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Antihyperlipidemic activity of *Cinnamomum tamala* Nees. on high cholesterol diet induced hyperlipidemia

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Abstract

The present study was designed to investigate the hypolipidemic effect of *Cinnamomum tamala* Nees. leaves extracts in high cholesterol diet induced hyperlipidemia. Aqueous and ethanolic extracts of leaves of *Cinnamomum tamala* Nees. were administered in doses of 400mg/kg /day p.o. each for 10 days. Simultaneous administration of *Cinnamomum tamala* Nees. leaves extracts significantly($p<0.001$) prevent the rise in serum levels of total cholesterol, triglyceride, LDL-C,VLDL-C and atherogenic index whereas significant ($p<0.01$) increases in the level of HDL-C.

Keywords: Hyperlipidemia, HCD, LDL-C

Introduction

Hyperlipidemia contributes significantly in the manifestation and development of atherosclerosis and coronary heart diseases (CHD). Atherosclerosis, are the most common cause of mortality and morbidity worldwide. Although several factors, such as diet high in saturated fats and cholesterol, age, family history, hypertension and life style play a significant role in causing heart failure, the high levels of cholesterol particularly TC, TG and LDL cholesterol is mainly responsible for the onset of CHDs. A 20% reduction of blood cholesterol level can decrease about 31% of CHD incidence, and 33% of its mortality rate[1].

In addition hyperlipidemia is induced by secondary effect of diabetes, therefore ,the agent having some antioxidant and anti-diabetic effect also showed favorable effect to hyperlipidemia.HMG Co A reductase inhibitor has been used in the treatment of hyperlipidemia, and simvastatin is one of the most perevalently used HMG CO A reductase inhibitors [2].

Spices are dried parts of herbs used as flavouring agents in cooking in oriental countries owing to their taste and aroma. Indian bay leaf (*Cinnamomum tamala* Nees.) is one among them .The dried leaf of this plant is a spice commonly used in Indian homes for seasoning. It belongs to the family *Lauraceae* and is indigenous to the Asian minor and southern Europe [3-4]

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Until now, the antidiabetic activity[5], anti-bacterial activity[6], antioxidant activity[7], antimicrobial[8], anti-inflammatory activity[9], anti-diarrhoeal activity[10], of CT extracts have been evaluated.

Based on this information present study was designed to investigate the antihyperlipidemic effect of *Cinnamomum tamala* Nees. extracts (ethanolic and aqueous) serum lipid and lipoprotein profile in high cholesterol diet induced hyperlipidemia.

Material and Methods

Plant materials and chemicals

The leaves of *Cinnamomum tamala* Nees. collected at local area of Sangli were authenticated from botanist of Jaysingpur College , Jaysingpur. Simvastatin was obtained as gift sample from Cipla, Kurkumbh, Pune. Diagnostic kits for estimation of Cholesterol (Span Diagnostics), triglyceride (Biolab diagnostics), HDL-C (Coral Clinical) were used. High cholesterol diet was prepared in college lab.

Plant extracts

The leaves of plant were dried in shade, under normal environmental condition and then coarse powder was prepared. Aqueous extract was prepared by cold maceration. Drug powder was taken in a 1000 ml conical flask and macerated with sufficient quantity of chloroform water for 7 days. During maceration, it was shaked twice daily. On 7th day it was filtered and the filtrate was concentrated. The remaining solvent was evaporated by heating on a water bath (50^{o}C) to get aqueous extract. Ethanolic extract was obtained by extracting powder with 95%ethanol by soxhlet extraction method with for 72 hr. After completion of

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the extraction the solvent was removed completely to get extract. All the extracts were stored in desiccators.

Experimental

Male albino rats (Wistar strain) weighing between 150-200gm were maintained at 25 to 300C and kept in well ventilated animal house in large polypropylene cages and were fed standard rats chow and water *ad libitum*. The animal experiment was approved by animal ethical committee of institute.

Preparation of doses

Oral administration of extract

Dissolving 500mg/kg, body weight of *Cinnamomum tamala* Aqueous extract in distilled water and ethanolic extract suspended in tween-80, and given by oral gavage.

Composition of High fat diet (HCD)

High fat diet cocktail was prepared by mixing cholesterol (100g), cholic acid (50g) in 1 liter of coconut oil supplemented with egg[11-13].

Experimental procedure

The animals were fed a high-cholesterol diet for 10 days. To confirm the induction of hyperlipidemia, blood samples were collected by retro orbital vein. The TC concentration of the blood samples was then determined using a standard diagnostic kit . The rats were then divided into 5 groups of 6 animals based on their cholesterol levels, after which the treatments were administered orally once daily for 10 days.

Biochemical assay

At the end of the experimental period Blood was withdrawn from retro-orbital plexus of rat under ether anesthesia and centrifuged at 2000 rpm for 30min so at to get serum. Serum total cholesterol, triglyceride HDL-C was estimated by using diagnostic kits. Atherogenic index was calculated from TC and HDL-C.

