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Research Paper

Hypoglycaemic and Antihyperglycaemic Effect of Ethanol Extract of *Elytraria acaulis* Lindau. in STZ Induced Albino Wistar Rats

N. Kiruthika*[1] and M. Shabana Begum[2]

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A B S T R A C T

The hypoglycaemic and antihyperglycaemic activities of the leaves ethanol extracts of *Elytraria acaulis* Lindau were estimated in normoglycemic and in streptozotocin-induced diabetic rats, to validate its use in traditional medicine. Examined animals were given the ethanol extracts of the herb at dosage amounts of 100, 200 and 300 mg/kg. After a 60-day therapy with the ethanol extract, the rats were given up and also blood was obtained for biochemical parameters examination. The main impact observed was a decrease in product glucose, insulin, lipids and also transaminases in diabetic rats after the administration of *Elytraria acaulis* ethanol extract. Of all dosages, the extracts at 300 mg/kg proved statistically significant hypoglycaemic and antihyperglycaemic activities. Consequently, these outcomes confirmed the hypoglycaemic properties of the results of *Elytraria acaulis*.

***Key words*:** *Elytraria acaulis*, Hypoglycaemic activity, Antihyperglycaemic activity, Biochemical parameters

Diabetes mellitus (DM) is actually a metabolic disorder in the endocrine process. The illness takes place worldwide and its particular occurrence is escalating swiftly in most of the globe [1]. Individuals suffering from DM are incapable of produce or properly use insulin, therefore they have higher blood glucose (BG) levels [2]. Being a common chronic sickness, DM is the third 'killer' of mankind, right after malignancy, cardiac and cerebrovascular conditions, owing to its high frequency, morbidity and mortality [3].

In modern treatments, no adequate powerful therapy is open to heal DM, although it might be handled by exercising, diet and chemotherapy. However, pharmaceutical drug found in diabetic therapy are either too costly or have unfavorable adverse-effects or incongruity [4]. As a result, the quest for more efficient and less hazardous hypoglycaemic agencies has persisting a location of effective research everywhere in the earth. Previously, the hypoglycaemic property of a different of indigenous Indian herbs keeps to be reported. Many of these herbs decreased BG ranges inside the alloxan-diabetic animals only, in contrast to some triggered hypoglycaemia within normal and DM rats [5]. *Elytraria acaulis* Lindau. (Acanthaceae) is a famous herb that has been employed in numerous countries for the medication of different ailments with DM. So far, the claim of *Elytraria acaulis* Lindau. antidiabetic impact have not been established experimentally. For that reason, the existing study was designed to estimate the hypoglycaemic potential of leaves ethanol extract of *Elytraria acaulis* Lindau. (*Ea*L-Et) in normal and streptozotocin (STZ) induced diabetic rats.

*N. Kiruthika
kiruthi405@gmail.com

[1-2]Department of Biochemistry, Muthayammal College of Arts and Science, Rasipuram - 637 408, Namakkal District, Tamil Nadu, India

MATERIALS AND METHODS

Collection and preparation of plant material

Mature *Elytraria acaulis* Lindau. was gathered in and around Salem Region, Tamil Nadu, India. The leaves were shade-dried for approximately two weeks at room temperature and produced into coarse powder.

Preparation of the extracts

The leaves in the plant have been dried, at room temperature, and grounded to coarse powder (100g), and after that soaked in ethanol (500ml) for 48hrs. This decoction was filtered and the extracted with ethanol. The yield was additional employed for more experiments.

Drugs and chemicals

Glibenclamide was purchased from Strides Arcolat Ltd. Bangalore, India and Streptozotocin (STZ) was purchased from Himedia, Bangalore, India. All other chemicals used were of analytical grade.

Animals

Male albino Wistar rats (150–180 g) were maintained on standard laboratory diet and tap water *ad libitum* in the Animal House of the Muthayammal College of Arts and Science, Rasipuram, Namakkal, Tamil Nadu. Prior to the experiment, the rats were divided into 6 experimental groups of 6 animals each. The animals were subjected to fasting for overnight but allowed free access to water. The study was carried out with the approval by the Institutional Animal Ethics Committee. (1416/PO/a/11/CPCSEA&7 MARCH 2011).

