,IV,V.

**Table 2: Effects of Costus igneus on Blood glucose level by using glucometer in diabetic rats.**

| Groups | 0day | $7^{th}$ day | $14^{th}$ day | $21^{st}$ day | $28^{th}$ day |
|---|---|---|---|---|---|
| Group-I Normal( 1ml 2% gum acasia) | 130.03±0.44 | 131.17±0.48* | 129±0.77* | 128.7±0.80* | 129.83±0.31* |
| Group-II diabetic, (alloxan 150mg/kg b.w.) | 129.53±2.58 | 193.5±1.73 | 236.5±5.38 | 326±2.48 | 349.17±1.01 |
| Group-III Standard (glibenclamide 5mg/kg b.w.) | 131.67±0.33 | 173.18±1.31* | 163.63±0.99* | 155.88±1.39* | 146.53±0.82* |
| Group-IV (extract C.I.250mg/kg b.w) | 131.98±0.36 | 162.18±0.53* | 151.32±0.81* | 146.77±0.75* | 143.22±0.59* |
| Group- V Extract C.I.500mg/b.w | 130.13±0.46 | 179.98±0.80* | 172.45±0.93* | 165.35±0.53* | 154.17±0.41* |

Values are Mean ± S.E.M; n=6 and p-value <0.0001* when compared group II with groupI, III,IV,V.

In Alloxan induced diabetic rats (group .II 150mg/kg b.w.) shows significantly increased in blood sugar level on $7^{th}$,$14^{th}$,$21^{st}$,$28^{th}$ day when compared with normal (group I) rats group. Group III (standard group received glibenclamide 5mg/kg b.w) shows decreased blood glucose level when compared with diabetic group II rats on $7^{th}$, $14^{th}$, $21^{st}$, $28^{th}$ day. Group IV(receiving 250mg/kg costus igneus crude extract also showed reduction in blood sugar level on $7^{th}$,$14^{th}$,$21^{st}$,$28^{th}$ day. A significant reduction in blood glucose level seen with Group V (500mg/kg b.w. costus igneus) when compared with group II diabetic rats' blood sugar levels.

**Table 3. Effects of Costus igneus on Serum Triglyceride level in diabetic rats.**

| groups | 0 day | $7^{th}$ day | $14^{th}$ day | $21^{st}$ day | $28^{th}$ day |
|---|---|---|---|---|---|
| Group-I Normal(1ml 2%gum acasia) | 142.5±2.88* | 146.33±2.50* | 142.33±2.87* | 143.67±1.86 | 143.17±3.12* |
| Group-II diabetic, (alloxan 150mg/kg b.w.) | 187.5±2.26 | 202.17±1.72 | 214.17±2.93 | 225.83±3.82 | 239.17±4.99 |
| Group-III Standard (glibenclamide 5mg/kg b.w.) | 182.5±1.87 | 184.83±1.33* | 181±0.89* | 176.17±1.60* | 168.5±1.87* |
| Group-IV (extract C.I.250mg/kg b.w) | 173.33±1.21* | 176±1.26* | 171±1.41* | 167.5±1.52* | 160.83±0.98* |
| Group- V Extract C.I.500mg/b.w | 171.17±1.17* | 168.83±0.75* | 164.5±1.38* | 161.17±1.17* | 160.83±0.98* |

Values are Mean ± S.E.M; n=6 and p-value <0.0001* when compared group II with groupI, III,IV,V.

