

Study the Effect of Microwaves-Exposed Ration on Some Organs of Pregnant Albino Mice and the Role of Ginger in Reducing these Damages

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Abstract— This study was conducted to investigate the effects of consumption of exposed ration with microwaves radiation on histopathology of liver and kidney of pregnancy, and the role of ginger *Zingiber officinale* in curing these effects. 100 *Mus musculus* pregnant mouse used at age (10-14) weeks and weight (25±2) gm., were divided into 10 groups: control group and nine experimental groups, 10 mice \ group. Ginger used in form of aqueous extract with concentration (1000mg/kg) body weight. The period of treatment was 18 days starting from the 1st day until 18th day of pregnancy which is the dissecting day. The organs fixed in 10% formalin, cut as 5µ and stained with Ehrlich's Haematoxylin & Eosin. Microscopic examination of liver and kidney showed presence of histopathological changes and these increased with the increasing of duration of the exposure. In liver there were vacular degeneration, coagulative necrosis of hepatocytes and congestion of central veins with infiltration of inflammatory mononuclear cells, particularly lymphocytes. While in kidney there is shrinkage in glomerular tuft, degeneration and swelling of epithelial cells lining the renal tubules with congestion of blood vessels in addition to the infiltration of inflammatory cells. Groups which were treated with ginger extract showed efficient effect in reducing histopathological effects of the ration exposed to microwave in all periods of time that has been used in liver and kidney.

Keywords— Microwaves, pregnancy's liver and kidney, ginger, *Zingiber officinale*.

I. INTRODUCTION

Many studies referred to the effects of foods cooked by microwave oven on general health, many studies shown that food cooked in microwave oven causing digestive disorders, and disrupt the lymphatic system, causing weakening of the immune and the ability to self-protection from cancer as a result of chemical modifications in food items and increase the incidence of stomach and colon cancer for those who eat foods cooked in microwave oven [1]. In (1991) Blanc and Hertel conducted a study about the effect of food cooked in a microwave oven in Switzerland on eight people participated in the study, and lived for eight weeks in a specific place and eating uncooked foods and foods cooked in traditional ways and other cooked in microwave oven, blood samples tested after each meal and discovered that eating food cooked in a microwave oven caused with the passage of time changes in blood chemistry, such as

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a decrease in the concentration of hemoglobin and high density lipoprotein to low density lipoprotein and increase the number of white blood cells and the weakness in the immune system, which refers to the occurrence of poisoning and damage to cells, and explain the results of the study the microwave ovens cook food by forcing the atoms, molecules and cells in the food to change the polar about billions of times per second, causing friction, and when the friction increase the heat also increased and this acceleration distorts the molecular structure of food, consisting of new compounds called decomposing radiation compounds which not exist in nature [2]. Microwave ovens heats the food by absorbing radiation by water molecules and then heated the whole food, the chemistry expert Chad Mueller said that microwaves radiation causes heat the skin and different parts of the body in same way, as radiation is harmful to most of the body parts that do not can heat conduction to the outside effectively, especially the eye, as the microwave radiation causes the opacity of the lens of the eye, birth defects, cancer and serious disease, and this is dangerous in the case of radiation leak from the microwave oven [3]. Both of aqueous and alcoholic ginger rhizomes extract are antioxidant in many oxidative reactions resulted from free radicals therefore, it has been chosen in the present study.

II. MATERIALS AND METHODS

Healthy albino mice obtained from experimental research laboratory in the Faculty of Medicine at the University of Mosul, where the animals selected at the age of (10-14) weeks for both sexes, weights rate (25 ± 2) gm. Females placed with males with rate 3:1 per cage in the afternoon, and were sure to get mating in the next morning by observing the vaginal plug [4], pregnant mice isolated in separate cages with writing the date of mating, which was considered zero-day of pregnancy, and the next day is the first day of pregnancy [5]. The breeding and mating process occurred in a large cage enveloped with thick nylon and contains shelves and the temperature inside the cage about 25 C⁰ and the light cycle 12 hours light and 12 hours darkness per day. Standard ration used for mice feeding as food negotiable for radiation treatment, using the microwave oven to expose the ration to radiation. Ginger used in form of aqueous extract for rhizomes with concentration (1000 mg/kg) body weight [6]. The pregnant divided into 10 groups as follows:

1st group (control group):

Included 10 pregnant given standard ration and gulped with distilled water.

2nd, 3rd, 4th and 5th group:

Each group included 10 pregnant given standard ration exposed to microwaves 2.45GHz frequency and power of 280 watts for a period of 5, 10, 15 and 20 minutes respectively, and gulped with distilled water.

