THE PROTECTIVE ROLE OF CERTAIN ANTIOXIDANTS (VITAMINS C, E AND OMEGA-3) AGAINST ALUMINUM CHLORIDE INDUCED HISTOLOGICAL CHANGES IN THE LIVER AND KIDNEY OF FEMALE ALBINO RATS (*RATTUS RATTUS NORVEGICUS*)

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ABSTRACT

The present study was undertaken to evaluate the protective effect of certain antioxidants such as Vitamins C, E and Omega-3 oil on Aluminum induced histological changes in the liver and kidney of the female albino rats. Sixty four female adult rats were divided randomly into eight groups two of them control: (control 1) without $AlCl_3$ /Kg body weight (b.w.); (control 2) supplied orally with 0.2 ml/rat oil and six groups treated as follow: $AlCl_3$ (60 mg/kg b. w.) ; $AlCl_3$ (60 mg/kg b. w.) plus 0.2ml/rat acetic acid (0.5%); $AlCl_3$ (60 mg/kg b. w.) plus Vit.C (50 mg/kg); $AlCl_3$ (60 mg/kg b. w.) plus Vit.E (100 mg/kg); $AlCl_3$ (60 mg/kg b. w.) plus 0.2 ml/rat Omega-3 (5%) and $AlCl_3$ (60 mg/kg b. w.) plus Vit.C (50 mg/kg) plus Vit.E (100 mg/kg) plus 0.2ml/rat 5 % Omega-3) respectively. Rats were orally administered their respective doses every other day for 35 days. At the end of the experiments, livers and kidneys samples were fixed in Bouin's fluid and processed for histological examination.

Histological examination of liver taken from rats treated with aluminum chloride in the presence or absence of acetic acid showed several abnormalities in the structure of liver histology such as dilatation of blood sinusoid, degeneration of hepatocytes, vacuolated hepatocytes, necrosis, apoptosis, infiltration of lymphocytes, and steatosis. Furthermore, Kidneys taken from rats treated with aluminum chloride also, showed some abnormalities in kidney histology such as inflammation, degeneration of kidney tubules cells and hemorrhage. The presence of antioxidants (Vitamins C, E and omega-3 oil) along with aluminum chloride relatively diminished the toxic effect of aluminum on both liver and kidney and tended to protect them as indicated by more or less normal histological structure of liver and kidney.

Key words: Aluminum, toxicity, antioxidants, Vitamins, Omega-3, histology.

INTRODUCTION

The main sources of Aluminum (Al) include corn, yellow cheese, salt, herbs, spices, tea, cosmetics, and Al cooking utensils (El-Demerdash *et al*., 2004 and Yousef, 2004). In addition, Al compounds are widely used in medicines such as antacids, phosphate binders, buffered aspirin, vaccines and allergen injections and fluids used in renal dialysis (Kaehny *et al*., 1997 and Yokel, 2004).

Aluminum is absorbed through the skin, gastrointestinal tract, lung, and nasal mucosa. After absorption, most Al is transported by the blood to various body organs. Bone, muscle and lung contain the highest Al contents in the normal human being. Al uptake by the brain is linked to the presence of high affinity of transferring receptors (Anane *et al*., 1997).

Aluminum is also accumulates in a number of mammalian tissues, including kidney, liver, brain and bone (Anand *et al*., 2002). Al accumulation in the kidney promotes the degeneration of the renal tubular cells, and inducing nephrotoxicity (Mansour *et al*., 2006). Therefore, Al accumulation in the kidney promotes renal failure and the subsequent systemic toxicity (Mahieu *et al*., 2005). Also, Al accumulation in the liver leads to cholestasis (Osinska *et al*., 2004).The toxicological effects of Al on humans include encephalopathy (Alfrey *et al*., 1976), bone disease (Ward *et al*., 1978), anemia (Short *et al*., 1980) and skeletal system disease (Gupta *et al*., 2005).It may also be a contributing factor for the development of Alzheimer's disease (AD) (Campbell, 2002). These toxic effects of Al have been suggested to be due to the generation of reactive oxygen species (El-Demerdash, 2004), which results in the oxidative deterioration of cellular lipids, proteins, and DNA (El- Demerdash 2004; Mansour *et al*., 2006). So, these toxic effects of Al appear to be mediated, at least in part, by free-radical generation (Moumen *et al*., 2001; Anane and Creppy, 2001). Cronan and Schofield (1979) have shown at neutral pH, Al minerals are insoluble, but solubility increases at lower pH. Thus, acidification of lakes and streams by acid rain mobilized Al from the soil to the aquatic environment. The levels of dissolved Al in water are strongly influenced by pH and the

presence of other substances in the water (Browne *et al*., 1990). Some studies were carried out to evaluate the potential protective role of antioxidant vitamins, such as vitamin C, vitamin E (Yousef *et al*., 1999; Salem *et al*., 2001).

Vitamin E (Vit.E) (α-tocopherol) is a naturally occurring antioxidant nutrient that has an important role in animal health through the inactivation of harmful free radicals that are produced during normal cellular activity and under various stress conditions (El-Demerdash ,2004 ; Yousef, 2004). The antioxidant functions of this micronutrient, also, at least in part, enhance immune reactions by maintenance of the functional and structural integrity of the all-important immune cells (Yousef *et al*., 2003; El-Demerdash *et al*., 2004). Omega-3fatty acid from fish and fish oil can protect against chronic heart disease (CHD), both health professional and publics are increasingly interested in its role in the prevention and management of CHD. During multiple pharmacological treatments for cardiovascular disease, many researchers believed that dietary intervention or nutritional supplements may be a more natural and acceptable method of providing benefits (Garrido-Sanchez *et al.,* 2008). Thus, the aim of the present study was: 1- The effect of $AlCl_3$ in the presence or absence of acetic acid on the histology of the liver and kidney. 2 -The protective effects of some antioxidants (Vitamins C and E and Omega-3 oil) on Al induced histological changes of liver and kidney.