Study of EaL-Et in experimental rats

Group I offered like a normal control and received appropriate volumes of vehicle (distilled water) orally. Group II – VI were made diabetic intravenously, by an intravenous injection of any freshly well prepared STZ solution at the dosage of 45mg/kg bw in acidified saline solution (0.9%; pH 4.5). In this case, the group II animals obtained simply the acidified saline solution. Following 72h, when the condition of DM was stabilized, the animals with blood glucose (BG) levels above 200mg/dl had been selected to the research. Group III and V were given the *Ea*L-Et by mouth on the doses of: 100, 200 and 300mg/kg. Animals of group VI received glibenclamide at the dose of 10mg/kg as a standard. Blood samples for (BG) were estimated from the tail of rats before administration of drugs.

Estimation of biochemical parameters

Biochemical parameters

Blood was collected and serum was immediately frozen and stored at -70ºC until biochemical determinations were performed. The serum levels of glucose [6], cholesterol [7], triacylglycerides [8], high-density lipoprotein-cholesterol [9], aspartate aminotransferase (AST), and alanine aminotransferase (ALT) [10] were analyzed using a Clinical Chemistry System from Random Access Diagnostics. Plasma insulin concentrations were determined by an enzymatic immunoassay method (Bertin-pharma rat insulin ELISA).

Statistical analysis

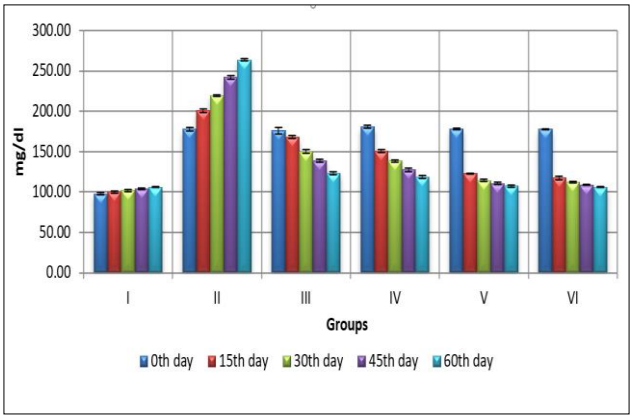
All data are expressed as mean ± S.E.M. One-way analysis of variance (ANOVA) was performed followed by Tukey's test to compare the differences between treatments. Differences were considered statistically significant for $p < 0.05$.

RESULTS AND DISCUSSION

Effect of EaL-Et on Serum Glucose and Insulin

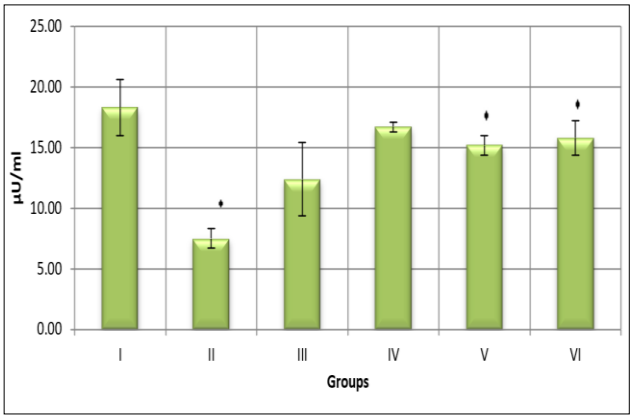
Research reports confirmed that a number of ayurvedic medications effectively reduced the BG level in STZ treated diabetic animals [11]. From the existing study, *Ea*L-Et effectively lowered the BG level and greater the serum proteins level in STZ induced diabetic rats through healing of pancreatic β-tissues that generated insulin and thereby reduced BG level.

