Faculty of Home Economics

Journal of Home Economics
Print ISSN: 2735-5934, Online ISSN: 2735-590X
Menoufia University, Shibin El Kom, Egypt
https://mkas.journals.ekb.eg

Menoufia University

Nutrition and Food Sciences

Article Type
Original Article

Protective and Curative Effect of Costus Roots on Hepatotoxicity in Male Albino Rats

Authors
Sara A Ali, Shafika M Sabry

Author Affiliation:
Department of Nutrition and Food Sciences, Faculty of Home Economics, Helwan University, Cairo, Egypt

Corresponding author:
Sara Ali,
email: sara_atife@yahoo.com
Mobile: +2 01282269180

DOI:*10.21608/mkas.2023.232147.1248*

Cite as:
Atef & Ibrahim, 2023, Protective and Curative Effect of Costus Roots on Hepatotoxicity in Male Albino Rats. J Home Econ. 33(4), 51-66.

Received: 29 Aug 2023
Accepted: 11 Oct Jul 2023
Published: 1 Oct 2023

Printed in Menoufia University, Egypt.
Copyrights © The JHE

Abstract:
The purpose of this study was to ascertain the impact of costus (CS roots powder concentrations2.5% and 5% on the hepatotoxicity of male albino rats. Forty-two male albino rats were employed in the experiment. The rats were separated into seven main groups, including omit it curative and protective groups, after being fed the optimal diet for one week (six rats omit it each). Therapeutic teams: Group 1 was served a basal diet as the negative control group. Group 2 was a positive control group that received a basal diet along with three weekly injections of carbon tetrachloride (CCl4) (1 mg/kg body weight) to cause hepatotoxicity. The group (2) plus 2.5% (CS) powdered roots was fed to the third group. Group (4) was fed the same as group (2) plus 5% (CS) powdered roots. Defense Organizations Group (1)'s curative group and negative control group were similar. After eight weeks, the group (5) positive add the control group was given a basal diet plus a CCl4 injection (1 mg/kg body weight). The group (5) plus 2.5% (CS) powdered roots was fed to the group (6). The group (7) received the group (5) plus 5% (CS) powdered roots. Phytochemical analysis for costus roots was determined. The investigation documented that providing hepatotoxicity CS root powder at 2.5% and 5% in the curative add and protective groups increased body weight gain, feed intake and feed efficiency ratio. Our results could be add as follows: diets enriched with 2.5% and 5% CS roots powder improved blood lipid levels and reduced kidney and liver function risks.

***Keywords**: Hepatotoxicity - Costus roots - Liver function - Kidney function - antioxidant*

Introduction

The treatment of liver illness is still difficult for hepatologists and liver diseases continue to be major health problems. [1,2]. Particularly in Egypt, liver fibrosis is a significant public health concern. Fibrosis of the liver is a long-term wound-healing response to recurrent injury that is related to the etiology of the lesion. However, liver fibrosis is a dynamic condition that may reverse after the injury's underlying cause is dealt with. However,

cirrhosis develops when an injury is prolonged, which reduces the likelihood that it will heal [3,4].

The ccl4 model is a special model that mimics all significant features of human liver fibrosis, especially in those with hepatitis C virus infection. These features include inflammation, portal hypertension, ascites, fibrous formation, and possibly fibrosis regression. It is also very easy to compare, has excellent reproducibility, and has been used in several previous investigations. [5]. CCl3, a dangerous product of CCl4, binds to lipoprotein, causing lipids to oxidize, increasing liver malonaldehyde (MDA), releasing reactive oxygen species, and lowering liver glutathione (GSH). Following this, the properties of hepatocyte the bloodstream, mitochondrial, and lysosomal membranes alter, resulting in hepatocyte enlargement and lysis, which boosts the blood level of the enzyme alanine transaminase (ALT) and the enzyme aspartate transaminase (AST)[6]. Acute damage, the start of fiber synthesis, and severe fibrosis are the three stages that make up the development of liver fibrosis. Kupffer cell activation & the beginning of an inflammatory response, which promotes the production of cytokines and chemokines, as well as the attraction and activation of neutrophils and lymphocytes, which contribute to liver necrosis, are characteristics of the phase of acute ccl4-mediated liver fibrosis [7].

Herbal medicines are frequently utilized for the treatment and prevention of a variety of illnesses and frequently contain highly active pharmacological substances that are typically thought to be harmless and nontoxic in comparison to synthetic drugs [8]. Dry seeds of costus (SC) have been utilized by folk medicine since ancient times for the treatment of many diseases and conditions, like allergies & asthma, vomiting, certain bronchitis, ulcer, throat infections, arthritis, coughing, tuberculosis, gastrointestinal difficulties & many others [9,10]. The costus of Saussurea is also known as the Indian costus or costus [11]. For many thousands of years, S. costus has been applied as a medicine, plus its root of this species is the major part utilized for medicinal purposes, and it was suggested by Prophet Muhammad to "treat with Indian burning incense, for the purpose of treatment for seven disorders" [12]. S. costus roots, besides other types, were used for cancer treatment by ancient physicians & more recently, by Japanese scientists & S. costus compounds and extractions have been listed in numerous pharmacopoeias [13]. Whenever consumed as a nutritional product, the Food and Drug Administration of America concerns S. costus to be commonly accepted safe [14].

Saussurea costus is used separately or in mixture with other medications in Indian health systems. Because its roots include antispasmodic, antifungal, and antibacterial effects, S. costus should be used in more human-related healthcare and pharmaceuticals [15,16]. Considering the worldwide increase in resistant to drugs diseases and the expensive nature of therapy, plants used for medicinal purposes with antifungal abilities is a potential factor in innovative antimicrobial drugs in the type of pure elements or natural extracts [17]. SO, this study was conducted to investigate the effect of feeding rats with hepatotoxicity on costus roots on serum liver functions, kidney function, lipid profile and antioxidant enzymes.