MATERIALS AND METHODS

Materials

Experimental animals

Adult female albino rats *Rattus rattus norvegicus* were used during the present study. The rats were 10-12 weeks old with a body weight ranging from 190-210 g. The rats were kept in polypropylene rat's cages (30 x 25 x 17 cm) at a rate of 2 animals per cage. The cages were bedded with wood chips and the animals had free access to standard rodent diet and tap water *ad libitum*. The animals were kept in animal house of biology department (Faculty of science, University of Zakho), maintained under laboratory conditions at a controlled temperature of about 24± 2 °C and exposed to a photoperiod of 12 hrs light followed by 12 hrs of darkness. Animals were acclimated to the laboratory condition for about 7 days before the application of experimental work.

Methods

Sixty four adult female albino rats were used in this study. The rats were divided randomly into eight groups, each of eight individuals and treated as in (Table1).

Table (1): Distribution of rats in their experimental groups and their treatment protocols.

Groups	Number of Rats	Dose	Duration
G1: Control	8	----------	35 days
G2: Control 2	8	0.2 ml Oil/rat	35 days
3G:Aluminum chloride	8	60 mg/kg b.w	
G4: $AlCl_3$ + Acetic acid	8	60 mg/kg b.w.+ 0.2ml/rat 5% acetic acid.	35 days
G5: $AlCl_3$ + Vitamin C	8	60 mg/kg b.w. + 50 mgVit.C/kg b.w.	35 days
G6: $AlCl_3$ + Vitamin E	8	60 mg/kg b.w. + 100 mgVit.E/kg b.w.	35 days
G7: $AlCl_3$ + Omega-3	8	60 mg/kg b.w. +5% Omega-3	35 days
G8: $AlCl_3$ + Vitamin C + Vitamin E + Omega-3	8	60 mg/kg b.w .+ 50 mgVit.C/kg b.w. + 100 mgVit.E/kg b.w .+ 5% Omega-3	35 days

The desired doses of $AlCl_3$, Vit. C, Vit. E, Acetic acid and Omega-3 for each animal were intubated into oesopharyngael region daily, using small syringe connected to thin silicon tube.

Histological study

After immediate removal of livers and kidneys, they were chopped into small pieces and fixed in Bouin's solution for 24 hours. The selected fixed pieces of both kidney and liver were tagged and processed according to the method described by (Al-Hajj, 1998).

The prepared slides were examined under light microscope (Motic, Italy) to observe the histological changes in the studied sections. Photomicrograph of the control and treated sections were photographed using Digital Camera (Samsung 7.1 Mega Pixels).

RESULTS

Histological Effects of $AlCl_3$ and some antioxidants on the liver.

The liver of the control rats revealed normal appearance (Figure 1-a), including healthy hepatocytes with normal cytoplasm and nuclei and without any inflammation. Treating the rats with oil also showed normal liver structures except the presence of few dead hepatocytes (Figure 1-b).

Rats treated with $AlCl_3$ showed dilation in the blood sinusoid and presence of apoptotic cell with sinusoid dilation (Figure 1-d).with the exhibition of a large number of dead hepatocytes (Figures 1-e). The liver sections also showed steatosis (fat accumulation) (Figure 1-c) and the presence of Inflammatory cells (Figure 2-a).

Inflammatory cells were appeared as a response to the treatment with Al plus acetic acid (Figure 2-b).In addition to the appearance of steatosis and a number of dead hepatocytes (Figure 2-c). Animals treated with $AlCl_3$ along with Vit.C have approximately normalized the liver structure, except some inflammation which was still existed (Figure 2-d).Vit. E has a more protective effect in $AlCl_3$treated rats since they returned approximately normal cellular structures. The liver showed normal histological structures in which there were no inflammation, no dilation in the lumen of sinusoids, any dead hepatocytes but congested blood vessels with blood cells and fat droplets accumulation was occasionally detected (Figure 2-e-f).

Rats treated with Omega-3 in $AlCl_3$ showed normal liver structure and histology (Figure 3-a).After administration of a combination of Vit.C, E and Omega-3 to $AlCl_3$ treated rats, the liver histology showed approximately normal appearance, although, some dead cells were detected (Figure 3-b).

