Studies on *in-vitro* and *in-vivo* antidiabetic activity of *Eranthemum capense* Linn

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ABSTRACT

OBJECTIVE: The present study is to evaluate *In-vitro* and *In-vivo* antidiabetic activity of ethanol extract of *Eranthemum capense* Linn on Streptozotocoin Induced diabetic rats.

METHODS: The ethanol extract of *Eranthemum capense* Linn (Acanthaceae) was investigated for *In-vitro* antidiabetic activity of alpha amylase inhibitory activity. Also the *In-vivo* antidiabetic activity of ethanol extract of *Eranthemum capense* Linn on streptozotocin induced diabetic rats were investigated. Gliclazide was used as a reference drug at a dose of 25 mg/kg b.w. p.o. Albino wistar rats with Streptozotocin induced diabetes were divided into 5 groups of 6 each. In this study, antidiabetic effect of the two different doses (200 and 400 mg/kg b.w. p.o) of EEEC will be investigated for 21 days to evaluate dose dependent activity. Effect of EEEC on fasting plasma glucose level, plasma triglycerides, total cholesterol (TC), plasma HDL-cholesterol, plasma LDL-cholesterol, plasma VLDL-cholesterol, total proteins, albumin, globulin, insulin and glycosylated hemoglobin values were evaluated in control and the experimental rats after 21 days.

RESULTS: In *In-vitro* studies EEEC shows significant activity and in diabetic rats, blood glucose levels were significantly reduced on consumption of the extracts, with greater effect exhibited by the 400 mg/kg extract. At the end of the experiment the results of biochemical analysis show significant changes on compared with diabetic control group.

CONCLUSION: From the results, it was concluded that EEEC have antidiabetic and hypolipidemic effects. Further studies will be needed in future in order to determine which one or more of its active constituents have the main antidiabetic and hypolipidemic effects.

Key Words: *In-vitro* and *In-vivo*, Antidiabetic activity, *Eranthemum capense* Linn.

INTRODUCTION

Diabetes is a growing global health issue that is now emerging as an epidemic [1]. Diabetes is a chronic condition that affects how proteins, fats, and carbohydrates are metabolised [2]. Diabetes influences many individuals in the 21st century and is known as the fifth driving reason to death [3]. The starting point and etiology of DM can differ enormously yet consistently remember deserts for either insulin discharge or response of target tissues or in both [4]. The hallmarks of DM are uncontrolled urine production (polyuria), uncontrolled thirst (polydipsia) and uncontrolled eating (polyphagia) [5]. If not treated properly the diabetes is linked with developing of various serious disorders like micro vascular complications such as nephropathy, retinopathy, nephropathy and macro vascular complications such as peripheral vascular disease and coronary heart diseases [6]. Diabetes mellitus are three types Type 1, Type 2 and gestational diabetes mellitus. Type 1 diabetes is also known as insulin-dependent diabetes mellitus and is caused by the complete loss of function in the pancreatic islets of Langerhans cells. Type 2 Diabetes mellitus is known as insulin non subordinate diabetes mellitus which is brief loss of β cell mass and it is because of hereditary inclination and generally happen in large people and connected with hypertension and elevated cholesterol levels. Type 1 Diabetes mellitus is known as insulin dependent diabetes mellitus which is due to total loss of function of β cell of islets of Langerhans which are present in pancreas. Type 2 Diabetes mellitus is

known as insulin non dependent diabetes mellitus which is temporary loss of β cell mass and it is due to genetic predisposition and mostly occur in obese persons and associated with high blood pressure and high cholesterol levels. Gestational diabetes is a sort of diabetes which present with hyperglycemia in pregnant ladies. It usually appears in 2-4% pregnancies in 2nd or 3rd trimester [7].

Type 1 DM are fundamentally managed with dietary limitation, exercise and insulin treatment while Type 2 DM are managed with weight decrease, dietary limitation, exercise and medication like oral hypoglycaemics and antihyperglycaemics. Constant utilization of oral hypoglycaemics and antihyperglycaemics in Type 2 DM causes haematological impacts and influences the elements of significant organs of liver, kidney and so on., [8]. The management of diabetes is a worldwide issue as of recently and effective treatment is not yet discovered. Although numerous synthetic medicines have been developed for patients, it has never been reported that someone had completely recovered from diabetes [9].

The most pressing concern that physicians continue to face is how to treat diabetes mellitus without causing any side effects. As indicated by world ethanobotanical 800 restorative plants are utilized for the avoidance of diabetes mellitus. Traditional plants have been used for diabetes management for a long time in India and China [10].

Eranthemum capense Linn is one of the important species used traditionally for various disorders belonging to the family Acanthaceae. The aerial part of the plant provided for antimicrobial studies and anti-inflammatory activity [11]. Still there was lack in scientific study for diabetic effect of *Eranthemum capense* Linn to substantiate the traditional claim. Hence, the current work was embraced to assess the antidiabetic activities of ethanol extract of *Eranthemum capense* Linn.

MATERIALS AND METHODS

Chemicals and reagent

All the chemicals and reagents used in these *in-vitro* and *in-vivo* antidiabetic studies were of analytical grade.

Source and authentication of plant material

Fresh aerial parts of *Eranthemum capense* Linn (Acanthaceae) were pull together from surrounded arears of kadapa region and authentified by Dr. A. Madhusudhana Reddy, Professor, Department of Botany, Sri Yogi Vemana University, Kadapa. Andhra Pradesh, India. Voucher specimen (No: EC- 1634) of this plant has been kept in the P. Rami Reddy Memorial College of Pharmacy, Kadapa, Andhra Pradesh, India.

