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Hypolipidemic activity of *Eclipta prostrata* (L.) L. leaf extract in atherogenic diet induced hyperlipidemic rats

R. Dhandapani

Medicinal Plants Research Unit, P.G. & Research Department of Microbiology,Thanthai Hans Roever College, Perambalur 621 212, India

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In atherogenic diet induced hyperlipidemic model, the rats receiving treatment with the aqueous extract of the leaves of *E. prostrata* showed significant reduction in total cholesterol, triglyceride, total protein and elevation in high density lipoprotein cholesterol.The aqueous extract of *E. prostrata* was found to possess significant hypolipidemic activity. The results also suggest that *E. prostrata* leaf extract at 100 and 200 mg/kg b.wt. concentrations is an excellent lipid-lowering agent.

Keywords: Cholesterol, *Eclipta prostrata*, Hyperlipidemia, Triglyceride

Eclipta prostrata (Asteraceae) is a perennial herb, distributed in the tropical and sub-tropical regions of the world. It is common weed in moist situations throughout India[1]. It is very common in clayey moist ground, like bunds of paddy fields, water courses and driainages[2]. The leaves contains beta-amyrin (0.06%), wedelolactone (0.02%), triterpenoids, flavonoids, luteolin-7-o-glucoside (0.04%), L-terthienyl methanol and stigmasterol[3]. The herb is used as tonic and deobstruent in hepatic and spleen enlargements and in skin diseases and the plant juice is administered in catarrhal jaundice in Ayurvedic system of medicine[1]. The expressed leaf juice along with honey is a popular remedy for catarrh in infants[4]. Its hypolipidemic activity has not yet been explored. The present study has been undertaken to establish the hypolipidemic effect of an aqueous extract of *E. prostrata* on normal and atherogenic diet induced hyperlipidemia in rats.

Materials and Methods

Plant material—Fresh leaves of *E. prostrata* were collected from Villamuthur village, Perambalur district,Tamilnadu, India (Latitude $11^0$23N; Longitude $78^0$88E). The plant was verified with the help of specimens available at the Rapinat Herbarium, St. Joseph's College, Tiruchirappalli, Tamilnadu, India.

Telphone: 04328-225273
Fax: 04328—276344, 276354
E-mail: paniroever2007@rediffmail.com

Preparation of leaf powder—Leaves were first shade-dried for four days, then sun-dried for a day and stored in block polythene bags. The leaves were powdered in pulverize as and when required, sieved, labeled and stored in PET bottles[5].

Preparation of the aqueous extract —Leaf powder was boiled in distilled water. After filtration through Whatmann No.40 filter paper the extract was evaporated to dryness by slow heating and continuous stirring in a water bath. The residue left behind was collected and was used as the drug[6].

Phytochemical investigation of the extract—In order to detect the various constituents present in the aqueous extract of *E. prostrata* it was subjected to the tests as per Kokate[7].

Animals—Wistar albino adult male rats (150-200g) randomly bred in the animal house of Periyar Pharmacy College for Girls, Trichirappalli, Tamilnadu, India were used. The animals were kept on standard environmental conditions and fed on pellet diet and water was provided *ad libitum.* The composition of atherogenic diet used during the study was as given in Table 1.

Induction of hyperlipidemia—In order to induce heperlipidemia, the method reported by Bopanna *et al.*[8] was followed. The animals were divided into 4 groups of 6 rats each and they received the following diets with or without treatment for 45 days orally:

Group I: Normal diet

Group II: Atherogenic diet containing 1% cholesterol.

Group III: Atherogenic diet + aqueous extract of *E. prostrata* (100 mg/kg/day).

Group IV: Atherogenic diet + aqueous extract of *E. prostrata* (200 mg/kg/day).

At the end of the treatment the rats were fasted overnight, blood was drawn from retro orbital plexus. Serum was separated and stored in refrigerator until assay.

Measurement of serum lipid profile—Total cholesterol (TC), total triglycride (TG), total protein (TP) and total high density lipoprotein (HDL) were estimated by using standard kits of Randox, Mumbai. The atherogenic index was calculated by using the following formula.

$$\text{Atherogenic index} = \frac{\text{Total serum cholesterol}}{\text{Total serum HDL} - \text{Cholesterol}}$$

Statistical analysis—Statistical analysis was carried out by Student's *t*- test[9].