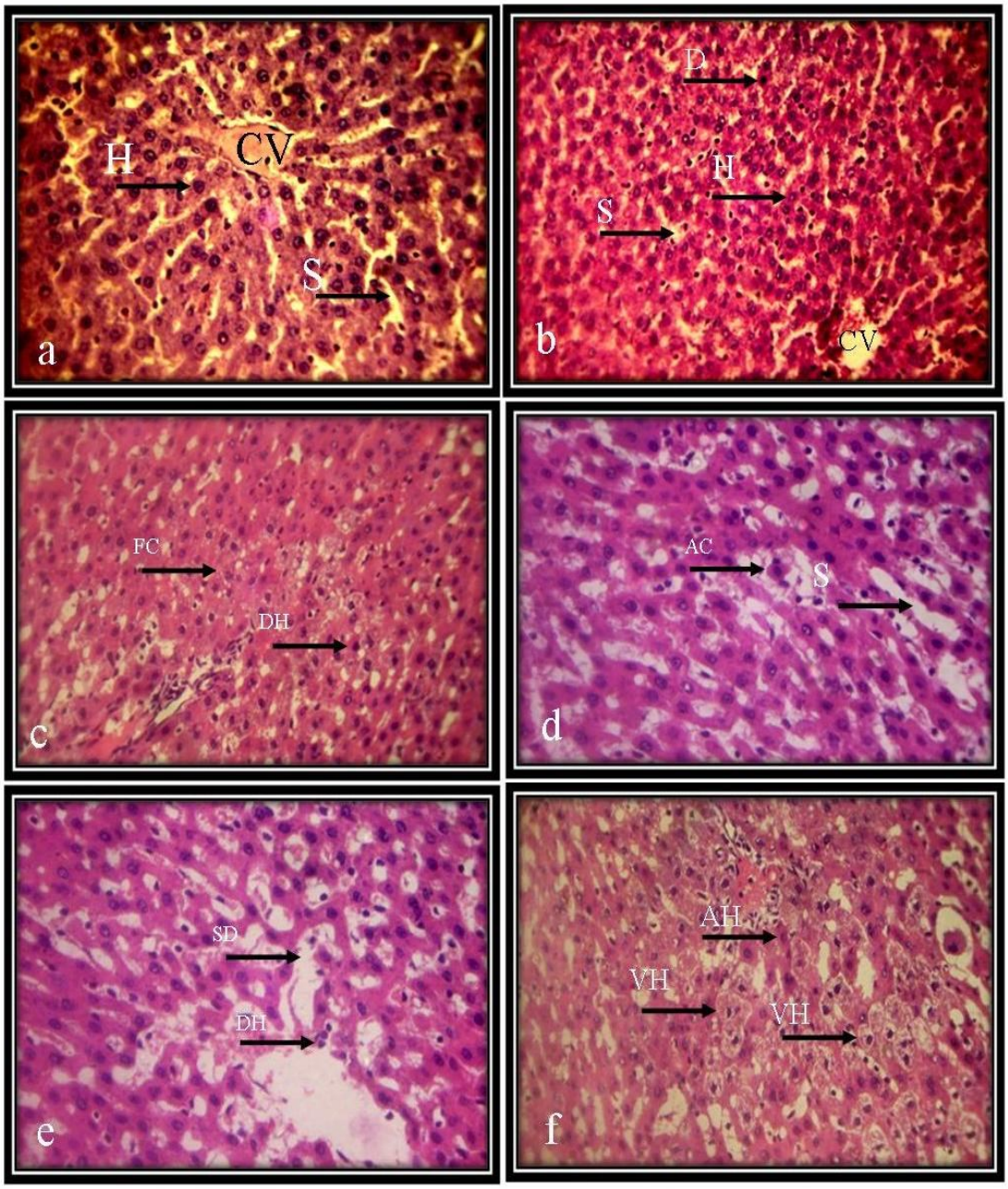

Figure (1): (**a**) Sections through the liver of rats of control group showing the Central vein (CV), hepatocytes (H) and sinusoids (S),400X.H&E. (**b**): Sections through the liver of rats of positive group showing normal appearance of the liver structure, the central vein (CV), hepatocytes (H) and sinusoids (S) notice the dead hepatocyte (DH), 400X.H&E. (**c**): Sections through the liver of rats treated with $AlCl_3$ showing, degeneration of hepatocytes and fatty changes (FC), 400X. H&E. (**d**) dilatation of the blood sinusoid lumen(S), dead hepatocytes (DH), notice the apoptotic cell (AC), 400X.H&E. (**e**): Sections of the liver of rats treated with $AlCl_3$ Showing different degrees of dilation in the sinusoids (SD), notice the degenerated hepatocytes (DH), 400X. H&E. (**f**): Sections through the liver of $AlCl_3$ treated rats, showing the vacuolized hepatocytes (VH) and apoptotic hepatocytes (AH), 400X. H&E