Materials and methods

Materials:

1-Plants:

Costus roots was obtained from Agriculture Research Center, Egypt.

2-Basal diet:

Starch and corn oil were bought at the local market. The Cairo Company for Chemical Trading, in Cairo, Egypt, provided the casein, cellulose, vitamins, minerals, dextrin, L-cysteine, choline chloride.

3- Carbon tetra chloride (CCl4):

Carbon tetrachloride (CCl4) was obtained from EI-Gomhoryia Company for Chemical Industries, Cairo, Egypt as 10% liquid solution.

4-Rats:

Adults male albino rats (n = 42) of Sprague- Dawely strain weighing (150-180g) were purchased from Helwan Farm of Experimental Animals, Helwan, Egypt.

5-Chemical Kits

Chemical kits manufactured by Egyptian American Corporation and given by Alkan Organization for laboratory service are employed for monitoring triglycerides, cholesterol, LDL-C, urinary acid, ammonia nitrogen, creatinine level, and transaminases.

Methods:

1-Animal ethics statement:

The Institutional Animal Care and Use Committee (ARC-IACUC) at Agriculture Research Center is organized and operated according to the world Organization for Animal Health (OIE) and the Eighth Edition of the Guide for the Care and Use of Laboratory Animal (2011). Ethical committee approved this study via authorized veterinarian with applying minimum constrain to the animals and using approved sample collection methods.

2-Dry costus roots preparation

Dry costus roots were prepared by being ground in an electric blender, then root powders were added to the daily basic diet.

3-Determination of phytochemical qualitatively analysis of costus roots by HPLC:

The colorimetric measurements were performed in the manner described by [18, 19].

4-Induction of hepatotoxicity in experimental rats:

Protective group:

Intraperitoneal infusion of CCl4 (50%) in olive oil as the solvent (1ml/kg) was administered at three intervals per week to both groups to elicit hepatotoxicity throughout the last week of the research. [20], proposed a method for sacrificing rats twenty-four hours after the previous CCl4 treatment.

Curative group:

In both groups, CCl4 (50%) in olive oil (1 ml/kg) was administered through the abdomen 3 times a week for one week to elicit toxicity to the liver. The trial ended for 8 weeks throughout the testing period.

5-Concept of the study:

Animals were habituated for a week beforehand the trial began. Water was available all day. The rats were separated into seven groups, including therapeutic and protection groups (each with six rats). Curative groups: Group (1): Negative control group was fed on basal diet. Group (2): Positive control group was fed on basal diet + CCl4 injection (1mg/kg body wt.) from the first day Groups (3 & 4) were fed as the group (2) + 2.5% & 5% (CS) roots powder. Protective groups: Group (1): Negative control group was the same as Group (1) in curative group. Group (5) Positive control group was fed on basal diet + CCl4 injection (1 mg/kg body wt.) in the last week. Groups (6 & 7) were fed as the group (5) + 2.5% & 5% (CS) roots powder.

6-Blood sampling:

Following a night of fasting after the experiment, the rats were sedated, slaughter & blood from them was extracted from the aorta. The serum was separated by centrifuging the blood samples for fifteen minutes at 3000 rpm per minute. The blood sample was properly split into dry, sterile Wassermann tubes with a pipette from Pasteur and placed at -20°C until testing.

7-Biochemical analysis of serum:

Total cholesterol [21], triglycerides [22], HDL-C; [23], LDL-C, and VLDL-C were calculated as the equation of [24]. All provided methods for determining uric acid, urea nitrogen, and creatine [25, 26, 27], respectively. Both the AST and ALT enzymes were discovered by researchers using the methods described by [28]. Serum alkaline phosphatase (ALP) was determined according to the method described by [29]. Serum malondialdehyde (MDA) and glutathione were measured according to [30, 31].

8-Statistical evaluation:

The outcomes are shown in terms of mean standard deviation. A single-way analysis of variation, or "ANOVA," was utilized to statistically evaluate the variance in the information [32]. These computations were performed using SPSS (version 15) computer software.

Results and discussion

The phytochemical examination results revealed that costus roots have a high concentration of bioactive elements for example resins that are terpenoids, phenols, alkaloids, coumarins, flavonoids, tannins, steroids, and quinones. These phytochemical elements are essential for health care applications [33]. Our findings supported prior research, which found that S. lappa (synonymous S. costus) is a rich source of alkaloids, flavonoids, steroids, and resins. Furthermore,[34] stated that various bioactive compounds, including sesquiterpene lactones, isodehydrocostus, isozaluzanin-C, guiainolide, santamarine, and others, were discovered and extracted from S costus. The abundance of phytochemical substances in costus is undoubtedly responsible for its various biological operations.

Also, [35] found that, various polyphenols have been discovered to have a wide spectrum of activities that may aid in the prevention of serious illnesses. The existence of for medicinal purposes valuable bio active components such as flavonoids, tannins, alkaloids, phenolic elements, saponin, reducing sugar, and glycosides is revealed by quantitative analysis of five distinct leaf extracts of Costus igneus.

Table (1): Costus roots phytochemical analysis.

The components of phytochemistry	The outcomes of the tests
Resins	+
Terpenoids	+
Phenol/Polyphenols	+
Alkaloids	+
Coumarins	+
Flavonoids	+
Tannins	+
Steroids	+
Quinones	+
Volatile oil	-
Phlobatannins	-
Saponins	-
Lipids	-

+ = test positive, - = test negative

The second table shows the impact of administering liver injury rats costus roots powder on rat body weight gain, consumption of food & feed effectiveness ratio. According to the information that was brought about, there was a substantial decline in BWG, FI, and FER for the treatment positive group. (108.60±5.41; 8.90±0.52 and 12.20±1.02) after the single dose of ccl4 (2mg/kg) as contrasted with the negative control group (142.20±6.14; 11.20±0.70 and 12.70±0.84), respectively. Feeding acute renal failure with CS roots powder at 2.5% & 5% from the first day in curative groups showed significant increase values of BWG%; FI and FER contrasted with control positive group. Results revealed that the mean values and ±SD for curative group fed at 2.5% CS were 117.66±1.81; 9.92±0.30 and11.80±0.37%. While, the mean values and ±SD for curative group fed at 5% CS were 122.00±2.12; 11.02±0.41 and11.07±0.50% respectively, compared to the control positive group (108.60±5.41; 8.90±0.52 and 12.20±1.02), respectively.

