

Effect of Sesame Oil on Lipid Profile and Liver Enzymes in Male Albino Rats Treated with Carbene Tetrachloride (CCl₄)

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Abstract

This study was designed to investigate the effect of sesame oil on lipid profile and liver enzyme in male albino rats treated with Carbene tetrachloride (CCl₄).

Forty adult male rats were divided into four equal groups, first group was daily administrated with tap water, the second group was injected with CCl₄ (80mg/kg.BW/day), the third group was administrated with sesame oil (150mg/kg.BW/day) and the fourth group was injected with CCl₄ (80mg/kg.BW/day) and was administrated with sesame oil (150 mg /kg.BW /day) for 30 days. The statistical results of the present study showed a significant ($p<0.05$) increase in the level of cholesterol , triglycerides and Low density lipoprotein (LDL) in the group treated with CCl₄ compared with control group, also a significant ($p<0.05$) increase in the level of liver enzymes Aspartate aminotransferase (AST) and Alanine aminotransferase (ALT) , no difference on High density lipoprotein (HDL) level .The fourth group that was administrated with sesame oil and injected with CCl₄ showed a significant ($p<0.05$) decrease in the level of cholesterol, triglyceride , LDL and also a significant ($p<0.05$) decrease in liver enzymes Aspartate aminotransferase (AST) and Alanine aminotransferase (ALT) compared with the group that injected with Carbene tetrachloride CCl₄.

It is concluded that sesame oil has a protective effect against the toxicity of Carbene tetrachloride on the liver.

Key wards: - lipid profile, CCl₄, liver enzymes, rats.

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1. Introduction

Sesame oil is the extract of the plant *sesamum indicum* [1], family *pedaliaceae* [2, 3]. Sesame has part of the human diet since ancient times [4], sesame oil is one of the major dietary oil in Asian countries [5], also it is one of the oldest oil seeds and it is considered to have medicinal properties also nutritional value [6]. Sesame seeds and sesame oil have long been cauterized as a traditional health food in India and other East Asian countries [7], sesame seeds and sesame oil contain several kinds of sesame lignans that contribute to improved human health. The most abundant lignans [4], in sesame seeds sesamin, sesaminol, episesamin and sesamol [7], sesame seeds contain fatty acid and non-fatty [9], the relative amount of each depends upon variety and quality of seeds. Sesame oil consists of glycerides, linoleic, palmitic, stearic and myristic acids, and also contains a crystal in substance. Sesame is rich in Selenium it contains amino oxalic acids 2.5% and phytic 5% [2], sesame is also an excellent source of copper and calcium, also it is rich in phosphorus, iron, zinc [10], manganese, magnesium and vitamins thiamin B1 (0.98% mg/100g) [11] riboflavin (0.25% mg/g) Nicotinamide (5.4% mg/g) –E [9,12], as well as sesame oil rich in phospholipids [13], mineral trace element [14].

Sesame oil employed in ancient Chinese medicine to increase energy and prevent aging [15], also sesame oil contains 34% of polyunsaturated fatty acids that are useful for body [7,16,17] 40% of monounsaturated fatty acids [4]. Sesamin and sesaminol are the major constituents of the sesame oil, with broad spectrum pharmacological effect, the effect included anti-mutagenic, antihypertension, anti-inflammatory, antithrombotic, antioxidant and anti-estrogenic [5,11] the high antioxidant properties of sesame seeds appeared to be related to lignans such as pinoselinol, sesamolol, sesamol and sesaminol [12], sesame oil was effective in improving the reproductive system parameters [16].

Carbon tetrachloride (CCl₄) is one of the most commonly used hepatotoxins in the experimental study of liver disease [18], CCl₄ is well established as xenobiotic [19], it is highly chemical toxic agent and the most famous drug that used to induce liver damage [20], previous studies showed that liver and kidney are the target organs of CCl₄, the acute hepatic damage of CCl₄ lies in its biotransformation to trichloromethyl radical (CCl₃) [21], which initiates free radical mediated lipid peroxidation of cytoplasmic membrane phospholipids and causes functional and morphological changes in the cell membrane which lead to accumulation of lipid-derived oxidants cause injury [22], or trichloroperoxy radical (CCl₃OO) by the mixed function cytochrome P-450 [20], CCl₄ metabolized to toxic component by the mixed function oxidase system and free radical may be important modelers of the toxicity of these two halothanes [19].

