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Hepatoprotective Effect of *Lepidium sativum* Against Carbon *Tetrachloride* Induced Damage in Rats

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Abstract: The role of *Lepidium sativum* was investigated for the prevention of Ccl_4 induced liver damage. Twenty albino wister rats were allotted to four groups (control, Ccl_4induced hepatotoxicity and hepatotoxicity with *Lepidium sativum* treated with 200 and 400 mg/kg body weight (Bwt)). Rats were scarified after 10 days. Toxicity was performed using 12 rats. They were randomly divided into three groups (control and treated with 200 and 400 mg/kg (Bwt) *Lepidium sativum*). Blood samples were collected for hemogram and serum analysis. Mean serum AST, ALT, ALP levels and bilirubin concentration were significantly increased in Ccl_4 induced hepatotoxic group of rats compared to the control ($P< 0.05$). However significant reduction in these parameters were found in groups treated with *Lepidium sativum*. Anaemia was evident in the group received Ccl_4. The severe fatty changes in the livers of rats caused by Ccl_4 were decreased in the treated groups. Toxicity evaluation of similar doses of the plant revealed no alteration in the parameters measured above except in the higher dose few scattered fatty changes in the liver was present.

Keywords: *Lepidium sativum*, carbon teterachloride, hepatoprotective, toxicity

INTRODUCTION

Liver diseases remain one of the serious health problems. Conventional drugs used in pharmacotherapy provided a substantial contribution for treatment but may have serious adverse effects. The use of natural remedies for liver disease treatment has been reported along history.

Carbon tetrachloride (Ccl_4) is widely used for experimental induction of liver injury. The injury produced depends on Ccl_4 metabolism to a highly reactive of free radicals which initiate lipid perioxidiation[7]. Antioxidant agents of natural origin have attracted special interest because they can protect from free radical. Numerous medicinal plants and their formulation are used for liver disorders in ethnomedical practices as well as in traditional medicine.

Lepidium sativum known as pepper cress or ELRshad belongs to the family Brassicaceae (cruciferae). The seeds and leaves of the plant contain volatile oils[10]. The plant is eaten and seed oils are used in treating dysentery and diarrhea[3]. It has also been reported to treat migraine[6]. The plant was found to contain glucosinolate and glucotropaeolin[8].

The present study was aimed to screen the plant constituents and evaluate its safety and ability in the prevention of Ccl_4 induced liver injury.

MATERIALS AND METHODS

Plant Material: Seeds of *Lepidium sativum* were obtained from general market at Sudan and identified by staff of the Medicinal and Aromatic Plant Research Institute.

Phytochemical screening for triterpenes, alkaloids, flavanoids, tannins, saponins, cyanogenic glucosides, anthraquinone glucosides and coumarins were carried out using the methods described by Harborne[4].

Seeds of the plant were dried. Sixty gm of granulated seeds were packed in a soxhlet apparatus (Quick Fit Ex 5183). 100 ml of chloroform were used as a solvent to separate lipids and terepenoids. The samples were unpacked and left to dry and repacked again with methanol to get the polar constituents of the plant. The extract was evaporated till dryness.

Animals and Experimental Design: Wister albino rats of both sexes were used. They were kept in cages and housed in standard environmental conditions of temperature, humidity and light. They were left for seven days as adaptation period and supplied with standard diet and water *ad libitum*.

Two experiments were carried out. In the first experiment twenty rats were used. They were divided randomly into 4 groups, 5 rats each. They were injected intraperitoneally daily for 10 days.

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Group A served as a control and was injected with 0.2 ml/kg (Bwt) of paraffin oil. In the other three groups (B, C, D) liver damage was produced by injection of Ccl_4 at concentration of 1 Ccl_4 to 9^{th} volume paraffin oil. Rats in groups C and D received methanolic extract of the plant at a dose of 200 and 400 mg/kg (Bwt) respectively.

In the second experiment 12 rats were randomly divided into 3 groups, 4 rats each. Group A served as a control. Groups B and C treated daily for 21 days by plant methanolic extracts at doses of 200 and 400 mg/kg (Bwt).

Clinical signs and body weights were recorded. Blood samples were collected from the orbital plexus according to Waynforth[11] using halothane as anaesthetic. Blood was collected either on EDTA for haematological studies or in centrifuge tubes to separate serum. Serum transaminase, alkaline phosphatase and bilirubin concentration were measured. At necropsy, by the end of the experimental period, specimens of livers, hearts, kidneys and lungs were fixed in 10% neutral formalin and routinely processed for histopathological examination.

Data were analyzed for significance using the student t-test according to Mendenhall[5].

RESULTS AND DISCUSSIONS

Results: Phytochemical screening of *Lepidium sativum* revealed presence of triterpenes, alkaloids, flavanoids, tannins, coumarins and Saponins. Cyanogenic glucosides and anthraquinone glucosides were absent.

There were no pathological alterations observed in the control groups in all parameters measured.