Moreover, results revealed that protective groups which fed on basal diet containing CS roots powder at 2.5 percent & 5 percent then injected with CCL4 in the last week, improved the BWG %; FI and FER, contrasted with control positive group. The mean values for protective group fed on 2.5% CS were 138.00±1.67; 9.80±0.21 & 10.56±1.67; and the mean values for protective group fed on 5% CS were 140.00±1.87; 11.64±0.37 & 12.00±0.46 compared with control positive group 130.00±5.24; 10.82±0.32 & 12.02±0.52 respectively. The effect of the rats' diet's odour, taste, and palatability may be the cause of the body weight gain that increases when costus levels rise.

According to [36], the injection of CCl4 is linked to reduced nutrient metabolism and absorption due to poor bile secretion as well as hunger loss that results in weight loss. According to [37], ccl4 significantly decreased feed intake, body weight gain, and feed efficiency rate.

Table (2): Effect of feeding hepatotoxicity rats on costus roots powder on body weight gain, feed intake and feed efficiency ratio.

Categories	Variables	Body weight Gain (%)	Feed intake (g/day)	Feed efficiency ratio
Control (-ve)		142.20±6.14a	11.20±0.70a	12.70±0.840a
Control (+ ve) ccl4 injection (1mg/kg body wt.) from the first day three times a week		108.60±5.41e	8.90±0.52c	12.20±.1.02a
Curative groups	Control (+ve) +2.5%CS	117.60±1.81d	9.92±0.30b	11.80±0.37b
	Control (+ve) +5%CS	122.00±2.12d	11.02±0.41a	11.07±0.50b
Control (+ ve) ccl4 injection (1mg/kg body wt.) in the last week three times a week		130.00±5.24c	10.82±0.32b	12.02±0.52a
Protective Groups	Control (+ve) +2.5%CS	138.00±1.67b	9.80±0.21b	10.56±1.67c
	Control (+ve) +5%CS	140.00±1.87b	11.64±0.37a	12.00±0.46a

**Values are presented in terms of averages ± SE.*
**Values numbers in the exact same column with different lettering vary considerably.*

The findings presented in Table 3 demonstrated that there were statistically significant differences in the blood levels of triglyceride (TG) and total cholesterol (TC) among the rats in the negative control group and the rats in the positive control group (hepatotoxicity), the values were 99.80±3.11 & 150.60±9.31 vs 188.80±6.38 & 261.40±6.98 (curative group) and the values were 99.80±3.114 & 150.60±9.31 vs 134.80±3.49 & 163.00±2.73 (protective group) respectively.

Feeding curative groups with 2.5 and 5 percent of CS induced significant reduction ($p < 0.05$) in triglyceride & total cholesterol (106.20±4.43 & 159.60±4.72 (2.5% CS) & 124.00±6.04 & 129.60±6.30 (5% CS contrasted with those of the control positive group 188.80±6.38 & 261.40±6.98 respectively. Moreover, with protective groups, the values were 117.80±8.34 162.60±5.32 (2.5% CS) and 100.60±1.81 & 162.20±5.63 (5% CS), contrasted with those of the control positive group 134.80±3.49 & 163.00±3.73 respectively. In fact, rats which fed on CS roots powder at 2.5% & 5% had lesser mean values of TC and TG contrasted with the positive control group.

Additionally, costus administration considerably controlled any changes in the blood lipid profile of hypercholesterolemic rats, which was likely attributable to the antidyslipidemic effect exhibited by the phytochemicals, particularly castanoside [38]. Our findings agree with [39] who reported that total cholesterol levels in the positive control group were clearly greater than those in the group with a negative control, with a statistically significant difference ($P<0.05$).

Table (3): Effect of feeding hepatotoxicity rats on costus roots powder at different ratios on triglyceride and total cholesterol.

Variables Categories		TG (mg/dl)	TC (mg/dl)
Control (-ve)		99.80±3.114f	150.60±9.31d
Control (+ ve) ccl4 injection (1mg/kg body wt.) from the first day three times a week		188.80±6.38a	261.40±6.98a
Curative groups	Control (+ve) +2.5%CS	106.20±4.43e	159.60±4.72c
	Control (+ve) +5%CS	124.00±6.04c	129.60±6.30e
Control (+ ve) ccl4 injection (1mg/kg body wt.) in the last week three times a week		134.80±3.49b	163.00±2.73b
Protective Groups	Control (+ve) +2.5%CS	117.80±8.34d	162.60±5.32b
	Control (+ve) +5%CS	100.60±1.81f	162.20±5.63b

**Values are presented in terms of averages ± SE.*
**Values numbers in the exact same column with different lettering vary considerably.*

Table (4) demonstrates that when the blood levels of high-density lipoprotein, low density lipoprotein, and very low-density lipoprotein in the rats that were exposed to hepatotoxicity were contrasted with the negative control group, there were significant differences. Rats that were given a diet enriched with CS roots powder at 2.5 percent and 5 percent had significantly reduced levels of both LDL-C and VLDL-C on average when contrasted with the positive control group. All treatment groups (curative and protective) with enriched meals including various levels of CS demonstrated greater mean HDL-C values when contrasted with the positive control group.

