Effect of Aqueous Leaves Extract of *Coriandrum sativum* on Histological Structure and Liver Function of Male Albino mice

Rana H. K. Al-Rubaye
Dept.of Biology, College of Education for Pure Sciences Ibn Al-Haitham, University of Baghdad

Received in :8November 2015, Accepted in :6December2015

Abstract

Medicinal plants are used to treat various diseases although little is known about their toxicity. *Coriandrum sativum* is one of the most commonly plants that is used to treat several physiological disorders. Thus, this study was conducted to evaluate the effect of aqueous extract of *C. sativum* on the structure and function of liver in male albino mice. Thirty male mice were randomly divided into three groups: Group 1 untreated (control), Group 2 and 3 were administrated orally with the aqueous extract of the plant at dose 125 and 250 mg/kg. b. w. For 30 days. The effect of the extract on liver weights, biochemical parameters as well as histological study were assessed.

There were no significant difference ($P>0.05$) observed in relative organ weights, serum Gpt and Got levels in mice treated with the extract at dose 125 mg/kg. b. w. while the histological section showed moderate degeneration in hepatocytes. However the treatment with 250 mg/kg. b. w. of the extract caused significant reduction ($P<0.05$) in liver relative weight,highly significant increased ($P<0.01$) in serum level of GPT and GOT as compared with control. Further histological examination revealed marked degeneration and distortion of hepatocyte, conjestion, inflammatory cells infiltration and cytoplasmic vaculation at dose of 250 mg/kg. b. w. these results suggest that oral administration of *C. sativum* leaves aqueous extract have a toxic effect on liver at dose 250 mg/kg. b. w.

Keywords: *Coriandrum sativum*, Aqueous, Liver, Toxicity and Extract.

Introduction

Plants are one of the most important sources of medicine. Plant derived compounds (Phytochemicals) have been attracting much interests as natural alternatives to synthetic compounds [1].

These phytochemicals often secondary metabolites present in smaller quantities in higher plants which include the alkaloids, steroids, flavonoids, terpenoids tannins and many others the active principles of many chemicals found in plants are secondary metabolites [2], Therefore basic phytochemical investigation of these extracts for their major phytoconstituents is also vital.

Coraindrum sativum is described as a glabrous aromatic herbaceous annual plant [3] that belongs to the family Umbelliferae (Apiaceae), order Apiales with over 30 genera and 300 species of trees [4]. It is fresh leaves and dried seed are extensively used in Middle Eastern, Mediterranean, Indian, Latin American, African and Southeast Asian Cuisine [5]. *Coraindrum sativum* has poles apart names in different languages, i.e. English (Coriander), Arabic (Kuzbara), Urdu (Dhania), Hindi (Dhania), Chinese (Yuan sui) and (Korion) in Greek [6].

The fresh leaves of coriander contain 87.9 moisture 3.3 percent protein, 6.5 percent carbohydrate, 1.7 percent total ash, 0.14 percent calcium, 0.06 percent phosphorus, 0.01 percent iron, 60 mg/100g vitamin B_2, 0.8 mg/100g niacin, 135 mg/100g vitamin C and 10.460 international unit (IU)/100g vitamin A [7].

Coriander leaves are rich in flavonoids (quercetin, kaempferol and acacetin) [8] and contain substantial amount of poly phenols (caffeic acid, ferulic acid, gallic acid and chlorogenic acid) [9], and other molecules are found like linalool and linoleic acid [10].

The odor and flavor of seed and leaves of coriander are completely different aliphatic compounds (90.20%) mainly comprised of C_8-C_{16} aldehydes and alcohol predominate in steam volatile oil extracted from leaves. While coriander seed contains these compounds as a minor components [11, 12].

The present of fats minerals like (calcium, phosphorus and iron) carotene fiber and carbohydrate in leaves can stimulate the appetite and its fresh juice is recommended for patients suffering from vitamin A, B and C deficiencies and also for the relief of anxiety and insomnia [13]. Moreover this plant is used to cure diseases like digestive tract disorders, respiratory tract disorders and urinary tract infections [14]. Coriander has been identified as one of the herbs that can be used to treat diabetes [15] and its leaves have shown stronger antioxidant activity than the seed [16].

Coriander was reported to improve blood circulation to the brain and recover memory capabilities [17] and it is identified to possess antihyperlipidemic [18], antimicrobial activity [19]. Since coriander leaves are one of the commonly used spices.Therefore the present study investigation aim to clarify the effect of *Coriandrum sativum* leaves aqueous extract on the structure and function of livers.