Preparation of plant material

The gathered aerial parts of *Eranthemum capense* Linn was washed with running water, cut into little pieces and shade dried at room temperature to avoid from loss of phytoconstituents of plant. The total shade dried materials pounded for powder and sieved up to 80 meshes. At that point it was homogenized to fine powder and put away in air-tight compartment for further activities.

Preparation of plant extracts

Aerial parts plant powder of the *Eranthemum capense* Linn was extracted with ethanol as a solvent in a Soxhlet apparatus in batches of 500 gm each. The excess solvent was expelled from extract utilizing a rotary vacuum evaporator and later on concentrated on a water bath. At last dried extracts were put away in desiccators for assess for its antidiabetic activities [12].

Animals and maintenance

Wistar Albino rats of either sex, with the body weight of 150-250 gms were acquired from Sri Venkateswara Enterprises, Bangalore, India. Animals were kept up according to rules of NIN animal client manual. Animals are adjusted for 10 days to our creature house, kept up at temperature of 22ºC to ± 2 ºC. The animal was directed by a 12 hours light, 12 hours dark calendar. Five animals are housed per cage estimated 41 cm length, 28 cm width and height of

14 cm. Paddy husk was utilized for bedding and on elective day bedding was changed and washed altogether with water using domex, a disinfectant and detergenic. The rats were feed with a standard pellet diet bought from Suresh organizations, Hyderabad and water not obligatory. The examination convention was investigated and endorsed by the Institutional Animal Ethical Committee (IAEC) and trials were done according to the rules of CPCSEA. Reg. Number: 1423/PO/Re/S/11/CPCSEA, date 25th November 2022.

Induction of diabetes to experimental animals:

After one week of acclimatization, the rats were subjected to overnight fasting. Diabetes was induced with a single intraperitoneal injection of streptozotocin (STZ) at a dose of 55 mg/kg body weight. The STZ was freshly dissolved in citrate buffer (0.01M, pH 4.5) [13]. The injection volume was prepared to contain 1.0 ml/kg [14]. The animals were allowed to drink 5% glucose solution overnight to overcome the drug induced hypoglycemia. After 3 days, blood glucose levels were measured and the animals with a glucose concentration of more than 250 mg/dL were classified as diabetic [15] and taken for the experiment. Administration of the ethanol extract of *Eranthemum capense* Linn was started on 4th day after STZ injection and this was considered to be the 1st day of treatment, which was continued for 21 days.

Experimental design:

- **Extract used:**

The ethanol extract of *Eranthemum capense* Linn (EEEC) was used. Weighed amount of the dried extract was suspended in 1% V/V Tween 80 solution and administered through orally to rats at a dose of 200 mg/kg & 400 mg/kg body weight.

- **Test Drug:**

  STZ was used for this study, at 55 mg/kg by i.p. route.

- **Standard Drug:**

  Gliclazide was used for this study as a standard drug at a dose of 25 mg/kg b.w.

Effect of EEEC treatment on blood glucose level in normoglycemic rats:

The animals were divided into four groups of 6 rats in each group.

Group I - Animals received 1% Tween-80 2 ml/kg b.w per orally.

Group II - Animals received EEEC 200 mg/kg b.w. per orally.

Group III - Animals received EEEC 400 mg/kg b.w per orally.

Group IV - Animals received Gliclazide 25 mg/kg b.w per orally.

In this study, the entire group of animals was overnight fasted prior to the experimentation and administered with the respective drugs as per the above mentioned dosage schedule. Blood samples were collected initially before administration of the drugs and at 60^{th} and 120^{th} min after drug administration to determine the blood glucose level by using electronic glucometer.

Effect of EEEC on plasma in streptozotocin induced diabetic rats:

The animals were divided into 5 groups. Group I consisted of 6 normoglycemic animals. The remaining 4 groups consisted of 6 streptozotocin induced diabetic rats.

Group I - Normal control animals received 1% Tween-80 2 ml/kg per orally.

Group II - streptozotocin (55 mg/kg b.w.) induced diabetic animal received 1% Tween-80, 2 ml/kg per orally.

Group III - streptozotocin (55 mg/kg b.w.) induced diabetic animal received EEEC 200 mg/kg b.w per orally

Group IV - streptozotocin (55 mg/kg b.w.) induced diabetic animal received EEEC 400 mg/kg b.w per orally

Group V - streptozotocin (55 mg/kg b.w.) induced diabetic animal received Gliclazide 25 mg/kg b.w per orally.

This is a sub chronic study. This experiment is conducted for a period of 21 days. The EEEC and Gliclazide are given for 21 days. Plasma glucose levels of rats are checked at the intervals

of 7 days. At the end of the experiment, all the rats were kept fasting for 16 hours. Blood was collected from retro-orbital plexus of the animals for the estimation of various biochemical parameters.

Effect of EEEC on blood glucose level on glucose fed hyperglycemic rats (oral glucose tolerance test):

The oral glucose tolerance test is the only form of glucose tolerance testing recommended for diagnosis of diabetes. The relationship between plasma levels of glucose and insulin after an external load of glucose can be studied using OGTT. OGTT was performed at the end of experimental period.

The animals were divided into five groups of 6 rats in each group.

Group I - Animals received glucose solution at a dose of 2g/kg per orally.

Group II - streptozotocin (55 mg/kg b.w.) induced diabetic animal received glucose solution at a dose of 2 g/kg per orally.

Group III - Animals received EEEC 200 mg/kg b.w. and glucose solution at a dose of 2 g/kg per orally.