Decline in HDL-C at all doses studied may not be functionally advantageous to the rats due to the reduced rate of blood cholesterol transfer to the organ of liver, the considerable reduction in triacylglycerol may be due to decreased lipolysis[40].

Table (4): Effect of feeding hepatotoxicity rats on costus roots powder at different ratios on HDL, LDL and VLDL.

Variables Categories		HDL (mg/dl)	LDL (mg/dl)	VLDL (mg/dl)
Control (-ve)		35.40±1.67d	84.24±2.40d	19.96±0.62c,d
Control (+ ve) ccl4 injection (1mg/kg body wt.) from the first day three times a week		34.80±3.11a	180.04±8.15c	37.76±1.27a
Curative groups	Control (+ve) +2.5%CS	38.60±1.67c	88.76±7.68d	21.24±0.88c
	Control (+ve) +5%CS	42.60±1.67b	92.20±4.51c	24.80±1.20b
Control (+ ve) ccl4 injection (1mg/kg body wt.) in the last week three times a week		37.80±1.30a	105.08±6.04b	26.96±0.69b
Protective Groups	Control (+ve) +2.5%CS	41.40±1.67b	96.80±5.21C	23.56±1.67b,c
	Control (+ve) +5%CS	43.00±1.22c	80.20±1.77e	20.12±0.36c

**Values are presented in terms of averages ± SE.*
**Values numbers in the exact same column with different lettering vary considerably.*

Table (5) displays the influence of costus roots powder on the renal systems (urea nitrogen, uric acid & creatinine) in rats with hepatotoxicity. Carbon tetrachloride caused hepatotoxicity by increasing biochemical indicators for kidney not liver. Furthermore, the results revealed a significant difference between the positive control group and the other groups (negative control, curative, and protective groups) fed CS roots powder at 2.5% and 5%. While rats fed CS powder at 2.5% and 5% lowered their uric acid levels dramatically.

The hepatic damage group had a higher mean value of urea nitrogen at 42.00±2.12 mg/dl contrasted with the negative control group at 36.40±2.40 mg/dl. In treatment groups provided on CS roots powder at 2.5% and 5%, the levels of urea nitrogen reached 38.80±1.92 and 36.60±2.30 mg/dl, respectively, contrasted with the positive control group 42.00±2.12 mg/dl. In protective groups, the levels of urea nitrogen reached 39.00±1.00 and 40.60±1.51 mg/dl, respectively, compared to the positive control group 41.00±1.00 mg/dl.

Additionally, table (5) demonstrated that creatinine elevated with ccl4 injection, reaching 0.86±0.05 mg/dl in contrast to 0.48±0.08 mg/dl in the negative control group. Furthermore, results confirmed that the consequences of feeding on basal diet containing CS roots powder at 2.5% & 5% (curative groups), creatinine levels reached 0.60±0.10 & 0.54±0.05 mg/dl contrasted with positive control group 0.86±0.05mg/dl. When compared to the positive control group, the protective groups achieved levels of 0.70±0.07 and 0.70±0.05 mg/dl. Our findings corresponded with those of [41], who showed that the levels of creatinine, uric acid, and urea did not change in comparison to group one (control).

[42] demonstrated in related research that lipid peroxidation and a decrease in antioxidant status may be linked to a chain of events leading to methotrexate (MTX)-induced renal damage. Increased serum urea & creatinine levels can also indicate renal failure and the activation of apoptotic cell markers like PARP, which may play a role in the kidney damage caused by MTX. In lead-exposed populations, kidney impairment is related with distortions in several renal functions such as albuminuria, impaired glomerular filtration rate, and lower creatinine clearance [43, 44].

Table (5): Effect of feeding hepatotoxicity rats on costus at different ratios on kidney function.

Variables / Categories		Creatinine	Urea (mg/dl)	Uric acid
Control (-ve)		0.48±0.08d,e	36.40±2.40c	3.68±0.08b
Control (+ ve) ccl4 injection (1mg/kg body wt.) from the first day three times a week		0.86±0.05a	42.00±2.12a	4.96±0.19a
Curative groups	Control (+ve) +2.5%CS	0.60±0.10c	38.80±1.92b	3.94±0.23a,b
	Control (+ve) +5%CS	0.54±0.05d	36.60±2.30c	3.88±0.08a,b
Control (+ ve) ccl4 injection (1mg/kg body wt.) in the last week three times a week		0.74±0.05b	41.00±1.00a	4.16±0.26a
Protective Groups	Control (+ve) +2.5%CS	0.70±0.07b	39.00±1.00b	3.88±0.31a,b
	Control (+ve) +5%CS	0.70±0.05b	40.60±1.51a,b	4.12±0.39 a

**Values are presented in terms of averages ± SE.*

**Values numbers in the exact same column with different lettering vary considerably.*

Results in Table (6) displayed that serum AST, ALT, and ALP activity considerably elevated ($P < 0.05$) in the positive group contrasted with the negative control group. Our findings support [39] findings from, which show how costus roots affect the levels of ALT, AST, and ALP in rats with liver fibrosis. The results revealed a statistically significant difference among the ALT liver enzyme levels in the positive control rat group and the negative control rat group. Rats were given calcium carbide, and [45, 46] found that the ALT and AST greatly increased.
According to [47] Costus speciosus could modify plasma enzyme levels (AST, ALT, LDH, and ALP) to be quite close to normal. Additionally, rats that had been poisoned with carbon tetrachloride [48, 49] to determine whether the ethanolic extract of the Costus speciosus rhizomes showed hepatoprotective properties. The serum levels of urea and creatinine were considerably greater in the hypothyroidism and hyperthyroid mice as contrasted with the control & costus groups, according to the most recent research ($p < 0.05$).
According to [50] the cholesterol-treated group (+Ve) significantly outperformed the negative control group (-Ve) and all other groups in terms of the activities of liver function (tissue injury markers). The costus, on the other hand, significantly decreased all tissue injury markers in the hypercholesterolemic rats. This effect may be attributable to the costus' free radical scavenging ability, which can maintain the integrity of the cell membrane [51].
[52,53] both declared that costus (S. lappa) root extract had hepatoprotective action towards liver damage brought on by contact with deltamethrin. [54, 55, 56] demonstrated that Costus speciosus might alter plasma enzyme levels to close to their usual levels and function as a hepatoprotective agent regarding carbon tetrachloride. These enzymes included aspartate aminotransferase, alanine aminotransferase, alkaline phosphatase, lactate dehydrogenase, alkaline phosphatase, and acid phosphate.

