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Protective role of *eclipta alba* against hyperlipidemia induced by high-fat diet in albino rats

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ABSTRACT

Eclipta Alba has been used in traditional and folklore medicine to treat Hyperlipidemia and hepatic disorders. The present study was aimed to investigate the Antihyperlipidemic and hepatoprotective potentials of *Eclipta Alba* in high-fat diet -induced Albino rats and to determine the underlying mechanism. A total of 30 adult albino rats of Wistar strain weighing 165–215 g were utilized. Animals were treated with high-fat diet for 8 weeks followed by post-treatment of *E. Alba* for 1 week, 2 weeks, and 3 weeks, respectively. After 12 h of fasting on the last day of the experiment, serum blood samples were collected in EDTA vials and processed for biochemical analysis. A significant decrease in levels of total cholesterol and triglycerides was noted on animals treated with *E. alba* compared to high-fat diet animals. Treatment of hypercholesterolemic rats with *E. Alba* showed a marked decrease of serum low-density lipoprotein (LDL) and very LDL cholesterol concentrations compared to the hypercholesterolemic rats. High-fat diet feeding worsened the levels of serum glutamic oxaloacetic transaminase, serum glutamic pyruvic transaminase, and alkaline phosphatase enzymes, whereas the same markers were significantly improved by supplementation with *E. alba* compared to the normal group. *E. alba* acts as an antihyperlipidemic agent in hyperlipidemic conditions and helps for better health.



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INTRODUCTION

Hyperlipidemia has been known to promote oxidative stress leading to the development of

coronary artery diseases, atherosclerosis, and other obesity-associated complications (Maruthappan V. *et al.*, 2010). Atherosclerosis is a condition that involves the interplay of several factors such as oxidation of lipoproteins and atherosclerotic plaque formation (Bhathena J. *et al.*, 2011). Elevated levels of serum triglycerides (TG), cholesterol, and low-density lipoprotein (LDL) are major risk factors for the development of cardiovascular diseases such as atherosclerosis, hypertension, and coronary heart disease ([Ansarullah A. *et al.*, 2009). Increased plasma lipid levels mainly total cholesterol (TC), TG, and LDL along with a decrease in high-density lipoprotein (HDL) are known to cause hyperlipidemia (Ghule BV. *et al.*, 2006). *Eclipta alba* (Asteraceae) is an

annual herbaceous plant, commonly known as a false daisy. It is an erect or prostrate, much branched, roughly hairy, annual, rooting at the nodes; the leaves are opposite, sessile, and lanceolate. Main active principles consist of coumestans such as wedelolactone, desmethyl-wedelolactone, furanocoumarins, oleanane, and taraxastane (Wagner H. *et al.*, 1986 and Singh A. *et al.*, 2010). The root stem and leaves of *E. alba* were analysed for steroids such as diosgenin, tigogenin, and lanosterol (Singh P. *et al.*, 1988). *Eclipta prostrata* is a binominal husk of *E. alba*. *E. alba* is one of the most widely used plants in Ayurvedic formulations for the liver and is said to be the best drug for the treatment of liver ailments such as cirrhosis and infective hepatitis and other conditions involving hepatic enlargements. *E. alba* has a folk reputation in rural Southern India as a hypoglycemic agent (Bhattacharya SK. *et al.*, 2004). The present study was undertaken to study the antihyperlipidemic activity of *E. alba* against high fat diet-treated animals.

