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Chenopodium album ameliorates cyclophosphamide-induced hyperlipidemia in Sprague dawley rats

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Abstract

Hyperlipidemia is the common cause of cardiovascular diseases associated by increasing total cholesterol, Triglyceride, atherogenic index, LDL and decreasing level of HDL. Cyclophosphamide is an alkylating drug used for the treatment of different types of cancer. *Chenopodium album* is herbal medicinal plant found worldwide in early grain field. It contains phytochemical components such as alkaloid, flavonoids, saponins, mineral and essential oil. This study was aimed to determine lipid profiles of cyclophosphamide induced hyperlipidemic Sprague dawley rats which given the hydroethanolic extract of *Chenopodium album*. The result showed that giving of extract of *Chenopodium album* reduced the triglyceride, total cholesterol, LDL-Cholesterol levels, and increased of HDL-cholesterol levels significantly ($P < 0.05$) in rats.

Keywords: Hyperlipidemia, *Chenopodium album*, cyclophosphamide, Sprague dawley rats

Introduction

Incidences of cardiovascular diseases are increasing day by day globally and hyperlipidemia is the most common precipitating factor. Most of the synthetic drugs agents available in the market provide only symptomatic relief and have cytotoxic, immunosuppressant and variety of side effects. However, herbal medicines are relatively cheaper and safer alternative (Fulzele *et al.*, 2002) [2].

Cyclophosphamide induced hyper lipidimia is well documented (Lespine *et al.*, 1988) [15]. *Chenopodium album* Linn. commonly known as Bathua or goose foot is usually found as weed in early grain fields and is well distributed throughout the country (Kirtikar and Basu, 1999) [3]. It has been explored for its anthelmintic, hepatoprotective and anticancer activity (Kim and Jeong, 2010) [4]. The curative property of this plant is due to presence of essential oils, minerals and active phytochemical like alkaloids, apocarotenoids, flavonoids and phytoecdysteroids are present in leaves and seeds (Usman *et al.*, 2010) [5].

The present study was conducted to explore the potential of *Chenopodium album* against hyperlipidemia in rats.

Materials and methods

Plant materials

The areal parts of *Chenopodium album* were collected during winters from mustard fields of the University. Areal parts of the plant were washed to remove dirt and then shade dried. Dried plant was powdered in a mechanical grinder and kept in closed glass container for further use.

Preparation of plant extract

The extract was prepared by the method of Jabbar *et al.*, 2007 [6]. The powder of *Chenopodium album* (500 g) was soaked in 5 liter of 50 % hydroethanolic solution by cold maceration at room temperature. After 24 hours, the mixture was filtered through a muslin cloth followed by filter paper (whatman, filter paper No.-42). The residue was re-soaked and filtrate was collected. This process was repeated twice. The filtrate was concentrated in a rotary evaporator at 40°C and dried in a hot air oven at 42°C and 72hr of keeping the filtrate. The dried extracts were stored in closed glass container in refrigerator at 4 °C until use.

Animals

24 sprague dawley albino rats weighing 150-200 gm of 4 to 6 month of age were used in the

study and were procured from National Laboratory Animal Center (NLAC), CSIR-Central Drug Research Institute, Lucknow. Animals were kept in plastic cages and acclimatized for two weeks before the experiment in the experimental laboratory animal house of the college.

Fresh water and standard rat feed were provided *ad libitum* throughout the period of experiment.

The experimental study was done as per standards of Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) approved by the Institutional Animal Ethics Committee (IAEC).

Experimental design

Rats were randomly divided into six groups containing six rats in each. Group I served as control, group II rats were administered cyclophosphamide @100 mg/kg b. wt. orally on 9th and 16th day of study, group III and IV was administered hydroethanolic extract of *Chenopodium album* (CAHE) @ 200 and 400 mg/kg b. wt. respectively orally daily and in group V and VI hydroethanolic extract of *Chenopodium album* (CAHE) @ 200 and 400 mg/kg b. wt. respectively orally was given along with cyclophosphamide @100mg/kg b wt. orally on 9th and 16th day of study respectively, for 28 days.