6th group:

Included 10 pregnant s given standard and gulped with aqueous extract of ginger with concentration (1000 mg/kg) body weight. 7th, 8th, 9th and 10th group:

Each group included 10 pregnant given standard ration exposed to microwaves 2.45GHz frequency and power of 280 watts for a period of 5, 10, 15 and 20 minutes respectively, and gulped with aqueous extract of ginger with concentration (1000 mg/kg) body weight.

All experimental groups anesthetized by ether [5]. Period of treatment 18 days starting from the 1st day until the 18th day of pregnancy. Animals were anesthetized and the organs fixed in 10% formalin, cut as 5µ and stained with Ehrlich's Haematoxylin & Eosin.

III. RESULTS AND DISCUSSION

The microscopic histological examination of some organs of the pregnant mice that were fed a standard ration exposed to MW for 5, 10, 15 and 20 minutes for 18 days showed presence of pathological changes in the liver and kidney, especially for 20 minutes treatment. Vascular degeneration and necrosis of the hepatic cell where observed (figures (1-2-3-4)). This may be because of free radicals that formed in standard ration exposed to MW [7], which are attacking cell membranes, causing crashing through the oxidation of fatty acids that present within the phospholipid in cell membranes. So the peroxidation lipid linked to cases of cell damage not to mention that mitochondria inside the cell has a biological membranes with characteristics similar to plasma membranes in terms of components and function and this is what also makes them susceptible to damage, and then losing a function and confirms this is the presence of degeneration and necrosis of the hepatocytes which indicates the presence of damage to the liver tissue, which may be caused by oxidative stress, and the electromagnetic field's ability to generate hydroxyl radical [8]. And the free radicals attack the lysosomes, causing destroys the membranes leading to release digestive enzymes into the cell and then destroy cellular compounds [9]. Or the MW may causes a decrease in the nutritional value of foods as it causes a decrease in the bioavailability of vitamins B complex, vitamin C and E and essential minerals [1]. It also causes transformation of vitamin B₁₂ from the active form to the inactive when exposed to MW [10]. It was found that a deficiency of vitamin B₆ causes a decrease in antioxidant defense system and an increase in oxidative stress in the liver tissue [11]. And that a deficiency of vitamin E leads to the destruction of the cells that give rise to different types of cancer [12][13]. The results of this study showed occurring coagulative necrosis of some hepatocytes (figures (1-2-3-4)) which occurs due to the acute toxicity of some toxic substances or due to the acute anoxia like that happens from clogging blood flow [14]. This indicates that the ration exposed to MW cause significant disruption in the metabolic processes of the hepatocyte in detoxification. The results of this study also indicated to the congestion of central veins (figures (1-2-3-4)) which arises from clogging physicist of any small or large blood vessels or arising from the Inability to rush blood flow forward and thus the blood accumulates in the veins and appears in the form of venous congestion [14]. Results also showed infiltration of inflammatory cells monocyte around the central veins (figures (1-2-3-4)) which caused by movement of these cells toward the highest concentration of some toxic substances called factors attracting chemically and the intensity of migration of these cells depends on the intensity of the histological damage [15]. This indicates that exposing ration to MW affect on the food ingredients and leads to the formation of the components differ significantly from foods components is non-exposing to MW and this is consistent with what he found [7]. In the heating or cooking foods in the microwave oven affect the nutritional components and lead to the formation of new