Table (6): Effect of feeding hepatotoxicity rats on costus at different ratios on liver function.

Variables / Categories		ALT	AST (U/L)	ALP
Control (-ve)		30.60±4.61e	40.80±0.83d	809.00±7.28e
Control (+ ve) ccle injection (1mg/kg body wt.) from the first day three times a week		66.40±2.07a	116.00±7.48a	862.20±4.76a
Curative groups	Control (+ve) +2.5%CS	36.80±3.76d	39.00±1.00d	834.00±3.80c
	Control (+ve) +5%CS	31.60±2.07e	36.60±2.30e	825.20±4.32d
Control (+ ve) ccl4 injection (1mg/kg body wt.) in the last week three times a week		54.60±5.89b	86.60±5.12b	843.60±3.64b
Protective Groups	Control (+ve) +2.5%CS	37.00±2.55d	55.80±4.43c	842.40±5.50b
	Control (+ve) +5%CS	41.40±1.67c	51.40±5.50c	838.00±5.56c

**Values are presented in terms of averages ± SE.*
**Values numbers in the exact same column with different lettering vary considerably.*

As can be shown in Table (7), rats in the positive control group had significantly greater serum MDA levels than rats in the healthy group (153.40±6.95 mM/g vs 78.00±7.17 mM/g).

Rats in other groups, as opposed to the treatment group, saw a considerably (p 0.05) lower level of serum MDA.

In addition, the results showed that supplying "curative groups" to liver-toxic rats lead to a considerable decline in the mean values of serum MDA; these values were 94.60±5.81 mM/g (for 2.5%) and 91.20±2.58 mM/g (for 5%), as opposed to 153.40±6.95 mM/g for the positive control group, respectively. Additionally, the mean serum MDA levels in the current study's "protective groups" were significantly lesser than those in the "positive control group" (129.60±5.41 mM/g), at 100.40±3.20 mM/g(for 2.5%) and 94.60±5.81 mM/g (for 5%), respectively.

According to the study's findings, rats in the control positive group had serum glutathione levels that were substantially lower than rats in the negative control group.

According to [41], the levels of MDA in red blood cells (RBCs) were statistically considerably reduced while GSH dramatically increased. MDA levels in the liver homogenate of the ccl4 treated group 2 were significantly greater than those in the untreated group 1 (P <0.05), according to the comparison. This can be explained by the fact that ccl4 is changed into the dangerous metabolite trichloromethyl (ccl3) radical by CYP2E1 in hepatocytes. The binding of ccl3 to lipoproteins causes the lipids in the endoplasmic reticulum to undergo peroxidation, which increases the level of MDA in the liver [56]. GSH levels in the liver homogenate of the ccl4-treated group 2 significantly decreased in comparison to the negative control (-Ve), demonstrating that oxidative stress mediated by ccl4-induced hepatocyte damage led to the depletion of reduced GSH. This conclusion is in line with those reached by the investigations by [57, 58].

Table (7): Effect of feeding hepatotoxicity rats on costus at different ratios on malondialdehyde and glutathione.

Categories	Variables	MDA (mM/g)	GSH (µM/g)
Control (-ve)		78.00±7.17f	4.96±0.19a
Control (+ ve) ccl4 injection (1mg/kg body wt.) from the first day three times a week		153.40±6.95a	3.00±0.56c
Curative groups	Control (+ve) +2.5%CS	94.60±5.81d	3.94±0.23a,b
	Control (+ve) +5%CS	91.20±2.58d,e	3.72±0.40b
Control (+ ve) ccl4 injection (1mg/kg body wt.) in the last week three times a week		129.60±5.41b	4.16±0.26a
Protective Groups	Control (+ve) +2.5%CS	100.40±3.20c	4.12±0.39a
	Control (+ve) +5%CS	94.60±5.81d	3.88±0.31a,b

**Values are presented in terms of averages ± SE.*

**Values numbers in the exact same column with different lettering vary considerably.*

The aforementioned chemical analysis of the costus was crucial in reducing lipid peroxidation and oxidative stress, which are a result of an imbalance between the production of ROS (reactive oxygen species) & the antioxidant enzymes' capacity to scavenge free radicals. Excessive ROS production results in this imbalance and antioxidant exhaustion [59 & 38].

According to [60] study, rats treated with lead acetate had considerably lower levels of total glutathione, superoxide dismutase, and glutathione peroxidase. Costus afer, which likewise considerably decreased the value of the lead acetate-induced indicator of lipid peroxidation, malondialdehyde, significantly reversed these lead acetate-induced decreases. This outcome is consistent with that which [61] reported. This was consistent with the earlier study, which found that C. speciosus rhizomes have preventive potential due to their antioxidant effects in preventing degenerative disorders with obvious oxidative damage from ROS or free radicals [62].

Conclusion

Diets enriched with 2.5% and 5% CS roots powder improved blood lipid levels and reduced kidney and liver function risks.