Table 1—Composition of normal and atherogenic diet

Composition	Normal diet (%)	Atherogenic diet (%)
Protein (Milk powder)	12	10
Carbohydrates (Wheat flour)	71	61
Sugar	05	05
Fat (Butter)	05	16
Salts	04	04
Vitamins	01	02
Fibers	02	01
Cholesterol	-	01
Total Weight	100g	100g

Results

Phytochemical screening revealed the presence of alkaloids, phytosterols, flavonoids, saponins, tannins, sugars and gums and mucilages in the aqueous extract of *E. prostrata*. The results reveal that feeding of atherogenic diet increased serum total cholesterol, triglyceride and total protein and decreased serum HDL-cholesterol level when compared to normal group at over a period of 45 days (Table 2). Administration of 100 and 200 mg/kg per day of aqueous extract of *E. prostrata* showed statistically significant decrease in total cholesterol ($P<0.05$), triglyceride ($P<0.001$) and total protein ($P<0.001$) level as compared to hyperlipidemic animals (Table 2). At this time an increase of HDL-cholesterol level was also observed. Both 100 and 200 mg/kg body wt. aqueous extract treated animals showed decrease in the atherogenic index and increased percentage of protection (Table 3).

Discussion

Tratment with *E. prostrata* extract produced a significant decrease in the serum level of lipids in atherogenic diet induced hyperlipidemia in rats. Atherogenic diet induced hyperlipidemic model has been successfully employed for the evaluation of hypocholesterolemic effect of protein[10] and S-allyl cystein sulphoxide of *Allium sativam*[11] in albino rats. Ahluwalia and Amma[12] found that feeding of oleo-resin of gum guggal (*Commiphora mukul*) lowered the total cholesterol and its fractions in lipoproteins. Reshma *et al.*[13] have reported hypolipidemic activity of the saponins from *Acorus calamus.* Cell culture derived from *Hemidesmus indicus* (CCH) contain

Table 2—Effect of treatment for 45 days with aqueous extract of *E. prostrata* on plasma lipid profile of normal and atherogenic diet induced hyperlipidemic rats

[Values expressed as mg/100ml are mean ± SD of 6 animals]

Groups	Total cholesterol	Total triglyceride	Total protein	Total HDL
Group I (Normal)	160.0 ±14.4[a]	51.68 ±1.09[b]	5.41 ±0.07[b]	50.41 ±2.96[b]
Group II (Control) (Atherogenic diet only)	240.0 ±16.0	182.48 ±1.82	12.42 ±0.09	55.81 ±0.46
Group III (Atherogenic diet + Aqueous extract 100 mg/kg)	139.1 ±34.8[a]	84.71 ±0.98[b]	5.74 ±0.06[b]	72.89 ±0.98[b]
Group IV (Atherogenic diet + Aqueous extract 200 mg/kg)	130.2 ±30.0[a]	36.23 ±0.74[b]	5.43 ±0.07[b]	97.41 ±0.38[b]

Statistical significance in comparison to group – III, IV with group II
P values: [a]<0.05, [b]<0.001

Table 3—Atherogenic index in various groups

Groups	Atherogenic index	Protection* (%)
Group I (Normal)	3.173	-
Group II (Control) (Atherogenic diet only)	4.300	-
Group III (Atherogenic diet + Aqueous extract 100 mg/kg)	1.908	55.62
Group IV (Atherogenic diet + Aqueous extract 200 mg/kg)	1.336	68.93

*Protection (%) =

$$\frac{\text{Atherogenic index of control} - \text{Atherogenic index treated group}}{\text{Atherogenic index of control}} \times 100$$

high amount of phytosterols. Beta sitosterol a phytosterol is reported as useful in the treatment of hyperlipidemia[8]. Sudheesh *et al.*[14] reported that condensed tannins of *Solanum melongena* are reduced in hyperlipidemia and hyperglycemia. Hypolipidemic effect of the proteins, gums, saponins and beta-sitosterol have been reported by several authors. The aqueous extract of *E. prostrata* contains alkaloids, phytosterols, flavonoids, saponins, tannins, sugars and gums and mucilages. The high amount of saponins and phytosterol present in *E. prostrata* may be responsible for the hypolipidemic effect. Faulty diet is a very common cause of heart disease. Particularly, with an increase in inclination towards fast foods, which are rich in saturated fats, an increase in coronary heart disorder (CHD) is being observed in the developing countries since past few decades[15]. A 1% decrease in HDL-cholesterol is associated with a 3-4% increase in the risk of heart disease. For male and females, concentration of HDL-cholesterol below 1.0 and 1.2 mmol/L (39, 46 mg/dl) and especially below 0.8 and 1.0 mmol/L (31,39 mg/dl), confer an increased risk of CHD, whereas concentration exceeding 1.5 and 1.7 mmol/L (58,66 mm/dl) diminishes the influence of other risk factors[16]. In the present study an increase in plasma HDL-cholesterol with a concomitant percentage decrease from other lipid was observed (Tables 2 and 3). It can be concluded from the present data that the levels of total serum cholesterol, triglyceride and total protein which are actually raised in atherogenic diet, can be lowered significantly with the aqueous extract of *E. prostrata*. Aqueous extract of *E. prostrata* can be utilized for providing dietary management in the prevention of atherosclerosis in hyperlipidemic patients.

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