Assessment of antilipidemic activity

Blood samples were collected from each rat separately into serum collecting tubes and allowed to stand for 30 minute at room temperature. The serum was separated in a centrifuge machine at 2500 rpm for 15 minutes and biochemical tests were carried out to assess the effect on lipid profile (total cholesterol, LDL, HDL, triglyceride level and atherogenic index).

Data Analysis

Statistical analysis was carried out by analysis of variance (one-way ANOVA) at 5% level of significance. Data were processed with Graph pad prism software 8thed.

Result and discussion

The percent yield of *Chenopodium album* extracts using 50% hydroethanolic (CAHE) was 15.40%. The extract was light brownish black and crystalline in appearance. The level of total cholesterol, low density lipid (LDL), high density lipid (HDL), triglyceride and atherogenic index in serum of groups I – IV are depicted in table-1 and graph 1-5. Total cholesterol, LDL, HDL, Triglyceride and Atherogenic index increased significantly ($P < 0.05$) in cyclophosphamide treated group II and level of these parameter decreased in CAHE treated group III when compared with control group I. In group IV, given combination therapy of cyclophosphamide and CAHE lipid component diminished significantly ($P < 0.05$) compared with cyclophosphamide treated group II animals and were nearly similar to the values of control group I.

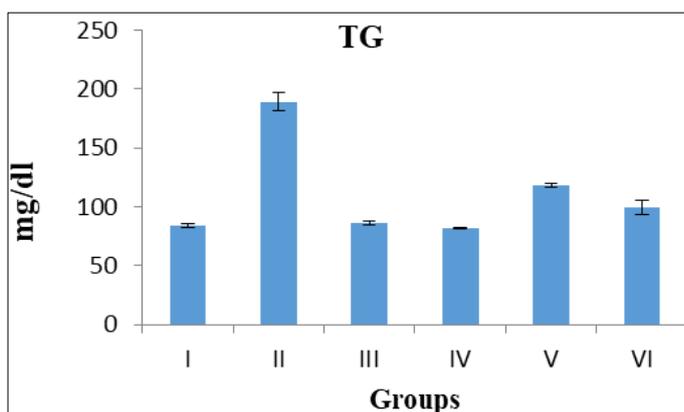
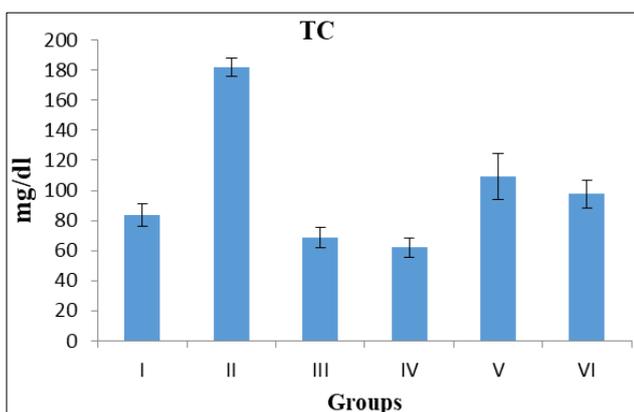
Treatment of hydroethanolic extract of *Chenopodium album* in rats reduced the total cholesterol and triglyceride levels in blood serum significantly ($P < 0.05$). This might be due to presence of flavonoids in *Chenopodium album* (Adeolu *et al.*, 2011) [1]. The intake of flavonoid was correlated to resolving coronary heart disease.