Group IV - Animals received EEEC 400 mg/kg b.w and glucose solution at a dose of 2 g/kg per orally.

Group V - Animals received Gliclazide 25 mg/kg and glucose solution at a dose of 2 g/kg per orally.

In this study, the entire group of animals were fasted overnight (at least 12 h) and treated with above dosage schedule orally. The EEEC 200 mg/kg, 400 mg/kg and Gliclazide (25 mg/kg) were administered half an hour before administration of glucose solution. Blood samples were collected initially before glucose administration and at 30, 60, 90 and 120th min after glucose administration to determine the blood glucose level by using electronic glucometer.

Blood collection and plasma separation:

Blood was collected from 12 hrs fasted rats with heparinized capillary tube from retro-orbital plexus of the animals in fresh vials containing EDTA (10mg/ml) as anti-coagulant. The samples were centrifuged at 3000 rpm for 5 min (MSE Centaur, U.K) and the plasma obtained was used for the estimation of blood plasma glucose level and other biochemical parameters. The blood sample used for oral glucose tolerance test was collected from the tail vein of the animals [16].

Blood glucose determination:

Glucose was estimated by GOD-POD enzymatic method using wet reagent diagnostic kits (Erba Mannheim, Germany) according to manufacturer's protocol. Glucose is determined after enzymatic oxidation in the presence of glucose oxidase. The hydrogen peroxide so formed reacts under catalysis of peroxidase with phenol and 4-aminoantipyrine (4-APP) to form a red coloured quinoneimine compound which is measured at 505 nm using semi auto analyzer (Kamineni life sciences Pvt Ltd) and is directly proportional to glucose concentration (Trinder's method, 1969) and the values expressed as mg/dl.

The blood glucose levels of blood samples collected from the tail vein of the animals was estimated by commercially available glucose strips using a commercial one touch glucometer (Accu-chek® Active, Roche diagnostic, Mannheim, Germany).

Biochemical analysis:

At the end of the experiment i.e. after 21 days' plasma was separated from the collected blood samples by retro orbital with a capillary for various biochemical parameters like Glucose, triglycerides, total cholesterol, HDL cholesterol, LDL cholesterol, VLDL cholesterol, total protein, albumin, globulin, insulin and glycosylated haemoglobin by commercially available diagnostic kits.

Measurement of plasma glucose concentration:

Plasma glucose levels were determined by using Trinder method (Glucose, GOP-POD) by the addition of reagents present in reagent kit (Erba Mannheim). The absorbance of standard and test against reagent blank were measured at 505 nm. The values of glucose present in plasma were expressed in mg/dL.

Measurement of serum triglycerides concentration

Serum triglycerides levels were determined by utilizing GPO-POD technique by the expansion of reagents present in reagent unit (Lifechem). The absorbance of standard and test against reagent blank were estimated at 546 nm. The estimations of triglycerides present in serum were communicated in mg/dL.

Measurement of plasma cholesterol and HDL cholesterol concentration:

Plasma cholesterol and HDL Cholesterol levels were determined by using CHOD-POD method by the addition of reagents present in reagent kit (Erba Mannheim). The absorbance of standard and test against reagent blank were measured at 505 nm. The values of Cholesterol and HDL cholesterol present in plasma were expressed in mg/dL.

Measurement of plasma low density lipopreotein cholesterol concentration:

Low density lipoprotein (LDL) cholesterol was calculated as per Friedevald's equation: [17]

LDL-Cholesterol = Total Cholesterol – VLDL cholesterol – HDL cholesterol

And the values are expressed in mg/dL.

Measurement of plasma very low density lipopreotein cholesterol concentration:

Very low density lipoprotein (VLDL) Cholesterol was calculated as per Friedevald's equation: [17]

VLDL cholesterol = Triglycerides / 5

And the values are expressed in mg/dL.

Measurement of serum total protein concentration

Serum total protein levels were dictated by utilizing End Point Assay technique by the expansion of reagents present in reagent pack (Span Diagnostic Ltd.). The absorbance of standard and test against reagent blank were estimated at 578 nm. The estimations of total proteins present in serum were communicated in g/dL.

Measurement of serum albumin concentration

Serum albumin levels were dictated by utilizing Bromocresol Green, End Point Assay strategy by the expansion of reagents present in reagent unit (Span Diagnostic Ltd.). The absorbance of standard and test against reagent blank were estimated at 630 nm. The estimations of albumin present in serum were communicated in g/dL.

Measurement of serum globulins concentration

Serum globulins levels were determined by using the equation:

$$\text{Globulins} = \text{Total proteins} - \text{Albumin}$$

And the values are expressed in g/dL.

Measurement of serum insulin

Serum insulin levels were dictated by solid phase enzyme connected immunosorbent test utilizing commercial unit (ELISA Kit, Roche Diagnostic). The estimations of insulin present in serum were communicated in μU/ml.

Measurement of glycosylated haemoglobin

The glycosylated haemoglobin was determined utilizing entire blood by commercially available kits. Information were communicated as % Hb.

Histopathological studies

On day 21, one from each gathering of the exploratory animals were sacrificed under mild ether sedation. The pancreas was moved to 10% formalin arrangement following washing with normal saline and the part of pancreas are read for histological assessments.