**Table 4: Effects of Costus igneus on Serum Cholesterol level in diabetic rats.**

| Groups | 0 day | 7th day | 14th day | 21st day | 28th day |
|---|---|---|---|---|---|
| Group-I Normal( 1ml 2% gum acasia) | 56.17±1.72* | 58±1.22* | 57.83±1.33* | 60.17±0.98* | 60.67±0.52* |
| Group-II diabetic, (alloxan 150mg/kg b.w.) | 143.83±1.60* | 152±1.67* | 158.33±0.82* | 165.17±1.60* | 164.67±1.63* |
| Group-III Standard (glibenclamide 5mg/kg b.w.) | 176.83±2.23* | 107.17±4.22* | 81.17±0.98* | 72.17±1.94* | 69±0.84* |
| Group-IV (extract C.I.250mg/kg b.w) | 125.83±1.72* | 109±0.89* | 88.17±1.47* | 85.33±1.51* | 82.33±1.63* |
| Group- V Extract C.I.500mg/b.w | 138.17±2.32 | 107.5±3.08* | 85.17±1.47* | 81.67±1.21* | 75.33±2.16* |

**Table 5: Effects of Costus igneus on Serum HDL in diabetic rats**

| groups | 0 day | 7th day | 14th day | 21st day | 28th day |
|---|---|---|---|---|---|
| Group-I Normal( 1ml 2% gum acasia) | 52.83±1.17* | 51.17±1.17* | 52.17±1.17* | 52.17±1.16* | 52.5±1.048* |
| Group-II diabetic, (alloxan 150mg/kg b.w.) | 48±0.89 | 45.67±1.21 | 43.5±1.76 | 43.5±1.76 | 38.33±2.25 |
| Group-III Standard (glibenclamide 5mg/kg b.w.) | 51.5±0.54* | 52.83±0.75* | 54.67±0.51* | 54.67±0.52* | 56.5±1.05* |
| Group-IV (extract C.I.250mg/kg b.w) | 51.67±0.82* | 53.17±1.17* | 54.83±1.17* | 54.83±1.17* | 57.33±0.82* |
| Group- V Extract C.I.500mg/b.w | 54±0.89* | 56±0.89* | 58.17±1.47* | 58.17±1.47* | 61.83±1.17* |

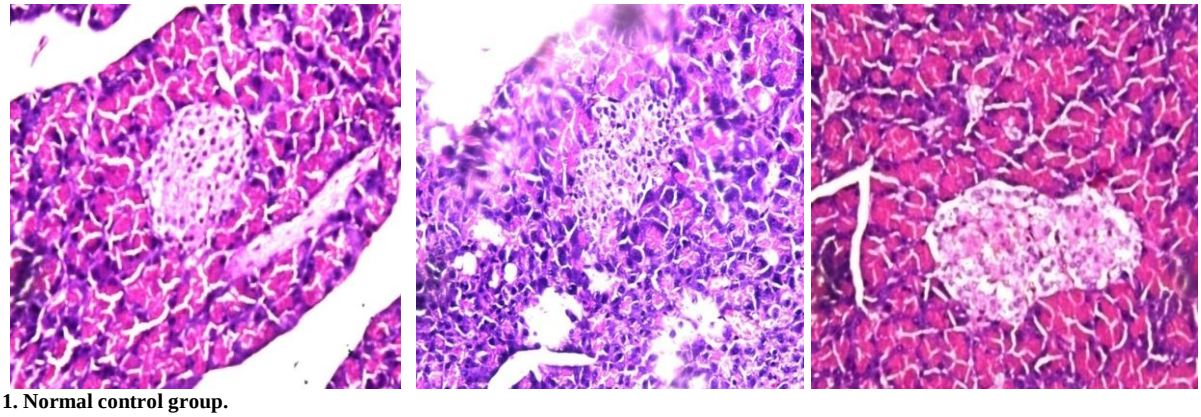
Values are Mean ± S.E.M; n=6 and p-value <0.0001* when compared group II with group I,III,IV,V.