Statistical analysis

One way analysis of variance (ANOVA) followed by Dunnets t-test was carried out and $P<0.005$ was considered significant.

Results and Conclusion

A significant increase in body weight was detected in HCD feed rats compare to normal control. In present study, however no favorable changes in body weight were detected after C*innamomum leaves* Nees. leaves extract dosing. Feeding animal with high cholesterol diet enriched with coconut oil and egg produced a significant elevation in serum CHOL concentration (135.73%; $P<0.05$), as well as increase in TG and LDL-C concentrations (112.28 %, 109.15%, $p<0.05$ respectively) with decrease in the level of good cholesterol carrier, HDL (-46.82%). Supplementation of the HCD with 400mg/kg ethanolic and aqueous extracts of leaves of *Cinnamomum tamala* Nees. reduced the serum TC by about 30.00%, 20.01% respectively compared to rats fed HCD alone. There was marked decline in serum TG condition has shown by 24.29%, 19.68% in ethanolic and aqueous extracts treated group respectively. Elevated level of HDL-C is considered as cardioprotective effect. Treatment with CT extracts, ethanolic and aqueous shown increase in HDL-C by 51.8%, 43.97% respectively. CT treated groups showed marked reduction in atherogenic index. Atherogeni index which is most important indicator of CHD at both high and low serum cholesterol level[14].

Hyperlipidemia a well known risk factor for cardiovascular disease, especially atherosclerotic coronary artery disease (CAD) is one of the major cause of premature death globally and it is expected to be the most important cause of mortality in India by the year 2010[15]. It has been well established that nutrition plays an important role in the etiology of hyperlipidemias and atherosclerosis. Several animal and human studies have confirmed the hypercholesterolemic properties of saturated fatty acids and cholesterol which include increasing total cholesterol and altering lipoprotein pattern and whose mechanisms remain under study. Cholesterol feeding has been often used to elevate serum or tissue cholesterol levels to assess hypercholesterolemia-related metabolic disturbances in different animal models[16]. Rats fed with a diet supplemented with 100g cholesterol and 50gm cholic acid in coconut oil with egg for 20 days served as the experimental model. This is in accord with previous finding reported by Na Young Yoon et al; 2008 who showed that feeding rats with high cholesterol diet for 7 days induced hyperlipidemia. Similar results have been reported[11], feeding rats with an HCD for 7 consecutive days resulted in marked hypercholesterolemia. The mechanism of action of cholic acid is twofold: an increase in cholesterol absorption and a concomitant suppression of cholesterol 7a-hydroxlyase activity that results in decreased cholesterol excretion[17]. Cholic acid improves cholesterol absorption by its emulsifying property. From obtained result it was observed that keeping the animal on HCD significantly increased the TC, TG, LDL-C level in serum ($P<0.05$) as compared to rats on normal diet. When HCD was co-administered with CT extracts, the elevated levels of TC, TG and LDL-C condition has shown considerable decline. It was noted that TC, TG and LDL-C lowering activity of ethanolic extract (400mg/kg) of CT leaves was more significant as compared to aqueous extract. There was significant elevation in plasma HDL-C in CT treated rats as compared to HCD rats, thus indicating the efficacy of CT extract in preventing the elevation seen

in various components of lipid profile under experimentally induced hyperlipidemia. Ample of evidence exists with respect to the fact that HDL cholesterol is inversely related to total body cholesterol and a reduction of plasma HDL cholesterol concentration may accelerate the development of atherosclerosis leading to ischaemic heart diseases, by impairing the clearing of cholesterol from the arterial wall[18]. Flavonoids are reported to increase HDL-C concentration and decrease in LDL and VLDL levels in hypercholesteremic rats[19]. Flavonoids and polyphenols found in our CT extracts could therefore be considered favorable in increasing HDL and decreasing LDL and VLDL in CT treated rats. Simvastatin which was used as positive control in this study is a HMG-CoA reductase inhibitor. HMG-CoA reduces serum triglyceride levels through the modulation of apolipoprotein C-III and lipoprotein lipase. Rats treated with Simvastatin showed marked reduction in all serum lipoproteins and increase in HDL level as compared with HCD group.

Result of present study revealed that the aqueous and ethanolic extract of leaves of *Cinnamomum tamala* Nees. improved the serum lipid profile in rats by decreasing serum TC, TG, LDL-C and increasing serum HDL-C, thus improving the atherogenic index. This finding provides some biochemical basis for the use of leaves extract of *Cinnamomum tamala* Nees. as antihyperlipidemic agent having preventive and curative effect against hyperlipidemia. Further, studies are required to again more insight in to the possible mechanism of action.

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Table 1: Effect of ethanolic and aqueous extracts of leaves of *Cinnamomum tamala* Nees. on lipid profile in HCD induced hyperlipidemic rats.