***In-vitro* antidiabetic activity:**

Alpha-amylase inhibitory activity:

The Assay was carried out following the standard protocol with slight modifications. Starch azure (2 mg) was suspended in 0.2 mL of 0.5M Tris–HCl buffer (pH 6.9) containing 0.01 M $CaCl_2$ (substrate solution). The tubes containing substrate solution were boiled for 5 min and then preincubated at 37°C for 5 min. Ethanol extract of *Eranthemum capense* Linn was dissolved in DMSO in order to obtain concentrations of 5, 10, 25, 50, 75, and 100 μg/mL. Then, 0.2 mL of *Eranthemum capense* Linn extract of particular concentration was added to the tube containing the substrate solution. In addition, 0.1 mL of porcine pancreatic amylase in Tris–HCl buffer (2 units/mL) was added to the tube containing the *Eranthemum capense* Linn extract and substrate solution. The reaction was carried out at 37°C for 10 min. The reaction was stopped by adding 0.5 mL of 50% acetic acid in each tube. The reaction mixture was centrifuged at 3000 rpm for 5 min at 4°C. The absorbance of resulting supernatant was measured at 595 nm using spectrophotometer. The α-amylase inhibitory activity was calculated by using following formula:

The Alpha – amylase inhibitory activity =

$$(Ac+) - (Ac-) - (As - Ab) / (Ac+) - (Ac-) \times 100$$

where Ac+, Ac−, As, and Ab are defined as the absorbance of 100% enzyme activity (only solvent with enzyme), 0% enzyme activity (only solvent without enzyme), a test sample (with enzyme), and a blank (a test sample without enzyme), respectively. The α-amylase inhibitory activities of plant extract and acarbose were calculated [18].

Statistical analysis

All investigations information was communicated as mean ± standard error mean (SEM). This statistical analysis was done utilizing one-way ANOVA strategy followed by Dunnet-t test with SPSS statistical programming for correlation with the control group. $p \leq 0.001$ was appraised as statistically significant.

Results and Discussion:

Effect of EEEC on glucose level:

The EEEC at low and high doses of 200 and 400 mg/kg body weight per orally respectively did not significantly suppress blood glucose levels in over night fasted normoglycemic ratsas shown in Figure 1. The Gliclazide at a dose of 25 mg/kg b.w p.o shows significant decreased blood glucose levels in over night fasted normoglycemic rats after initial, 1st, and 2nd hour of oral administration, when compared with control group of animals.

The results of plasma glucose level changes in normal, STZ induced diabetic rats and EEEC treated diabetic rats were shown in Figure 2. There was a significant ($p<0.001$) increase in plasma glucose levels in STZ induced diabetic rats (Group II) when observed with normal rats (Group I). Administration of EEEC at a dose 200 mg/kg, 400 mg/kg b.w and Gliclazide 25 mg/kg b.w p.o significantly ($p<0.001$) decreased the elevated blood glucose level in STZ induce diabetic rats (Group III, Group IV and Group V). The results were found to be in a dose dependent manner when compared with that of standard Gliclazide given at a dose of 25 mg/kg b.w. p.o.

Results of oral glucose tolerance test shown in Figure 3 which revealed that blood glucose levels are significantly increased in glucose fed diabetic control as compared to glucose fed non-diabetic control. Treatment with EEEC at a dose of 200 mg/kg b.w p.o show significant decrease in elevated blood glucose levels of glucose fed hyperglycemic normal rats when compared with animals received only glucose at a dose 2 g/kg b.w p.o. The same effect was observed at a higher dose level of 400 mg/kg b.w p.o of EEEC and the gliclazide at a dose of 25 mg/kg b.w p.o after initial, 30 min, 60 min, 90 min, 120 min.

