

Study The Physiological Changes That Induced by Cadmium Chloride in Male Rat's and The Role of *Sonchus oleraceus* Leaves Extract to Treatment

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ABSTRACT

Key words:

Physiological Changes,
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The present study was designed to find the physiological changes in male rat's which were treated with cadmium chloride, then the extract of *Sonchus oleraceus* leaves was use for treatment to find its role as antioxidant . In this study used 16 male rats that divided randomly to four groups (each group consist of 4 rats), the first group was control group administrated only normal diet and water, the second group administrated with 1mg/kg cadmium chloride for four weeks, the third group administrated with 100 mg/kg leaves extract for 15 days, the fourth group administrated with 1mg/kg cadmium chloride for four weeks and then, treated with 100 mg/kg leaves extract for 15 days. The alanine transaminase (ALT), aspartate transaminase (AST), alkaline phosphatase (ALP), total protein, urea, creatinine, malondialdehyde (MDA) and catalase levels were showed high significant differences ($P < 0.01$) in groups that administrated with cadmium chloride compared with control group, but the levels of all parameters back to normal ranges when the groups that administrated with cadmium chloride and treated with *Sonchus oleraceus* leaves extract. It was concluded that leaves extract has amply good effect on liver , kidneys and Oxidative Stress parameters.

دراسة التغيرات الفسلجية المحدثّة بواسطة كلوريد الكاديوم في ذكور الجرذان البيض ودور مستخلص اوراق نبات المرير في المعالجة

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الخلاصة

صممت هذه الدراسة لإيجاد التغيرات الفسلجية في ذكور الجرذان والتي تم معاملتها بكلوريد الكاديوم ، ثم عولجت بعد ذلك بمستخلص اوراق نبات المرير بوصفه مضاداً للأكسدة . استخدمت في الدراسة الحالية 16 من الجرذان البيض والتي قسمت عشوائياً إلى أربع مجاميع (كل مجموعة تتكون من 4 جرذان) ، المجموعة الأولى هي مجموعة السيطرة والتي جرعت بحمية غذائية وماء فقط ، المجموعة الثانية والتي جرعت بكلوريد الكاديوم (1mg/kg) لمدة 4 اسابيع، المجموعة الثالثة والتي جرعت بمستخلص اوراق نبات المرير (100 mg/kg) لمدة 15 يوم ، المجموعة الرابعة والتي جرعت بكلوريد الكاديوم (1mg/kg) لمدة 4 اسابيع ومن ثم تم معالجتها بمستخلص اوراق نبات المرير بجرعة (100 mg/kg) لمدة 15 يوم . كانت مستويات ALT ، AST ، ALP ، MDA ، البروتين الكلي ، اليوريا ، الكرياتينين والكاتاليز ذات تغيرات عالية المعنوية ($P < 0.01$) في المجاميع المجرعة بكلوريد الكاديوم مقارنة مع مجموعة السيطرة ولكن عادت مستويات ALT ، AST ، ALP ، MDA ، البروتين الكلي ، اليوريا ، الكرياتينين والكاتاليز الى المستويات الطبيعية عندما تم معالجة المجاميع المعاملة بكلوريد الكاديوم بمستخلص اوراق نبات المرير . يستنتج من هذه الدراسة أن لمستخلص اوراق نبات المرير تأثير جيد بما فيه الكفاية على معايير الكبد والكلى والاجهاد التأكسدي .

الكلمات المفتاحية:

التغيرات الفسلجية ، كلوريد الكاديوم ،
ذكور الجرذان البيض ، نبات
المرير .

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INTRODUCTION

Sonchus oleraceus L. belongs to the Asteraceae family and is a grass-weed affecting several crops in Brazil. Originally from North Africa, Asia and Europe. It is an annual plant that is herbal, milky and popularly known by the name of milkweed, wild chicory, smooth, jealousy or locksmith (Prichoa et al., 2011). One particular feature about this sow thistle is that most of the plant is smooth and glabrous without ant hair or bristles. The stems are hollowed and have a milky sap and its lower part usually gets a purple brown colour later in spring. The leaves differ according to age, the old leaves are stalked elongated and deeply lobde. Colour of the leaves vary from pale green and green blue and may have a serrated outline but on prickles or hair (Jain and Singh, 2014). *Sonchus oleraceus* is well-known for its high content of antioxidants and antioxidant activity (Xia et al.,2011; McDowell et al., 2011). There are three major antioxidants in leaf extracts of *S. oleraceus* : caftaric acid , chlorogenic acid and chicoric acid, with chicoric acid having the highest concentration (Ou et al., 2013). Also, Leaves of *S. oleraceus* contain vitamin C, carotenoids, oxalic acid, proteins, short chain fatty acids, calcium, sodium and other minerals (Liu et al., 2002).

