HYPOLIPIDEMIC ACTIVITY OF CAYENNE PEPPER ON DEXAMETHASONE INDUCED HYPERLIPIDEMIA IN RATS

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ABSTRACT
The objective of present study is to evaluate the hypolipidemic activity of Cayenne pepper against dexamethasone induced hyperlipidemia in rats. Administration of dexamethasone was given at 10 mg/kg, sc to adult rats for 28 days induced hyperlipidemia characterized by marked increase in serum cholesterol and triglyceride levels alongwith increase in atherogenic index. Cayenne pepper (50 and 100 mg/kg, po.) treatment has showed significant inhibition against dexamethasone induced hyperlipidemia by maintaining serum levels of cholesterol, triglyceride and atherogenic index near to normal levels and the effect of Cayenne pepper was comparable with atorvastatin (10 mg/kg/day, p.o). The possible mechanism may be associated with its high antioxidant values and HDL cholesterol-raising effect. These results suggested that Cayenne pepper possess significant hypolipidemic activity.

Keywords: Dexamethasone, Cayenne pepper, Hyperlipidemia

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INTRODUCTION

Experimental and epidemiological studies have shown that the plasma hypercholesterolemic state could contribute to the development of atherosclerosis[1], cerebral vascular diseases[2]and related cardiovascular system diseases. Coronary heart disease, stroke, atherosclerosis are the primary causes of death[3]. Hyperlipidemia is characterized by elevated serum total cholesterol. Low density and very low density lipoprotein cholesterol and decreased high density lipoprotein levels. Hyperlipidemia associated lipid disorders are considered to cause atherosclerotic cardiovascular disease[4]. Hyperlipidemia is classified into a primary and a secondary type, which indicates the complexities associated with disease. The primary disease may be treated using anti-lipidemic drugs but the secondary type originating from diabetes, renal lipid nephrosis or hypothyroidism demands the treatment of the original disease rather than hyperlipidemia[5].

The herbal hypolipidemics have gained importance to fill the lacunae created by the allopathic drugs .A number of plants have been found to be useful in hyperlipidemia. Condiments like garlic, onion and coriander used in day to day preparation of food in Indian kitchens have been identified as hypolipidemics in Ayurveda. Capsicum annum is a vegetable used daily, and the substance capsaicin is responsible for its hot and spicy flavour, sought after in gastronomy. The naturally occurring content of capsaicinoids in spices ranges typically from 0.1 mg/g in chilli pepper to 2.5 mg/g in red pepper and 60 mg/g in oleoresin red

pepper[6]. Capsaicin and dihydrocapsaicin are the major capsaicinoids produced; however, others exist and are produced in smaller quantities. Capsaicin is also known to inhibit Substance P, a neuropeptide that is the key transmitter of pain to the brain thus providing relief to pain. It has potent antibacterial properties that fight and prevent chronic sinus infections, or sinusitis. Capsaicin is also a thermogenic agent, which means it increases metabolic activity. This, in turn, helps to burn calories and fat. Capsaicin may help to protect the heart by reducing cholesterol, triglycerides and platelet aggregation. Capsaicin is claimed to have high antioxidant values and HDLcholesterol-raising effect. Hence this study aims at exploring the possible effects of Capsaicin on serum TC, TG, LDL and HDL levels in dexamethasone induced hyperlipidemic rats

MATERIALS AND METHODS

Chemicals

Dexamethasone is obtained from local medical store. In the present study, treatment with cayenne pepper (50 and 100 mg/kg) has significantly reduced the serum cholesterol, triglycerides levels and atherogenic index when compared to dexamethasone per se treated animals, indicating the ability of cayenne pepper to reverse the hyperlipidemia caused by dexamethasone administration. All other chemicals and reagents were the highest commercial grade available. All the serum biochemical parameters were measured by using commercially available diagnostic kits.

Animals

Male Wistar rats aged between 8-10 w (250-300 g) were used for the study. Animals were kept in the controlled condition in the institutional animal house at an ambient temperature of 25-30 °C and relative humidity of 55-60% and 12/12 h light/dark cycle and were provided pellet diet along with water ad libitum. The experimental protocol was accepted by Institutional Animal Ethics Committee.

Preparation of fruit extract

Mature *Capsicum annum* were collected and washed thoroughly with water and air dried in shade at room temperature. It was ground into powder by a miniature high-speed universal pulveniser. The three liquid phase extraction system of acetone, K2HPO4 and n-hexane was prepared by weighing acetone 22% (w/w), K2HPO4 20% (w/w), n-hexane 10% (w/w) and water (58% (w/w) and mixing. The powdered *Capsicum annum* was added to this three liquid phase extraction system in a mass ratio of 1:20. The mixture was thoroughly vibrated for 10 min and then settled at room temperature. After the separation of three phases, the volume of the acetone was removed from the middle layer by using a pipette and kept aside. This procedure was done again for three times by adding fresh acetone into the same extract. The acetone extracts were pooled and dried under vacuum. The percent yield of capsaicin was 10 mg/g of *Capsicum annum* powder.