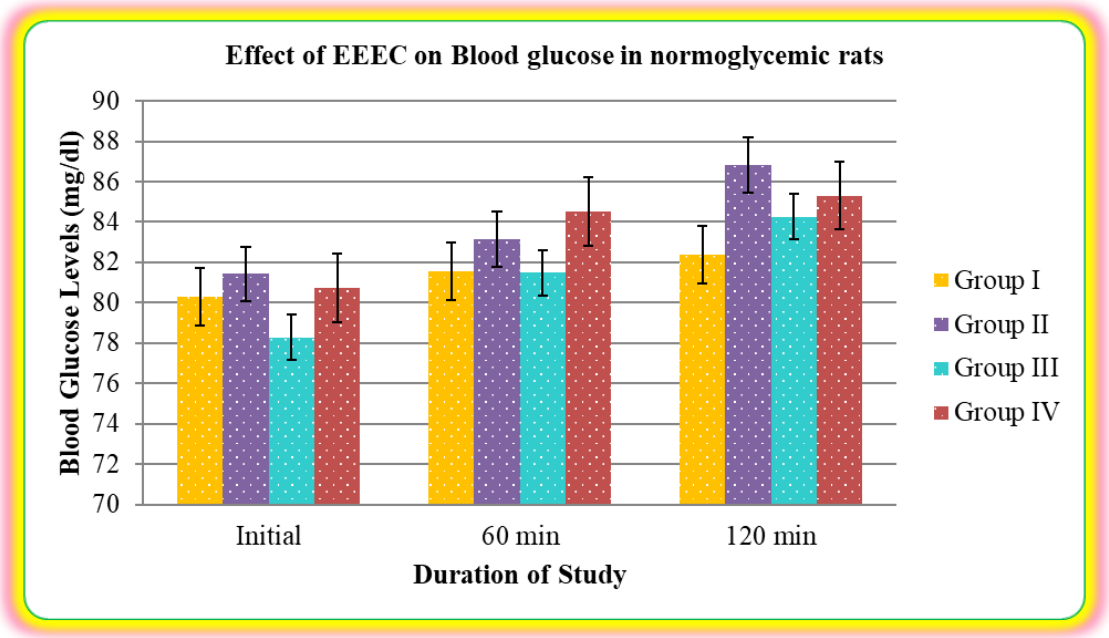

Figure 1: Effect of EEEC on Blood glucose in normoglycemic rats

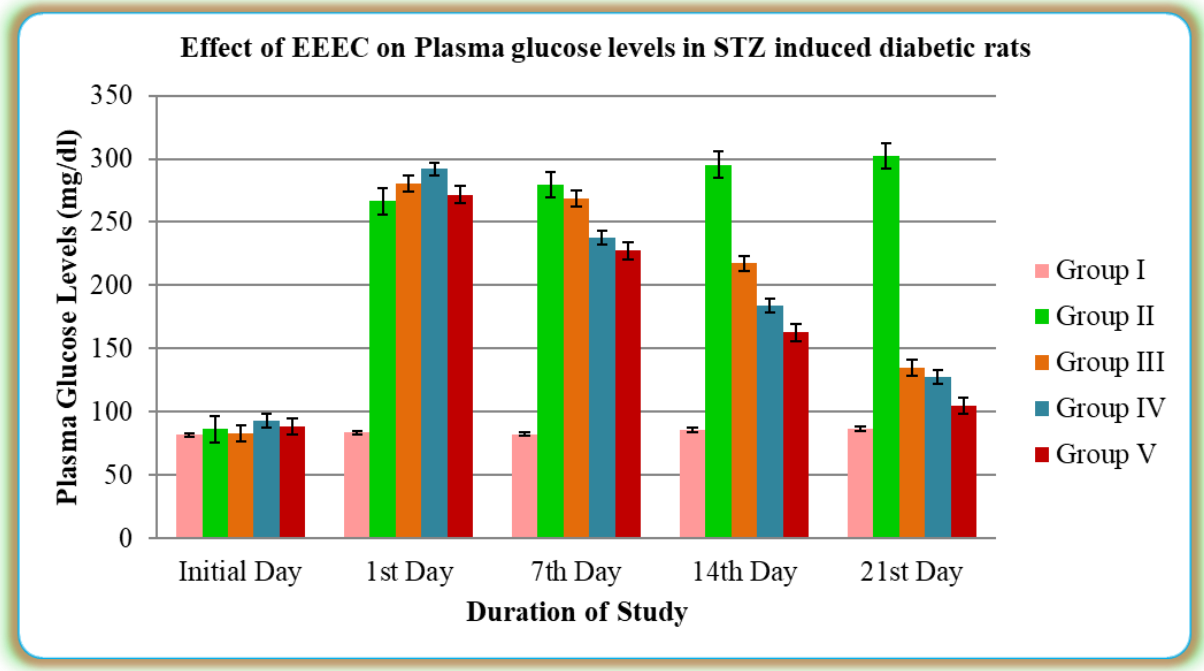

Figure 2: Effect of EEEC on Plasma glucose levels in STZ induced diabetic rats.

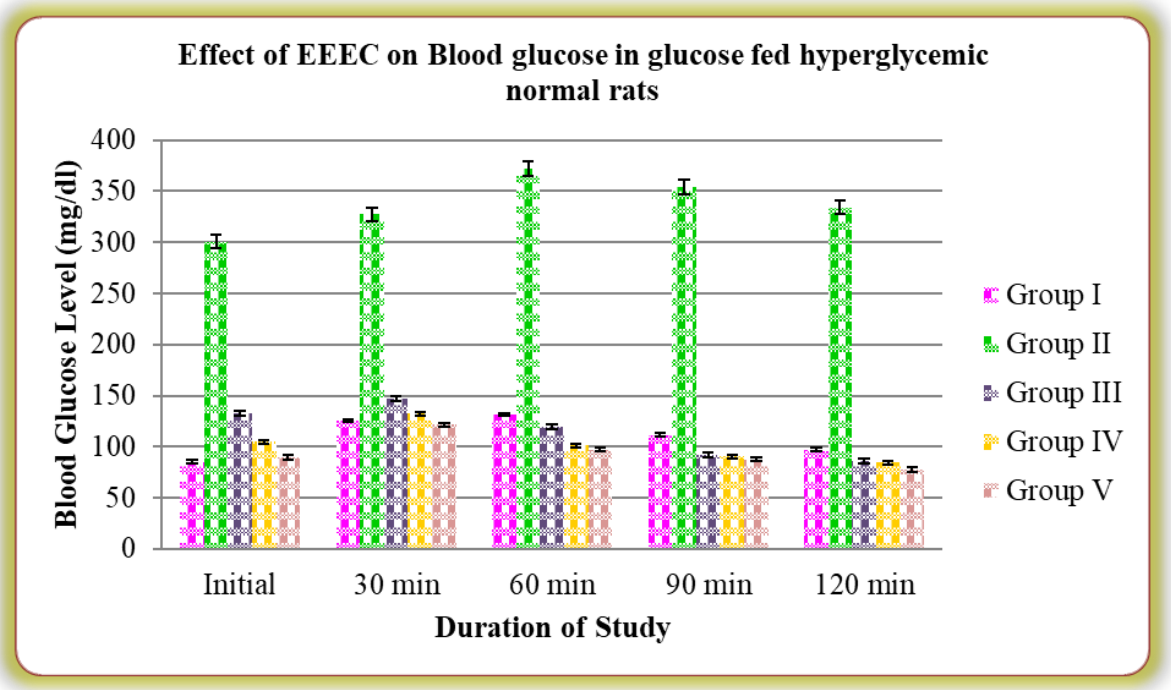

Figure 3: Effect of EEEC on Blood glucose in glucose fed hyperglycemic normal rats

Biochemical analysis:

