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Effect of Hydroalcoholic Extract of Capparis Spinosa Fruit on Blood Sugar and Lipid Profile of Diabetic and normal Rats

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Abstract

***Background*:** Diabetes mellitus is a common disorder of endocrine glands worldwide. Caper as a medicinal plant has anti-oxidant properties and has been used traditionally to cure diabetes. The aim of present research was to evaluate the effect of 200 and 800 mg/kg of caper fruit extract on blood sugar, glycated hemoglobin and lipid profile in diabetic and normal male rats.

***Materials & Methods*:** In this experimental study 60 rats were divided into 6 groups randomly, in which three diabetic groups received distilled water (control) and 200 and 800 mg/kg caper fruit extract respectively and three normal groups were treated as diabetic groups. The animals were received orally either water or fruit extract by gavages for 28 days. To measure the level of blood sugar, glycosylated hemoglobin and lipid profile, blood samples of animals were collected at the beginning and the end of experiment and $p<0.05$ was considered as significant.

***Results*:** The blood sugar decreased in all groups receiving fruit extract compare to control groups and the decrease in blood sugar was dose dependent. Blood triglycerides decreased in all diabetic groups receiving extract compare to control but in normal rats the changes were not significant. The changes in glycated hemoglobin was not significant. Other blood metabolites that were measured in the present study were not changed significantly.

***Conclusion*:** The results of present study showed that consumption of Caper fruit extract lead to a significant decrease in blood sugar and also a considerable decrease in blood triglycerides in diabetic rats, therefore it seems that Caper fruit consumption may has beneficial effects on blood sugar and lipid profile.

Introduction

According to the World Health Organization estimation the number of people with diabetes is increasing and will rise to 333 million in 2025 [1]. Diabetes mellitus is a disease that the body is lacking insulin or does not use insulin properly [2]. Insulin deficiency or relative decline of Insulin in this disease is associated with metabolic complications [3]. Oxidative stress is the most important conditions that cause by reactive oxygen species overproduction or decreased antioxidant reserve [4, 5]. Synthetic drugs that are used to treat or prevent diabetes have side effects [6]. Today, medicinal plants due to easy availability and low side effects have a special place in medicine to treat various diseases [7, 8]. Capparis Spinosa is one of the aromatic plants that grows in the hot and dry climates such as West and Central Asia and the Mediterranean region and various parts of Iran like Kerman and Balouchestan [9], that its fruit, roots and barks are used for medical purposes [10]. In traditional medicine, this plant is used as a diuretic, treatment of gout, rheumatism and liver disease [11]. Previous researches have been reported the effects of analgesic, anti-hepatotoxic, hypolipidemic effects and also anti-allergic effects of this plant [12-17]. Researches on this plant revealed the presence of compounds such as alkaloid, lipids, poly-phenols, flavonoids, and Glvcosinolates [18]. It is also rich in flavonoids such as kaempferol, rutin, quercetin [19, 20], Because of these compounds, it has posses many medicinal properties [21]. Medicinal properties of Capparis Spinosa are due to its valuable compounds and their antioxidant properties [22]. Rutin possess antioxidant and anticancer properties and is also able to reduce the fragility of the vessel wall [23]. Reduction of blood antioxidants can increase blood lipid [24]. Plants containing phenolic compounds like caper have powerful antioxidant effects, this ability depends on the number of aromatic rings and nature of moving hydroxyl groups [25].

Lemhadri et al., fed diabetic rats with the sodden fruit for three weeks and after measuring the glucose tolerance test, they observed in sodden receiving rats, glucose tolerance was improved compare to control group [16].

Researchers have shown that plants containing phenol reduce risk of cancer and Cardio vascular disease [26]. Germano et al. have shown that alcoholic extract of this plant have high level of antioxidant [27]. Given that finding new drugs with fewer side effects ,more effective

and less costly to reduce blood lipids and glucose in normal and diabetic individuals seems necessary and on the other hand because a few number of researches has been done on caper properties, so in the present study the effects of caper fruit hydroalcholic extracts on a number of biochemical metabolites in rats were examined.

Materials and Methods

Present survey was an experimental study that 60 male albino wistar rats were randomly selected from male rats weighting approximately 250-300 g at the same conditions in RUMS animal house in 20-22ºC and 12 h light dark cycle, and then randomly divided into 6 groups of 10.

Caper fruits collected then gently dried for one week at room temperature in the shade. In order to extract, 300 g of caper fruit powder were mixed with water/ethanol (30/70) and the mixture was placed on the Shaker for 24 hours at room temperature. Then the supernatant filtered and the remnant was placed in suxuseleh (50ºC) to concentrate the extraction. Then the extracts were collected and placed within the rotator (50ºC) to volatile the water and alcohol from extract. To dry fully, finally concentrated extracts were incubated for 48 hours inside incubator (40ºC) .The resulting powder before doing experiments was placed in 20ºC conditions. To provide different doses of oral solutions for the administration, 200 and 800 mg of extract powder mixed with 5 ml saline and then the 5 mg/kg of it was given to the rats daily .In this study, the exact dose administered to the rats on time by gavage. Gavage was performed using special steel tube with rounded end, this was done daily for 28 days.

