Sugar cane extract: A treatment for atherosclerosis disease?

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Abstract

Introduction: Sugar cane is a giant plant of grain products. Regarding the benefits of the use of medications with herbal origin, in the present study the impact of sugar cane extract on atherosclerosis and LDL-c and HDL-c in the serum of hypercholesterolemic rabbits was studied.
Materials and methods: 24 adult male New Zealand rabbits race with an average weight of 2 kg were classified into four groups: the control group had a normal diet, Sham group and the 1 , 2 experimental group were cholesteroled with 2% high cholesterol regime and received drug solvent, sugar cane extract with 3.7 and 7.4 mg/kg doses as an oral treatment per day, respectively . After eight weeks of treatment, Blood were collected and subjected for measuring of LDL-C and HDL-c. For histological studies, Aorta was removed and was fixed in formalin %10. SPSS with ANOVA was applied for data analysis.
Results: The results demonstrated treatment via sugar cane extract with 3.7 and 7.4 mg/kg per day, significant reduction in LDL-c and significant increase in HDL-c, in compare with Sham group, was occurred. In addition, histological examination showed that treatment by 3.7 and 7.4 mg/kg per day of Sugar cane extract (the experimental groups 1, 2, respectively), prevented atheroma plaques.
Conclusion: Sugar cane extract may be effective in reducing the amount of LDL-c and increasing HDL-c and prevents the formation of atheroma plaques.

Keywords: Sugar cane, LDL-c, HDL-c, atherosclerosis

Introduction

Cardiovascular disease (CVD) is the leading cause of death in most countries of the world (1). Worldwide, 16.7 million deaths due to this disease occurs (2). In Iran, this disease accounts for %50 of deaths and is the top causes of death (3).
So far, several factors have been implicated in the development of coronary artery disease, including high blood pressure, abnormal blood lipids, smoking and family history (4). It is possible that these factors, in addition to being a cause of coronary artery disease, also are effective in severity and breadth of heart artery clogging, which this issue is not approved fully by all researchers, so far (5). In examining risk factors for cardiovascular disease, laboratory results indicate that controlling blood fats, specially LDL-c, can reduce the ischemic. There is a significant relation between HDL-c and coronary artery disease, in a way that by increasing HDL-c, the risk of dying from these diseases is reduced (6). Sugar can With the scientific name of Saccharum Officinarum, is a giant plant from the Cereals plants, which produced to withdraw Stem sugar. Sugar canes have a core that Glucose is stored in. sugar cane stem has between 14 to 17% sucrose, and

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is used in the construction paper and paperboard and it's pulp and molasses, after Glucose extraction, used in the production of alcohol and livestock feed as a byproduct.

Cultivation of this plant have been reported about 600 BC in Guinea and Indonesia and India (7).

The main components of the sugar mixture is called Policosanol, Policosanol is an alcohol with a series of long-chain alcohols containing octacosanol, Triacontanol, hexacosanol and smaller amounts of other alcohols with carbon chain lengths of 24 to 34 carbon (8).

In other words, policosanol is a mixture of aliphatic alcohols which can be obtained from sugarcane or other plants, in different ways.

Policosanol first discovered and produced in Cuba, and has been called Panacea (9). This product is no risk of toxicity. Its active component is unknown, but it has been shown that Very long -chain alcohols, can lead to fatty acid oxidation in combination with Proxisomal beta–oxidation, which leads to short -chain metabolites (9). Statins, are inhibitors of cholesterol synthesis, and are used for the treatment of dyslipidemia and prevention of cardiovascular disease (10).

New research suggests that LDL decreasing by use of high-dose Statins, increases the risk of cancer and Makes the likelihood of damage to the liver by increased dose (11).

In the present study the impact of the amount of sugar cane extract on serum HDL-c and LDL-c and atheroma plaque has been checked.

Materials and methods

Sugarcane Were prepared in Khuzestan and After drying, was powdered and extracted using a rotary machine. Weigh 50 gr of powder and 320 ml of %96 ethanol and 80 ml Distilled water was dissolved in soaked Scott and incubated in a shaking incubator for 72 hours at 34°C and 140 rpm. After the desired time, firstly the resulting solution was passed of 1 Whatman filter paper, then using a rotary machine and a vacuum pump, the ethanol extract was separated. The obtained extract was placed for 5 days in Feb. The obtained condensed extract was kept at 4°C in the sterile Falcon (12).