In diabetes mellitus because of different metabolic confusions and advancement of insulin obstruction may animate lipolysis in the fat tissue and offer ascent to hyperlipidemia. Hence, diabetes hyperlipidemia happens and which is related with cardiovascular danger [19 & 20]. Figure 4 uncover the ethanol concentrate of *Eranthemum capense* Linn consequences for serum lipid levels in control and experimental groups. It was seen that the diabetic rats of group II indicated the raised degrees of serum triglycerides, total cholesterol, LDL cholesterol and VLDL cholesterol and diminished degrees of HDL cholesterol on contrasted with normal rats of group I. Oral treatment with ethanol extract of *Eranthemum capense* Linn at tried portions of 200 and 400 mg/kg body weight significantly brought down the raised degrees of serum triglycerides, total cholesterol, LDL cholesterol and VLDL cholesterol and increased the degrees of HDL cholesterol on contrasted and diabetic control. These impacts are giving off an impression of being equivalent with that of standard gliclazide at the portion of 25 mg/kg body weight. In this manner, the aftereffects of ethanol concentrate of *Eranthemum capense* Linn

consequences for serum lipid levels reports in decrease in the cardiovascular danger related with diabetes.

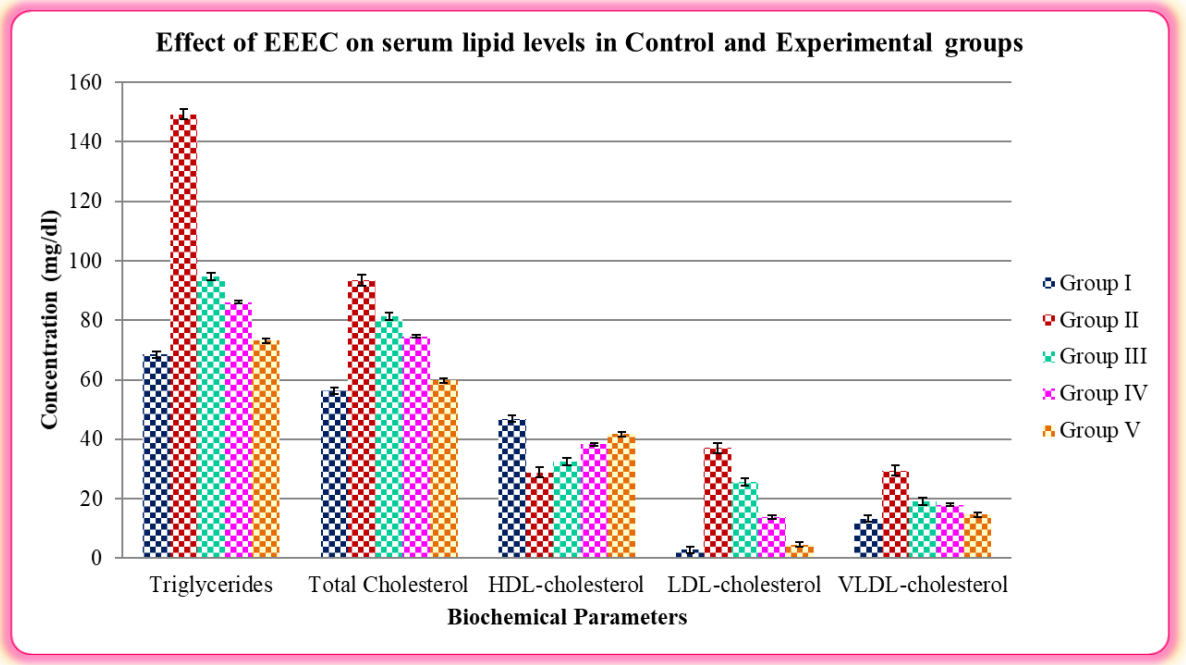

Figure 4: Effect of EEEC on serum lipid levels in Control and Experimental groups.

Figure 5 speaks to the adequacy of ethanol concentrates of *Eranthemum capense* Linn on serum protein levels in diabetic rats. The total protein, albumin and globulin levels were significantly ($P<0.001$) changed in STZ instigated diabetic rats contrasted with normal control group rats. Decrease in serum total protein, albumin and globulin levels had been accounted for in diabetic rats and this is demonstrated by an expansion in the lipid peroxidation and a diminished antioxidant shielding system [21]. The current investigation uncovered those diabetic rats treated with ethanol extracts at portions of 200 and 400 mg/kg body weight of *Eranthemum capense* Linn and standard gliclazide at the portion of 25 mg/kg body weight significantly improved the serum total protein, albumin and globulin levels in contrast with both normal and diabetic control groups.