MATERIALS AND METHODS

A total of 30 adult albino rats of Wistar strain weighing 165–215g were utilized from the animal house of the Basaveshwara Medical College, Hospital, and Research Centre, Chitradurga, for the present study. The rats were maintained in the laboratory under controlled environmental conditions (12h light/dark cycle and room temperature [22–240°C]) and humidity (50+5%), and rats were housed in polypropylene cages and given food and water *ad libitum*. Group I: Animals fed with normal diet (Control); Group II: Animals treated with hyperlipidemic diet for 8 weeks; Group III: Animals treated with hyperlipidemic diet for 8 weeks, followed by 1-week post-treatment of *E. alba* with normal diet; Group IV: Animals treated with hyperlipidemic diet for 8 weeks followed by 2 weeks' post-treatment of *E. alba* with normal diet; and Group V: Animals treated with hyperlipidemic diet for 8 weeks followed by 3 weeks' post-treatment of *E. alba* with normal diet. After 12 h of fasting on the last day of the experiment, all the animals were anaesthetised using chloroform and serum blood samples were collected in plane and EDTA vials by heart puncture, and then, animals sacrificed. The blood samples were processed for biochemical analysis. The present study has clearance with the Institutional Animal Ethical Committee of Basaveshwara Medical College and Hospital 04/06/2015 and BMCH/ IAEC/01 Anat/2015.

Preparation of hyperlipidemic diet

For 1 kg of diet, carbohydrate 520 g, proteins 180 g, fats 300 g, 2% NaCl, and 1% multivitamins were taken (Mani DN. *et al.*, 2012).

Statistical analysis

All the data obtained were statistically analyzed for any significant differences of various parameters studied between groups by the one-way analysis of variance followed by a Tukey's post hoc analysis. $P < 0.05$ has been considered to be statistically significant. 5 Statistical analyses were performed using the MEDCALC software.

RESULTS AND DISCUSSION

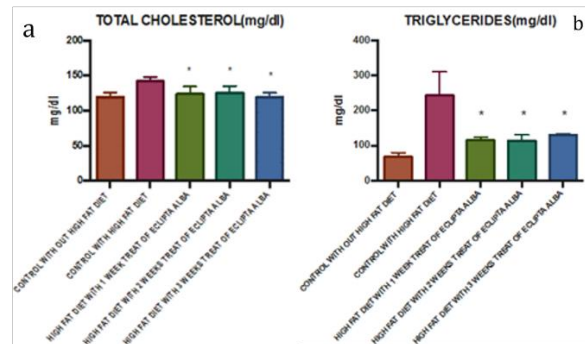


Figure 1: (a and b) Total cholesterol and triglycerides of animals from different groups a b

There was a significant decrease in the TC and TG levels in animals treated with *E. alba* compared to their high-fat diet controls (Fig. 1).

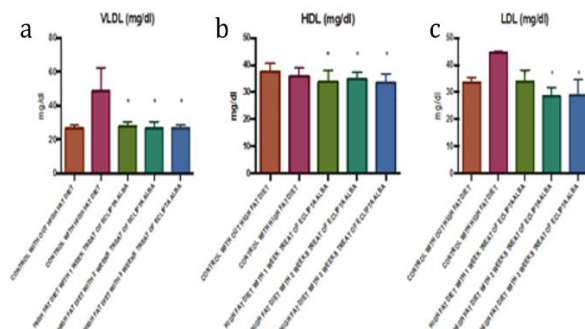


Figure 2: Hyperlipidemic rats treated with *Eclipta alba* in different groups (a-c) Treatment of hypercholesterolemic rats treated in different groups (parameters such as very low-density lipoprotein, high-density lipoprotein, and low-density lipoprotein) a b c

Plasma TC, LDL, and very LDL (VLDL) levels were increased in animals treated with high fatty diet, but no significant difference was observed in the levels of HDL in the animals treated with high-fat diet. Treatment of hypercholesterolemic rats with *E. alba* showed a markedly significant decrease of serum LDL and VLDL-cholesterol concentrations compared to the hypercholesterolemic rats (Fig. 2).

High-fat diet feeding worsened the levels of serum glutamic oxaloacetic transaminase (SGOT), serum glutamic pyruvic transaminase (SGPT), and alkaline phosphatase (ALP) enzymes which are major metabolic enzymes in the liver. The levels of

these markers were significantly improved by supplementation with *E. alba* when compared to the normal group (Fig. 3).