**Effects of Costus igneus on Serum TGs, Serum LDL and Sr.HDL**

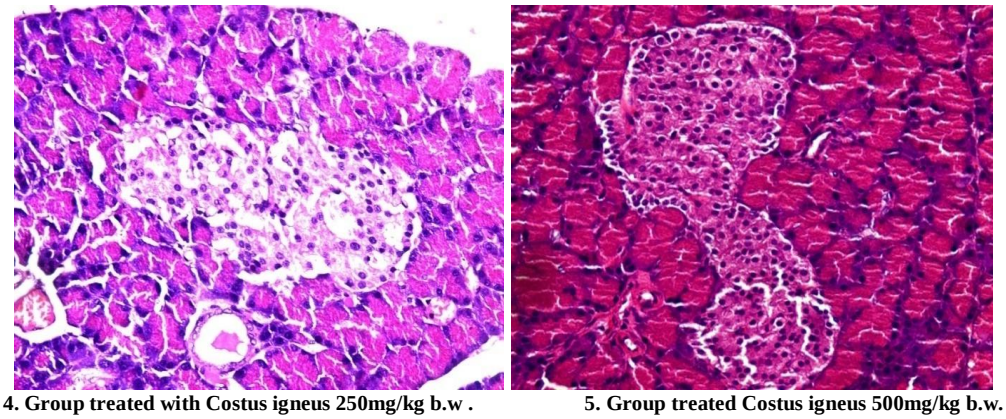
Animals receiving alloxan shows a significant increase in the triglyceride level and Serum LDL level while decreased in HDL level. On 14th, 21st and 28th day when compared to normal group (I). Rats treated with standard drug had significantly reduced the level of serum TGs and LDL while increased in HDL level when compared to diabetic group (II). The test drug Costus igneus alone caused significant decreased serum TGs and LDL while decreased in HDL level compare with diabetic group.

**Histopathological changes:**

- **Group I: photomicrograph of pancreas of normal rat.**
  Photomicrograph showing regular, normal appearance of nucleus, tightly arranged islet cells were observed in the normal control group.
- **Group II: photomicrograph of pancreas of rat treated with Alloxan 150 mg/kg body wt.-**Pancreatic sections stained with hematoxylin and eosin (H & E) showed that alloxan caused changes like severe necrosis of pancreatic islets, especially in the centre of islets. Nuclear changes, karyolysis, disappearance of nucleus and in some places, residue of destroyed cells were visible. Relative reduction of size and number of islets especially around the central vessel and severe reduction of cells were clearly seen.
- **Group III: Photomicrograph of pancreas of rat treated with standard drug glibenclamide 5 mg/kg.-** Photomicrographs of standard (glibenclamide 5mg/kg) treated group rat showing moderate expansion & restoration of normal cellular population size of islets with hyperplasia by glibenclamide, stained with H & E.
- **Group IV: Photomicrograph of pancreas of rat treated with Costus igneus extract at dose 250mg/kg body wt. on 28th day.**
  The photomicrograph of ETA treated group(100 mg/kg) showing increased volume and density of islets and increased percentage of cells, showed increase in the diameter of cell, which may be a sign of regeneration.
- **Group V: Photomicrograph of pancreas of rat treated with Costus igneus 500 mg/kg on 28th day.-**Photomicrograph showing that the size of islets was significantly increased, and the necrosis and atrophy of islets were significantly improved; also increase in the number and diameter of the cell islets appeared to be regular as compared to the diabetic group.



**1. Normal control group.**
**2. Alloxan induced Diabetic group**
**3.Group treated with standard drug Glibenclamide 5mg/kg b.w.**



**4. Group treated with Costus igneus 250mg/kg b.w .** **5. Group treated Costus igneus 500mg/kg b.w.**

## DISCUSSION

Diabetes is a complex metabolic disorder, one of the leading causes of death, illness and economic loss all over the world. [2,6] The antidiabetic activity of costus igneus was evaluated in alloxan induced diabetic rats by administering orally for 28 days. The potency and efficacy of the extract as evaluated by measuring blood glucose level, lipid profile levels and histopathology of pancreatic tissues.