References

1. Pal RK, Manoj J. Hepatoprotective activity of alcoholic and aqueous extracts of fruits of Luffa cylindrica Linn in rats. Ann. Biol. Res. 2011; 2(1):132-41.
2. El-Naggar MS, Shouman LE, Tantawy HM, Tag HM. Anti-fibrotic Effect of Saussurea lappa Ethanolic Extract against Induced Liver Fibrosis in Male Albino Rats. The Egy. Soci. for environ. Sci.2017; 16(1): 22-30.
3. Pellicoro, A.; Ramachandran, P. and Iredale, P. Reversibility of liver fibrosis. Fibroge. Tiss. Rep. 2012; 5: S26.
4. Elsayed H, Abd-Elmonem M, Gabr O, Badria F. Saussurea lappa root extract accelerates the reversion of liver fibrosis induced by carbon tetrachloride in rats. Ben. Medic. J. 2015; 1; 32 (2).
5. Liedtke C, Luedde T, Sauerbruch T, Scholten D, Streetz K, Tacke F, Tolba R, Trautwein C, Trebicka J, Weiskirchen R. Experimental liver fibrosis research: update on animal models, legal issues and translational aspects. Fibroge.& tis. Rep. 2013; 6:1-25.
6. Starkel, P. Animal models for the study of hepatic fi brosis. Be. Pract. Res. Clin. Gastro.2011; 25:319–333.
7. Heindryckx F, Colle I, Van Vlierberghe H. Experimental mouse models for hepatocellular carcinoma research. Internati. J. of experim. Pathol. 2009; 90(4):367-86.
8. Amer N. The histological changes on liver and spleen of mice treated with alcoholic and aquatic extract of Cupressus sempervirens. Al-Anb. Medi. J.2012; 10(2):51-7.
9. Chhabra BR, Gupta S, Jain M, Kalsi PS. Sesquiterpene lactones from Saussurea lappa. Phytochem.1998 Oct 1; 49(3):801-4.
10. Al-Duais MA, Al-Awthan YS. Hepatoprotective effect of costus roots extract against carbon tetrachloride (CCl4)-induced liver injury in Guinea Pigs. J. Lif. Sci. 2017; 11:176-84.
11. Naik A, Prajapat P, Krishnamurthy R, Pathak JM. Assessment of genetic diversity in Costus pictus accessions based on RAPD and ISSR markers. 3 Biot.2017 May; 7:1-2.
12. Khan MM. Sahih Al-Bukhari: Arabic-English. Taleem-ul-Quran Trust. 1971.
13. Kamil M. Sassurea lappa: A Scientific Review. Herbal Medicine in India: Indigenous Knowledge, Practice, Innovation and its Value. 2020; 215-221.

14. Soliman MF, Shetaia YM, Tayel AA, Munshi AM, Alatawi FA, Alsieni MA, Al-Saman MA. Exploring the antifungal activity and action of Saussurea costus Root extracts against Candida albicans and non-albicans species. Antibio.2022 Mar 1; 11 (3):327.

15. Kamala A, Middha SK, Karigar CS. Plants in traditional medicine with special reference to Cyperus rotundus L.: a review. 3 Biot.2018 Jul; 8:1-1.

16. Panigrahy SK, Bhatt R, Kumar A. Targeting type II diabetes with plant terpenes: The new and promising antidiabetic therapeutics. Biolo. 2021 Jan; 76(1):241-254.

17. Karpiński TM, Ożarowski M, Seremak-Mrozikiewicz A, Wolski H, Adamczak A. plant preparations and compounds with activities against biofilms formed by Candida spp. J. of Fun. 2021 May 5; 7(5):360.

18. Al Ghasham A, Al Muzaini M, Qureshi KA, Elhassan GO, Khan RA, Farhana SA, Hashmi S, El-Agamy E, Abdallah WE. Phytochemical Screening, Antioxidant and Antimicrobial Activities of Methanolic Extract of Ziziphus mauritiana Lam. Leaves Collected from Unaizah, Saudi Arabia. Interna. J. of Pharma. Rese. & Alli. Scien. 2017 Jul 1; 6(3).

19. Sasidharan S, Chen Y, Saravanan D, Sundram KM, Latha LY. Extraction, isolation and characterization of bioactive compounds from plants' extracts. Afri. J. of trade.comple. and altern. Medici. 2011; 8(1).

20. Sundaresan S, Subramanian P. S-allylcysteine inhibits circulatory lipid peroxidation and promotes antioxidants in N-nitrosodiethylamine-induced carcinogenesis. Pol. J. of Pharmaco. 2003 Jan 1; 55(1):37-42.

21. Allain CC, Poon LS, Chan CS, Richmond WF, Fu PC. Enzymatic determination of total serum cholesterol. Clin. Chem. 1974 Apr 1; 20(4):470-475.

22. Fossati P, Prencipe L. Serum triglycerides determined colorimetrically with an enzyme that produces hydrogen peroxide. Clin. Chem. 1982 Oct 1; 28(10):2077-0780.

23. López-Miranda J, Badimon L, Bonanome A, Lairon D, Kris-Etherton PM, Mata P, Pérez-Jiménez F. Monounsaturated fat and cardiovascular risk. Nutr. Revi. 2006 Oct; 64:S2-12.

24. Friedewald WT, Levy RI, Fredrickson DS. Estimation of the concentration of low-density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. Clini. Chemi. 1972 Jun 1; 18(6):499-502.

25. Fossati P, Prencipe L, Berti G. Use of 3, 5-dichloro-2-hydroxybenzenesulfonicacid/4-aminophenazone chromogenic system in direct enzymic assay of uric acid in serum and urine. Clin. Chemi. 1980 Feb 1; 26(2):227-231.

26. Patton CJ, Crouch SR. Spectrophotometric and kinetics investigation of the Berthelot reaction for the determination of ammonia. Analyti. Chemi. 1977 Mar 1; 49(3):464-469.