Materials and Methods

Plant preparation and extraction

Coraindrium sativum leaves were collected from local markets in Baghdad city washed with distilled water, leaves were sliced in to small pieces and ground with pestle to produce a fine paste. Coriander leaves aqueous extract were prepared by mixing limited weight of the paste in 10 ml of distilled water and then the mixture was filtered by cleaning cloth to prepare the extract at dose level 125, 250 mg/kg.b.w. Fresh extract was administrated to mice immediately [20, 21].

Animals

Thirty males of Swiss albino mice (*Mus musculus*) their age was between 80-100 day and their weight between 25-30g were used in the investigation. Mice were maintained under hygienic condition in well ventilated room and had free access to maintenance food and water *ad libitum*.

Treatment and Dosage

The animals were randomly categorized into three groups of ten animals in each group and treated as follows.

Group-1: Control mice that is received orally by gavage needle 0.1ml of tap water daily for 30 days.

Group-2: Male mice treated orally by gavage needle with 0.1 ml of coriander leaves aqueous extract at dose 125 mg/kg of body's weight daily for 30 days.

Group-3: Male mice treated orally by gavage needle with 0.1 ml of coriander leaves aqueous extract at dose 250mg/kg.b.w. daily for 30 days.

Blood samples and biochemical analysis

blood samples from each mouse were collected via cardiac puncture into a sterilized sample tube and was allowed to clot at room temperature, the samples were centrifuged at 3000 xg for 15 min and sera were collected and stored at 20°C. the sera were analyzed to evaluate the liver enzymes GPT (Glutamic pyruvate transaminase) also known as ALT and GOT -Glutamic oxaloacetic transaminase) it is also called AST by using standard kits.

Organs and histological studies

At the end of the treatment period mice were sacrificed. Livers were carefully dissected out, weighted and fixed in formalin (10%) for histological study. Tissue section of 10 µm in thickness were prepared according to [22] and stained with hematoxylin-eosin stain.

Statistical analysis

Data were expressed as mean ±Standard Error of Mean(SEM). Statistical significance between the various groups was determined by using ANOVA[23] .

Results

Organ relative weight

There was no significant difference ($P>0.05$) in the relative weights of livers in mice treated with 125 mg/kg b. w. of aqueous extract of *C. sativum* while highly significant decrease ($P<0.05$) in relative weights of liver was observed with mice treated with 250 mg/Kg b. w. of the same extract (Table 1).

Biochemical analysis

No significant difference ($P>0.05$) was observed in serum levels of GPT and GOT after oral administration of coriander extract at dose 125 mg/Kg b. w. However there was significant elevate ($P<0.01$) in these parameters at dose 250 mg/Kg b. w. of *Coraindrum sativum* extract as compared to control (Table 2).

Histological study

The histological study showed normal structure of liver in mice of control group, radially arranged of hepatic cords around central vein and hepatocytes were separated by sinusoids containing large spheroidal nucleus (Figure 1).

Examination of liver in mice treated with 125 mg/Kg b. w. of coriander extract showed that the normal structural organization of hepatic lobules was impaired with moderate distortion and degeneration of hepatocytes (Figure 2). While the examination of liver in mice treated with 250 mg/Kg b. w. of coriander extract showed marked distortion and degeneration of hepatocytes, conjestion, inflammatory cells infiltration, vaculation in hepatocytes and degeneration their nucleus (Figure 3).

Discussion

The use of herbal medicines in the treatment of various disease conditions has expanded rapidly and globally [24]. Some have been mistakenly regarded that bioactive products from medicinal plants are devoid of toxic effecting just because a natural source. Therefore further oral toxicity study is vital needed to identify the range of dose that could be used subsequently [25].

Liver is an organ of paramount importance which plays an essential role in the metabolism of foreign compound entering the body [26]. Therefore it is an important organ in any toxicological study.

Several plants were described to have toxical effect on their liver such as *Rhaphidophora decursiva*, *Lawsonia inermis* and *Vernomia bipontini* [27, 28, 29], thus this study was conducted to investigate the effect of *Coriandrum sativum leaves* extract on biochemical and histological structure of liver.