50-55 mg/kg body weight of streptozotocin (STZ) was injected intraperitoneally, for preparing diabetic rats. Five days after injection, blood glucose was measured in rats and some which had blood glucose over 250 mg/dl and also the symptoms associated with diabetes were selected as diabetic subjects and were divided into three groups. Due to metabolic differences in diabetic and healthy rats, three groups of healthy rats have examined here, too. This category was as follows.

Group 1, Diabetic rats received only distilled water. Group 2, Diabetic rats received 200 mg/kg extract. Group 3, Diabetic rats received 800 mg/kg extract. Group 4, healthy rats received only distilled water. Group 5, healthy rats received 200 mg/kg extract. Group 6, healthy rats received 800 mg/kg extract.

All procedures with laboratory animals were done in accordance to the guidelines of the ethics committee and were conducted under the University Research Center. In order to assay the blood glucose, HbA1c and lipid profile, all healthy and diabetic rats were anesthetized and blood was collected from the corner of the eye and also after 28 days administration of caper fruit extract, blood was collected again and assays was repeated. At the end of the study, the initial and final assays results of each groups and the results of assays between all groups, individually were compared by the software SPSS-17 and EPI through statistical tests ANOVA and paired *t*-test and *t*-test and $p<0.05$ was considered as significant level.

Results

Our experiments showed that blood glucose levels reduced in diabetic groups 2 and 3 compared with the control group. This reduction was statistically significant in both groups ($p<0.05$). Reduction of blood glucose was dose-dependent (Fig. 1).

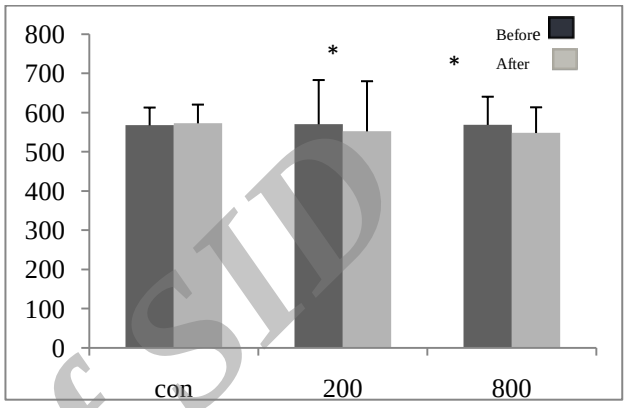

Figure 1. Blood sugar in diabetic rats before and after experimental
* Significant reduce

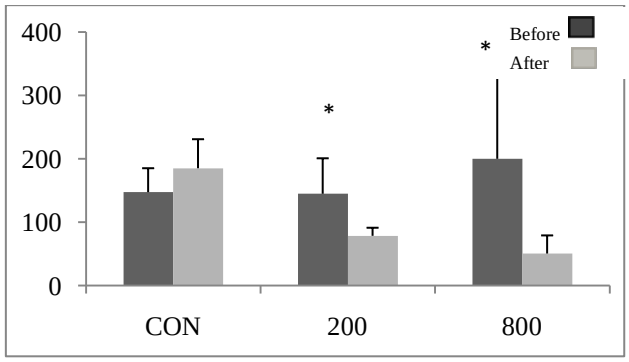

Figure 2. Blood sugar in normal rats before and after experimental
* Significant reduce

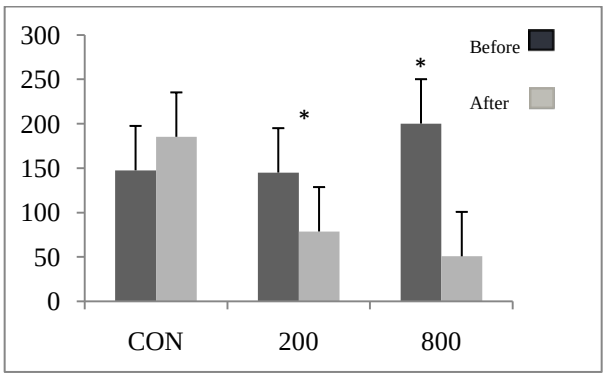

Figure 3. Triglyceride serum in diabetic rats before and after experimental

Table 1. Serum cholesterol in diabetic and normal rats

		Control		200 Group		800 Group	
		Before	After	Before	After	Before	After
Diabetic	Cholesterol	63.37 ±13.09	59.75±10.57	66.75±11.98	58.75±9.43	64.00±5.2	58.85±13.8
	Before - after	3.62±2.52		8±2.56**		5.14±8.56	
Normal	Cholesterol	74.6±10.38	61±8.2	69.14±8.85	57.00±6.88	72.44±16.89	62.44±11.65
	Before-after	13.6±2.17		12.14±1.97		12±5.24	

**Significant reduce ($p \leq 0.05$)

Blood glucose levels in healthy groups 5 and 6 showed a significant reduction compared with the control group and this decline was directly proportional to the extract concentration rising (Fig. 2).

