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Original Article

The Effects of Celery (*Apium graveolens* L.) Extract on Some Biochemical Parameters in Rats That Consume a Concentrated Feed

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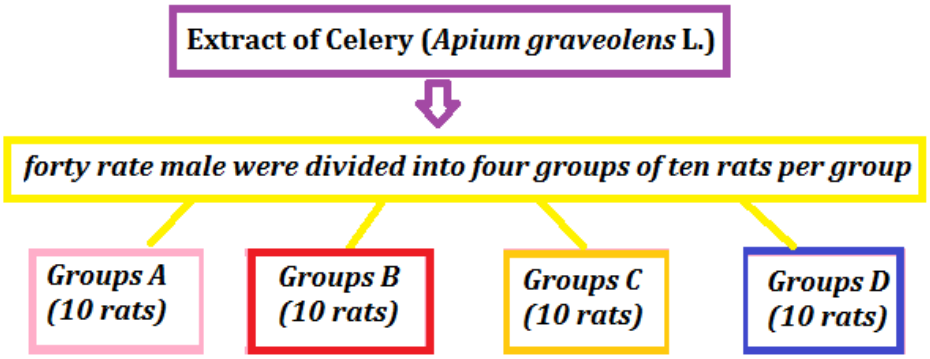
ABSTRACT

The purpose of this study was to examine the liver function effects of aqueous celery extracts on liver function tests and lipid profile in rats. A total of forty rats were split into four classes, 10 rats per category, fed for 30 days as Group A: received regular diet, Group B: received concentrated feed diet, Group C: received 20% celery extract in the regular diet, Group D: received a concentrated feed diet with 20% celery extract. The levels of serum alanine aminotransferase (ALT), aspartate aminotransferase (AST), and lipids profile have been also determined in all subjects. The results indicated significant variations at ($P \leq 0.05$) between tested groups for triglycerides, total cholesterol, and HDL levels in the blood serum, except in rats group B, the group D recorded a high levels of lipid profile, while the lowest value has been reported in group A. The results indicated that rats group C compared with B over an experimental duration had low triglycerides, average cholesterol, and high-density lipoprotein (HDL) amounts. Also, AST and ALT were substantially reduced in D. Based on the results, it was clear that celery can reduce the lipid profile levels and it has hepatoprotective effects by decreasing AST and ALT enzymes.

GRAPHICAL ABSTRACT



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Introduction

Among medicinal annual plants that occur all over European, the tropical, subtropical African countries, and Asian is celery (*Apium graveolens* L.). It belongs to the *apiaceae* family, and is a source of natural active products as well as a part of regular diet around the world [1,2]. The reason behind the celery use in traditional medicine to contain compounds such as limonene, selinene, frocoumarin glycosides, flavonoids, and vitamins A and C [3]. Research on rats shows that ethanol extracts of celery leaves increase spermatogenesis and further improves their fertility, while these extracts cause a significant decrease in cholesterol and low-density lipoprotein (LDL), seeds and stems of celery can also be used to treat gout, rheumatism, urinary tract inflammation, arthritis increase appetite, and as a prophylaxis for nerve agitation. However, a number of studies are still needed to validate the effectiveness of celery as a treatment [4- 6]. Celery additives improve the membrane of the liver cells and reduce the release into the blood of aspartate aminotransferase (AST), and alanine aminotransferase (ALT) enzymes. The study of [7] found a very low density lipoprotein (VLDL) and a high density lipoprotein (HDL) dose of LDL and cholesterol caused to decrease in mice diet (HDL). In addition, [8] observed that the amount of serum overall cholesterol, triglyceride, and triacylglycerol hepatic lipase in the treatment groups are significantly decreased by the chewing celery [7], 10% aqueous celery extract is used alone to boost blood fats and cholesterol levels [9]. The present study was considered to examine the effects of plant extracts on kidney and liver function in rats.

Materials and Methods

Plant samples

The celery leaves were taken, washed with distilled water to clean them of dust, kept in clean, sealed glass containers, covered with aluminum foil, and kept refrigerated until usage, and then they were cut with a clean knife into small pieces before the extraction process was carried out within minutes to preserve the volatile compounds.

Preparation of plant extract of celery (Apium graveolens L.)

Following the technique used by [10], 100 g of celery leaves were weighed after cutting them into little pieces and placing them in a one-liter glass flask with 500 mL of distilled water, and then the combination was left in the incubator for 24 hours at 35 °C. After that, the mixture was filtered with filter paper. Next, the resulting aqueous celery extract was put in a convection oven for drying, and then kept in clean glass bottles at 4 °C.

Experimental Design

Depending on the method followed with some modifications, forty male rats were divided into four groups of ten rats per group, and then regular and concentrated nutrition were adopted with the addition of proportions of celery extract to the food, as indicated in Table 1 [11].

Table 1: Experimental Design

Groups	Details
A	Standard Diet (SD) for 30 days
B	Concentrated feed diet (CFD) for 30 days
C	20% Celery extract with (SD) for 30 days
D	20% Celery extract with (CFD) for 30 days

Standard Kits for ELISA test

Kits of triglycerides, total lipids, AST, ALT, total cholesterol, and HDL were obtained from Biolabo Company tests and were done according to manufacturer instructions, the examinations were carried out by using Elisys Uno - HUMAN Diagnostics technology.