The results of this study indicate that mice treated with 125 mg/Kg b. w. of *C. sativum* leaves extract showed moderate signs of toxicity although the relative weights of liver and biochemical parameters were in normal range. However significant decrease in liver weights, elevate in serum GPT and GOT levels with marked degeneration in hepatocyte were observed in mice treated with 250 mg/Kg b. w. of coriander extract.

This result was not similar to the results of Patel *et al*. [30] who reported that no significant alteration was observed in liver after treatment with hydro-methanolic extract of *Coriandrum sativum* seeds as well as our results are in disagreement with the results of [31] who referred to protective role of *Coriandrum sativum* seed extract against lead nitrate induced oxidative stress and tissue damage in the liver and kidney of male mice. One reason for this discrepancy in results due to a variable part of plant is used in the experiment (seed in previous study and leaves in this study).

The phytochemicals of seeds and leaves are completely different [11] another reason could be related to the type of preparation used, dose, method of administration and duration of experiment.

Inflammatory changes were seen histologically in liver at dose 250 mg/Kg b. w. (Characterized by infiltration of lymphocyte at portal and central veins of liver) this result suggested that the extract exerted deleterious effect on the liver, the liver is capable of regenerating damaged tissue hence liver functions may not be impaired early following an insult from a toxicant [32].

There was no change in the relative organ weights of liver in mice treated with aqueous extract of *C. sativum* at dose 125 mg/Kg b. w. however the liver weights of mice treated with the plant extract at dose 250 mg/Kg b. w. were significantly decrease, the decrease in the weight of liver might be due to toxic potential of the extract. Organ weight is widely accepted for evaluation of test article associated toxicities [33] and this was supported by histopathological section of liver.

Both GPT and GOT are normally present in serum at low levels, in liver injury the transport function of hepatocytes is disturbed, resulting in the leakage of plasma membrane, thereby causing on increased enzyme level in serum [34].

The result of present study indicates that was no significant difference in serum levels of GPT and GOT at dose 125 mg/Kg b. w. of aqueous extract of *C. sativum* as compared with control. However increased dose to 250 caused increased in GPT and GOT levels, this result was provided a valuable tool for clinical diagnosis of liver damage as well as toxicity study.

Drugs and toxins could cause hepatic cell damage. the damage to hepatocytes will lead to release of intracellular constituents in to the circulation [35].

References

1-Sharif, H. B.; Mukhtar, M. D.; Mustapha, Y.; Baba, B. and Lawal, A. O. (2015). Acute and subchronic toxicity profile of *Euphorbia pulcherrima* methanol extract on Wistar albino rats. Adv. Pharmac., 2015: 9 pp.

3-Pandey, A.; Bigoniya, P.; Raj, V. and Patel, K. (2011). Pharmacological screening of coriandrum sativum L. forhepato protective activity. J. Pharm. Bioallied Sci., 3(3): 435-441.

4-Asgarphanah, J. and Kazemirash, N. (2012). Phytochemistry pharmacology and medicina l properties of *Coriandrum satuvim* L. Afr. J. Pharm. Pharmacol., 6(31): 2340-2345.

5-Patel, D. K.; Desai, S. N.; Devkar, R. V. and Ramachandran, A. V. (2011). *Coriandrum sativum* L. aqueous extract mitigates high fat diet induced insulin resistance by controlling visceral adiposity in C_{57}BL/6J mice. BLACPMA., 10(2): 125-135.

6-Prakash, V. (1990). Leafy spices. CRC. Press. Inc. Boca Raton. FL., : 31-32.

7-Naddem, M.; Anjum, F. M.; Khan, M. I. and Tehseen, S. (2013). Nutritional and medicinal aspects of coriander (*Coriandur sativum* L.) A review. British Food J., 115(5): 743-755.

8-Nambiar, V. S.; Daniel, M. and Guin, P. (2010). Characterization of polyphenols from coriander leaves (*Coriandrum stivum*), red amaranthus (*A. paniculatus*) and green amaranthus (*A. frumentaceuc*) using paper chromatography and their healthimplications. J. Herb. Med and Toxicol., 4(1): 173-177.

9-Sreelatha, S. and Inbavailli, R. (2012). Antioxidant, antihyperglycemic and antihymerlipidemic effect of *Coraindrum sativum* leaf and stem in albxan-induced diabetic rats. J. Food Sci., 77(7): T119-T123.