Alloxan became the first diabetogenic agent in rabbits produced necrosis of islet-cell while researching the nephrotoxicity uric acid derivatives by Dunn and Lettchie. It destroys the beta cells which produced a state of primary deficiency of insulin without affecting other islets types. [9]

Alloxan causes a massive reduction in insulin release due to destruction of beta cell produced hyperglycemia. Because of insulin deficiency there is a metabolic alteration in animals which leads to increased level of blood glucose, cholesterol. [3]

The observed weight loss (Table 1) in diabetic group could be due to fluid depletion or due to excessive breakdown of tissue proteins as well as muscle wasting, dehydration and catabolism of fats. Administration of glibenclamide, crude extract of costus igneus to diabetic rats minimized body weight loss which suggests interruption, at least partially, of the previously mentioned metabolic derangements. [7]

The blood glucose level of group 2 (Diabetic) observed significantly high. (Table 2) However, administration 250mg/kg and 500mg/kg of crude extract costus igneus reduced the sugar level in treated group animal (group 4 and 5) indicates a hypoglycemic effect of the extract. The hypoglycemic action can be due to release of insulin, insulin-sensitizing action or a combination of both. [10]

Blood cholesterol, triglycerides significantly increased in diabetic group

(table 4, 5). This may be due to increased action of hormone sensitive lipase, which promotes lipolysis and hence increase in the level of free fatty acids in the plasma which is subsequently catabolised to acetyl CoA. The acetyl CoA can be channeled to cholesterol synthesis, thus increasing blood cholesterol level. The lowering of plasma Total cholesterol, Triglyceride and significant increase in HDL-cholesterol level (table 3, 4, 5) in the treated animals clearly demonstrated the presence of hypolipidaemic agents in the extracts of *costus igneus* and standard drug glibenclamide.

## CONCLUSION

The present study demonstrated that the extract has promising anti-diabetic effects and hypolipidemic activity on the treated animals in dose of 250mg and 500mg per kg body weight.

## REFERENCES


1. Laxmi Verma, Anirudh Khatri et.al. Antidiabetic activity of Cassia occidentalis (Linn) in normal and alloxan-induced diabetic rats. Indian J Pharmacol. 2010 Aug; 42(4): 224–228.
2. Pradeep Kumar R et al. Potential hypoglycemic & hypolipidemic effect of *Morus Indica* and *Asystasia gangetica* in alloxan induced diabetes mellitus. Int. J. Res. Pharm. Sci. Vol-1, Issue-1, 51-56, 2010.
3. Vivek Kumar Sharma, Suresh Kumar et.al Hypoglycemic activity of Ficus Glomerata in alloxan induced rats. International Journal of Pharmaceutical Sciences Review and Research, Volume 1, Issue 2, 18-22, March – April 2010.
4. M.V. Kumudhavalli and B. Jaykar, Evaluation of Antidiabetic activity of *Costus igneus (L)* leaves on STZ induced diabetic rats Pelagia Research Library Der Pharmacia Sinica, 2012, 3 (1):1-4.
5. Mousa-al-reza hadjzadeh, ziba ranjeet et.al Effects of hydroalcoholic extract of watercress leaves on serum glucose and lopid levels in diabetic rats. Ind. J. Physiol Pharmacol 2015;59(2):223-230.
6. Prakash hedged, Harini Rao et al. A review on Insulin plant. Insulin Review vol.8(15); 67-72, 2014.
7. OECD guidelines for the testing of chemicals. Acute Oral Toxicity: Up -and-Down Procedure) (Internet) 2015 (cited 2015 Nov 24). Available from: https://ntp.niehs.nih.gov/iccvam/suppdocs/feddocs/oecd/oecdtg425.pdf.
8. Pallab Das Gupta et.al Diabetes mellitus and its herbal treatment. Int. J. of Res. in Pharm. and Bio. Sci. vol3(2);706-721; 2012.
9. Nwaneri-Chidozie VO, Yakubu OE et.al Lipid Profile Status of Streptozotocin-Induced Diabetic Rats Treated With Ethanol, N-Hexane and Aqueous Extracts of *Vitex Doniana* Leaves.
10. Ghada Z A Soliman and Nehal M Bahagt; Effect of Vitamin C and/or Vitamin E on Oxidative Stress and Lipid Profile in Diabetic Rats RJPBCS, April-June 2012 Volume 3 Issue 2, 639-652.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