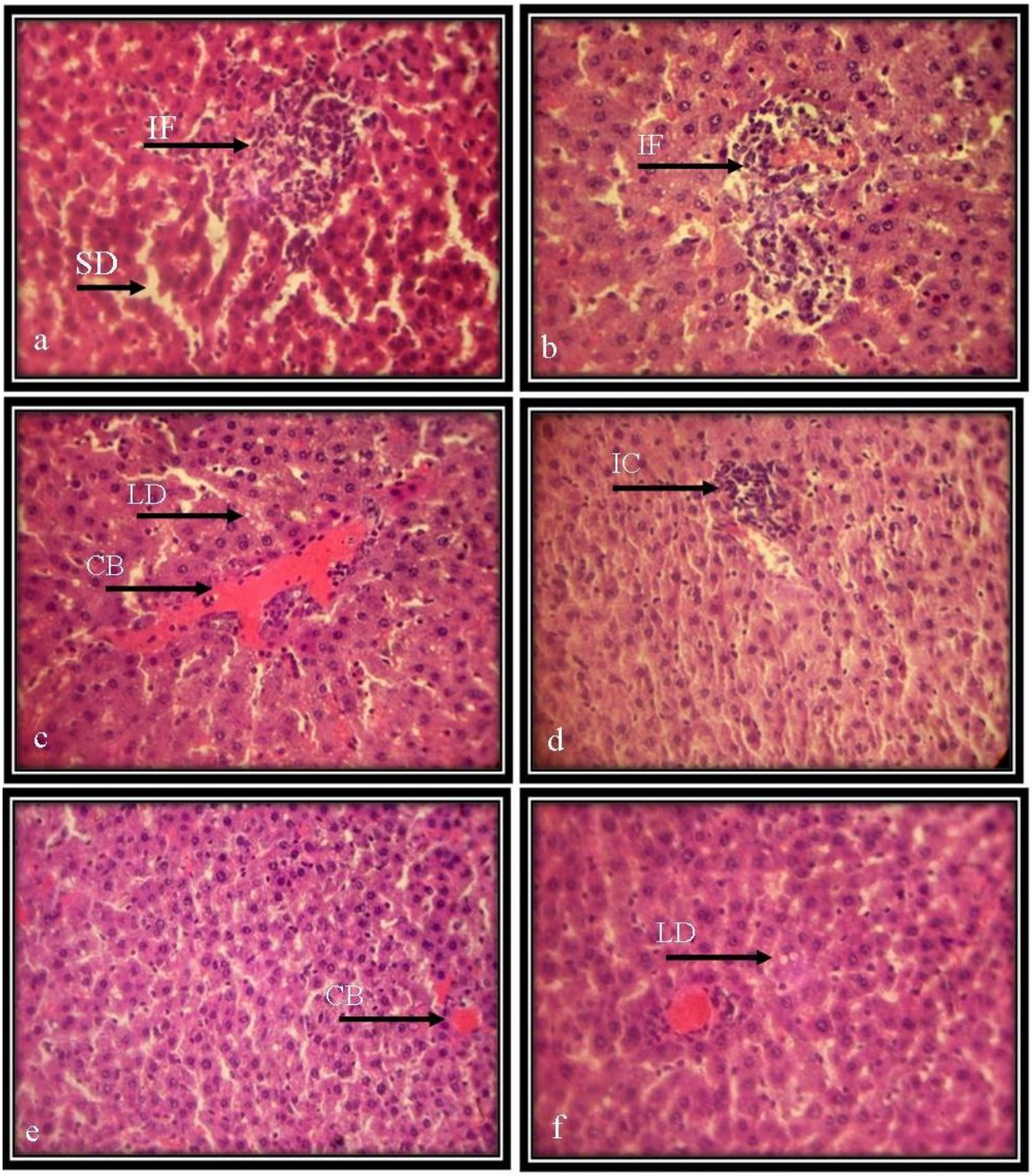

Figure (2): (**a**): Sections through the liver of $AlCl_3$ treated rats showing the infiltration of inflammatory leukocytes (IIL), dilation of sinusoid lumen (SD). 400X. H&E. (**b**): Sections through the liver of rats treated with $AlCl_3$ plus acetic acid showing high inflammatory foci (IF).400X. H&E. (**c**): Sections through the liver of rats treated with $AlCl_3$ plus acetic acid, showing the accumulated lipid droplets in the cytoplasm of hepatocytes (LD) and Showing a number of dead hepatocytes (DH).400X. H&E. (**d**): Sections through the liver of $AlCl_3$ plus Vit.C treated rats, showing the normal appearance of the liver and inflammatory cells (IC), 400X. H&E. (**e**): Sections through the liver of rats treated with $AlCl_3$ plus Vit.E, showing normal appearance of the liver with congested blood vessels with blood cells (CBV), 400X. H&E. (**f**): Sections through the liver of rats treated with $AlCl_3$ plus Vit.E, showing approximately normal appearance of the liver with congested blood vessels with blood cells (CBV) and lipid droplet accumulation in the hepatocytes (LD).400X.H&E.

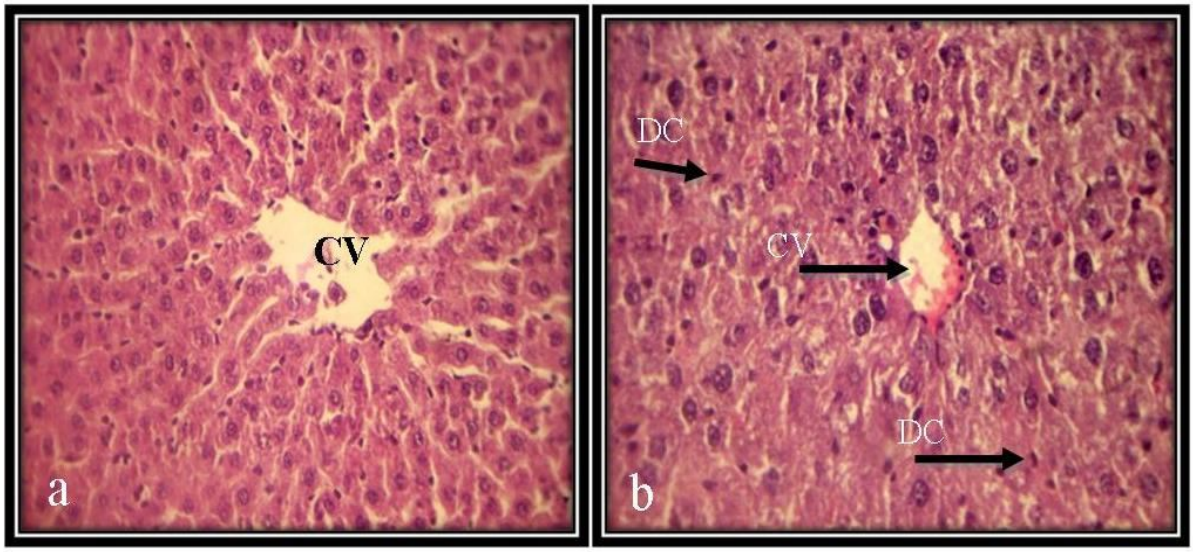

Figure (3). **a**): Sections through the liver of rats treated with $AlCl_3$ plus Omega-3, showing approximately normal appearance of the liver, central vein (CV). 400X, H&E. (**b**): Sections through the liver of rats treated with the combination of $AlCl_3$ plus Vit.C, Vit.E and omega 3, showing normal appearance, central vein (CV) and number of dead cells (DC).400X. H&E.

Effects of $AlCl_3$ and some antioxidants on the kidney.

Normal appearance of the cortical and medullary regions of kidney was seen in control group of rats (Figures 4-a). Rats treated with oil showed approximately normal kidney structures (Figures 4-b-c). Both groups showed no necrosis, inflammation or dilation in kidney tubules.

The sections of kidneys of rats treated with $AlCl_3$ showed many histological changes such as inflammation, hemorrhage, degeneration of kidney tubular cells and dilation of the kidney tubule lumen (Figures 4-d-e-f) and (Figure 5-a).These alterations included all region of the kidney.

