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ORIGINAL RESEARCH ARTICLE

Antihyperlipidemic Activity of Ethanolic Extract of Celery Stem on Rats (*Rattus norvegicus*)

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ABSTRACT

Cardio vascular disease (CVD) is one of the major causes of mortality and morbidity in Europe, United States, most parts of Asia and recently in developing countries. World Health Organization (WHO) reported that the high blood cholesterol contributes to approximately 56% cases of CVD worldwide and causes about 4.4 million deaths in each year. Presently, the existing drugs used in CVD are associated with side effects such as abnormal liver disease, diarrheal, gastric irritation and nausea. In recent times, focus on plant research has increased all over the world and copious amount of evidence is available regarding the potential use of medicinal plants in various traditional system of medicines. Several herbs have been reported to reduce high blood cholesterol without negative side effects and they are relatively affordable. In the present study, the effect of celery on cholesterol induced rats was studied. Ethanolic extract of celery stem was orally administered by post treatment at the dose level of 500mg/kg of body weight for 7th, 14th, 28th and 56th days respectively. Administration of cholesterol induced rats resulted in increased total cholesterol, triglycerides, LDL, VLDL and decreased the HDL cholesterol (Hyperlipidemic). Administration of celery extract resulted in HDL cholesterol increase and decrease in the total cholesterol, triglycerides, LDL and VLDL in time duration dependent manner. The above finding proved that 56th day treatment of ethanolic extract of celery was found to have more protective effect on lipid profiles in cholesterol induced rats. The results of the above studies are discussed in the light of recent literature.

Key words: *Apium graveolens*, Cholesterol, Triglyceride, LDL, VLDL and HDL.

1. INTRODUCTION

Cardio vascular disease (CVD) is one of the major causes of mortality and morbidity in Europe, United States, most parts of Asia [2,19] and recently in developing countries [9]. World Health Organization (WHO) reports that high blood cholesterol contributes to approximately 56% cases of CVD worldwide and causes about 4.4 million deaths in each year [6]. Many scientists have clearly demonstrated that the common risk factor for CVD is hypercholesterolemia [3, 10, 20]. Hyperlipidemia is a metabolic disorder, specially characterized by alteration occurring in serum lipid and lipoprotein profile due to increased concentration of Total Cholesterol (TC), Low Density Lipoprotein Cholesterol (LDL-C), Very Low Density Lipoprotein Cholesterol (VLDL-C) and Triglycerides (TAG) with a decrease in the concentration of High Density Lipoprotein Cholesterol (HDL-C) in the blood circulation [16]. Therefore, treatment of hypercholesterolemia may reduce the risk or development of CVD [7].

Presently, the existing drugs used in CVD are associated with side effects such as abnormal liver disease, diarrheal, gastric irritation and nausea [7]. In recent times, focus on plant research has increased all over the world and copious amount of evidence are available regarding the potential use of medicinal plants in various traditional system of medicines. Several herbs have been reported to reduce high blood cholesterol without negative side effects and they are relatively affordable [26]. India has about 45,000 plant species; while medicinal properties have been assigned to several thousand. The officially documented plants with medicinal potential are 3000 but traditional practitioners use more than

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6000 plants. India is the largest producer of medicinal herbs and is called the botanical garden of the world.

Celery is an excellent source of vitamin C. It is a very good source of dietary fiber, potassium, foliate, manganese and vitamin B6. It is also good source of calcium, vitamin B1, vitamin B2, magnesium, vitamin A, phosphorus and iron [14]. Essential oils from mountain celery seed (MC-E) contains 109 compounds, including mainly nine kinds of monoterpenoids, 31 kinds of sesquiterpenoids, and 22 kinds of alcohols [4]. Experimental studies have shown that celery possess antibacterial, antifungal, nematicidal, mosquitocidal [15], anti-aggregation [21], and analgesic [11].

Apium graveolens (Celery) an important commercial plant belongs to the family Apiaceae and is widely used as a spice and a seasoning in food. It is grown commercially in the USA, France and other parts of Europe. In India, it is grown in Punjab, UP and nowadays in Tamilnadu (Nilgiris). India produces 40,000 tons of Celery and exports 29,250 tons (Spices Board 2008).

2. MATERIALS AND METHODS

Plant processing

Celery was purchased from the local market (Chennai). The celery stem were shade dried, finely powdered and filled in the thimble and extracted successively with Ethanol using soxhlet extractor for 10 h. The extracts were concentrated using rotary flash evaporator and preserved at 5^{o}C in an airtight bottle until further use.

Cholesterol

Cholesterol was purchased from Sisco research laboratories Pvt. Ltd. Bombay, India.

Animal Model

Animals were housed, fed and treated in accordance with the in house guidelines for animal protection to minimize pain and discomfort. Adult male wistar rats weighing about 175 – 200 g each were used throughout the study. The animals were left for seven days to adapt to the room conditions (temperature, humidity, light and dark period, aeration and caging).

Treatment

Male wistar rats were divided into seven groups (n = 6). Group I served as control, group II served as vehicle control administered with vehicle only (2 ml of hydrogenated groundnut oil). Group III cholesterol control where in 500 mg/kg body wt of cholesterol in 2 ml of hydrogenated groundnut oil was administered for 30 days, the treatment of Group IV, V, VI and VII rats were fed with 1ml of ethanolic extract of celery stem of 500 mg/kg of body weight for 7th, 14th, 28th and 56th days respectively.

Collection of Blood

At the end of the experiment after 12 - 14 hrs of fasting blood samples were drawn from rats in plain tube, allowed to clot and were centrifuged to obtain serum. The serum was stored -20^{0}C for biochemical analysis.