For this study, 24 adult male New Zealand race rabbits with a mean weight of 2 kg, were purchased from Pasteur Institute and were kept in cages for rabbits in the animal room with controlled temperature 23 ± 2ºC.

In order to adapt to new environments, rabbits maintained for one week in proper temperature, humidity and light (12 h night and 12 h light). Then rabbits were randomly selected and divided into four groups (n=6): Control group : the normal diet, Sham group: were Cholesterol by 2 % cholesterol, 1 and 2 Experimental groups: had a high cholesterol diet and delivered sugarcane extract at doses of 3.7 and 7.4 mg/kg daily. Treatment continued for up to eight weeks.

After finishing treatment , the animals were fasted for about 15-12 hours. Using a 5 ml syringe, central venous blood were taken from rabbit ears. After serum, LDL-c and HDL-c content of each sample was measured by cholesterol kits. Then, in order to histological investigation and possible formation of atheroma plaque, aortic arteries were isolated using a scalpel and was washed in the bowl containing saline. To fix the samples of %1 formalin was used. Finally, 6 -micron thick sections were prepared from the artery and were stained with hematoxylin–eosin, and five sections of each sample were selected and examined. Using result, all data were statistically expressed for blood samples from 6 head in each group, on Mean±SEM. Statistical analysis by one way ANOVA and TUKEY post hoc test was used for Statistical analysis of multiple comparisons. In all analyzes, the $P<0.05$ values were considered significant. $P<0.05$ and $P<0.01$ suggest that the

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difference is significant in compared to sham group.

Results

Sugar cane extract effect on serum levels of LDL-c: As can be seen in figure 1, LDL-c serum levels increased significantly ($p<0.01$) in Hypercholesterolemia rabbits in compared with control rabbits. Treated with sugar cane extract with daily 3.7 and 7.4 mg/kg per day LDL-c Serum levels decreased significantly compared to sham($P<0.05$, $P<0.01$, respectively).

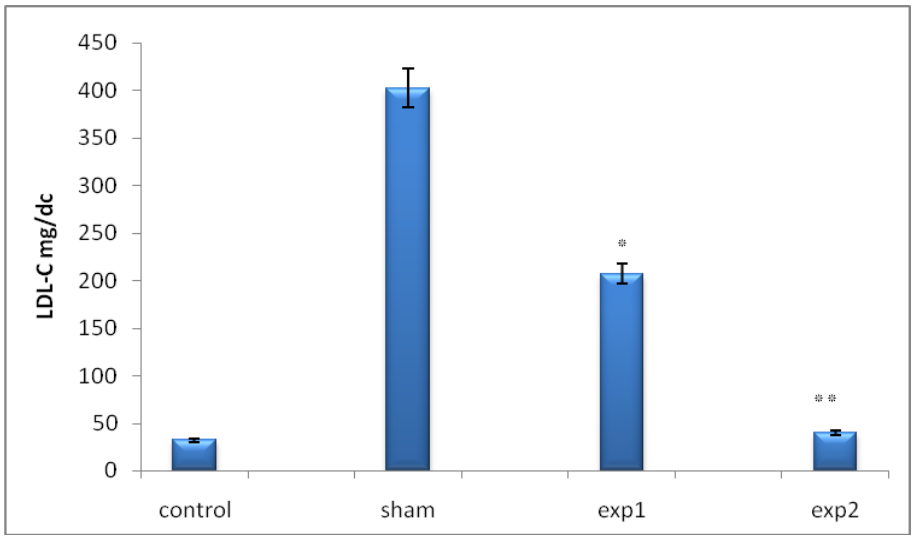

Figure 1. Effects of different concentrations of sugar cane extract on LDL-c serum levels in hypercholesterolemic (exp1 and exp 2 groups), sham and control rabbits. *P<0.05, **P<0.01

Sugar cane extract effect on serum levels of HDL-c: As can be seen in figure 2, in Hypercholesterolemia rabbits, HDL-c serum levels significantly decreased ($P<0.01$) compared with control rabbits. Sugar cane extract treated with doses of 3.7 and 7.4 mg/kg per day, HDL-c Serum levels amounts significantly increased compared to sham ($P<0.05$, $P<0.01$, respectively).