When acetic acid has been given along with $AlCl_3$, rats showed more alterations (Figure 5-b) especially the inflammatory regions in the cortex.

Almost normal histological structure has been seen in the kidney sections of rats treated with $AlCl_3$ plus Vit.C (Figure 5-c).Examination of most of the sections of the kidney in rats treated with $AlCl_3$ plus Vit.E showed normal cortical structure (Figure 5-d).Examination of kidney sections in rats treated with $AlCl_3$ plus Omega-3 showed normal histological appearance, without the detection of inflammation or degeneration of kidney tubule cells (Figure 5-e). Similar results were also obtained in the kidney of rats treated with the combinations of $AlCl_3$, Vit.C, Vit.E, and Omega-3 (Figure 5-f).

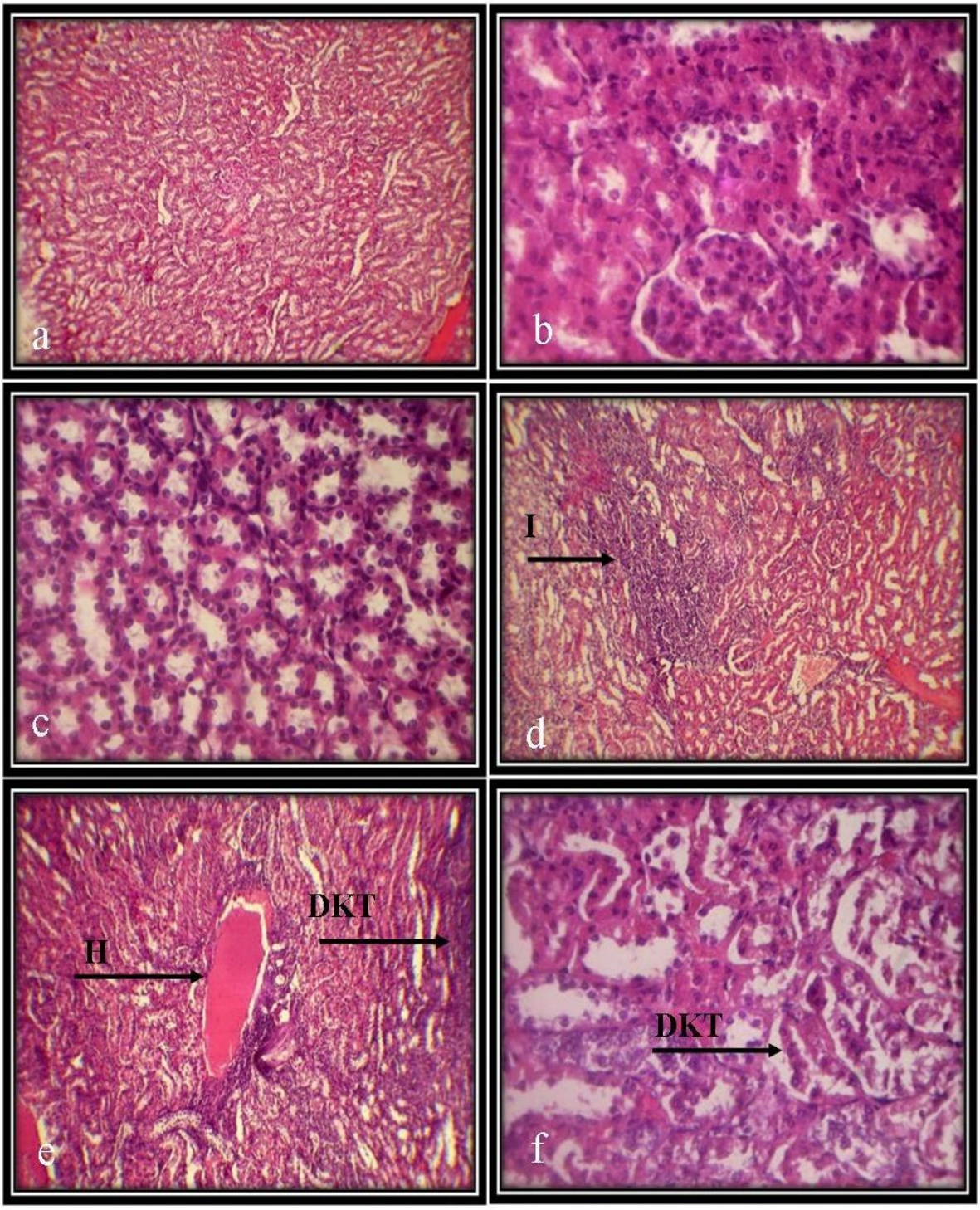

Figure (4): Sections through the kidney of rats. (a): control showing normal histological structure of ortical region,100X.H&E. (b and c): oil treated rats (positive control) showing normal histological structure, 400X. H&E. (d): the kidney of $AlCl_3$ treated rats showing inflammation (I) (e), dilation in the kidney tubule (DKT) and hemorrhage (H).100X .H&E. (f): the kidney of $AlCl_3$ treated rats, showing degeneration of kidney tubule cells (DKTC), 400X.H&E.