compounds of the most important free radicals, especially when you reach the high temperatures. This is also consistent with our study; it was observed that the pathological changes increase with the length of time where it was more severe at 20 minutes. These results are inconsistent with the findings of [16] who indicated that food cooked in microwave oven and after mixing with supplements of vitamins and minerals to supplement the nutritional needs of rats does not cause negative effects and histopathological in the liver of male and female rats. The reason may be due to the vitamins and minerals that have been mixed with food after exposing to microwave that are likely to may compensated for the deficiency in essential vitamins and minerals or that some of these vitamins and minerals from non-enzymatic antioxidants and that work on sweeping free radicals which led to the emergence of any non-pathological changes in rats when fed on cooked foods in microwave oven. While the histological sections of the livers of animals treated with extract of ginger have shown the existence of simple necrosis of hepatocyte and focal infiltration of inflammatory cells (figure (5)) and this indicates that ginger has a low toxicity. These results are consistent with the finding of [17] in that of ginger has a low toxicity when given to female rats at a dose (50 500 mg / kg body weight). The reason for this may be attributed to contain ginger rhizomes a high level of vitamin C, it was found that the negative effects when given to male rats at a doses (200, 300, 400, 500 mg / kg body weight) where caused histological changes in liver included vacular degeneration to some hepatocytes and gathering of inflammatory cells [18]. Also the contain ginger rhizomes on a high level of vitamin A may be the cause of hepatic cells necrosis and infiltration of inflammatory cells. It was found that high doses of vitamin A cause pathological changes in the liver of pregnant mice like the degeneration and necrosis of the liver cells [19]. Results of this study also showed expansion and congestion of the central veins (figure (5)). This is consistent with the findings of [17] when given a ginger extract to female rats as the cause of congestion in the central veins. These results are consistent with the findings of [20] when you give them a dose of powdered ginger rhizomes (1000 mg/kg) ration for male rabbits as they had noticed expansion and congestion of the central veins in the liver tissue. These results are also consistent with the observation [21] when given a dose of ginger powder (2 mg/kg) ration where noticed congestion central veins in the liver tissue, but they conflict with him in the infiltration of inflammatory cells which indicates to the absence of an inflammatory response in the groups treated with ginger. The reason for this may be due to the researcher used dose less than the dose used in the current study. While histological examination of the liver mice fed on a ration exposed to MW after-treatment of ginger extract showed amelioration in histological changes (figures (6-7)). This reflects the positive impact of the components of ginger extract as an anti-oxidant and the most important of which Gingerol and Shogaols which may have a role in sweeping free radicals [22]. As well as ginger rhizomes contain a high level of vitamin C, which is one of stronger natural antioxidants [23]. Where a sweeping works free radical foremost of which is the active oxygen species responsible for the destruction of the body's cells [24]. It was found that treatment with vitamin C reduces the histological changes that have occurred as a result of oxidative stress induced sodium fluoride in the liver of female rats [25]. Moreover, the ginger works to raise the enzymatic antioxidant in the liver tissue of the most important of SOD, CAT and GPx which has an important role in protecting tissues from peroxidation lipid [26]. These results are consistent with the findings of [27] in the treatment of male rabbits stressful with hydrogen peroxide then with ginger rhizomes reduce the histopathological changes in the liver. It also is consistent

with the findings of the [28] where noticed when giving male rats treated Anti-fungal (Mancozeb) ginger extract that there is amelioration of liver damage. Also consistent with the findings of [21] that rhizome of ginger reduces hepatic damage induced hydrogen peroxide.

Feeding pregnant mice to the ration exposed to MW also led to the appearance of pathological changes in the kidney consisted with degeneration and necrosis of the epithelial cells lining the renal tubules (figures (8-9-10-11-12)) which may be due to free radicals formed in the ration exposed to MW, referred to by [7]. Which are attacking cell membranes, causing crashing through the oxidation of fatty acids that present within the phospholipid in cell membranes. So the peroxidation lipid linked to cases of cell damage not to mention that mitochondria inside the cell has a biological membranes with characteristics similar to plasma membranes in terms of components and function and this is what also makes them susceptible to damage, and then losing a function and confirms this is the presence of degeneration and necrosis of the cells which indicates the presence of damage to the kidney tissue, which may be caused by oxidative stress, and the electromagnetic field's ability to generate hydroxyl radical [29]. [30] explained that causes necrosis of the renal tubules as a result of poisoning is the death of epithelial cells of the tubules as a result of the lack of enough of oxygen as the metabolic effectiveness dependent on oxygen supplied by blood vessels and that any damage happens in blood vessels necrosis, or narrowing of the renal artery leading to slow the flow of blood and then the lack of supply cells with oxygen. The results of this study also indicated that swelling epithelial cells lining the renal tubules (figures (8-9-10-11-12)) which may also be attributed to the free radicals that are formed in the ration exposed to MW, which cause oxidation of unsaturated fatty acids in the membranes, they also lead to degeneration of the phospholipid layer and then the protein components of the cell membrane [31]. Leading to rupture mechanism to control osmotic of the membrane, called the sodium-potassium pump, which is working to eject sodium ions to the outside and enter potassium ions into the interior, and when rupture of this mechanism the sodium remains inside the cell leads to increased osmotic pressure inside the cell and swollen as a result of water gathered inside [14]. Thus swelling cells occurs because of the absorption of water and the cells becomes large-sized, swelling may be so great that leads to convergence, some cells to some and closure cavity tubules as shown in the current study. This study also pointed to shrinkage in glomerular tuft (figures (8-9-10-11-12)) which may be due to toxins that have formed in the ration when exposed to MW which led to a decrease of glomerular filtration as a result of hypertension and low blood flow in kidney because of the damage of renal blood vessels or damage of tubules, or both [14]. For the infiltration of inflammatory cells monocytes, this appeared in this study (figures (8-9-10-11-12)) which caused by movement of these cells toward the highest concentration of some toxic substances which appears in the form of inflammation. This indicates that exposing the ration to MW affect on the food ingredients and cause converted into toxic components, this confirms what referred to [7] in the MW affect in the nutritional components of food, leading to the formation of toxic compounds that are the most important free radicals. These results are disagree with the findings of [16] who indicated that food cooked in microwave oven and after mixed with supplements of vitamins and minerals to complete the nutritional needs of rats does not cause negative effects and histopathological in the kidney of male and female rats. The reason may due to the vitamins and minerals that have been mixed with food after exposing to microwave that are likely to may compensated for the deficiency in essential vitamins and minerals or