10-Frederico, E. F.; Carmo, F. S.; Diniz, C. L.; Dantas, M. P.; Amorim, L. F.; Filho, D. S. and Folho, M. B. (2012). Influence of anaqueoys extract of *Coraindrum sativum* leaves on the labeling of blood constituents with technetium-99m and determination of some of its physical parameters. J. Med. Plants Res., 6(44): 5651-5657.

11-Padalia, R. C.; Karki, N.; Sah, A. N. and Verma, R. S. (2011). Volatile constituents of leaf and seed essential oil of *Coraindrum sativum* L. J. Essent. Oil Bearing Plants., 14(5): 610-616.

12-Shavandi, M. A.; Haddadian, Z. and Ismail, M. H. (2012). *Eryngium foetidum* L., *Coraindrum sativum* and *persicaria odorata* L. A review. J. Asian Scient. Res., 2(8): 410-436.

13-Elahadi-Salmani, M. E.; Khorshidi, M. and Ozbaki, J. (2015). Reversal effect of *Coraindrum sativum* leaves extract on learning and memory deficits induced by epilepsy in male rats. Zahedan J. Res. Sci., 15(1): 29-34

14-Bhat, S.; Kaushal, P.; Kaur, M. and Sharma, H. K. (2014). Coriander (*Coraindrum sativum* L.): processing nutritional and functional aspects. Afr. J. Plant Sci., 8(1): 25-33.

15-Mazhar, J. and Mazumder, A. (2013). Evaluation of antidiabetic activity of methanolic leaf extract of *Coraindrum sativum* in alloxan induced diabetic rats. RJPBCS., 4(3): 500-507.

16-Wangensteen, H.; Samuelsen, A. B. and Malterud, K. E. (2004). Antioxidant activity in extracts from coriander. Food Chemist., 88(2): 293-297.

17-Akhalil, E. (2010). Study the possible protective and therapeutic influence of coriander (*Coraindrum sativum* L.) against neurodegenerative disorders and Alzheimer's disease induced by aluminum chloride in cerebral cortex of male albino rats. Nat. and Sci., 8(11): 202-213.

18-Joshi, S. C.; Sharma, N. and Sharma, P. (2012). Antioxidant and lipid lowering effect of *Coraindrum sativum* in cholosterol fed rabbits. Internat. J. Pharm. and Pharmac. Sci., 4(3): 231-234.

19-Silva, F.; Ferreira, S.; Queiroz, J. A. and Dominques, F. C. (2011). Coriander (*Coraindrum sativum* L.) essential oil: its antibacterial activity and mode of action evaluated by flow cytometry. J. Med. Microbiol., 60(10): 1479-1486.

20-Assayed, M. E.; Salem, H. A. and Khalaf, A. A. (2008). Protective effect of garlic extract