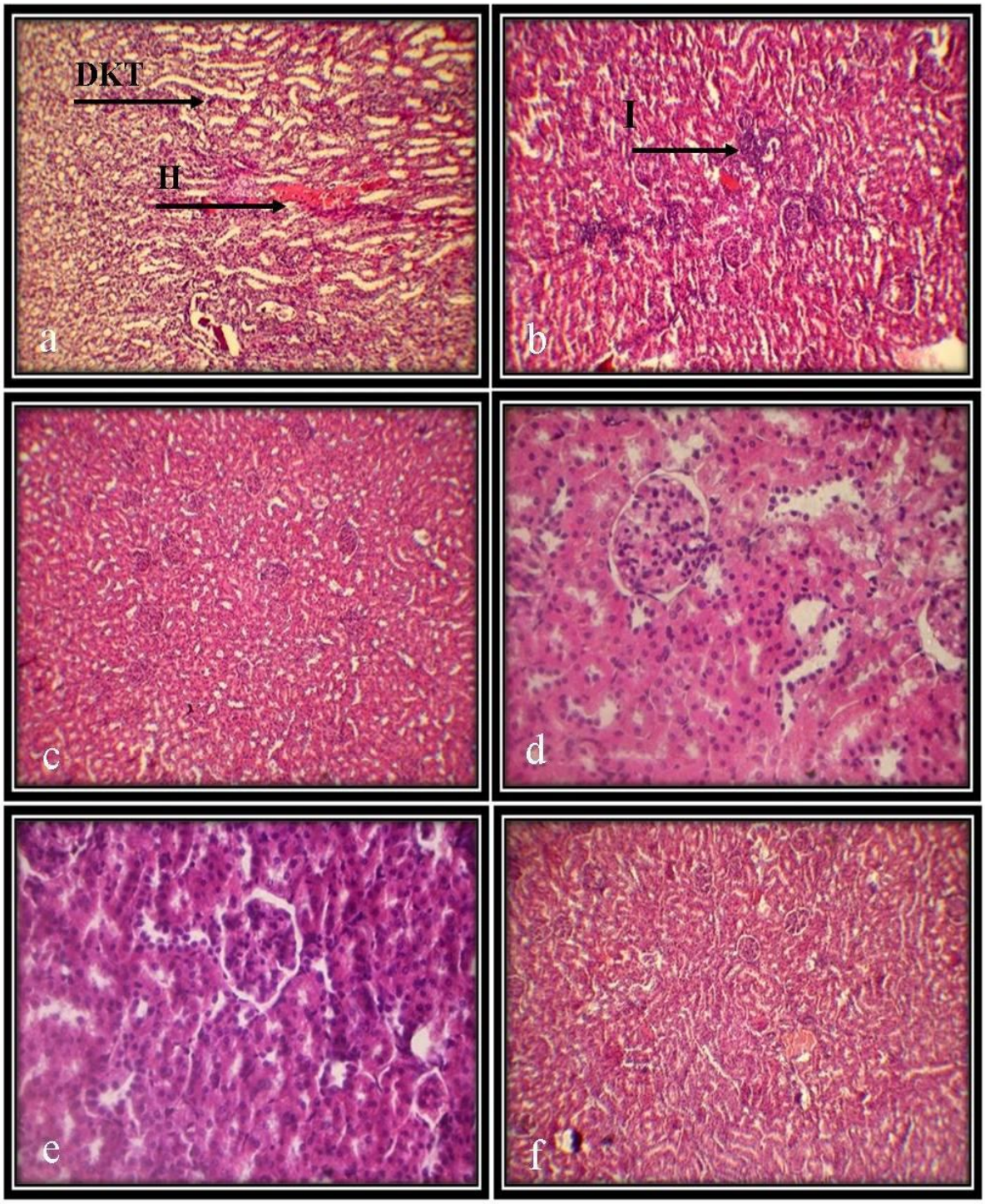

Figure (5): (a): Sections through the corticomedullar region of kidney of $AlCl_3$ treated rats, showing hemorrhage (H), dilation in kidney tubules (DKT), 100X. H&E. (b): Sections through the kidney of rats treated with $AlCl_3$ plus Acetic acid, showing inflammation in cortical region (I).100X. H&E. (c): Sections through the kidney of $AlCl_3$ plus Vit.C treated rats showing almost normal histological appearance. 100X. H&E. (d): Sections through the cortex of kidney of $AlCl_3$ plus Vit.E treated rats showing normal histological. 100X. H&E. (e): Sections through the cortex of kidney of the rats treated with $AlCl_3$ plus Omega-3 showing a slightly normal histological appearance. 400X. H&E. (f): Sections through the kidney of rats treated with $AlCl_3$ plus Vit.C, Vit.E and Omega-3 showing normal histological appearance of the cortical region of the kidney. 100X.H&E.

DISCUSSION

Exposure to Al caused death in a large number of hepatocytes in the liver of rats.These dead cells have characteristic apoptotic features such as shrinkage of the cells, hypereosinophilia, and condensed nuclei (Kerr *et al*., 1972).

It is claimed that Al toxicity increases the rate of lipid peroxidation and hence the formation of free radicals (Turguta *et al*., 2006). Furthermore, they added that as an index of lipid peroxidation, serum and tissue malondialdehyde (MDA) levels increase, whereas there is a reduction in the level of anti- oxidant glutathione (GSH).Also, El-Demerdash, (2004) and Yousef *et al*. (2007) reported that Al induced free radical generation, increased TBARs levels and inhibition in the activities of SOD, CAT and GST(endogenous antioxidants) .These change create an oxidative stress which induce the programmed cell death or apoptosis(Chu *et al*.,2003).

Exposure of rats to Al alone or with acetic acid showed inflammatory cells in the liver of treated rats. These agree with the results of Turkez *et al*. (2010) who showed severe pathological damages when rats exposed to aluminum such as: sinusoidal dilatation, congestion of central vein, lipid accumulation and lymphocyte infiltration were detected in liver. Inflammation as indicated by lobular activity was the most prominent effect in the liver of mice treated by lead (Al-Qudah, 2006). Also Sipos *et al*. (2003) found Lymphocytes infiltration and preportal inflammatory reaction in the liver of chicken treated with heavy metals.Metals can stimulate intercellular signaling between kupffer cell and hepatocytes and promotes a proteolytic activity (Milosevic and Maier, 2000). Therefore, exposure to Al may be responsible for liver cell damages.

