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[Short communication]

Lipid Lowering Effect of Ethanolic Extract of *Carduus crispus* L. on Hypercholesterolemic Rats

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Abstract

The main purpose of this study was to determine possible effects of the ethanolic extract of aerial parts of *Carduus crispus* L. on the serum lipids in hypercholesterolemic rats. After oral administration for two weeks, *C. crispus* extract produced significant decrease on serum total cholesterol, low density lipoprotein cholesterol, triglyceride levels and atherogenic indices in hypercholesterolemic groups ($P < 0.05$). *C. crispus* extract had no effects on serum high density lipoprotein cholesterol levels in these groups. It is concluded that the extract of aerial parts of *C. crispus* exhibits lipid lowering activity in hypercholesterolemic rats.

Key words: *Carduus crispus, lipoproteins, cholesterol, arteriosclerosis*

Introduction

Cardiovascular diseases are one of the leading causes of death in the world. Increased plasma cholesterol is known to be a major risk related to the development of cardiovascular disease and arteriosclerosis. Atherosclerosis plays a major role in the development of myocardial infarction and stroke. High level of low density lipoprotein cholesterol (LDL-c) and low level of high density lipoprotein cholesterol (HDL-c) have been strongly associated with the risk of coronary artery disease or arteriosclerosis. Abnormally low level of HDL-c is associated with increased possibility of atherosclerosis, probably because of disrupted reverse cholesterol transport (Khoja & Marzouki, 1994; Koolman & Roehm, 2003). Simvastatin is a cholesterol-lowering drug of a group of drugs called 3-hydroxy-3-methylglutaryl coenzyme A (HMG CoA) reductase inhibitors. It lowers serum cholesterol levels by inhibiting hepatic cholesterol biosynthesis and thus up regulates hepatic LDL-c receptors, resulting in an increased uptake of LDL-c from the blood and the subsequent lowering of circulating cholesterol levels (Kolovou *et al., 2008).*

Many herbal medicinal products have potential hypocholesterolemic activity and encouraging safety profiles, such as *Nigella sativa, Fetula assafoetida, Aloe vera*, *Piper longum, Aconitum barbatum* and *Citrus unshiu* (Ross, 2005; Kim *et al*., 2006; Jun *et al*., 2009; Sukhdolgor *et al*., 2009).

Carduus crispus L. is a plant species of the family *Asteraceae*, and it is used in Mongolian traditional medicine for the treatment of various diseases, such as stomachache, rheumatism, atherosclerosis, cancer and etc. (Zhang *et al*., 2002; Ligaa *et al*., 2005). In this work we report the results of study on the effect of aerial parts extract of *C. crispus* on serum lipids levels to evaluate hypolipidemic activity of the plant.

Material and Methods

This study was performed in 2009, in the Institute of Macromolecular Chemistry and Mongolian Medicine, Inner Mongolia University, Huhhot, China.

Aerial part of *C. crispus* and its full flowering stage were collected in July 2008 from Erdenesant district, Tuv province, Mongolia. A species was identified by Dr. Ch. Sanchir, Institute of Botany, Mongolian Academy of Sciences. Aerial part of the samples were separated, cleaned and dried in the open air. Air dried plant materials were roughly cut and ground to the powder. The plant material (50 g) was weighed and soxhlet extracted with

150 ml EtOH-H_2O (7:3) 60^0C for 8–10hr. The hydroalcholic extract was evaporated in a rotating evaporator under reduced pressure until dryness. Weighed samples of the extract were then used to prepare the stock solution.

Diet and treatment. The weights of male Wistar rats ranged from 180-200 g at the beginning of the study were used. Rats were housed identically in an air conditioned room under a 12 hour light-dark cycle. Forty male albino Wistar rats were randomly assigned into four groups of 10 rats per group. The group 1 (normal control) was fed a standard diet. Group 2 (hypercholesterolemic control) was fed a standard diet enriched with 10% fat of pig, 3% cholesterol and 0.5% cholic acid. Groups 3-4 receiving cholesterol-enriched diet plus 10 mg simvastatin and 60 mg plant extract per kg body weight, respectively (treated groups), in a daily oral dose. Experimental hypercholesterolemia was induced by feeding rats a cholesterol enriched diet for 14 days. Tap water was freely available for all groups of rats.

The body weight of each rat was determined before starting the treatment. Blood samples were collected from the jugular vein; serum was separated by centrifugation (3000 rpm for 15 min) and used for biochemical analysis. Serum concentrations of cholesterol, triglyceride, LDL-c and HDL-c were determined with enzyme kits.

All values used in analysis are presented as mean ±SEM for 10 rats in each group of experiments. Comparisons among the different groups were performed by one-way analysis of variance (ANOVA), followed by Tukey's multiple comparisons test and differences were considered significant when $p<0.05$.