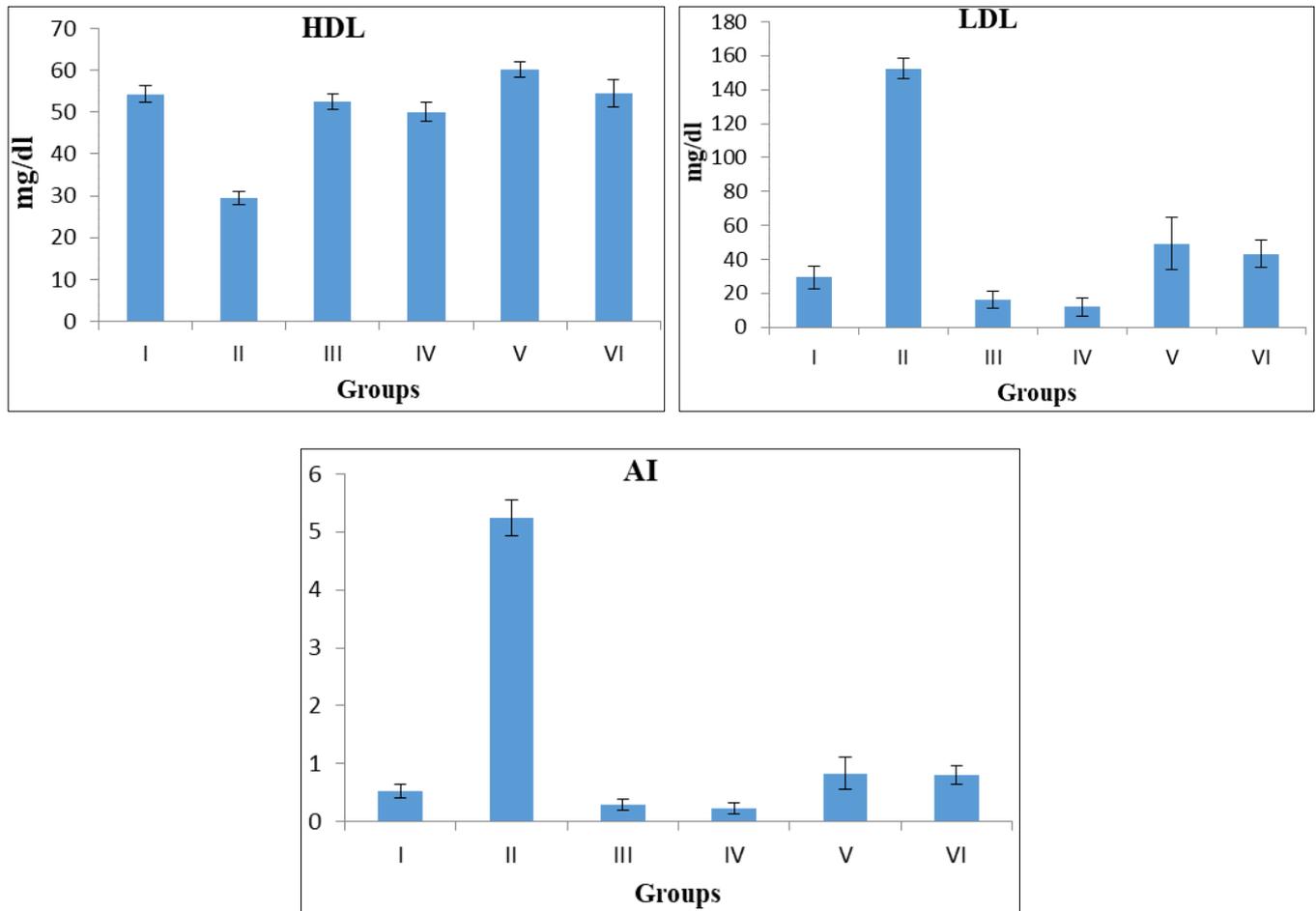
Flavonoids have strongest antioxidants potential and prevent atherogenesis by protecting to LDL oxidation (Yang *et al.*, 2008) [12]. Flavonoid compounds also inhibit the lipase activity (Martins *et al.*, 2010) [11]. Flavonoids inhibiting the lipase activity have been reported, such as Yerba mate herbal plant from North America that contains quercetin and rutin flavonoids and phenolic acids. That compounds have the ability to prevent oxidation of the hormone-sensitive lipase which regulate lipid and cholesterol metabolism (Balani *et al.*, 2011) [8], (Martins *et al.*, 2010) [11].

