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Effects of Caper (*Capparis Spinosa*) and Acetic Acid on Lipid Profile and Protein Concentration in the Serum of Albino Mice

Saad Thabit Jassim Alrawi[1*], A. O. Humide[2], Mohanad D. Al- jeboori[3]
[1]Department of Veterinary Public Health, College of Veterinary Medicine, University of Fallujah
[2]College of Applied Science, University of Fallujah
[3]Department of Pathology, College of Veterinary Medicine, University of Fallujah

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Abstract

This study aimed to determine the effects of alcoholic and aqueous extracts of caper (*Capparis Spinosa*) and acetic acid on serum lipid profile and proteins levels in mice. Sixty adult mice with an average weight of 24±4 g grams were divided into four groups (15 mice for each). The first group (G1) was administrated daily with an oral dose of caper alcoholic extract (200 mg/kg) for 28 days. The second group (G2) was administrated daily with an oral dose of caper aqueous extract (200 mg/kg) for 28 days. The third group (G3) was administrated with a daily dose of 10 % acetic acid (2 ml/kg) for 28 days. The fourth Group (G4) was administrated daily with distilled water for 28 days, as a control group. The levels of lipid profile parameters, blood urea, total protein, albumin, and globulin were determined. The results showed a significant reduction ($P \leq 0.05$) in cholesterol and triglyceride levels in mice that were treated with alcohol or aqueous extracts of caper compared with acetic acid-treated and control groups. On the other hands, the results showed a significant reduction ($P \leq 0.05$) of blood urea levels in mice that were treated with alcohol or aqueous extracts of caper compared with acetic acid-treated and control groups. While the results recorded non-significant differences in the levels of total protein, albumin, and globulin in the serum of mice of different treatment groups. From the results, it can be concluded that caper has protective effects via acting to improve the lipid profile and urea level in the blood of mice.

Keywords: Caper, Acetic acid, Lipid profile, Protein, Mice

تأثير نبات الكبار (Capparis Spinosa) وحامض الخليك على مستوى الدهون وتركيز البروتين في مصل الفئران البيضاء

سعد ثابت جاسم الراوي[1] ، اناس عبيد حمادي[2] ، مهند ضياء الجبوري[3]
[1] فرع الصحة العامة البيطرية، كلية الطب البيطري، جامعة الفلوجة، الانبار، العراق
[2] كلية العلوم التطبيقية، جامعة الفلوجة، الانبار، العراق
[3] فرع الامراض ، كلية الطب البيطري، جامعة الفلوجة، الانبار، العراق

الخلاصة

هدفت هذه الدراسة إلى تقدير تأثير المستخلص الكحولي والمائي لنبات الكبار (Capparis Spinosa) وحمض الخليك على مستوى الدهون والبروتينات في مصل الفئران. تم تقسيم 60 فأر بالغ حيث كان وزنها 24

*Email: Saadalrawe50@gmail.com

± 4 غم إلى أربع مجموعات. (15 فأر لكل منهما) على النحو التالي: المجموعة الأولى G1 أعطيت جرعة يومية فموية من الكبار (مستخلص كحولي) 200 مجم / كغم يوميًا لمدة 28 يومًا. المجموعة الثانية G2: أعطيت جرعة يومية فموية من نبات الكبار (مستخلص مائي) 200 مجم / كغم يومياً لمدة 28 يوماً. المجموعة الثالثة G3 أعطيت جرعة يومية من حمض الخليك (10٪) 2 مل / كغم يومياً لمدة 28 يوماً، بينما تم إعطاء فئران المجموعة الرابعة G4 ماء مقطرًا يوميًا لمدة 28 يومًا كمجموعة سيطرة. تم قياس مستويات الدهون ،اليوريا، البروتين الكلي ، الألبومين والكلوبيولين في مصل الفئران. أظهرت النتائج وجود انخفاض معنوي ($P\leq0.05$) في مستويات الكوليسترول والدهون الثلاثية في الفئران التي تم معاملتها بالمستخلص الكحولي أو المائي للكبار مقارنة مع المجموعة المعاملة بحامض الخليك والمجموعة السيطرة. من ناحية أخرى ، أظهرت النتائج انخفاضًا معنويًا ($P\leq0.05$) في اليوريا في الدم في الفئران التي تم معاملتها بالمستخلص الكحولي أو المائي للكبار مقارنة مع المجموعة المعاملة بحامض الخليك والمجموعة السيطرة. بينما سجلت النتائج فروق غير معنوية في البروتين الكلي ، الألبومين والكلوبيولين في مصل الفئران بين المجموعات المختلفة. من النتائج يمكن أن نستنتج أن نبات الكبار له تأثير وقائي ويعمل على تحسين صورة الدهون واليوريا في دم الفئران.