and vitamin C against cypermethrim reproductive toxicity in male rats. Res. J. Veter. Sci., 1(1): 1-15.
21-Kasuga, S.; Uda, N.; Eyo, E.; Ushijim, M.; Morihara, N. and Itakura, Y. (2001). Pharmacologic activity of aged garlic extraction in comparison with other garlic preparation. J. Nutr., 131(3): 1080S-1084S.
22- Bancroft, J. and Stevens, A. (1982). Theory and Practice of Histological Technique. Second Edition. Churchill Livingston. Edinburgh and London,: 662.
23-Snedecor,G.W.andCochran,W.G.(1980).Statistical Method,7th edn.Iowa:Iowa state university press: 215.
24-Salawu, O. A.; Chindo, B. A.; Tijani, A. Y.; Obidike, I. C.; Salawu, T. A. and Akingbasote, A. J. (2009). Acute and sub-acute toxicological evaluation of the methanolic stem bark extract of *Crossoptery febrifuga* in rats. Afr. J. Pharm. and Pharmacol., 3(12): 621-626.
25-Jothy, S. L.; Zakaria, Z.; Chen, Y.; Lau, Y. L.; Latha, L. Y. and Sasidharan, S. (2011). Acute oral toxicity of methanolic seed extract of cassia fistula in mice. Molecules, 16(6): 5268-5282.
26-Rajesh, M. G. and Latha, M. S. (2004). Protective effect of *Glycyrrhiza glabra* Linn. on carbon tetrachloride induced peroxidative damage. Ind. J. Pharmacol., 36(501): 284-286.
27-Arsad, S. S.; Esa, N. M. and Hamzah, H. (2014). Histopathologic changes in liver and kidney tissues from male Sprague dawely rats treated with *Rhaphidophora decursiva* (Roxb.) Schott Extr. Cytol. and Histol., 54: 1-6.
28-Alferah, M. A. Z. (2012). Toxicity induced histological changes in selected organs of male (Wistar) rats by lawsonia inermis leaf extract. Europ. J. Med. Plants., 2(2): 151-158.
29-Alebachew, M.; Kinfu, Y.; Makonnen, E.; Bekuretsion, Y.; Urga, K. and Afework, M. (2014). Toxicological evaluation of methanol leaves extract of *Vernonia bipontini* Vatke in blood, liver and kidney tissue of mice. Afr. Health Sci., 14(4): 1012-1024.
30-Patel, D.; Desai, S.; Devkar, and Ramchandran, A. V. (2012). Acute subchronic toxicological evaluation of hydro-mathanolic extract of *Coraindrum sativum* L. seeds. EXLi J., 11: 566-575.
31-Kansal, L.; Sharma, V.; Sharma, A.; Lodi, Sh. and Sharma, S. H. (2011). Protective role of *Coraindrum sativum* (Coriander) extracts against lead nitrate induced oxidative stress and tissue damage in the liver and kidney in male mice. IJABPT., 2(3): 65-83.
32-Salawu, O. A.; Chindo, B. A.; Tijani, A. Y.; Obidike, I. C.; Salawu, T. A. and Akingbasote, A. J. (2009). Acute and subacute toxicological evaluation of the methanolic stem bark extract of *Crossopteryx febrifigo* in rats. Afr. J. Pharm. and Pharmacol., 3(12): 621-626.
33-Singh, T.; Sinha, N. A.and Singh, A. (2013). Biochemical and histopatholigical effects on liver due to acute toxicity of aqueous leaf extract of *Eclipta alba* on female Swiss albino mice. Ind. J. Pharmacol., 45(1): 61-65.
34-Yazdani, F.; Noori, A. and Amjad, L. (2013). Effect of artemisia deserti flowering taps extract on liver in male rats. IJACS., 5(13): 1432-1436.
35-Odesanmi, S. O.; Lawal, R. A. and Ojokuku, S. A. (2009). Effect of methanolic extract of *Tetrapleura tetraptera* on liver function profile and histopathology in male Dutch white rabbits. Internat. J. Trop. Med., 4(4): 136-139.

Table(1):Effect of *C. sativum* leaves extract on relative weight liver(mg/kg.b.w.)

Control	*C. sativum* 125 mg	*C. sativum* 250 mg
6.12 ± 0.3 A	5.8 ± 0.2 A	5.2 ± 0.5 B*

Data expressed as Means ± SEA
B* Significant different (P<0.05), n=10

Table(2): Effect of *C. sativum* leaves extract on serum GPTand GOT levels (IU/L)

Liver enzyme	Control	*C. sativum* 125 mg	*C. sativum*250mg
GPT	15 ± 2.1 A	18.3 ± 1.5 A	23 ± 4.6 B**
GOT	62 ± 5.1 A	66 ± 4.6 A	73 ± 5.9 B**