some of these vitamins and minerals from antioxidants and that work on sweeping free radicals which led to the emergence of any non-pathological changes in rats when fed on cooked foods in microwave oven. Results of the current study also showed the presence of histopathological changes in mice kidney treatment with ginger extract represented with shrinkage in glomerular tuft and necrosis of glomerular epithelial cells lining the renal tubules with a simple infiltration of inflammatory cells in the interstitial tissue (figure (13)). These results are inconsistent with the findings of [32] they noticed the absence of pathological changes in the tissues of the kidneys of male rats when given a dose of ginger extract (100 mg / kg body weight). The reason for this may due to the researchers used a lower dose than the dose used in this study. The reason for this may be attributed to contain ginger rhizomes a high level of vitamin C, it was found that the negative effects when given to male rats where caused histological changes in kidney included degeneration and necrosis of tubular epithelial cells [18]. Also contain ginger rhizomes a high level of vitamin A may be cause of necrosis of tubular epithelial cells. It was found that high doses of vitamin A cause pathological changes in the kidney of pregnant mice [19]. While histological examination of the kidney mice fed on a ration exposed to MW after-treatment of ginger extract showed amelioration in histological changes (figures (14)). This reflects the protective role of the components of ginger rhizomes, especially Gingerol and Shogaol as antioxidants [27]. As well as containing Vitamin C is the strongest non-enzymatic antioxidant works as a sweeping of free radicals [33]. It was found that treatment with vitamin C reduces the histological changes that have occurred as a result of oxidative stress induced sodium fluoride in the kidney of female rats [25]. These results are consistent with the findings of [34] when giving ginger to rats that infected with diabetic nephropathy as they had noticed amelioration in the kidney tissue and ginger causes decrease in lipid peroxidation in their tissues. Also these results consistent the findings of [32] whom noticed amelioration in the kidney tissue of rats that treated with alcohol after giving ginger extract.

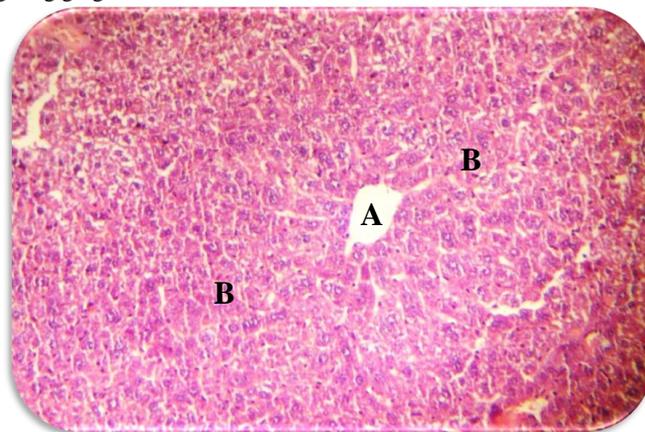


Figure (1): Histological section in the liver of a pregnant mouse of the control group shows, hepatocytes (B) around the central vein (A) (HE - 165X)

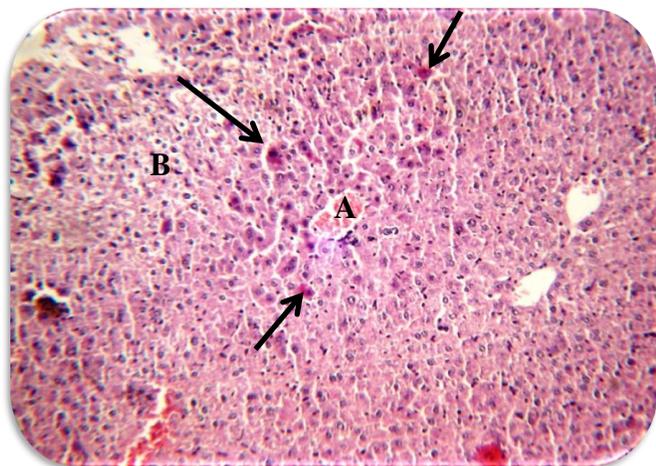


Figure (2): Histological section in the liver of a pregnant mouse fed on a standard ration exposed to MW for 5 minutes shows, congestion central vein (A), coagulative necrosis of hepatocytes → and vacuolar degeneration of other hepatocytes (B) (HE - 165X).