Also the liver in rats treated with Al showed congestion either in sinusoid or in the blood vasculature (central vein) (Al-Qudah, 2006). Furthermore, she added that this effect may be due to the weakness of cell membrane after metal absorption by hepatocytes or blood vasculature, elevation in blood pressure which results in congestion. Exposure to heavy metals may cause congestion also in the myocardium (Lal *et al*., 1991).

The hepatocytes of Al treated rats also showed steatosis, the accumulation of fat droplets in hepatocytes. This may be related to the modification in mitochondrial function (Douette *et al*., 2005). Al-Qudah, (2006) suggested that treatment with heavy metals in high concentration may caused a disturbance in liver fat metabolism and subsequent accumulation of fat inside the hepatocytes. Thus fat accumulation in hapatocytes may be partially explained by damage of mitochondrial structure in the liver of treated animals.

Exposing Al treated rats to Vit.C exerted a protective effect on the structure of the liver and kidney cells, except the existence of some inflammation response. This agree with the results of Yousef, (2004) who claimed that Vit. C reduced the harmful effect of Al. Vit. E when administrated to the Al treated rats also produced more protection effects on rats liver. However, in some occasions, few dead cells may be seen since cell death, especially apoptosis is a physiological cell death (Fink and Cookson 2005). Vitamins, especially Vit.C and Vit.E are considered as powerful antioxidants against free radical generation (i.e. against oxidative stress) (El-Demerdash, 2004 and Yousef, 2004).The protective effect of Vit.E has been detected in Al treated mice which showed decreased MDA level and increased GSH level after exposing the Al treated mice to Vit.E (Turguta *et al*., 2006).Vit.E plays an important role as an antioxidant and is consequently expected to protect tissues from damage caused by reactive oxygen metabolites (El-Demerdash, 2004).This confirm that the mechanism of toxic effect of Al is through oxidative stress or free radical formation (Turguta *et al*., 2006).

Administration of Omega-3 into the Al treated rats showed quit normal hepatocytes structure. Such protecting role is due to the strong antioxidant role of Omega-3 (Hornstra, 2001).

Actually there must be a balance between the level of free radicals and antioxidants and any disturbance in these levels may induce damage to the tissue (Gilgun-Sherki *et al*., 2000).

From the results of the current study, it can be concluded that $AlCl_3$ alone or with acetic acid caused an oxidative stress, as indicated by histological damage observed in the liver and kidney tissues including dilatation of blood sinusoid, degeneration of hepatocytes, vacuolated hepatocytes, necrosis, apoptosis, infiltration of lymphocytes, accumulated of lipid droplet in the cytoplasm (steatosis) of hepatocytes, as well as the degeneration of kidney tubules cells and hemorrhage. The antioxidants (Ascorbic acid and α-tocopherol) and Omega-3oil have protected the liver and

kidneys tissues from the toxic effects of Al since these tissues showed more or less their normal histological structures.

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الدور الوقائي لبعض مضادات الاكسدة (كفيتاميني C و E و زيت Omega-3) في التغيرات النسيجية للكبد والكلية الناتجة من التأثير السمي لكلوريد الالمنيوم في اناث الجرذان البيضاء (*Rattus rattus norvegicus*)

الخلاصة

تناولت الدراسة الحالية تقيم التأثير الوقائي لبعض المواد المضادة للتأكسد مثل فيتامين C و E وOmega-3 في التغيرات النسيجية في الكبد والكلية في الجرذان البيضاء المعرضة لكلوريد الالمنيوم.

أستخدمت اثناء هذه الدراسه 64 أنثى بالغة تراوحت أعمارها بين 10-12 اسبوعاً وتراوحت أوزانها بين 190-210 غم. تم تربية الجرذان في بيت الحيوانات لقسم علوم الحياة – كلية العلوم- جامعة زاخو، تحت ظروف مختبرية قياسية عند درجة حرارة 24 ْم وفترة اضاءه12 ساعة يوميا ' وزودت بغذاء الجرذان والماء طيلة فترة التجربة.وقسمت الجرذان المستخدمة في هذه الدراسة الى8 مجاميع وعلى نحو التالي:- المجموعة الاولى (السيطرة).المجموعة الثانية (السيطرة الثانية وقد جرعت ب0.2مل/للجرذ الواحد من زيت زهرة الشمس عن طريق الفم).المجموعة الثالثة (وقد جرعت الجرذان فيها من خلال الفم ب 60 ملغم/كغم منوزن الجسم من كلوريد الالمنيوم).المجموعة الرابعة (وقد جرعت الجرذان فيها من خلال الفم ب 60 ملغم/كغم من وزن الجسم من كلوريد الالمنيوم و0.2 مل/للجرذ الواحد من 0.5% من حامض الخليك).المجموعة الخامسة (وقد جرعت الجرذان فيها من خلال الفم ب 60 ملغم/كغم من وزن الجسم من كلوريد الالمنيوم اضافة الى50 ملغم /كغم من وزن الجسم من فيتامين C).المجموعة السادسة (وقد جرعت الجرذان فيها من خلال الفم ب 60 ملغم/كغم من وزن الجسم من كلوريد الالمنيوم و100 ملغم /كغم من وزن الجسم من فيتامين E).المجموعة السابعة (وقد جرعت الجرذان فيها من خلال الفم ب 60 ملغم/كغم من وزن الجسم من كلوريد الالمنيوم و0.2مل/للجرذ الواحد من 5% Omega-3).المجموعة الثامنة (وقد جرعت الجرذان فيها من خلال الفم ب 60 ملغم/كغم من وزن الجسم من كلوريد الالمنيوم فضلا عن 50 ملغم /كغم لوزن الجسم من

فيتامين C و100 ملغم /كغم من وزن الجسم من فيتامين E و 0.2مل/ لكل جرذي من 5% من Omega-3). وفي نهاية فترة التجربة والتي بلغت 35 يوما اخذت عينات من الكبد والكلى وثبتت في محلول بوين لاستخدامها في الدراسةالنسيجية.