Clinical signs were observed only in rats received Ccl_4. It included dullness, loss of appetite and reduction in body weights. In the group of rat received the methanolic extracts the body weights were not affected.

On postmortem examination the livers of the rats received Ccl_4 were pale with focal areas of hemorrhages. Livers in the groups received the methanolic extract showed slight to moderate paleness with few focal areas of hemorrhage.

The hematological findings were presented in Table (1). The rats received Ccl_4 showed significant reduction in Hb, RBC at day 10. However in groups of rats received 200 mg/kg and 400 mg/kg (Bwt) there were improvement in the PCV.

The serum constituents were shown in Table (2). Serum activity of ALP, AST and ALT were increased significantly at days 5 and 10 in the group of rats received Ccl_4 but the bilirubin concentration was elevated at day 10. However, in the group of rats received the methanolic extract activities of serum AST. ALT, ALP and bilirubin concentration were not affected.

Histopathologically sever centrilobular hepatocellular vacoula-tion, hemorrhages and congestion of the central veins was noticed in Ccl_4 group (Fig.1). In the groups received the methanolic extracts the changes were mild in groups received 200 mg/kg (Bwt) (Fig.2) and moderate in groups received 400 mg/kg (Bwt).

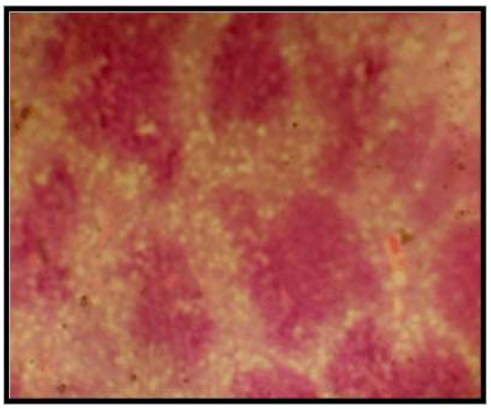

Fig. 1: Group received Ccl_4

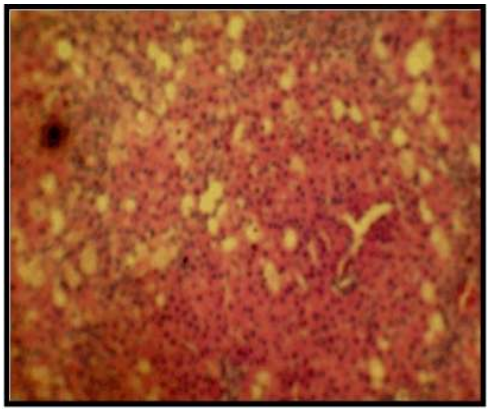

Fig. 2: Group treated with 200mg/kg methanolic extract.

In the second experiment where toxicity of the methanolic extracts was performed, there was an improvement in body weight. The serum activities of AST, ALT, ALP and bilirubin concentration were not significantly altered.

On postmortem examination there were areas of congestion in the group of rats received 400 mg/kg (Bwt). Histologically the group received 400 mg/kg (Bwt) showed congestion and scarred vacuolated cells (Fig.3).

Discussion: This study was undertaken to demonstrate the protective ability of seed extracts of *Lepidium sativum* on liver injury induced by Ccl_4 and the toxic effects of the similar doses in rats.

Table 1: Haematological values in wister albino rats treated with methanolic extract of *Lepidium sativum*.

Duration (day)	Treatment	PCV	Hb	RBC
0	Parafin oil	33.4 ± 1.2	11.2 ± 0.4	492.8 ± 36.0
	Ccl_e	34.2 ± 1.0^{NS}	12.3 ± 0.4 ^{NS}	4362 ± 15.0 ^{NS}
	Ccl_4 + 200 mg/kg extract	35.6 ± 1.2 ^{NS}	11.7 ± 0.5 ^{NS}	387.2 ± 38.0 ^{NS}
	Ccl_4 + 400 mg/kg extract	35.4 ± 0.8 ^{NS}	11.2 ± 0.5 ^{NS}	342.8 ± 10.0 ^{NS}
5	Parafin oil	32.2 ± 0.9	10.8 ± 0.3	448.0 ± 19.0
	Ccl_e	29.2 ± 0.9 ^{NS}	10.0 ± 0.4 ^{NS}	316.4 ± 27.0 ^{NS}
	Ccl_4 + 200 mg/kg extract	36.2 ± 0.4 ^{NS}	12.9 ± 0.9 ^{NS}	386.0 ± 35.0 ^{NS}
	Ccl_4 + 400 mg/kg extract	37.0 ± 1.2 ^{NS}	12.8 ± 0.3 ^{NS}	340.8 ± 5.0 ^{NS}
10	Parafin oil	32.0 ± 0.7	10.8 ± 0.13	461.4 ± 30.0
	Ccl_e	30.6± 2.0 ^{NS}	7.5 ± 0.8*	261.2 ± 45.0$^{*(significant)}$
	Ccl_4 + 200 mg/kg extract	36.6 ± 0.4 ^{NS}	11.3 ± 1.0 ^{NS}	362.0 ± 30.0 ^{NS}
	Ccl_4 + 400 mg/kg extract	37.4 ± 1.0 ^{NS}	12.9 ± 0.3 ^{NS}	380.0 ± 2.0 ^{NS}

* P<0.05
NS:-not significant

Table 2: The serum constituents in wister albino rats treated with methanolic extract of *Lepidium sativum*.