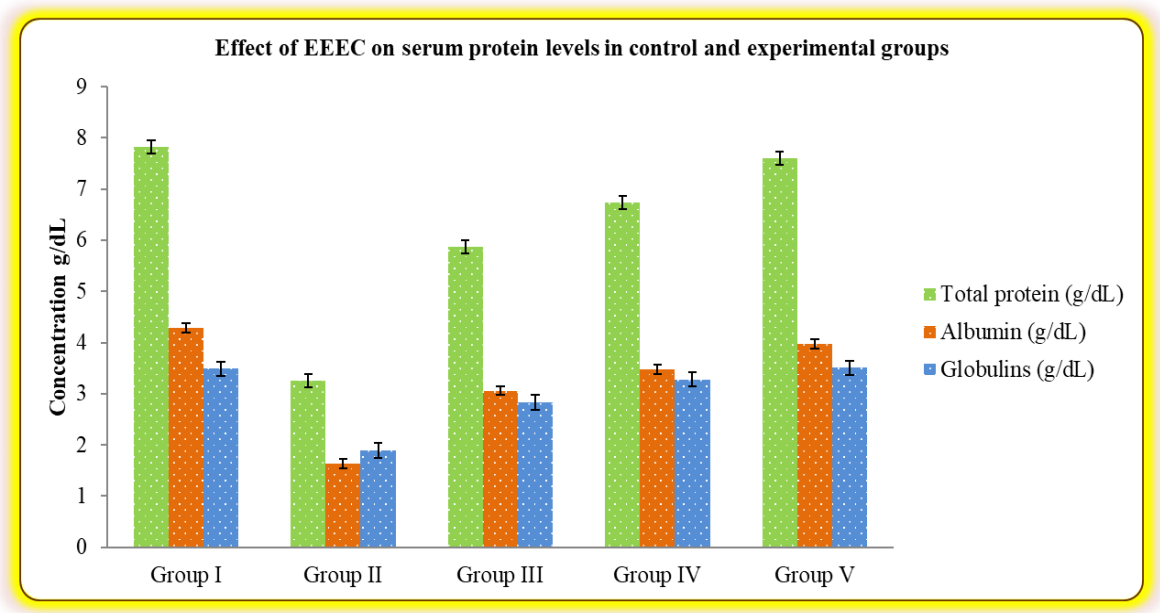

Figure 5: Effect of EEEC on serum protein levels in control and experimental groups

Figure 6 speaks to the adequacy of ethanol concentrates of *Eranthemum capense* Linn on serum insulin and glycosylated haemoglobin levels. In the current examination on organization of streptozotocin diminishes the serum insulin levels in diabetic rats contrasted and normal rats speaks to the β-cell damage. The diabetic rats managed with ethanol extracts of *Eranthemum capense* Linn at portions of 200 and 400 mg/kg body weight and standard gliclazide at the portion of 25 mg/kg body weight significantly ($p<0.001$) rises the serum insulin levels in contrast with diabetic rats. Increment in the serum insulin levels on treated with extracts of *Eranthemum capense* Linn in streptozotocin diabetic rats might be because of its defensive activity against streptozotocin interceded harm to the pancreatic β-cells and furthermore conceivable due to recovery of harmed β-cell or expanded insulin delivery or discharge.

Glycosylated haemoglobin (HbA1c) is the result of non-enzymatic response among glucose and free amino acid groups of haemoglobin (glycosylation). It is a marker of rise of long-term glycaemic control in diabetic patients and predicts risk for the improvement of and additionally movement of diabetic complications [22]. In the current investigation the aftereffects of Figure 6 speak to the expanded degrees of HbA1c in diabetic rats contrasted with normal control rats

which demonstrates the event of glycosylation in diabetic rats because of hyperglycemia. Scheduled with ethanol extract of *Eranthemum capense* Linn at dosages of 200 and 400 mg/kg body weight and standard gliclazide at the dose of 25 mg/kg body weight significantly ($p<0.001$) diminished the serum HbA1c levels contrasted with diabetic rats. Subsequently, the aftereffects of ethanol extracts of *Eranthemum capense* Linn impacts on HbA1c speaks to a capacity to prevent the improvement of diabetes related complications.

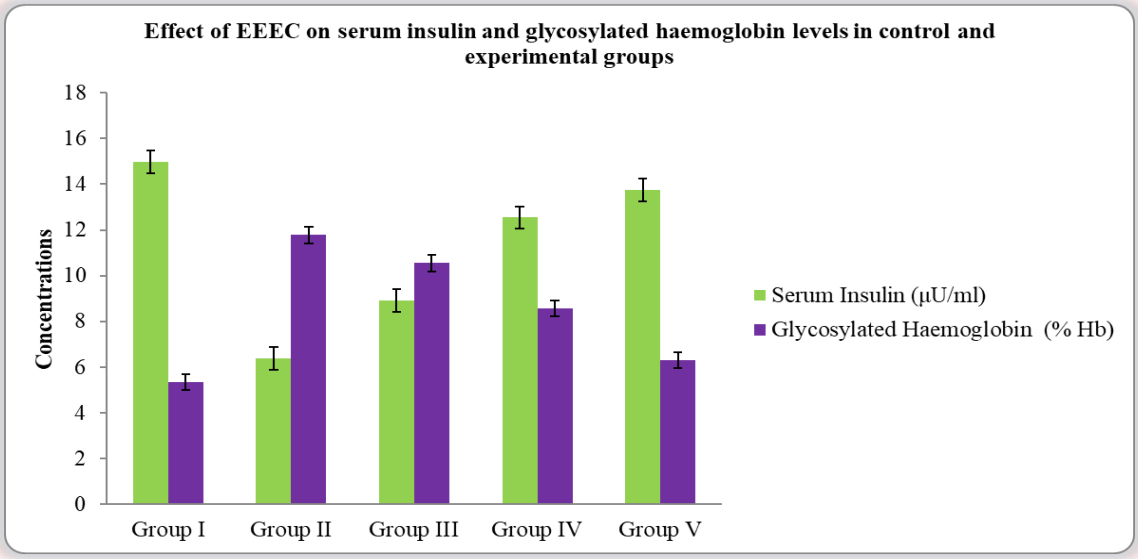

Figure 6: Effect of EEEC on serum insulin and glycosylated haemoglobin levels in control and experimental groups

In-vitro antidiabetic activity:

Alpha-amylase inhibitory activity:

The alpha amylase inhibitory action of ethanol concentrates of *Eranthemum capense* Linn were contrasted and basic standard alpha amylase inhibitor acarbose with IC_{50} esteems and appeared in Table 7 and Figure 7. The IC_{50} estimations of ethanol extract of *Eranthemum capense* Linn were 10.02 µg/ml which were the better on contrasted and standard acarbose 5.13 µg/ml. The plant-based α-amylase inhibitor offers a forthcoming helpful methodology for the management of diabetes.