اظهرت نتائج التحضيرات المجهرية لاكباد الجرذان المعامله بكلوريد الالمنيوم بوجود حامض الخليك او غيابه، تشوهات وتغيرات في التركيب النسيجي للكبد مثل التوسع في الجيوب الدموية، واضمحلال بعض الخلايا الكبدية ، وتكوين الفجوات فيها، ولوحظ تنخر في بعض خلايا الكبد، مع الموت المبرمج لخلاياه، فضلا عن ذلك فقد لوحظ ارتشاح الخلايا اللمفية، وتراكم القطيرات الدهنية في سايتوبلازم الخلايا الكبدية. اما التحضيرات المجهرية التي تم الحصول عليها من كلى الجرذان المعامله بكلوريد الالمنيوم، فقد ظهرت بعض التشوهات في نسيج الكلي مثل الالتهابات واضمحلال بعض خلايا النبيبات الكلوية مع ظهور حالات من النزف الداخلي للكلية.

وعلى العكس من ذلك فقد ادى وجود المواد المضاد للاكسده (فيتامين C وE و Omega-3) مع كلوريد الالمنيوم الى تثبيط التاثير السمي للالمنيوم مع محاوله حماية التركيب النسيجي للكبد والكلية بشكل نسبي.

رولێ خو پاراستنا هندە ك كە رەستێن دژی ئە كسە دێ(وەك فیتامین س و ی و زەیتامێلاكا نەهە نگی) ل سە رگوهورینێن شانە یی یێن مێلاكێ و گولچێسكێن جردێن سپی ئەوێن هاتینە توشكرن بو ئەلە منیوم كلورایدی

كورتیا ڤە كولینێ

مەرەم ژ ڤێ ڤەكولینێ ئە وە هە لسەنگاندنا كارتێكەرێت پاراستنا هندە ك كە رەستێت دژی ئە كسە دێ وەك فیتامین سی و یی و زەیتامێلاكا نەهە نگی ل سەر وگوهورینێت شانە یی یێن مێلاك وگولجێسكێت جردێن سپی ئەوێت هاتینە توشكرن بو ئەلمنیوم كلورایدی.

دڤێ ڤە كولینێدا 64 جردێن سپی ئەڤ جردێن هەنێ هاتنە دابەشكرن ل سەر 8 كوما وەكی ل خوارێ دیاركری:- كوما ئیكێ(كونترول). كومادووێ(كونترول 2 ،دانا 0.2 ملێت زەیتا گولبەروژا بو هەر جردەكی بریكا دەڤی). كوماسیێ0دانا 60 ملیگرامێت ئەلەمنیوم كلورایدی بوهەركیلویەكی ژكێشا لەشی بریكا دەڤی). كوماچوارێ (دانا 60 ملیگرامێت ئەلەمنیوم كلورایدی بوهەركیلویەكی ژكێشا لەشی دگەل 0.2ملا ژ0.5٪ ژ ترشێ خەلیكی بریكا دەڤی). كوماپینجێ(دانا 60 ملیگرامێت ئەلەمنیوم كلورایدی بوهەركیلویەكێ ژكێشا لەشی دگەل50ملیگرامێت ڤیتامین سی بوهەركیلویەكی ژكێشا لەشی بریكا دەڤی). كوماشەشێ(دانا 60ملیگرامیت ئەلەمنیوم كلورایدی بوهەركیلویەكێ ژكێشا لەشی دگەل 100ملیگرامێت فیتامین ی بوهەركیلویەكی ژكێشا لەشی بریكا دەڤی). كوماحەفتێ(دانا 60 ملیگرامێت ئەلەمنیوم كلورایدی بوهەركێلویەكی ژكێشا لەشی دگەل 0.2ملا بو هەر جردەكی ژ 5٪ ژ زەیتامێلاكا نەهەنگی بریكا دەڤی). كوماهەشتێ(60ملیگرامێت ئەلەمنیوم كلورایدی بوهەركیلویەكی ژكێشا لەشێ دگەل50 ملیگرامێت ڤیتامین سی بوهەركیلویەكێ ژكێشا لەشێ دگەل 100ملیگرامێت فیتامین ی بوهەركیلویەكی ژكێشا لەشێ دگەل 0.2 ملا بو هەر جردەكێ ژ 5٪ ژ زەیتامێلاكا نەهەنگی بریكا دەڤی). لدوماهیا ڤەكولینی كوبوماوی 35 روژا ڤەكێشا و مێلاك و گولچیسك هاتنە وەرگرتن بو ڤەكولینا شانەیێ.

دیاربودئەنجامێت شانەییداكوئەوجردێن هاتینە توشكرن بو ئەلمنیوم كلوراید دگەل ترشێ خەلیكی یان ژی بتنێ تێكچون و گوهورینێن شانەیی ل مێلاكی پەیدابون وەك بەرفرەهبونا دەماریێن پچویك یێت خوێنی،مرنا خانەیین مێلاكێ، ،apoptosis, ,necrosis, infiltration of lymphocytes, كومبونا رینی دناف سایتوپلازمێ خانە یێن مێلاكێدا.هەروەسا د كولچیسكادازی inflammation وتێكچونا خانەیین نبەیبی یین گولچیسكێ وهەروەسادیتناخوێنی دناڤ گولچیسكادا دیاربو.

بەلێ دانا چەند كەرەستێن دژی ئەكسەدێ وەك(فیتامین سی و ی و زەیتامێلاكا نەهە نگی) دگەل ئەلمنیوم كلوراید بوئەگەر كو كێمبونا كارتێكرنا ژەهراوی یا ئەلەمنیومی كێمبییت وپاراستنا شانەیین مێلاكا وگولچیسكا ب شێوەیەكی دیاربەرچاڤبن.