Data expressed as Means ± SEA
B**Significant different (P<0.01), n=10

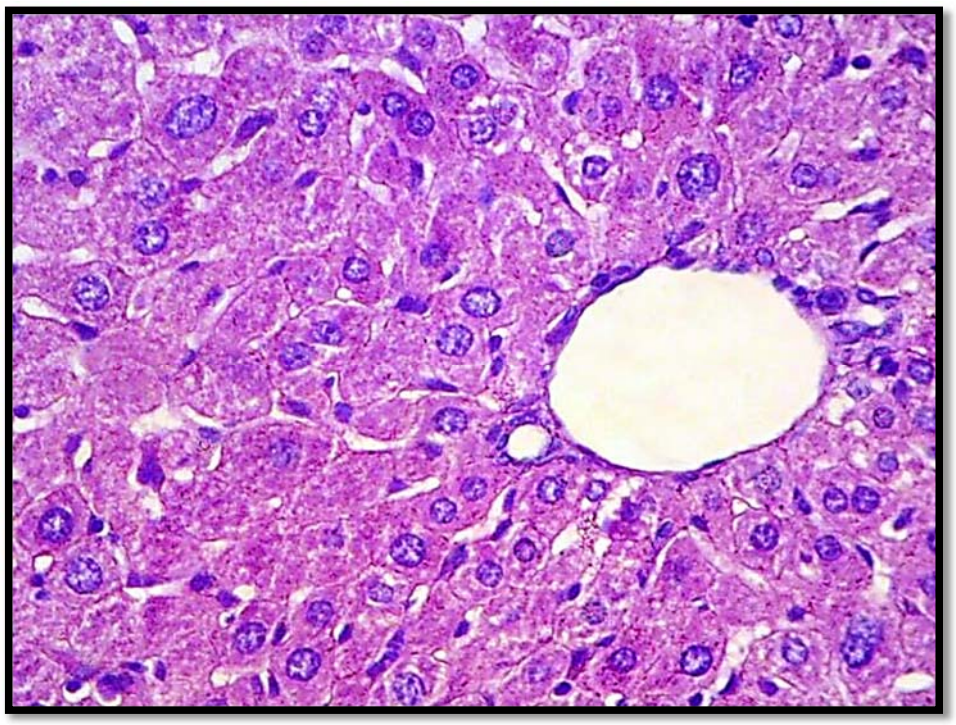

Figure (1): Cross section in liver of control group showing normal structure of hepatocyte (H&E100x)

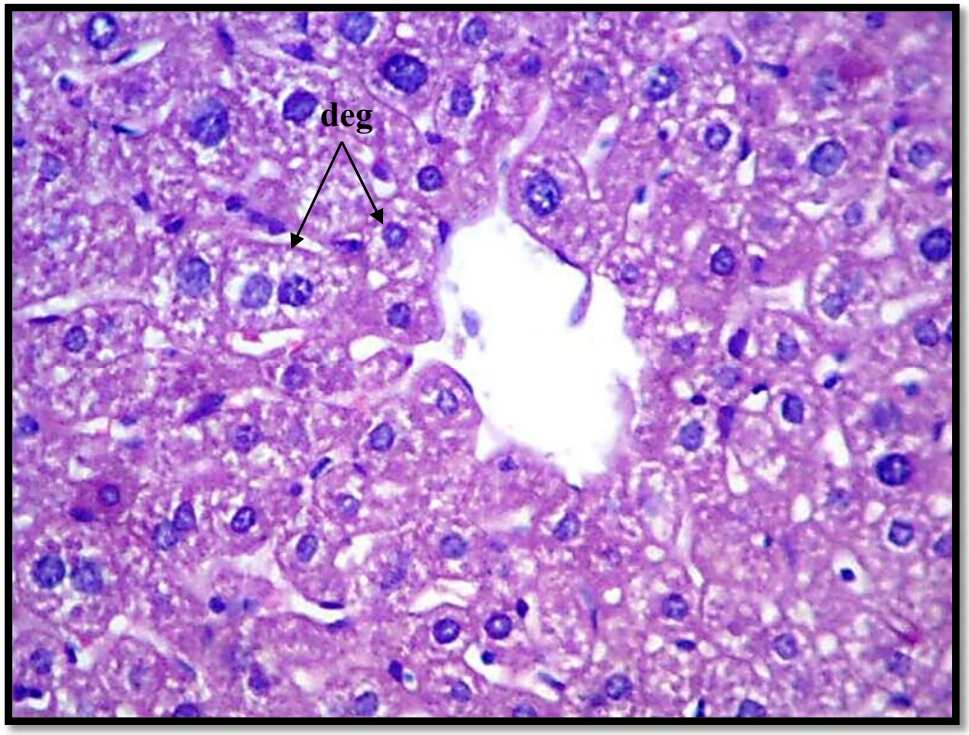

Figure (2):Cross section in liver of mouse treated with 125mg/kg b.w.showing moderate degeneration and distortion of the hepatocytes(deg) (H&E100x)