Measurement of the amount of triglycerides in the diabetic groups 2 and 3 and comparison with the control group represents a significant reduction in the serum of rats that according to figure 3, with increasing concentration, triglyceride levels declined by a greater amount, also the cholesterol has lower levels in all diabetic groups and this reduction was significant in group 2 But the cholesterol level did not change in the healthy groups (Table 1).

Discussion

The results showed the 15 to 20 units reduction of blood glucose in diabetics and healthy groups receiving the extract, this reduction was significant in both groups. Furthermore, the comparison of the results between case and control groups show that with increasing concentration, blood glucose levels are more reduced. Also comparison of HbA1c levels in all groups showed this factor is not affected by the administration of the extract, which one reason is the short duration of the study because measurement of HbA1c levels represents its 3 months modification in body but our study was 28 days.

Previous researches suggests that certain herbs, including caper fruits with reduce digestion and absorption of carbohydrates in the digestive system, causing progressive entry of glucose into the blood and prevent a sudden increase in blood glucose after food intake [28].

Other researchers found that feeding hyperlipidemic rats with caper reduce the levels of blood glucose and lipid. In fact such plants due to having different fiber and antioxidants such as polyphenols can decrease serum levels of glucose and lipids. The caper fruit is also rich in these components that cause the activation of the hypolipidemic and hypoglycemic properties in the body that confirm our findings [29]. Our results showed that triglyceride levels in healthy groups received extract had 5 to 7 units lower than in the control group; however, this reduction was not statistically significant. Cholesterol levels in these groups than in the control group had an increase of 1 to 2 units which was not statistically significant. In fact, these groups had normal range of serum triglyceride levels and caper extract reduced triglyceride levels to help optimize its level in the blood. Triglyceride levels in diabetic rats receiving the extract showed 100-180 unit reduction that the reduction was statistically significant. It should be noted that blood lipid levels are increased in diabetic conditions but in the treated groups, extract has been prevented the increase of serum lipids in rats. The cholesterol levels among these groups were significantly reduced only in the group of 200. One of the reasons why fat loss can be linked to fiber of plants, as several studies have reported hypolipidemic effects of fiber on serum lipid [30]. The researchers found that rats fed by extract showed reduction in serum triglyceride and urea, also, it was found that this plant has high levels of antioxidants and vitamin C. The researchers stated that the combined use of these two factors decreased blood oxidants and reactive oxygen species.

Furthermore, it activates the Glutathion-S-Transferase enzyme that initiate glutathione pathway and it helps to neutralize toxic oxidants and neutrophils. Feeding rats by caper increase the activity of these enzymes, which modify oxidant and glutathione pathway [31].

Another study found that concurrent administration of ethanol extract of the root bark of caper and CCL4 prevent destroying of the hepatocytes. So that the CCL4 prescription has been increased Liver hormones, indicating its negative effect on the liver. However, the co-administration of CCL4 and caper root extract repairs liver tissue damage which has been caused by the CCL4 [32]. Heidari et al. results indicate that human consumption doses are non-toxic but it is likely that the extract, especially at high doses have toxic effects on the kidney [33].

Unlike previous studies, in our study hydroalcholic extract was used for administration to rats. Also the study period was 28 days. What are clear from the above studies are the effects of caper fruit extract on reduction of blood glucose and lipids in diabetic rats. (The blood glucose and lipids reduction effects are obvious in diabetic rats which received caper fruit extract). It has no toxic effect on the liver and in some cases it also had the effect of protecting , but the effects of kidney toxicity has not yet clearly. On the other hand, this plant has a therapeutic effect on some diseases like rheumatoid and coronary heart disease. Many health benefits of this plant make it more prone to use but it should always pay attention to the toxicity of many medicinal plants. So if the caper fruit does not possess the toxic effects on human tissue it can be considered as a most effective drugs used to reducing blood glucose and especially the blood lipid.

Of executive constraints pointed out the initial values (before gavage) of some blood biochemical factors in rats

that was not close, which to reduce the number of errors we used 10 rats in each group. All rats were purchased from same center and during the study, all conditions were kept the same.

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Authors' Contributions

All authors had equal role in design, work, statistical analysis and manuscript writing.

Conflict of interest

The authors declare no conflict of interest.

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