The atherogenic diet-induced hyperlipidemic model followed by treatment of the aqueous leaf extract of the *E. prostrata* showed significantly reduced TC, TG, and total protein and observed a significant elevation in the HDL-cholesterol levels (Jahan R. *et al.*, 2014).

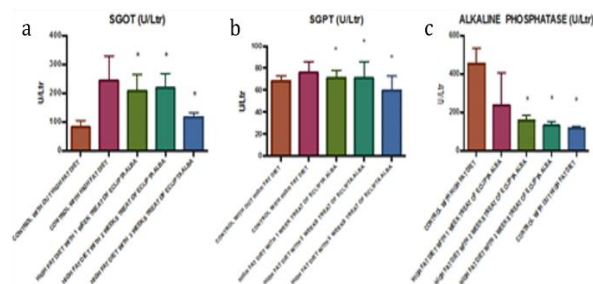


Figure 3: Effects of *Eclipta alba* on liver enzymes in different treatment groups (a-c) (serum glutamic oxaloacetic transaminase, serum glutamic pyruvic transaminase, and alkaline phosphatase levels) a b c

- Control without high-fat diet
- Control with a high-fat diet
- A high-fat diet with the 1-week treatment of *Eclipta Alba*
- A high-fat diet with the 2week treatment of *Eclipta Alba*
- A high-fat diet with the 3-week treatment of *Eclipta Alba*

Biherbal ethanolic extract from the leaves of *E. alba* and seeds of *Piper longum* at a dose level of 50 mg/kg body weight was administered orally once for 14 days which restored elevated serum marker enzymes such as SGOT, SGPT, ALP, LDH, acid phosphatase, gamma-glutamyl transferase, and 5'-nucleotidase, due to CCl₄ treatment (Saxena AK. *et al.*, 1993). All the biochemical parameters such as total protein, total bilirubin, TC, TG, and urea were also restored toward normal levels (Samudram P. *et al.*, 2008 and Dhandapani R. *et al.*, 2007).

Hepatoprotective activity of the methanolic extract and subfractions of leaves and the chloroform extract and subfractions of roots of *E. alba* was carried out using carbon tetrachloride-induced liver damage and lysosomal enzyme level in Wistar albino rats. The methanolic extract of leaves and the chloroform extract of roots of *Eclipta alba* showed significant activities ($P < 0.01$) and ($P < 0.05$) respectively causing 72.8% & 47.96% reduction of a lysosomal enzyme. The Coumestan fraction and Triterpenoidal Saponins fraction from the chloroform extract of roots produced very significantly ($P < 0.01$) (75.6%) and ($P < 0.05$) (52.41%) respectively reduction of carbon tetrachloride-induced increase in lysosomal

enzyme levels in the blood (Lal VK *et al.*, 2010). Albino rats fed with High-fat diet supplemented with freeze-dried butanol fraction of *E. prostrata* per kilogram of diet for 6 weeks reported a significant reduction of serum triacylglycerol, TC, and LDL-cholesterol levels and elevation in the HDL when compared with the normal diet, fed animals (Kim Diet. *al.*, 2008). Leaf Extract of *Eclipta alba* administered orally in alloxan-induced diabetic rats resulted in a reduction in blood glucose level, glycosylated hemoglobin due to decreased activity of glucose-6 phosphatase and fructose-1, 6-bisphosphatase, and increased activity of liver hexokinase stated that oral administration of *Eclipta alba* extract possesses potent antihyperglycemic activity (Ananthi J. *et al.*, 2003). *E. alba* scientifically and clinically proved to possess antidiabetic and diuretic activity by acting on the pancreas by restoration and regeneration of pancreatic β -cell activity ([Hemalatha S. *et al.*, 2006). The findings of the present study in agreement with previous literature and also stating that antihyperlipidemic and Hepatoprotective properties of *Eclipta alba* by reducing the serum biomarkers and metabolic enzymes in high fatty diet treated animals.

CONCLUSION

E. alba has potential effects on hyperlipidemia, reduces the higher levels of lipid markers, and acts as an antihyperlipidemic agent for better health.

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