Cadmium, a toxic heavy metal with short and long term effects particularly showing accumulation in organs as kidney, liver brain and testis (Holt and Webb, 1987). Cadmium has been demonstrated to stimulate free radical production, resulting in oxidative deterioration of lipids, DNA and proteins (Shaikh and Saman, 1999). After the intake and resorption, Cadmium enters the blood where it binds to the red blood cell (RBC) membranes and plasma albumin (Bauman et al., 1993). In the blood and tissues, Cadmium stimulates the formation of metallothioneins (Smipkin et al.,1998) and reactive oxygen species (ROS), thus causing oxidative damage in RBCs and in various tissues, which result in a loss of membrane functions (Sarkar et al., 1995). Therefore, the present study deigned to show the protective effects of *Sonchus oleraceus* leave extract against cadmium chloride toxicity in the liver , kidneys and Oxidative Stress parameters .

MATERIALS & METHODS

Animal model

Sixteen adult male albino rats (weigh 220-250 g), (age 4-6 months) obtained from the Public company of medicines manufacture and requirements medicals - Samara, Iraq, and kept on standard pellet diet and water. The laboratory conditions was (25 ± 2 C°) and light period (12 hours light) and (12 hours dark) .

Preparation of the extract

The plant was collected locally (farms of Samarra) . The shade dried plant was ground into fine powder (Arhoghro et al., 2012). 50 g of powder was put in glass beaker contain 500ml of distilled water, then the mixture leave in room temperature for 24 hours. After that, the mixture was filtered by using medical gauze and filter paper, filtrate was placed in petri dishes glass thickness of 1-2 ml and then put the dishes inside the oven at 35°C for 24 hours. The extract collected and storage in refrigeration until the use. Three concentrations (50mg, 100 mg and 150mg) from extract were taken and then the most activated concentration was determining as a treatment dose (100 mg/kg).

Chemicals

Cadmium chloride ($\text{CdCl}_2\cdot\text{H}_2\text{O}$) was dissolved in distilled water (1g for each liter), the dose of administrated is 1mg/kg (Sajjad et al., 2014).

Experimental design

In this study 16 male rats were used and divided to four groups (each group consist of four rats) as follow:

1. **Group A:** control group administrated with normal saline only for seven days, then killed all by euthanized at eighth day.
2. **Group B:** administrated with 1mg/kg cadmium chloride for four weeks, then killed .

3. **Group C:** administrated with 100 mg/kg leaves extract for 15 days, and then killed all by euthanized at sixteenth day after treatment.
4. **Group D:** administrated with 1mg/kg cadmium chloride for four weeks. After that, treated with 100 mg/kg leaves extract for 15 days, and then killed all by euthanized at sixteenth day after treatment.

Prepare of blood solution

Rats subjected to anesthesia to take cardiac blood (3 ml) and put in test tubes that contain EDTA. Then mixed with phosphate buffer, centrifugation 2000 cycl/min for 10 min. Supernated was taken and 1 ml distilled water added for it. Serum concentration of AST , ALT , ALK , cholesterol and triglyceride were measured by using kits of Rondax company,UK in spectrophotometer, also serum MDA levels were estimated by the method of Yagi (Yagi, 1976) using thiobarbituric acid (TBA) and the catalase levels in serum was measured by the method of Sinha (Sinha, 1972).

Statistical analysis

Data were analyzed statistically using a statistical Minitab program under SPSS and Microsoft Excel XP system. Means of data were compared using Duncan's Multiple Range test. Probability levels of more than 0.01 were regarded as statistically non-significant, whereas values less than 0.01 were considered as significant as follows:

$P < 0.01$ highly significant * (Beth et al., 2004).

RESULTS

Liver function tests

The results of the present study showed high significant changes ($P < 0.01$) in level of ALT, AST and ALP between groups. As shown in table (1), the group B that administrated with cadmium chloride for four weeks showed significant change compared with control group, but in the groups C and D, (group that administrated with leave extract and group that administrated with cadmium chloride and treated extract), showed non-significant differences compared with control group. Also, total protein levels were decreased in the group B that compared with control group, but in the groups C and D showed non-significant differences compared with control group.