STZ triggers DM with the fast depletion of β-cells where there by brings about a decrease in insulin discharge [12]. Hyperglycemia raises the technology of free radicals by glucose autooxidation and dealing with toxins could lead to liver injury. Oxygen free-radicals in DM may be principally improved in due to the increase in BG levels after which because of the outcomes from the diabetogenic agent STZ [13]. With this review, an increase in the level of BG in group II rats validated the induction of DM by STZ. A statistically significant ($p<0.05$) lessen was seen in the BG level of diabetic person rats cured with *Ea*L-Et applied under study at the dose levels of 100, 200 and 300 mg/kg bw in comparison to diabetic rats following the 60th day of experimental period.



Values are Mean±SE, n = 6; *p<0.05 statistically significant when compared with Group I; **p<0.05 statistically significant when compared to Group II

Fig 1 Effect of *Ea*L-Et on glucose level of experimental animals



Values are Mean±SE, n = 6; *p<0.05 statistically significant when compared with Group I; **p<0.05 statistically significant when compared to Group II

Fig 2 Effect of *Ea*L-Et on Insulin of experimental animals

The data of glucose levels (Fig 1) establish obviously revealed that *Ea*L-Et yielded notable and reliable anti-hyperglycemic effect in STZ induced diabetic rats. The continuous treatment method with *Ea*L-Et for a period of 60 days produced a significant lowering of the BG levels. These results strengthened the makes use of *E. acaulis* in tradition medicines being an antidiabetic.

Data depicted in (Fig 2) indicated that there was a significant ($p<0.05$) lowering of insulin levels in DM control rats a weeks after the STZ injection, but that insulin levels in regular rats treated *Ea*L-Et were significantly raised. Sixty days of treatment with *Ea*L-Et and insulin also greater insulin levels in diabetic rats.

STZ administration to rats lowered insulin level. *Ea*L-Et treated STZ diabetic rats displayed an increase in insulin levels. The *Ea*L-Et by being able to scavenge free radicals and also to hinder lipid peroxidation prevents STZ induced oxidative stress and safeguards β-cellular material leading to increased insulin secretion and decreased glucose levels. This is demonstrated that secondary metabolites of *Ea*L-Et elevated insulin relieve in STZ induced diabetic rats. STZ induced DM rats, secondary metabolites safeguarded pancreatic β-tissue by lowering oxidative stress and conserving pancreatic β-cell integrity [14]. Improved insulin levels could also be as a result of stimulatory impact of *Ea*L-Et, and thus potentiating the present β-cells of the islets of langerhans in DM rats. It showed the improved number of pancreatic islets in secondary metabolites-treated animals [15].

Effect of EaL-Et on AST and ALT

Aspartate Transaminase (AST) and Alanine Transaminase (ALT) are cytosolic marker enzymes reflecting hepatocellular necrosis as they are released into blood flow after cell membrane harm [16]. Therefore, the levels of AST and ALT in the blood circulation show hepatic injury.

In the evaluation, the free-radicals injure the liver. The purpose of serum enzymes like ALP and ALT are mainly utilized. Membrane damage or necrosis releases these enzymes into circulation and therefore it is estimated in serum. High level of AST in serum denotes liver damage and muscle injury and cardiac infarction [17]. Therefore, ALT is far more specific on the liver and it is thus a better parameter for finding liver damage [18]. Increased levels of liver enzymes in serum are indicative of cellular problems and loss in efficient dependability of cell membrane in liver cells [19]. In the current review, management of STZ triggered hyperglycemia which resulted in the formation of toxins combined with liver damage which triggered a significant raise of AST and ALT. Within the present research, the levels of AST and ALT were identified being higher in a STZ induced diabetic rats. On other hand, all dealt with groups with *Ea*L-Et effectively showed a significant decline in the levels of serum AST and ALT advising the extract may stop hepatic injuries related to Diabetes mellitus (DM).