Measurement of lipid profile, AST, ALT, total cholesterol, and HDL by Elisys Uno - HUMAN

The method mentioned by [12] was approved; enzymatic methods including cholesterol

ester/oxidase were used to quantify the total cholesterol levels in the blood. Phosphotungstic acid and $MgCl_2$ were used to assess the serum HDL content in the supernatant fraction. Cholesterol levels were determined. After breakdown by lipoprotein lipase in glycerol, conversion into glycerol phosphate, dihydroxyacetone phosphate, and H_2O_2 which was converted into aminophenazone in the presence of peroxidase, the levels of triacylglycerol were determined enzymatically in the serum.

Statistical Analysis

To determine the influence of different factors on research variables, the Statistical Analysis System-SAS (2018) program was employed. In this investigation, a significant analysis of means was performed to use the least significant difference (LSD) test (ANOVA) [13].

Results and Discussions

The results in Table 2 revealed that there were substantial variations within the various studied classes between triglycerides, total cholesterol, and HDL levels in blood serum. In rats supplemented with a concentrated diet (B), backed up by the concentrated diet feed classes of rats supplemented with 20 percent celery leaves (D). The lowest value in rats fed regular diets was reported (A). The findings of the same table showed that rats in C, compared with those that had a high diet of fatty (B) had low triglycerides, average cholesterol, and HDL amounts over an experimental duration.

Table 2: The effect of oral dosing of celery *(Apium graveolens L.)* extracts in fat levels of male rats

Parameters	Mean ± SE				LSD value
	M1	M2	M3	M4	
Triglyceride (mg/dl)	81.4 ±3.48 b	122.8 ±4.92 a	74.3 ±2.91 c	101.4 ±4.75 ab	24.628 *
Cholesterol (mg/dl)	90.2 ±3.91 c	127.3 ±6.02 a	86.1 ±3.52 c	97.2 ±3.97 b	22.073 *
HDL (mg/dl)	49.1 ±2.37 ab	25.76 ±1.75 c	52.2 ±2.85 a	43.6 ±2.53 b	8.026 *
Means with the different letters in same row differed significantly. * (P≤0.05).					

Celery *(Apium graveolens L.)* extracts have different biological activities compared with antibiotics recorded by [14]. The isolated materials revealed that cyclooxygenase and topoisomerase enzymes had anti-oxidant and inhibition effects [15]. Hepatoprotective effectiveness for paracetamin and thioacetamide treated rats was seen in methanol extracts from celery [16]. The root and leaf extracts graveolens has been shown to scavenge DPPH radicals, free OH, and prevent liposome peroxidation. Therefore, they may serve as antioxidants [17]. The active ingredient is the sugar or amino acid side chains, which primarily lowers overall cholesterol levels by increasing bile acid excretion [18]. In this analysis accompanied by [12] the outcome of vitamins as oxidizing agents was evaluated on the lipid profile of rats, it was shown that vitamin E enhanced lipid metabolism, which helps lowering their levels in the blood. Levels of liver enzymes ALT and AST of rats feeding on a focused diet were to be higher than those fed on a regular diet, as represented in Table 3.

Table 3: The effect of oral dosing of celery (*Apium graveolens* L.) extracts in liver function of male rats

Parameters	Mean ± SE				LSD value
	M1	M2	M3	M4	
AST(IU/L)	76.4 ±2.19 bc	91.1 ±3.52 a	71.5 ±2.97 c	82.4 ±3.61 b	7.552 *
ALT(IU/L)	42.8 ±2.52 c	62.3 ±2.78 a	40.1 ±2.03 c	53.6 ±2.75 b	6.407 *
Means with the different letters in same row differed significantly. * (P≤0.05).					

The rise in fat in the diet may be the reason. More food that is high in fat could be the source. In addition, amounts of ALT and AST in rats feeding on concentrated diet increased after longer durations. Levels of AST, ALT, and reducing levels of celery in the diet were marginally high at the beginning of the experimental phase. Then, the rats consuming the nicotine produced major decrements in the behavioral evaluation. The ALT Levels of rats fed celery extract demonstrated reduced behavior relative to those fed with diet substitution of celery extract. Another research has demonstrated that serum AST and ALT levels are significantly increased after eating hypercholesterolemic diets.

That indicates a hepatotoxic effect of obese rats**.** According the research [19], rats with hypercholesterolemia and liver illnesses may improve from ingesting a plant mixture of celery, chicory, and barley at a 15 % (5% of each) concentration.

Conclusion

A 20 % plant diet for 30 days may be useful for rats with hypercholesterolemia and liver damage, since it reduces blood liver enzyme levels, lipid profile, and triglyceride, while also improves the lipid profile of rats fed a diet higher in cholesterol. Furthermore, introducing this plant to the diet has a beneficial effect on the histologic of the liver, since it decreases the hepatic damage seen in the livers of hypercholesterolemia rats.

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Author Contributions

SJM, ATM, and RAA prepared the manuscript and provided the go-ahead again for the published version. The final manuscript were read and approved by all contributors.

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Conflict of Interest

No potential conflicts were reported by the authors.

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