Table 1: Effect of hydroethanolic extract of *Chenopodium album* on lipid profile in rats

Groups	Treatments	TC	TG	HDL	LDL	AI
I	Control	83.61±7.61 ^{cd}	84.32±1.52 ^d	54.32±2.08 ^b	29.29±6.68 ^{bd}	0.53±0.12 ^b
II	Cyclophosphamide	181.77±6.02 ^a	188.82±7.82 ^a	29.37±1.52 ^c	152.40±5.83 ^a	5.25±0.31 ^a
III	Cahe @200	68.44±6.82 ^d	86.39±1.72 ^d	52.44±1.86 ^b	16.00±5.19 ^c	0.29±0.09 ^c
IV	Cahe @400	61.93±6.45 ^d	81.83±0.65 ^d	50.03±2.26 ^b	11.90±5.39 ^c	0.23±0.10 ^c
V	CYP + Extract @200	109.28±15.22 ^b	118.56±1.57 ^b	60.09±1.89 ^a	49.20±15.41 ^b	0.83±0.28 ^b
VI	CYP + Extract@400	97.72±9.33 ^c	98.99±5.96 ^c	54.49±3.24 ^{ab}	43.24±8.15 ^b	0.80±0.16 ^b
	CD at 5%	26.39**	12.07**	6.37**	24.69**	0.56**

Values in the table are mean ±S.E. (n=6); Values having different superscripts (a, b, c, d) differ significantly ($P < 0.05$) when compared within a column. TC= Total cholesterol, TG= Triglyceride, HDL= High density lipoproteins, LDL= Low density lipoproteins, AI= Atherogenic index, CYP= Cyclophosphamide, CAHE= hydroethanolic extract of *Chenopodium album*, CYP was administered on 9th and 16th day only.





Cyclophosphamide causes lipid peroxidation has been well documented (Berrigan *et al.*, 1987) [16]. A high dose of cyclophosphamide causes inhibition of lipoprotein lipase activity (Lespine *et al.*, 1993) [13]. There by slow down hydrolysis of blood plasma triglycerides. The study of cyclophosphamide treatment in rabbits has been reported to increase the total cholesterol level with accumulation of VLDL (Loudet *et al.*, 1984) [16].

Cyclophosphamide induced hyperlipidemia changes blood serum as well as tissue lipids. The rising level of triglyceride observed in cyclophosphamide treated rats may be due to increase synthesis of VLDL cholesterol and lipoprotein lipase activity (Ilanchezhian *et al.*, 1995) [17].

Treatment of hydroethanolic extract of *Chenopodium album* in hyperlipidemic rat reduces significantly level of LDL. Cholesterol or cholesterol esters transported by LDL particles from the liver to all peripheral tissues, and has been linked to atherogenesis and cardiovascular disease (Zawistowski *et al.*, 2009) [10].

The reduction in total cholesterol and LDL-cholesterol level by the treatment of hydroethanolic extract of *Chenopodium album*, it was due to flavonoids component in *Chenopodium album*. The previous study showed significantly reduction in total cholesterol, lipoprotein, triglycerides and LDL-Cholesterol level due to intake of black rice which is rich in flavonoids and anthocyanins (Pratiwi *et al.*, 2017) [9]. They said that anthocyanin of berries increase the HDL-C level approximately 13.7 % and decrease the LDL-C levels until 13.6 % compare with control. The increased Level of total cholesterol and LDL-Cholesterol are responsible for atherogenesis. Increasing HDL Cholesterol and reducing total cholesterol levels reduces the risk of atherosclerosis. High

level of total cholesterol and LDL levels were positively correlated with the atherogenic index, whereas HDL levels were negatively correlated with the atherogenic index. The result showed that giving of extract of *Chenopodium album* reduced the total cholesterol and increased of HDL-cholesterol levels, so the atherogenic index reduce significantly ($p < 0.05$). It indicates the lower risk of atherosclerosis.

Conclusion

The results obtained from the experiment have led to the conclusions that, hydroethanolic extract of *Chenopodium album* both lower and higher doses have significant antihyperlipidemic activity. Antihyperlipidemic activity may be due to the presence of flavonoids and tannins like polyphenolic compounds in the hydroethanolic extracts. The hydroethanolic extracts of *Chenopodium album* showed marked decrease in the serum Total Cholesterol, Triglyceride, LDL levels and increase in HDL level in cyclophosphamide induced hyperlipidemia model in a dose dependent manner. Hence it can be exploited as an antihyperlipidemic therapeutic agent for the treatment of hyperlipidemia.

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