Experimental study design:

Thirty Rats were divided into five groups (n = 6) and they received following treatment

■ Group I (Normal Control): Received vehicle orally.
■ Group II (Disease Control): Received dexamethasone (10 mg/kg, sc) for 28 days.
■ Group III (Standard): Received atorvastatin (10 mg/kg/day, p.o).
+dexamethasone for 28 days
■ Group IV (Drug Treated50): Received cayenne pepper (50 mg/kg/day, p.o).
+dexamethasone for 28days
■ Group V (Drug Treated 100): Received cayenne pepper (100 mg/kg/day, p.o).
+dexamethasone for 28days.

At the end of experimental period, all the animals were fasted overnight, blood samples were taken through retro-orbital plexus using heparinised capillary tubes under light ether anaesthesia. The blood was allowed to clot for 30 min at room temperature and centrifuged at 5 000 rpm, the upper layer of serum was collected in clean centrifuge tubes, which is taken for the biochemical analysis.

The serum samples were analyzed for cholesterol, triglycerides, HDL-cholesterol using the respective biochemical kits, while LDL-cholesterol[7] and Atherogenic index[8, 9] were calculated using the following formula.

LDL-C= Cholesterol - (Triglyceride/5) - HDL-C
Atherogenic index = (Total cholesterol - HDL-C)/HDL-C

RESULTS

Dexamethasone administration for 28 consecutive days caused acute hyperlipidemia in rats wherein the serum levels of cholesterol, triglycerides and atherogenic index was increased. Atorvastatin (10 mg/kg, po.) treatment showed significant protection against dexamethasone induced elevated serum cholesterol, triglyceride, HDL, LDL, VLDL and atherogenic index in statistically significant manner (Table 1) ($P < 0.01$, $P < 0.01$, $P < 0.05$, $P < 0.01$, $P < 0.01$, $P < 0.01$ respectively) and these values are comparable to normal control group. Similarly the group of rats treated with cayenne pepper 50 and 100 mg/kg also showed significant reversal of cholesterol ($P < 0.01$, $P < 0.01$), triglyceride ($P < 0.01$, $P < 0.01$), HDL ($P < 0.05$, $P < 0.05$), LDL ($P < 0.01$, $P < 0.01$), VLDL ($P < 0.01$, $P < 0.01$) and atherogenic index ($P < 0.01$, $P < 0.01$).

Table 1: Effect of Cayenne pepper on dexamethasone induced hyperlipidemia in rats (n = 6)
The values are Mean ±SEM, (n = 6).* $P<0.05$, $^{**}P<0.01$, $^{***}P<0.001$ Disease control vs normal control.
$^{+}$ $P<0.05$, $^{++}P<0.01$, $^{+++}P<0.001$. Treatments vs disease control

Treatments	**Cholesterol** (mg/dL)	**Triglyceride** (mg/dL)	**HDL** (mg/dL)	**LDL** (mg/dL)	**VLDL** (mg/dL)	**Atherogenic index**
Normal control	60.6±1.0039	65.5±0.8465	24.023±0.236	14.7±0.601	12.66±0.7149	1.55±0.0884
Disease control	157.5±4.2**	183.3±2.78**	16.562±0.152*	95.8±3.048**	43.3±3.421**	4.51±0.0192**

Atorvastati 10 mg/kg	72.5±4.232^{+++}	72.8±0.787^{++}	22.024±0.526^{+}	22.16±0.767^{++}	16.6±0.08001^{++}	2.28±0.0249^{++}
Cayenne pe 50 mg/kg	93.5±0.921^{+++}	91.6±0.344^{++}	20.635±0.515^{+}	35.16±1.514^{++}	26.83±0.6706^{++}	3.451±0.022^{++}
Cayenne pe 100 mg/kg	83.3±1.1737^{++}	92±0.774^{++}	21.145±0.246^{+}	27.16±0.472^{++}	20.83±0.4013^{++}	2.73±0.0099^{++}

DISCUSSION

The animal model of dexamethasone induced hyperlipidemia in rats is been successfully used for evaluating the lipid lowering activity of natural products and chemical entities[10,11]. The corticoid treatment is known to cause an increase in the secretion of VLDL by liver and in addition corticoids may also stimulate VLDL formation by the intestine. The low level of liver lipoprotein lipase activity could have been responsible for the high VLDL-Triglyceride level and this also causes imbalance in lipid metabolism leading to hyperlipidemia[12].

In present study, treatment with cayenne pepper(50 and 100 mg/kg) has significantly reduced the serum cholesterol, triglycerides levels and atherogenic index when compared to dexamethasone per se treated animals, indicating the ability of cayenne pepper to reverse the hyperlipidemia caused by dexamethasone administration.

Furthermore, the dexamethasone treatment is been reported to show an increase in free cholesterol along with the decrease in Lecithin cholesterol acetyl transferase (LCAT) activity in experimental animals, co-treatment with cayenne pepper may be able to reverse the plasma free cholesterol levels. Capsaicin present in cayenne pepper is claimed to have high antioxidant values and HDLcholesterol-raising effect.

CONCLUSION

In the present study, co-administration of cayenne pepper (50 & 100 mg/kg, po.) has significantly normalized the dexamethasone induced increase in serum cholesterol, triglycerides levels and also decreased the atherogenic index. These findings would support the therapeutic property of cayenne pepper against dexamethasone induced hyperlipidemia in rats.

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