Introduction

Obesity is a major endemic problem in the world, while coronary artery disease is still the leading cause of global death rates [1]. Atherosclerosis was estimated to be the biggest cause of mortality in world [2]. On the other hand, blood lipids are major risk factors for atherosclerosis and coronary heart disease. Cholesterol, phospholipids, and triglyceride are transported as lipoproteins to other tissues. The main constituents of lipoproteins are chylomicrons, low-density lipoproteins, and high-density lipoproteins [3]. In the liver, lipids are transformed to triacylglycerol then degraded to free fatty acid, while free cholesterol is transformed into very low-density lipoproteins with a variety of apoproteins [4].

Herbal drugs are a significant part of traditional therapy, including the medicinal plants and their bioactive components [5]. Herbal plants are the major source of potential substances with potent pharmacological effects [6, 7]. The Capparidaceae family contains some of the widespread wild aromatic foliage in the arid regions of Asia. *Capparis spinosa* has been well regarded in various countries as 'Capers' [8, 9]. *C. spinosa* has been revealed to have many bioactivities, such as those of antioxidant, antifungal, antihepatotoxic, anti-inflammatory, antiallergic, and antihistaminic impacts. Also, it is considered as antidiabetic, chondroprotective, hypolipidemic, diuretic, antihypertensive, and antibacterial [10-17]. Acetic acid is a short-chain fatty acid which was reported to exert enhancement roles in the digestion and metabolism processes [18]. An earlier study suggested that acetic acid stimulates the metabolic cascade, contributing to increase lipid oxidation and decrease lipid formation in BRL-3A cells [18]. Another study showed that mice treated with acetic acid had increased lipid oxidation and decreased hepatic triglyceride concentration [19].

Therefore, the present study was conducted to explore the role of caper and acetic acid on the lipid and protein profiles in mice.

Materials and methods

Animals and experimental design

This study was conducted on 60 adult mice with an average weight of 24±4 g grams. Animals were housed in separate cages under the controlled condition of temperature 25±1Cº. The standard laboratory ration was given to the control and experimental groups of animals. Mice were divided into four groups (15 mice for each. Mice of the first group (G1) were administrated daily with an oral dose of 200 mg/kg caper (alcohol extract) for 28 days. Mice of the second group (G2) were administrated daily with an oral dose of 200 mg/kg caper (aqueous extract) for 28 days [20, 21]. Mice of the third group (G3) were administrated daily with an oral dose of 2 ml/kg day acetic acid (10%) [22] for 28 days. Mice of the fourth Group (G4) received an oral dosage of 0.1 ml distilled water daily for 28 days, as a control group.

Plant preparation and extraction

Fresh flower of caper were collected from Haditha city, west Iraq. The flower fruits were dried at room temperature, grinded by an electrical grinder to a fine powder, and soaked in distilled water and

ethanol solution (70%) in two containers for three days with continuous shaking. The distilled water and ethanol were filtered by a filter paper and then evaporated by rotary evaporator until dried [23,24].

Blood samples collection and measurement of parameters

After 28 days of the experiments, animals were weighed by a sensitive balance and the blood samples were collected via cardiac puncture. The spectrophotometric methods kits (Biolabo, France) were used to measure the levels of cholesterol, triglyceride, urea, total protein, albumin, and globulin in the serum [25].