Sr. No.	GROUPS	TC (mg/dl)	TG (mg/dl)	HDL (mg/dl)	VLDL (mg/dl)	LDL (mg/dl)
1.	Control	77.77± 4.05	70.15± 6.16	34.81± 1.58	14.03± 1.23	27.08± 2.91
2.	HCD	183.33 ± 6.67 (↑135.73)	148.92± 6.53 (↑112.28)	18.51± 1.36 ↓46.82	29.77± 1.30 (↑112.18)	135.04± 5.47 (↑1041.40)
3.	HCD+ Simva.(10mg/kg)	103.33± 7.13* (↓43.64)	97.22± 5.28* (↓34.71)	31.47± 2.54* (↑70.01)	19.60± 1.03* (↓34.16)	51.80± 3.97* (↓61.64)
4.	HCD + Eth.200mg	150.00±10.33* (↓18.19)	121.54±3.29* (↓18.38)	25.92± 1.58* (↑40.03)	24.41± 0.75* (↓18.00)	99.77± 9.85* (↓26.57)
5.	HCD + Eth.400mg	128.33± 6.01* (↓30.00)	112.74± 5.56* (↓24.29)	28.10± 2.19* (↑51.80)	22.51± 1.12* (↓24.38)	77.67± 3.97* (↓42.48)
6.	HCD + Aqu.200mg	153.33±7.60* (↓16.37)	124.36±6.05* (↓16.49)	22.58± 1.66 (↑21.98)	24.86± 1.21* (↓16.49)	105.96 ±6.06 (↓21.53)
7.	HCD + Aqu.400mg	146.66± 6.15* (↓20.01)	119.60± 7.54* (↓19.68)	26.65± 1.72* (↑43.97)	23.86± 1.52* (↓19.85)	96.15± 4.88* (↓28.79)

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Table 2: Effect of ethanolic and aqueous extracts of leaves of *Cinnamomum tamala* Nees. on body weight HCD induced hyperlipidemic rats

Days	Mean Body weight (gm)(% change in body weight)						
	Normal	**HCD**	**STD**	**Eth.200 Mg**	**Eth400 Mg**	**Aqu.200 mg**	**Aqu.400 mg**
0th day	148.33	138.66	146.33	144.83	144.44	145.00	146.66
5th day	161.33 (↑8.76)	164.66 (↑18.75)	165.33 (↑12.98)	166.50 (↑14.96)	167.44 (↑15.92)	170.50 (↑17.58)	169.66 (↑15.68)
10th day	169.10 (↑14.00)	179.66 (↑29.56)	181.66 (↑24.14)	181.00 (↑24.97)	180.00 (↑24.61)	182.66 (↑25.97)	179.00 (↑22.05)
15st day	178.33 (↑20.22)	187.33 (↑35.10)	189.53 (↑29.72)	188.00 (↑29.80)	185.33 (↑28.30)	190.00 (↑31.03)	183.53 (↑25.13)
20th day	183.66 (↑23.81)	199.33 (↑44.09)	192.33 (↑31.43)	192.66 (↑33.02)	190.33 (↑31.77)	195.33 (↑34.71)	194.66 (↑32.72)

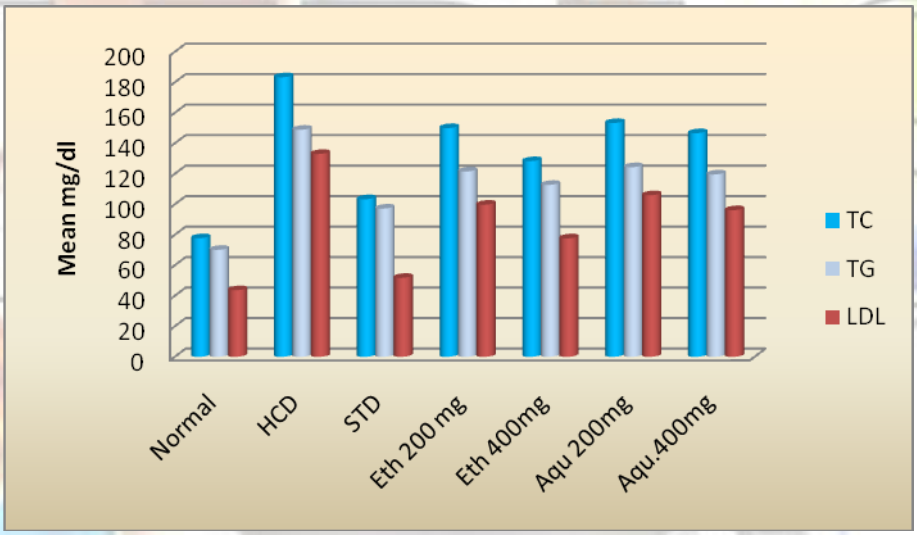

Fig.1: Effect of ethanolic and aqueous extracts of leaves of *Cinnamomum tamala* Nees. on lipid profile in HCD induced hyperlipidemic rats.