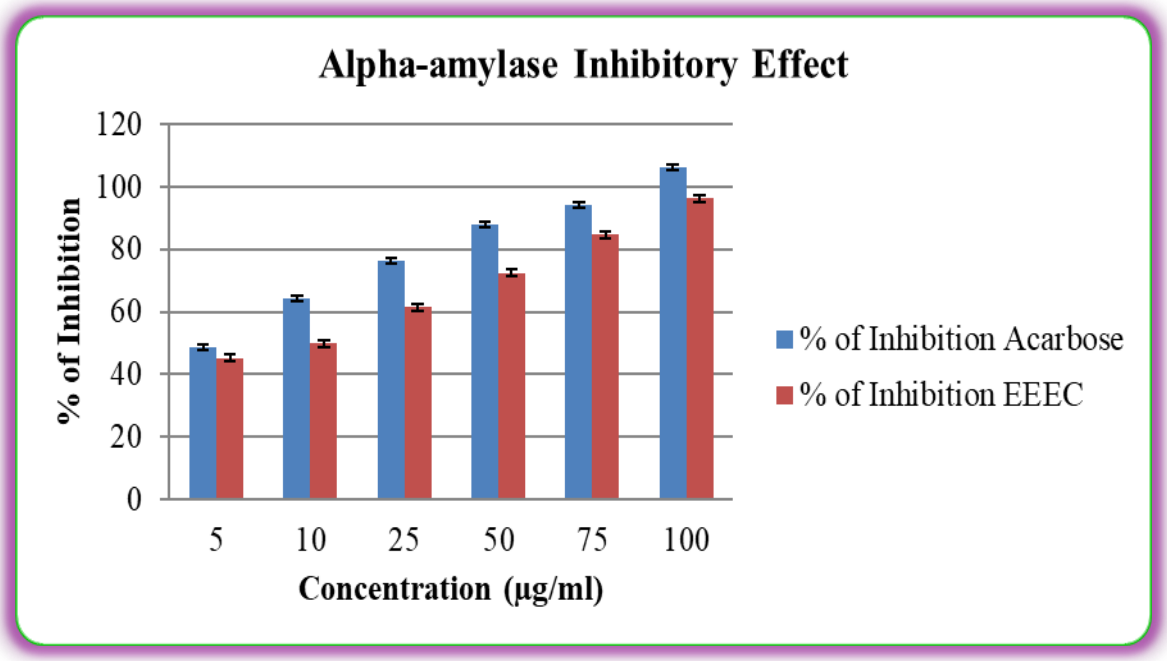

Figure 7: Alpha-amylase Inhibitory Effect.

Histopathological studies

Figure 8 describes the histopathological response of STZ incited diabetic rat pancreas of various groups treated with ethanol extract of *Eranthemum capense* Linn for 21 days. In the current investigation islets of pancreas were watched as without change in size and structure in normal control rats whereas the pancreas of STZ induced diabetic rats, damage of islets with shrunken in size and destruction of cells. In STZ induced diabetic rats handled with ethanol extract of *Eranthemum capense* Linn at 400 mg/kg body weight and standard gliclazide at the dose of 25 mg/kg body weight individually, pancreatic islets are practically identical with normal rats and very little change in their size and structure in spite of the fact that with slight damage were watched.

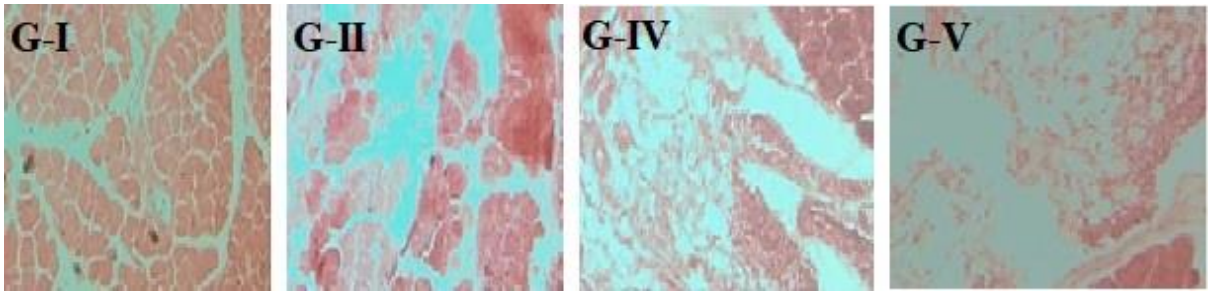

Figure 8: Effect of ethanol extract of *Eranthemum capense* Linn on histopathological studies of rat pancreas

CONCLUSION

The aftereffects concluded that ethanol extract of *Eranthemum capense* Linn is justified for its traditional use of antidiabetic and antihyperlipidemic activity. The extract of *Eranthemum capense* Linn shows significant antidiabetic activity which is comparable to that of standard drug gliclazide. Histopathological effects further conformed the antidiabetic and antihyperlipidemic activity of *Eranthemum capense* Linn. Present endeavours are coordinated to separate the dynamic constituents which are answerable for its action from different concentrate of plant and explanation of mechanism of action.

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CONFLICT OF INTERESTS

The authors proclaim that there was no conflict of interest in this research.

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