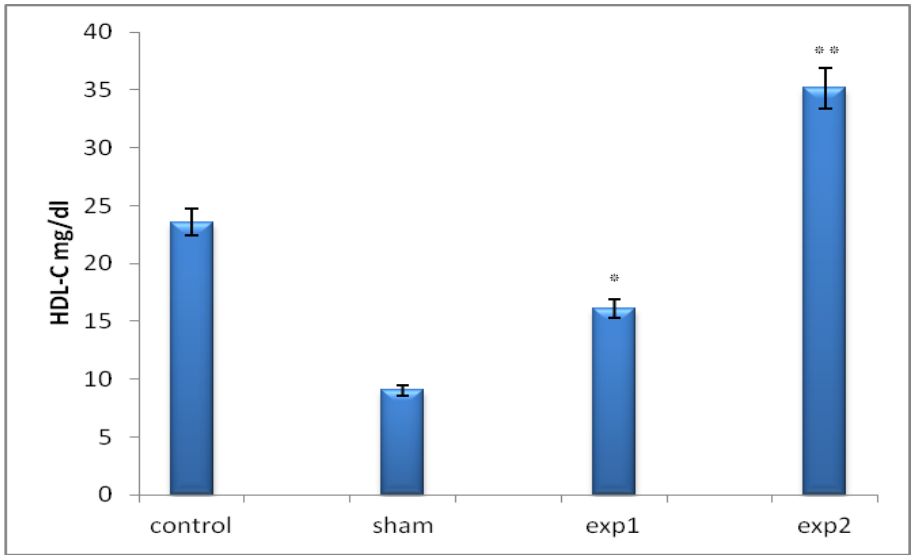

Figure 2. Effects of different concentrations of sugar cane extract on HDL-c serum levels in hypercholesterolemic (exp1 and exp 2 groups), sham and control rabbits . *P<0.05, **P<0.01

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Sugarcane extract effect on atheroma plaques: The results of histological studies showed that aortic wall in the control group were free of atheroma plaques and vessel wall is perfectly normal in this group. Figure 1 shows the vessel wall of the control group (Figure 3-A). Cholestrol consumption by %2 lead to atheroma plaque formation in the aortic wall (Fig 3-B). This was seen as a bulge in the wall of the aorta and heart and clearly visible in the form of sham group. In experimental groups 1 (Figure 3-C) and 2 (Figure 3-D), which received sugar cane extract at doses of 3.7 and 7.4 mg/kg per day respectively, the aortic wall was perfectly normal, and no difference in the texture of the two groups compared to control subjects was seen.