The present study aimed to investigate the effect of sesame oil on lipid profile and liver enzyme in male albino rats treated with CCl₄.

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2. Experimental

2.1. Material and method

Chemical material

Carbone tetrachloride was purchased from Sigma chemical company.

Preparation of sesame oil

Sesame oil was purchased from local markets in Baghdad.

Animals

Forty mature male of rats (145-160) gm were used in this study. They were obtained from animal house of the Biotechnology Research Center Al Nahrian university. The animals were kept in air conditional room at (25+3) c and with light period of 10:14 hours. animals were divided into four main groups: -

First group: -

Were administrated with 0.1 ml (tap water)

Second group: -

Were injected with CCl₄ (80mg/kg BW/day) for 30 days.

Third group

Were administrated with sesame oil (150mg/kg BW/ day) for 30 days.

Fourth group

Were injected with CCl₄ (80 mg/Kg BW/day) and administrated with sesame oil (150 mg/kg BW/day) for 30 days.

After the end of the experiment all groups were sacrificed post 24 h the last administration and injected. [23]

Blood collection

Blood samples were collected from rats by cardias puncture and were transferred into sterilized sample tube. The samples were allowed to clot at room temperature and then we were centrifuged at 3000 rpm for 10 minutes, the serum were collected and stored at 18 c for biochemical assay. To measure the lipid profile [a Spinreact, Spainy] minividas, and liver enzyme by using colorimetric [Biomerieux – France].

3. Result & Discussion

Effect of sesame oil on lipid profiles of male rats showed in table (1), the result showed a significant (P < 0. 05) increase on the level of cholesterol in the group that treated with CCl₄ compared with the control group, also result showed a significant (P < 0.05) increase

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in the level of triglycerides and LDL, but a significant decrease on the level of HDL compared with the control group.

Whereas the group that administrated with sesame oil the result showed no change ($p < 0.05$) on the level of cholesterol, triglyceride and LDL, and a significant ($p < 0.05$) increase on HDL level compared with the control group, the group that administrated with sesame oil and treated with CCl₄ the result showed an improving decrease ($p < 0.05$) of sesame oil effect on the level of cholesterol, triglycerides and LDL, but the level of HDL showed a significant ($p < 0.05$) increase compared with CCl₄ group.

Table(2) showed the result of sesame effect on liver enzymes, the result showed a significant ($p < 0.05$) increase on the level of AST and ALT in the group treated with CCl₄, in the group that administrated with sesame oil the present study showed a significant ($p < 0.05$) increase on AST level and no a significant increase on level of ALT, result showed also a protective effect of sesame oil on the level of AST and ALT a significant ($p < 0.05$) decrease in the group that treated with CCl₄ and administration with sesame oil compared with the group that treated with CCl₄.

CCl₄ has been known to produce hepatic damage by generation of highly reactive methyl (CCl₃) and trichloromethyl (CCl₃O) radical when metabolized by cytochrome p 450 [24]. CCl₄ also known to cause oxidative damage in the liver so hepatic lipid peroxidation level in the serum was increased, this agrees with [25,26], these activated radical bind covalently to the macro molecules and induce peroxidative degradation of membrane lipid of endoplasmic reticulum rich in polyunsaturated fatty acids [27], this leads to the formation of lipid peroxidation, this peroxidase degradation of bio membranes in one of the principles caused of hepatotoxicity of ccl₄ [28], this evidence by amelioration in the serum marker enzymes AST and ALT. Sesame oil was found to reduce significantly total cholesterol and decrease LDL and lower triglyceride to the normal level [29,30], the positive effect of sesame oil against ccl₄ effect due to antioxidant component lignans which inhibits the absorption of cholesterol in the intestine and increase the excretion of cholesterol in bile salt, and increase the activity of 3-hydroxy-3-methylglutamate coenzyme A dependent [29], also lipid lowering effect of sesame oil related to an increase excretion of cholesterol, neutral sterol, bile acids and an increase in hepatic acid content [31], sesame oil reduces LDL, this agrees with [32,33], because fiber content of sesame which reported lower plasma LDL by interrupting the cholesterol and bile acid or activity, sesame oil is also known to maintain HDL and lower LDL [22,34]. The presence of sesamin in sesame oil which a major lignans have lipid lowering effect as these lignans inhibits the absorption of cholesterol from the intestine [32], the increase of hdl level in serum group due to phytoestrogen content as estrogen in sesame that increasing HDL while lowering LDL [35], even the antioxidant component [25], in sesame oil plays role in the ion of lipid profile [30], also sesame oil contains a diversity of phytochemicals including lignans poly phenolic and flavonoids component, dietary fibers lecithin which all possess documented antihyperlipidemic functions [36]. Different lignans derivative of sesame such as sesamin, sesamol, sesaminol, sesaminolion and pinoresinol possess antioxidant function and can prevent against membrane lipid peroxidation, ADPFE3/NADPH-induced microsomal lipid peroxidation [37,7], even vitamins E and FL avoids that naturally occur in sesame have been reported to possess antioxidant and lipid lowering properties [38], sesamol and sesaminolion and sesaminol antioxidant component may be largely responsible for this protective response [39], liver damage induced by CCl₄