Duration (day)	Treatment	AST (v/l)	ALT (v/1)	ALP (v/l)	Bilirubin (mg/dl)
0	Parafin oil	28.8 ±3.0	30.2 ±5.0	384.8 ±35.0	0.15±0.02
	Ccl_e	34.3 ±7.0 ^{NS}	29.0 ±3.0 ^{NS}	293.3 ±30.0 ^{NS}	0.2±0.03 ^{NS}
	Ccl_4 + 200 mg/kg extract	22.3 ±2.0 ^{NS}	38.8 ±2.0 ^{NS}	469.2 ±62.0 ^{NS}	0.8±0.04 ^{NS}
	Ccl_4 + 400 mg/kg extract	20.2±4.0 ^{NS}	49.0 ±6.0 ^{NS}	33.0 ±60.0 ^{NS}	0.7±0.07 ^{NS}
5	Parafin oil	31.6±5.0	28.4 ±5.0	451.0±8.0	0.2±0.03
	Ccl_e	251.6±13.0 ^{NS}	74. ±5.4*	895.0 ±45.0*	0.5±0.09 ^{NS}
	Ccl_4 + 200 mg/kg extract	21.1±13.0 ^{NS}	58.0±10.0 ^{NS}	479.±50.0 ^{NS}	0.9±0.07 ^{NS}
	Ccl_4 + 400 mg/kg extract	19.5±2.0 ^{NS}	58.6±12.0 ^{NS}	355.8±60.0 ^{NS}	0.6±0.06 ^{NS}
10	Parafin oil	39.2±4.0	27.2±7.0	364.6±25.0	0.2±0.04
	Ccl_e	286.4± 45.0*	115.6±163.0*	987.8±66.0*	1±0.07*
	Ccl_4 + 200 mg/kg extract	19.8±4.0 ^{NS}	55.8±6.0 ^{NS}	341±30.0 ^{NS}	0.9±0.04 ^{NS}
	Ccl_4 + 400 mg/kg extract	19.7±7.0 ^{NS}	50.8±5.0 ^{NS}	455.4±44.0 ^{NS}	0.7±0.05 ^{NS}

* P<0.05
NS:-not significant

The damage of the liver caused by Ccl_4 was evident by the alteration in serum transaminases and bilirubin concentration beside the clinical signs and histopathology.

The reduction in bodyweights observed in Ccl_4 treated group is improved in rats treated with *Lepidium sativum*. This may be due to the anorexic effect produced by Ccl_4 due to its hepatotoxicity which was masked by the use of *Lepidium sativum*. Moreover the use of the plant alone in the second experiment caused increase in bodyweights. This may be attributed to presence of growth promoter factors in the seed of the plant.

The use of seed extracts of *Lepidium sativum* protects the liver from damage by Ccl_4 as evident by improved histologic picture and biochemical markers of liver damage. The mechanism of the hepatoprotective action of the plant is uncertain but may be related to

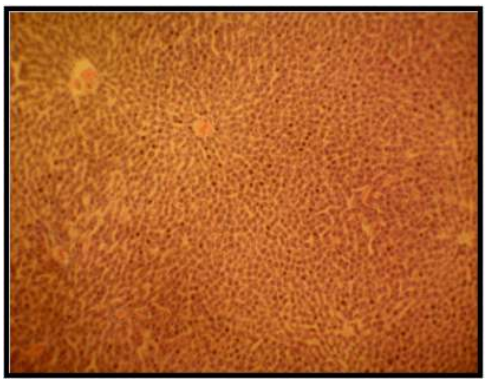

Fig. 4: Group treated with 400mg/kg, in toxicity experiment.

the ability of the plant to inhibit lipid peroxidation in the liver. The Ccl_4 induced hepatotoxicity produced in rats leading to hepatic injury triggers the generation of toxic radicals which can be masked by using a correct antioxidant in adequate amount. The presence of flavanoids triterpens, alkaloid, tannin and coumarins in *Lepidium sativum* explain its role in hepatoprotection by inhibiting the free radicals mediated damage. Banskota *et al.*[2] and Takeoka and Dao[9] claimed that flavonoids, triterpens and tannin were antioxidant agent and may interfere with free radicals formation. Babu *et al.*[1] stated that hepatoprotective activities of certain flavanoids are known.

The hemorrhage caused by Ccl_4 in the liver was minimized by use of plant extract as flavanoids are known to be vasculo protector.

On the basis of results obtained it can be concluded that the methanolic extract of *Lepidium sativum* seeds seems to possess hepatoprotective activity in rats. Further studies are needed to evaluate the potential usefulness of this extract in clinical conditions associated with liver damage.

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