Statistical analysis

Data are illustrated as mean and standard error. The method of one-way ANOVA was applied by using SPSS-25. The least significant differences were used to determine the significant differences between different groups [26].

Results and discussion

The results of the current study, as listed in Table-1 and Figure-1, showed a significant ($P \leq 0.05$) decrease in the level of blood cholesterol in the groups administrated with caper (alcohol extract) compared with the other treated groups and the control. The results revealed a significant reduction ($P \leq 0.05$) in the levels of cholesterol and triglyceride of mice treated with alcohol or aqueous extracts of caper compared with acetic acid-treated group and the control. Table-1 shows a significant reduction ($P \leq 0.05$) in the level of blood urea in mice treated with aqueous and alcoholic extracts of caper compared with other treated groups, acetic acid-treated group, and the control group. The results of protein levels, that are illustrated in Table-2 and Figure-2, showed non-significant differences in the levels of total protein, albumin, and globulin in the serum of mice among the different treated groups. Several researchers have found that antioxidants inhibit or maintain the normal lipid profile [27]. Many medicinal plants have antioxidant activities; for example, *C. Spinosa* was reported to have valuable compounds with antioxidant properties [28, 29]. Therefore, the results of the current study supported the protective effects of caper and recorded an improvement in the blood profile. These results agreed with those of earlier studies [30, 31], which recorded that the aqueous extract of caper reduced the levels of blood lipid profile components. Several reasons can explain these results; caper contains many components, such as flavonoids, tocopherols, carotenoids, phenols, polyphenols, glucosinolates, and alkaloid [9 , 32]. It also contains quercetin, rutin, and kaempferol, that have antioxidant and protective effects [33, 34, 35]. On the other hand, caper has anti-oxidant, anti-microbial, cardiovascular, chondroprotective, anti-diabetic, and hypolipidemic activities [31,36]. In addition, the results of protein levels in the current study recorded increased total protein and globulin concentrations, which revealed an improvement of animals' health and immunity. This might be because caper has components that exert protective roles via acting as anti-inflammatory, anti-histaminic, anti-cytotoxic, immune stimulator, and anti-hepatotoxic [31, 37].

Conclusions

From the result of the present study, it can be concluded that caper, especially the alcoholic extract, has hepatoprotective effects and acts to improve the lipid profile and urea level in the blood, ultimately improving the mice health.

Table 1- Effects of caper (aqueous and alcoholic extract) as well as acetic acid on blood lipid profile and urea of albino mice

Treated groups Parameters	Caper alcoholic Extract G1	Caper aqueous extract G2	Acetic acid 10% G3	Control G4
Cholesterol Mg/dl	135.50±8.99 B	147.50±6.62 AB	161.25±6.19 A	156.25±7.31 A
Triglyceride Mg/dl	77.48±2.83 B	82.87±1.92 B	88.68±4.01 A	92.61±2.21 A
Urea Mg/dl	40.55±6.36 B	44.61±8.90 B	68.12±9.71 A	65.23±1.69 A

The different letters in the raw refer to the significant differences among treatments ($p<0.05$).