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involves biotas' formation of free radicals devtivers increased lipid peroxidation and excusive cell death in liver tissue[40]. The hepatic cell after the treatment with CCl₄ were found suffer oblivious fatty degeneration , necrosis and vacuole formation, serum of AST and ALT are the most sensitive biomarker used in the diagnosis of liver disease ,and its marker of hepatocellular damage [25], CCl₄ causes necrosis and damage membrane release the enzyme into circulation and lance it can be measured in the serum ALT more specific to the liver [18] ,so the level of AST and ALT were increased [40] ,elevated level of serum enzyme are indicative of cellular leakage and loss of functional integrity of cell membrane in liver [27], the antioxidant component on sesame oil are able to block liver injury through free radical generated due to toxic chemicals [25], sesame seeds has potent hepato protective effect against CCl₄ induced hepatic damage in rats [6] and elevated the level of AST and ALT, this agrees with[40].

Sesame oil was more effective in lowering the enzymes level, the protective effect due to the antioxidant component and sesame oil contain some powerful antioxidant (1p-6,phytate ,lignans ,pinoresionol ,vitamins E ,lecithin , myristic acids and lineolate) which may prevent free radicals formation and scavenge free radicals that already formed [34] ,sesame oil works on increase of secretion bile salt in liver [36] ,ALT secretion from heart , liver and muscle ,and sesame oil known as protect heart work and lowering cholesterol blood because antioxidant component vitamins E, A,I and flavonoids (sesamin ,sesamol and sesamolol) which protect cell body from the damage of free radicals [40] also fatty acids contain non saturated and saturated lanolin which are important acid on action [28].AST because of flavonoids and antioxidant vitamins B6 transform to pyridol-5-phosphate PLP which work like co enzyme for amino translate and reduce glycogenesis and over antioxidant hydrogens for betides [41].Sesame oil also activated Co a-oxidation and increase the active of Co a-oxidase cycle, even sesame oil contains amino acids helping of protect liver function and immunity (sesamol , sesamolionl and sesaminol) responsible for this protective response [40,42] high amount of sesamin and sesamol have been identified in sesame and they are reported to increase the hepatic mitochondria and peroxismol fatty oxidation rate , also sesame lignans have antioxidant and health promoting activities [43].

Table (1): Effect of sesame oil on lipid profile of male rats treated with ccl4

Experimental parameters	Control Mean ±SE	CCl ₄ Mean ±SE	Sesame oil Mean ±SE	CCl ₄ and sesame oil Mean ±SE
Cholesterol mg/dl	96.64±2.3	159.12±5.72	88.17±1.82	120.52±3.28
TG mg/dl	87.10±1.09	145.39±5.02	90.33±1.21	110.23±2.06
HDL mg/dl	45.12±1.22	32.11±1.04	60.20±1.01	44.19±1.54
LDL mg/dl	40.04±.24	90.15±.28	39.11±0.35	57.12±0.62

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Table (2): Effect of sesame oil on liver enzymes of male rats treated with ccl4

Groups	Aspartate aminotransferase (AST) (U/L)	Alanine aminotransferase(ALT) (U/L)
Control	80.07± 3.22	35.62 ±1.43
CCl4 80mg/kg BW	120.98± 2.12	85.6 ±1.99
Sesame oil 150mg/kg. BW	95.56± 3.65	48 67± 0.44
Sesame oil 150mg/kg BW and.CCl4 80mg/kg BW	100.53± 2.96	59 40± 2.34

4. Conclusions

In conclusion the sesame oil has a protective effect against the liver toxicity by Carbone tetrachloride (CCl4).

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