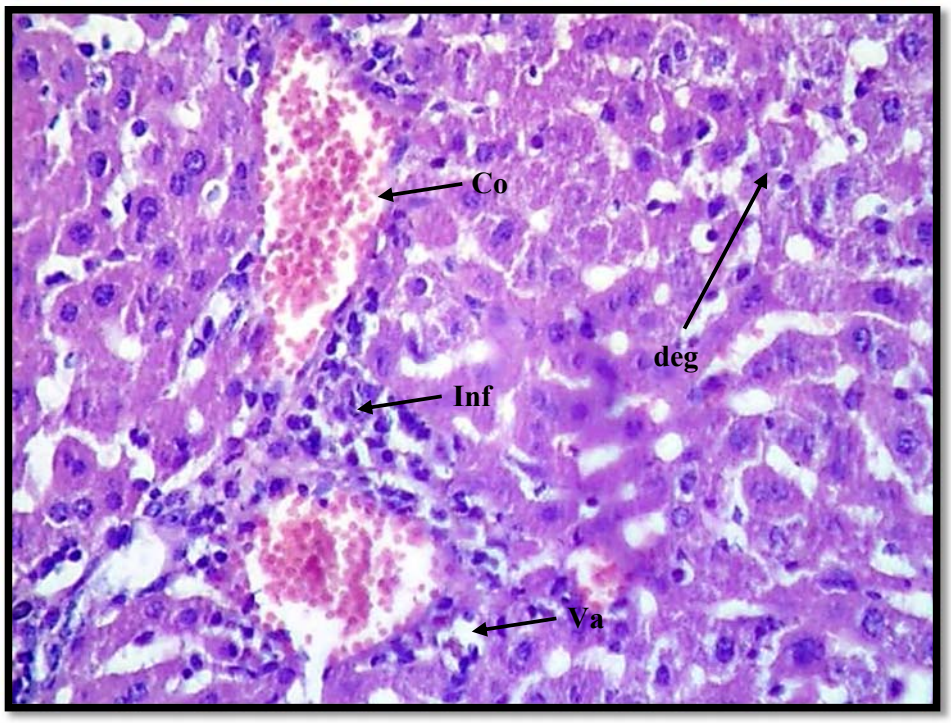

Figure (3): Cross section on liver of mouse treated with 250 mg/Kg b. w. showing conjestion (Con.), infiltration of inflammatory cells (Inf.), vaculation (Vac.) in hepatocytes and degeneration in their nucleus(deg) (H&E100x)

تأثير المستخلص المائي لأوراق الكزبرة في التركيب النسجي ووظائف الكبد لذكور الفئران البيض

رنا حنان خضير الربيعي
قسم علوم الحياة، كلية التربية للعلوم الصرفة/ ابن الهيثم، جامعة بغداد

استلم في:8 تشرين الثاني 2015، قبل في : 6 كانون الاول 2015

الخلاصة

استعملت النباتات الطبية في علاج عدد من الأمراض بالرغم من أن تأثيراتها السمية معروفة على نطاق ضيق. الكزبرة *Coriandrum sativum* واحدة من أكثر النباتات شيوعاً في علاج الكثير من الاضطرابات الفسيولوجية، لذلك صممت هذه الدراسة لتقدير تأثير المستخلص المائي لأوراق الكزبرة في تركيب ووظيفة الكبد لذكور الفئران البيض.

شملت الدراسة 30 فأراً قسمت الفئران عشوائياً إلى ثلاث مجاميع، المجموعة الاولى غير معاملة (السيطرة)، المجموعة الثانية والثالثة جرعت فموياً بالمستخلص المائي لأوراق الكزبرة بتركيز 125 و 250 ملغرام لكل كيلو غرام من وزن الجسم لمدة 30 يوماً، تم تقدير تأثير المستخلص في وزن الكبد والمتغيرات الكيموحياتية فضلاً عن الدراسة النسجية.

أظهرت النتائج عدم وجود فروقات معنوية في الوزن النسبي للعضو ومستويات الـGPT وGOTفي مصل الفئران المعاملة بالمستخلص عند جرعة الـ 125 بينما أظهرت المقاطع النسجية للكبد تنكساً طفيفاً في الخلايا الكبدية بالرغم من أن المعاملة بالمستخلص عند جرعة الـ 250 ملغرام تسبب في حدوث انخفاض معنوي ($P<0.05$) في الوزن النسبي للكبد وارتفاع عالي المعنوية ($P<0.01$) في مستويات الـGPTو GOTفي مصل الدم فضلاً عند ذلك أشارت الدراسة النسجية إلى تنكس وتشوه واضح في الخلايا الكبدية وظهور الاحتقانات الدموية وارتشاح للخلايا الالتهابية وتفجي في سايتوبلازم الخلايا الكبدية عند جرعة الـ 250 ملغرام.

تشير هذه النتائج إلى أن التجريع الفموي لمستخلص أوراق الكزبرة المائي له تأثيرات سمية في الكبد عند جرعة 250 ملغرام لكل كيلو غرام من وزن الجسم.

الكلمات المفتاحية: كزبرة، مائي، كبد، سمية، مستخلص.