Results

All groups exhibited the increases in body weight through the treatment without significant differences among them (Table 1).

Blood samples for analysis were collected at the end of the study from all rats. The serum concentrations of total cholesterol, triglyceride and HDL-c were increased in hypercholesterolemic group with respect to the normal control group at the end of treatment (Table 2).

Results of the analysis of the III and IY groups with the simvastatin and *C. crispus* L. extract produced significant lowering effect of serum lipids ($p<0,05$) (Fig. 1). The total cholesterol (TC) levels were lowered from 4.70±0.30 mmol/L (II group) to 3.24±0.22 mmol/L (III group), 4.11±0.27 mmol/L (IY group) (31.1%, 12.6% decrease); triglyceride (TG) from 2.26±0.15 mmol/L to 1.78±0.10 mmol/L, 2.17±0.20 mmol/L (21.2%, 4.0% decrease); low density lipoprotein cholesterol (LDL-c) from 3.22±0.21 mmol/L to 1.65±0.12 mmol/L, 2.71±0.20 mmol/L (48.7%, 15.8% decrease) and high density lipoprotein cholesterol (HDL-c) from 0.98±0.10 mmol/L to 1.20±0.12 mmol/L (18.3% increase) after two weeks. The *C. crispus* extract did not show any significant HDL-c level change from the hypercholesterolemic control values.

Table 1. Body weight ratios of Wistar rats.

Groups of Wistar rats		Body weight, g					
		1 day	3 day	6 day	9 day	12 day	15 day
I	Normal control	189.6±3.0	195.0±3.8	221.4±4.1	231.1±4.0	243.6±3.8	258.7±5.1
II	Hypercholesterolemic control	176.7±3.5	189.0±4.3	210.5±4.5	232.1±4.3	264.3±4.2	286.3±4.7
III	Simvastatin	186.7±3.8	204.0±3.9	222.8±3.6	241.8±4.6	264.3±4.0	292.4±3.6
IY	*C. crispus* extract	187.6±4.1	191.8±3.8	213.8±3.4	241.5±3.7	253.6±4.5	275.5±4.3

Table 2. Serum lipids in normal and hypercholesterolemic groups of Wistar rats.

Groups of Wistar rats	Serum lipids (mmol/L)			
	TC	TG	HDL-c	LDL-c
I –Normal control	2.86± 0.29	1.38± 0.13	1.03± 0.10	1.45± 0.13
II –Hypercholesterolemic control	4.70± 0.30	2.26± 0.15	0.98± 0.10	3.22± 0.21
III –Simvastatin	3.24± 0.22	1.78± 0.10	1.20± 0.11	1.65± 0.12
IY –*C. crispus* extract	4.11± 0.27	2.17± 0.20	0.96± 0.11	2.71± 0.20

Values are means ±SEM (n=10), $p<0.05$.

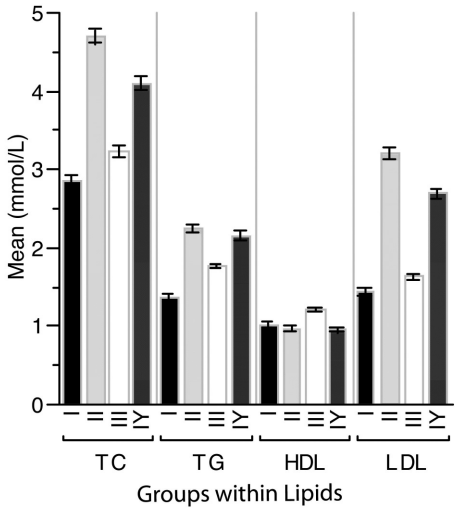

Figure 1. Effect of simvastatin (III group) and *C. crispus* extract (IY group) on the total cholesterol (TC), triglyceride (TG), high density lipoprotein cholesterol (HDL-c) and low density lipoprotein cholesterol (LDL-c) levels of hypercholesterolemic rats. Each point represents the mean ±SEM.

Our results showed that serum total cholesterol and lipoprotein cholesterol levels in rats were increased in the hypercholesterolemic group at the end of the 15-day study (Table 2). Supplementation of *C. crispus* to the diet had a favorable effect on the lipid profile. It decreased TG, TC and LDL-c as compared to hypercholesterolemic control. Because of folkloric use of *C. crispus* as a lipid lowering plant in Mongolia, we investigated the possible beneficial effects of the extract on the serum lipids levels in diet induced hypercholesterolemic rats. Present results indicate that *C. crispus* extract exerts a hypocholesterolemic effect in cholesterol fed rats.

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