Table (1): Showed the levels of ALT, AST, ALP and total protein in different groups

Groups	Parameters	ALT	AST	ALP	Total protein
A	Control	73 ± 6	51 ± 3	101 ± 5	6.3 ± 0.5
B	Cadmium chloride	$149^* \pm 13$	$104^* \pm 8$	$207^* \pm 12$	$3.2^* \pm 0.3$
C	Extract	68 ± 4	50 ± 5	98 ± 7	6.8 ± 0.4
D	Cadmium chloride + extract	79 ± 8	57 ± 4	112 ± 9	5.9 ± 0.2

$P < 0.01$ highly significant *

Kidney function tests

The results of the present study showed high significant changes ($P < 0.01$) in level of urea and creatinine between groups. As shown in table (2), the group B that administrated with cadmium chloride for four weeks showed significant differences compared with control group, but in the

groups C that administrated with leave extract and group D that administrated with cadmium chloride and treated extract, showed non-significant differences compared with control group.

Table (2): Showed the levels of urea and creatinine in different groups

Groups	Parameters	Urea	Creatinine
A	Control	42 ± 4	0.8 ± 0.1
B	Cadmium chloride	81* ± 9	2.9* ± 0.2
C	Extract	43 ± 5	0.7 ± 0.2
D	Cadmium chloride + extract	49 ± 6	1.1 ± 0.3

P< 0.01 highly significant *

Oxidative stress tests

The results of the present study showed high significant differences (P<0.01) in level of MDA between groups. As shown in table (3), the group B that administrated with cadmium chloride for four weeks showed significant increased compared with control group, where in the group C showed significant decreased compared with control group, while in the group D the levels of MDA back to the normal ranges. Also there were a high significant differences (P<0.01) in level of catalase between groups , As shown in table (3) the group B that administrated with cadmium chloride for four weeks showed significant decreased compared with control group, where in the group C showed significant increased compared with control group, while in the group D the levels of catalase back to the normal ranges.

Table (3): Showed the levels of MDA and catalase in different groups

Groups	Parameters	MDA	Catalase
A	Control	1.6 ± 0.1	6.3 ± 0.8
B	Cadmium chloride	2.7* ± 0.2	3.2* ± 0.6
C	Extract	1.2 ± 0.1	6.7 ± 0.4
D	Cadmium chloride + extract	1.5 ± 0.3	5.9 ± 0.7

P< 0.01 highly significant *

DISCUSSION

The results of present study showed the toxicity effect of cadmium chloride on liver and kidneys in rats. Where, the rats that administrated with cadmium chloride showed increasing in the levels of ALT, AST, ALP, urea, creatinine and MDA, also the total protein and catalase levels were decreasing when compared with control group.

Layachi & Zine (2012) referred that the Cadmium Chloride led to increase the levels of AST, ALT and ALP in rat's serum. Also they found that the Cadmium Chloride led to decrease the total protein levels. Also, Kowalczyk *et al.* (2002) referred that the Cadmium Chloride lead to increase the urea, creatinine, AST and ALT levels in rats serum after administration, that is in agreement with the results of the present study.

In study carried by Aslam *et al.* (2012) to show the effect of cadmium chloride in rats kidney. They found after administration, the urea, creatinine levels were increased compared with control

group, also they found that the catalase levels in serum and kidneys were decreased compared with control group. Also, Kara *et al.* (2005) referred that the cadmium chloride lead to increase the MDA levels in rats serum after administration , that is in agreement with the results of the present study.

The present study showed the protective effect of *Sonchus oleraceus* leave extract against the toxicity of cadmium chloride in rats. Where, rats that administrated with cadmium chloride and treated with leave extract showed a good recovery in levels of ALT, AST, ALP, total protein, urea, creatinine, MDA and catalase.

In study carried by El-Aassar *et al.* (2007) to show the protective effect of glycan of *Sonchus oleraceus* against carbon tetrachloride (CCl₄) in rats, they found that the CCl₄ lead to increased levels of ALT and AST compare with control group but after treatment with glycan of *Sonchus oleraceus* , they found that the levels of ALT and AST returned back to the normal ranges, that is in agreement with the results of the present study.

Khan *et al.* (2012) referred that the *Sonchus asper* extract has protective effect against Potassium bromate (KBrO₃)-induced toxicity in rat. Where, they found that KBrO₃ lead to increasing the levels of urea, creatinine and decreased total protein levels but after treatment with *Sonchus asper* extract they found that the levels of urea and creatinine and total protein returned back to the normal ranges, that is in agreement with the results of the present study.

Teugwa *et al.* (2013) studied the antioxidant properties of *Sonchus oleraceus* in rats, they found that the *Sonchus oleraceus* extract lead to decreasing the levels of (MDA) and increased catalase levels in serum and organs (liver and kidneys) homogenate. They suggest that the *Sonchus oleraceus* has antioxidant potential, that is in agreement with the results of the present study.

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