27. Bartels H, Bohmer M. Clinical chemistry. Acta. Tropica. 1972; 37:193-198.

28. Reitman, S. and Frankel, S.: Colorimetric method for the determination of serum glutamic oxalacetic and glutamic pyruvic transaminases. Amer. J. Clin. Pathol. 1957 ;28: 56-63.

29. Roy, E. Colorimetric determination of Co. St Louis. Tor. Princ. 1970; 1088-1273.

30. Draper HH, Hadley M. Malondialdehyde determination as index of lipid Peroxidation. In Meth. in enzyme. 1990 Jan 1; 186:421-431. Academic press.

31. Hamad A, Elshahawy M, Negm A, Mansour FR. Analytical methods for determination of glutathione and glutathione disulfide in pharmaceuticals and biological fluids. Revi. in Analyti. Chemi. 2020 Jan 17; 38(4):20190019.

32. Armitage P, Berry G, Matthews JN. Statistical methods in medical research. Joh. Wil. & Son. 2008 Apr; 15.

33. Abdallah EM, Qureshi KA, Ali AM, Elhassan GO. Evaluation of some biological properties of Saussurea costus crude root extract. Biosci. Biotechnol. Res. Commun. 2017; 10(4):601-11.

34. Pandey MM, Rastogi S, Rawat AK. Saussurea costus: Botanical, chemical and pharmacological review of an ayurvedic medicinal plant. J. of ethnopharma.. 2007 Apr 4; 110(3):379-90.

35. Muthukumar C, Cathrine L, Gurupriya S. Qualitative and quantitative phytochemical analysis of Costus igenus leaf extract. J. of Pharmaco. and Phytochem. 2019; 8(4):1595-8.

36. El-Hashash SA, ElMoslemany AM, El-Mageed A, Amany A. Effect of some medicinal plant seeds on CCl4-induced hepatotoxicity in experimental rats. Egypti. J. of Nutrit. and Heal. 2020 Jan 1; 15(1):101-20.

37. Behboodi HR, Samadi F, Shams SM, Ganji F, Samadi S. Effects of Silymarin on growth performance, internal organs and some blood parameters in Japanese quail subjected to oxidative stress induced by carbon tetrachloride. Poul. Scie. J. 2017; 5(1):31-40.

38. Zahara K, Tabassum S, Sabir S, Arshad M, Qureshi R, Amjad MS, Chaudhari SK. A review of therapeutic potential of Saussurea lappa-An endangered plant from Himalaya. Asi. Paci. J. of trop. Medic. 2014 Sep 1;7: S60-9.

39. Mohamed Ali H. Protective Effects of Costus Roots Against Carbon Tetra Chloride-Induced Liver Injured Rats. Facul. of Speci. Educa. 2022 May; 1; 8(40):307-336.

40. Yakubu T., Akanji A., and Oladiji T. Alterations in serum lipid profile of male rats by oral administration of aqueous extract of Fadogia agrestis stem. Res. J. Med. Pla. 2008; (2): 66-73.

41. El-Far AH, Abou-Ghanema II. Biochemical and hematological evaluation of Costus speciosus as a dietary supplement to Egyptian buffaloes. Afri. J. of Phar. and Pharmacol. 2013; 7(42):2774-9.

42. Huang SM, Chuang HC, Wu CH, Yen GC. Cytoprotective effects of phenolic acids on methylglyoxal-induced apoptosis in Neuro-2A cells. Molecu. Nutrit. & foo. Resea. 2008 Aug; 52(8):940-9.

43. Navas-Acien A, Tellez-Plaza M, Guallar E, Muntner P, Silbergeld E, Jaar B, Weaver V. Blood cadmium and lead and chronic kidney disease in US adults: a joint analysis. Ameri. J. of epidemioly. 2009 Nov; 1; 170(9):1156-64.

44. Fadrowski JJ, Navas-Acien A, Tellez-Plaza M, Guallar E, Weaver VM, Furth SL. Blood lead level and kidney function in US adolescents: The Third National Health and Nutrition Examination Survey. Archi. of internal. Medic. 2010 Jan 1; 170(1):75-82.

45. Igbinaduwa P, Aikpitanyi-Iduitua R. Calcium carbide induced alterations of some haematological and serum biochemical parameters of wistar rats. Asi. J. Phar. Heal. Scie. 2016; 6(1):1396-400.

46. Tousson E, El-Atrsh A, Mansour M, Assem A. Costus root aqueous extract modulates rat liver toxicity, DNA damage, injury, proliferation alterations induced by plant growth regulator Ethephon. Braz. J. of Pharmace. Scie. 2020 Dec; 7; 56.

47. El-Far A, Shaheen H, Alsenosy A, El-Sayed Y, Al Jaouni S, Mousa S. Costus speciosus: Traditional uses, phytochemistry, and therapeutic potentials. Pharmaco. Revi. 2018; 12(23).

48. Verma N, Khosa RL. Evaluation of protective effects of ethanolic extract of Costus speciosus (Koenig) Sm. rhizomes on carbon tetrachloride induced hepatotoxicity in rats. J. of Natu. Prod. Radi. 2009; 8(2):123-126.

49. Bolkiny Y, Tousson E, El-Atrsh A, Akela M, Farg E. Costus root extract alleviates blood biochemical derangements of experimentally-induced hypo-and hyperthyroidism in mice. Ann. Rese. & Revi. in Biol. 2019 May;1-10.

50. Marei AM. THE THERAPEUTIC EFFECTS OF COSTUS (SAUSSUREA LAPPA) AGAINST HYPERCHOLESTEROLEMIA IN MALE ALBINO RATS. Egypti. J. of Zoolo. 2022 Dec 1; 78(78):31-40.

51. Stapleton PA, Goodwill AG, James ME, Brock RW, Frisbee JC. Hypercholesterolemia and microvascular dysfunction: interventional strategies. J. of inflamm. 2010 Nov; 18; 7(1):54.