Table 1 Effect of *Ea*L-Et on AST, ALT, total cholesterol, on HDL, LDL and VLDL of experimental animals

c	AST (U/L)	ALT (U/L)	Total cholesterol (mg/dl)	Triglycerides (mg/dl)	HDL (mg/dl)	LDL (mg/dl)	VLDL (mg/dl)
I	83.44 ± 0.62	22.16 ± 0.99	130.67±0.42	112.83±0.6	55.47±0.61	22.57±0.12	52.64±0.99
II	116.36±2.98*	44.61± 1.28*	250±0.82	173.67±0.76	34.3±0.52	34.73±0.15	180.97±1.29
III	89.65 ± 1.37	26.65 ± 0.87	189.5±0.56	142.17±0.54	44.6±0.19	28.43±0.11	116.47±0.69
IV	87.23 ± 0.54	23.73 ± 0.81	169.5±0.76	127.5±0.76	48.45±0.23	25.5±0.15	95.56±0.96
V	85.34±1.48**	22.85 ± 1.21**	141.5±0.89**	117.33±0.49**	52.47±0.28**	23.47±0.1**	65.56±0.98**
VI	84.95±1.98 ***	21.31 ± 0.26**	132.5±0.62**	115.83±0.65**	53.55±0.21**	23.17±0.13**	55.78±0.63**

Values are Mean±SE, n = 6
*p<0.05 statistically significant when compared with Group I
**p<0.05 statistically significant when compared to Group II

Effect of EaL-Et on serum cholesterol and Triglyceride level

The raises in plasma lipid, total cholesterol and triglyceride levels occur in DM, is related with significant changes in lipid metabolism. The end result obtained from the present study was in accordance with earlier study [20]. Though deviations in cholesterol metabolism may be fairly accountable for the versions from the level of plasma cholesterol in DM, the specific mechanism causing these versions have yet to get exposed. The rise in triglyceride level might be as a result of deficiency of insulin under diabetic condition, even though the insulin activates the enzyme lipoprotein lipase which hydrolyses triglycerides in normal condition [21]. The administration of *Ea*L-Et and glibenclamide effectively reduced the level of serum lipids in DM rats by improving the activity of lipoprotein lipase through insulin.

Effect of EaL-Et on serum level of HDL – Cholesterol and tissue Glycogen

DM is a major risk component for the introduction of cardiovascular problems, and heart disease now accounts for 80% of all the DM mortality. Lipid-lowering treatment method in DM is useful in reducing the danger of vascular difficulties [22]. The level of total cholesterol and lipoproteins in serum and activity of HMG-CoA reductase in serum and tissues of normal and experimental rats (Table 1). The levels of total cholesterol, LDL and VLDL and hepatic HMG-CoA reductase activity had been significantly greater whereas the level of HDL was significantly decreased in Group II rats [23]. The administration of *Ea*L-Et to DM rats significantly decreased the levels of total cholesterol, LDL, VLDL as well as the activity of HMG-CoA reductase alone significantly elevated from the levels of HDL-C.

Hyperlipidaemia is a predictable impediment of DM described by increased levels of cholesterol, triglycerides and phospholipids and variants in lipoprotein formula [24]. The outcomes of present study evidently show that pterostilbene has a depressing motion on total cholesterol, triglyceride, PL, FFA, LDL and VLDL [25]. There may be large facts that reducing the total cholesterol level, especially the LDL level will cause a decrease in the likelihood of coronary heart disease (CHD). Decreasing of lipid levels through diet or drug treatment method appear to be connected with a decrease in the chance of vascular condition [26].

CONCLUSIONS

It may be concluded that leaves of ethanol extract of *Elytraria acaulis* Lindau. hold an antidiabetic activity, which can be proved from the different biochemical parameters. The results of present analysis clearly reveal that existence of bioactive components in *Elytraria acaulis* Lindau.that exhibits the antidiabetic activity. As a result, the investigation ascertains the value of plants used in pharmacy, which may be of considerable attention to the introduction of new medicines. Additional research needs to be carried out in isolation along with the characterization of active constituents as well as the mechanism active in the antidiabetic effect is required.

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