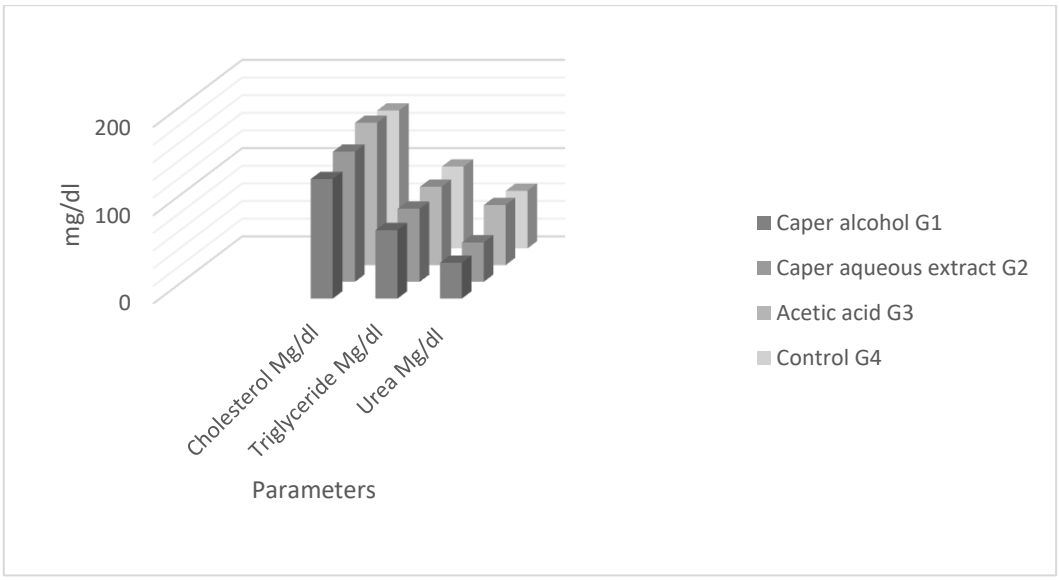

Figure 1- Effects of aqueous and alcoholic extracts of caper on serum lipid and urea concentrations in albino mice

Table 2-Effects of caper aqueous and alcoholic extract as well as acetic acid on protein levels in the serum of albino mice.

Treated groups Parameters	Caper alcohol extract G1	Caper aqueous extract G2	Acetic acid 10% G3	Control G4
Total protein g/l	5.65±0.35	5.46±0.43	6.05±0.33	5.42±0.18
Albumin g/l	3.67±0.22	3.83±0.24	4.15±0.22	3.87±0.16
Globulin g/l	1.97±0.34	1.62±0.22	1.89±0.30	1.64±0.33

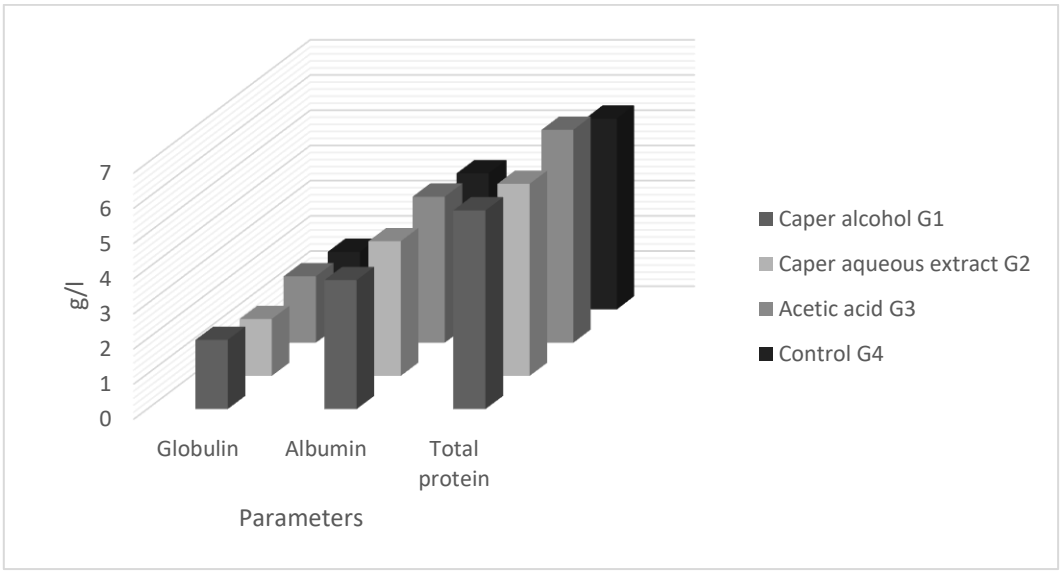

Figure 2- Effects of the aqueous and alcoholic extracts of caper on serum protein concentrations in albino mice

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