52. Alnahdi HS, Ayaz NO, Elhalwagy ME. Prophylactic effect of cousts saussurea lappa against liver injury induced by deltamethrin intoxication. Int. J. Clin. Exp. Pathol. 2016 Jan 1; 9(1):387-94.

53. Yaeesh S, Jamal Q, Shah AJ, Gilani AH. Antihepatotoxic activity of Saussurea lappa extract on D-galactosamine and lipopolysaccharide-induced hepatitis in mice. Phytothe. Resea. 2010 Jun; 24(S2):S229-32.

54. Naga M, Bakr ES. Potential therapeutic impacts of phyllanthus and costus aqueous extracts on CCl4 intoxicated rats. Egypti. J. of Nutri. and Heal. 2015 Jan 1; 10(1):1-2.

55. Eliza J, Daisy P, Ignacimuthu S, Duraipandiyan V. Antidiabetic and antilipidemic effect of eremanthin from Costus speciosus (Koen.) Sm., in STZ-induced diabetic rats. Chem. - Biolog. Interact. 2009 Nov 10; 182(1):67-72.

56. Gao TJ, Dong L, Shi HT, Li XM. Effect of alcohol extract of Plumula nelumbini on carbon tetrachloride induced rat liver fibrosis: an experimental study. Zhongguo Zhong xi yi jie he za zhi Zhongguo Zhongxiyi Jiehe Zazhi= Chinese J. of Integr. Traditi. and Weste. Medic.2014 Dec 1; 34(12):1476-80.

57. Abbas AT, El-Shitany NA, Shaala LA, Ali SS, Azhar EI, Abdel-Dayem UA, Youssef DT. Red Sea Suberea mollis sponge extract protects against CCl4-induced acute liver injury in rats via an antioxidant mechanism. Evide.-Bas. Complem. and Altern. Medic. 2014 Jan.

58. Adeneye AA, Awodele O, Aiyeola SA, Benebo AS. Modulatory potentials of the aqueous stem bark extract of Mangifera indica on carbon tetrachloride-induced hepatotoxicity in rats. J. of Traditi. and Complem. Medic. 2015 Apr 1; 5(2):106-15.

59. Tousson E, El-Atrsh A, Mansour M, Abdallah A. Modulatory effects of Saussurea lappa root aqueous extract against ethephon-induced kidney toxicity in male rats. Environm. Toxicol. 2019 Dec; 34(12):1277-84.

60. Ezejiofor AN, Orisakwe OE. Nephroprotective effect of Costus afer on lead induced kidney damage in albino rats. Interna. J. of physiol., pathophysiol. and pharmacol.. 2019; 11(2):36.

61. Hanan AA, Riham MR. Effect of lead toxicity on cytogenisity, biochemical constituents and tissue residue with protective role of activated charcoal and casein in male rats. Aust. J. Basic Appl. Sci. 2012; 7(6):497-509.

62. Tripathi, K. Essentials of medical pharmacology, Jaypee Brothers. Jayp. Broth. Medi. Publis.s (P) Ltd. 2003, 747- 391.

التأثير الوقائي والعلاجي لجذور القسط الهندي على التسمم الكبدي في ذكور الفئران

ساره عاطف على، شفيقه محمود صبرى

قسم التغذية وعلوم الأطعمة .كلية الاقتصاد المنزلى . جامعة حلوان، القاهره، مصر

الملخص العربي:

الغرض الأساسي من هذه التجربة دراسة تأثير تركيزات مسحوق جذور القسط الهندي (2.5% و5٪) على التسمم الكبدي لذكور الفرآن البيضاء. تم استخدام 42 من ذكور الفرآن البيضاء في التجربة. وتم تقسيم الفرآن إلى سبعة مجاميع، بما في ذلك المجموعات العلاجية والوقائية، بعد تغذيتهم على النظام الغذائي الأمثل لمدة أسبوع واحد (ستة فئران لكل منهما) المجاميع العلاجية: تم تقديم النظام الغذائي الأساسي للمجموعة الأولى كمجموعة ضابطة سالبة. المجموعة الثانية كانت مجموعة ضابطة موجبة التي تغذت على نظام غذائي أساسي مع ثلاث حقنات اسبوعيا من رابع كلوريد الكربون (1 ملجم/كجم من وزن الجسم) للتسبب في تسمم الكبد. المجموعة الثالثة تم تغذيتها بنفس طريقة تغذية المجموعة (2) بالإضافة إلى 2.5٪ من الجذور القسط الهندي. المجموعة (4) تم تغذيتها بنفس طريقة تغذية المجموعة (2) بالإضافة إلى 5٪ من مسحوق القسط الهندي. بعد ثمانية أسابيع، أعطيت المجموعة (5) مجموعة ضابطة موجبة نظام غذائي بالإضافة إلى حقنة برابع كلوريد الكربون (1 مجم/كجم من وزن الجسم) تم تغذية المجموعة (5) بالإضافة إلى 2.5٪ من جذور القسط البودر كمجموعة (6). تلقت المجموعة (7) نفس غذاء المجموعة (5) بالإضافة إلى 5٪ من مسحوق جذور القسط الهندى. تم تقدير المركبات الفعاله في جذور القسط الهندى .تم أخذ عينات دم من الشريان الأورطي للفئران في نهاية التجربة. اتضح من النتائج أن مسحوق جذور القسط الهندي عند مستوى (2.5٪ و5٪) في المجموعات العلاجية والوقائية أدى إلى زيادة وزن الجسم. يمكن تلخيص النتائج على النحو التالي: ساعد النظام الغذائي المدعم بنسبة (2.5٪ و5٪) من مسحوق جذور القسط الهندي على تعزيز مستويات الدهون في الدم وكذلك تقليل المخاطر على وظائف الكلى والكبد.

الكلمات المفتاحية: التسمم الكبدي، جذور القسط الهندي، وظائف الكبد، وظائف الكلى.