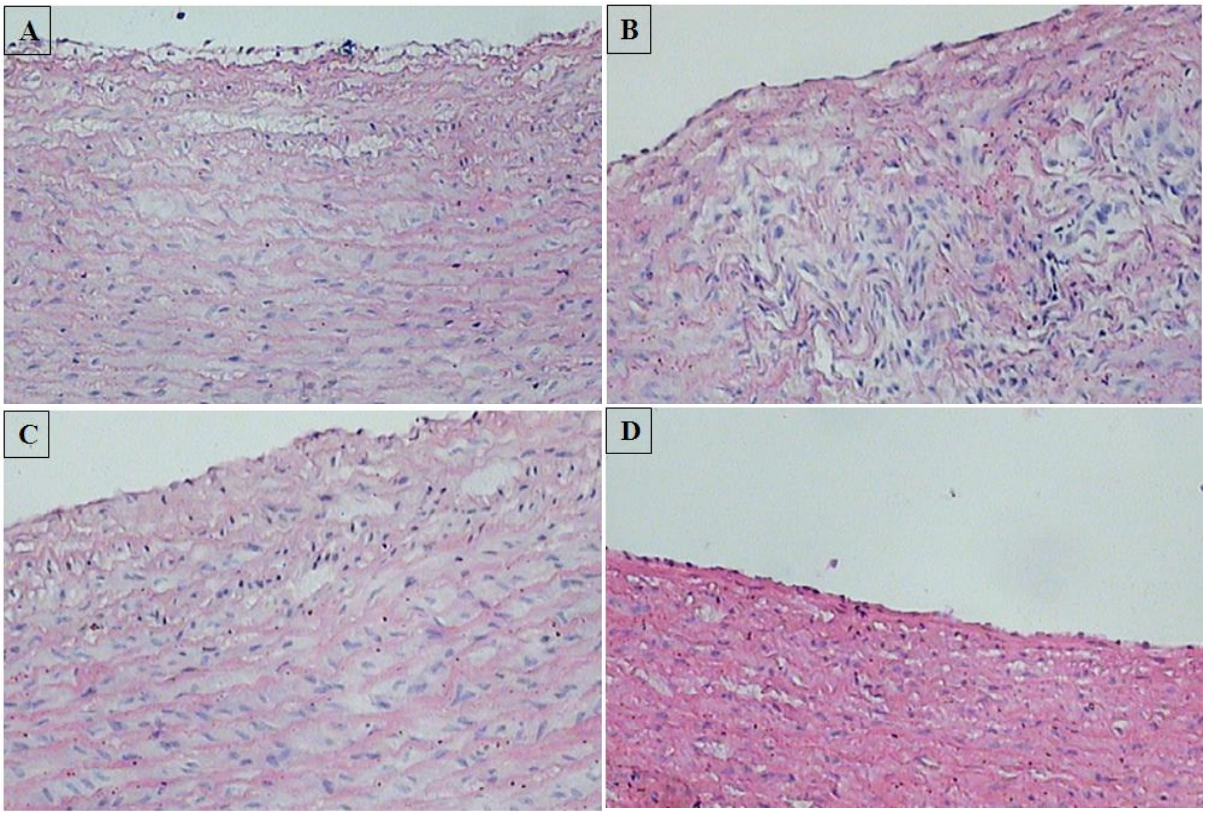

Figure 3. Intimal tissue section of aortic artery, stained with Hematoxylin–Eosin, Mag ×10, in control (A), sham (B), experiment1 (C) and experiment 2 (D) groups.

Discussion

In the present study, Treated with doses of 3.7 and 7.4 mg/kg per day sugar cane extract for eight weeks (13,14), significant decrease in the amount of LDL-c and a significant increase in the amount of HDL-c compared with the sham group was formed.

Nao et all - 2002 in histological studies showed that treated with industrial by 10 , 20 mg per day, prevent from formation of atheroma plaques (15). Menendez et all in 2000, in the research showed that taking policosanol can reduce LDL-c oxidation, while increases the HDL-c amount (16).

In our study, LDL-c levels in experimental groups 1 and 2 compared with the sham group significantly decreased ($P<0.05$, $P<0.01$), Which is consistent with research of Menendez et all, 2001 and McCarty, 2002, research, which is probably the reason for the decrease in serum concentrations of LDL-c. Since most of LDL-c components are from cholesterol and likely policosanol by effects on

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HMG-CoA reductase enzyme leads to reduced LDL-c (16,17). Dev et al (2006) conducted a study on mice, Showed that policosanol, by activation of AMP- kinase, leads to decrease of HMG-CoA redoctase (8). Mediated by an enzyme serum cholesterol synthesis takes place that one of these enzymes is HMG-CoA reductase. On the other hand, by AMP-Kinase activation, the activation of HMG-CoA-reductase enzyme is reduced. So any substance or metabolite that can be enhanced AMP-kinase, can reduce HMG-CoA-reductase activity, and thus prevent the synthesis of cholesterol (8). AMP-Kinase disable the acetyl-CoA carboxylase (18). So, AMP-Kinase both is the primary regulator of HMG-CoA reductase phosphorylation and acetyl-CoA carboxylase set by it, suggests its role in the regulation of cholesterol and fatty acid biosynthesis (8).

LDL-c Oxidation can lead to inflammation and cytotoxic effects on the endothelium (19). Vascular endothelial cell damage may be caused the tough lining of the arteries and clots in the veins (20).

The use of antioxidants may protect LDL-c against the oxidation change and thus prevent the formation of atherosclerosis. So, since that policosanol is a cholesterol-lowering agent and probably has an antioxidant effect, the combination of these features can be clinically important. Reduce the LDL-c concentration and reduce the LDL-c potential for oxidation can be important in reducing the risk of atherosclerosis (21).

In this study, Sugar cane extract helps prevent the destruction of the endothelium stimulated by cholesterol and reduces the thickness of the endothelium, this may be due to the reduction of oxidation of LDL-c as a a result of the use of this extract, which can prevent endothelial injury (22,23).

Conclusion

The findings of this study show that sugar cane extract can be a useful drug as a herbal treatment for hypocholesterolemia and hypolipidemia. However, Further biochemical and pharmacological investigations to determine exact mechanism by which is required.

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