Determination of serum lipid profile

Serum lipid profile, including: total cholesterol (TC) and triglycerides (TG) were calorimetrically determined [1, 25]; high - density lipoprotein cholesterol (HDL-c) was calorimetrically determined, low - density lipoprotein cholesterol (LDL-c), and very low-density lipoprotein cholesterol (VLDL-c) were mathematically calculated [8].

Statistical analysis

The data obtained from various studies were subjected to statistical analysis using SPSS package. Student's 't' test was applied for the studies. They are expressed as the mean ±SD and the differences between groups were statistically analyzed using one-way analysis of variances (ANOVA).

3. RESULTS

Herbal preparation has been used in many parts of the world since ancient times. In, recent years, their popularity has gained importance, as a alternative to modern medicine even in developing countries [13].

Among many plants analysed/investigated by many scientists worldwide, Research has shown Celery occupies a unique place in delipidation process. Which is also witnessed in this study likewise *Hibiscus sabdariffa* on rats [16], *Ocimum sanctum* on rats [22], *Emblica officinalis* on rats [17], *Lantana aculeata* on rats [24]. According to Choudhary *et al.* [5] ethanol extract of *Iris germanica* on rats significantly lowered the lipid components especially, the cholesterol and triglycerides.

On feeding normal rat with cholesterol significantly increases the level of total cholesterol, TGL-c, LDL-c, VLDL-c and decrease the HDL-c. On feeding of ethanolic extract of celery stem it increased the HDL-c and at the same time it remarkably decreases the Total cholesterol, TGL-c, LDL-c and VLDL-c when compared to the control experimental animal. Better results were obtained in 56th day of treatment with 500 mg/kg celery than the 7th, 14th

and 28th day treated animal (**Table 1**). The results suggest that the lipid lowering action of this natural product maybe reduction of lipid absorption in the intestine, such a result has also been obtained by Tsi and Tan [23] while using aqueous celery extract fed for 8 weeks after weaning, which significantly reduced the serum TC concentration of growing RICO rats. The reason for decrease in levels of total cholesterol, triglycerides, LDL and VLDL may be due to the short-chain fatty acids produced through the fermentation of soluble fiber by celery.

In the liver, conversion of cholesterol to bile acids is regulated by the rate limiting enzyme, cholesterol 7a-hydroxylase [23]. It may be pointed here that the mountain Celery seeds are products uniquely possessing hypolipidemic and HDL-C-elevating activities [4]. According to Mansi *et al.* [12] the lipid lowering action of this natural product may be mediated through inhibition of hepatic cholesterol biosynthesis, increased faucal bile acids excretion, and enhanced plasma lecithin: cholesterol acyltransferase activity, and reduction of lipid absorption in the intestine, thereby reducing the bad cholesterol.

The study shows that ethanolic extract of celery stem has antihyperlipidemic effect and could be of value in reducing serum Total cholesterol, Triglyceride, LDL-c, VLDL-c and increasing HDL-c. Which can be recommended to high cholesterol patients and also obese patients to use celery powder in their diet and also celery leaves can be used as green salads.

Table 1: Effect of *Apium graveolens* on lipid profiles in the blood of rats (*Rattus norvegicus*)

	Total Cholesterol	Triglycerides	HDL	LDL	VLDL
Normal control	53.17 ± 2.56	73.17 ± 3.97	35.83 ± 2.64	2.33 ± 0.82	14.33 ± 0.82
Vehicle control (HGNO)	88.67 ± 3.83 ^{a***}	106.17 ± 4.54 ^{a***}	25.50 ± 3.08 ^{a***}	41.83 ± 0.75 ^{a***}	20.83 ± 0.75 ^{a***}
Cholesterol control (30 Days)	179.33 ± 2.80 ^{a***}	150.83 ± 5.00 ^{a***}	16.67 ± 2.58 ^{a***}	132.17 ± 1.72 ^{a***}	29.67 ± 1.21 ^{a***}
30 Days C + 7 Days with *A. graveolens* Stem (37 Days)	129.83 ± 4.02 ^{b***}	133.50 ± 3.94 ^{b***}	27.33 ± 3.33 ^{b***}	75.33 ± 1.51 ^{b***}	26.33 ± 0.82 ^{b***}
30 Days C + 14 Days with *A. graveolens* Stem (44 Days)	91.83 ± 4.17 ^{b***}	120.50 ± 2.88 ^{b***}	31.83 ± 3.54 ^{b***}	35.50 ± 4.93 ^{b***}	23.50 ± 0.55 ^{b***}
30 Days C + 28 Days with *A. graveolens* Stem (58 Days)	72.83 ± 2.14 ^{b***}	110.67 ± 4.13 ^{b***}	36.50 ± 2.07 ^{b***}	13.83 ± 3.54 ^{b***}	21.83 ± 0.98 ^{b***}
30 Days C + 56 Days with *A. graveolens* Stem (86 Days)	58.83 ± 2.64 ^{b***}	91.50 ± 5.47 ^{b***}	38.67 ± 4.18 ^{b***}	2.67 ± 1.51 ^{b***}	18.00 ± 1.10 ^{b***}

A. graveolens – *Apium graveolens*; HDL – High density lipoprotein; HGNO – Hydrogenated ground nut oil; C – Cholesterol, LDL – Low Density Lipoprotein, VLDL – Very Low Density Lipoprotein.
Values represent mean ± SD of six animals
a – denotes parameters are compared to control rats, b - – denotes parameters are compared to cholesterol control rats
^{NS} - Non-significant, * P<0.05, ** P<0.01, *** P<0.001.

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