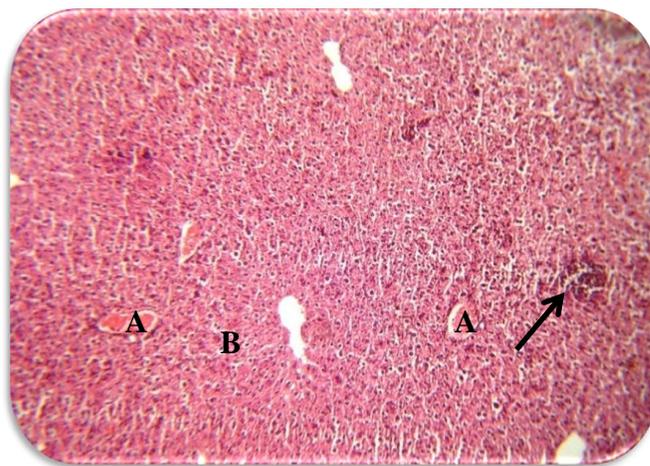


Figure (5): Histological section in the liver of a pregnant mouse treated with ginger extract (1000mg/kg body weight) shows, congestion central vein (A), necrosis of hepatocytes (B), focal infiltration of inflammatory cells → (HE - 90X).

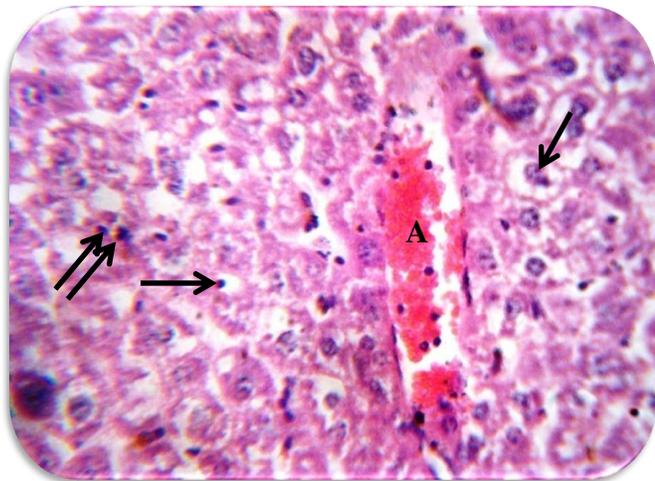


Figure (3): Histological section in the liver of a pregnant mouse fed on a standard ration exposed to MW for 10 minutes shows, congestion central vein (A), vacuolar degeneration of hepatocytes → and coagulative necrosis of other hepatocytes ⇒ (HE - 450X).

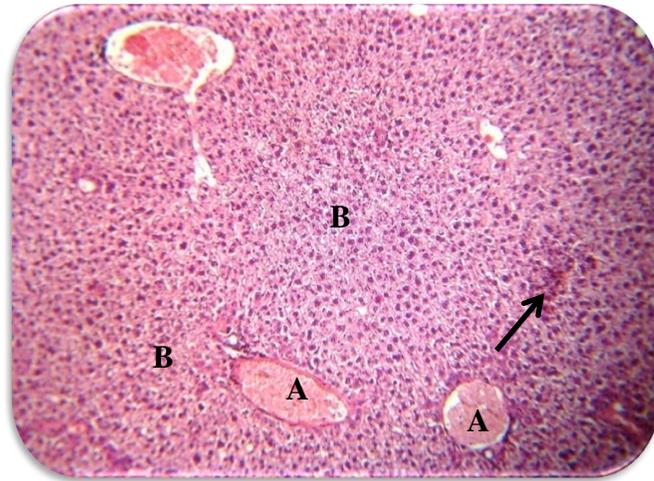


Figure (6): Histological section in the liver of a pregnant mouse fed on standard ration exposed to MW for 20 minutes and treated with ginger extract (1000mg/kg body weight) shows, congestion central vein (A), vacuolar degeneration of hepatocytes (B), coagulative necrosis of hepatocytes → (HE - 90X).

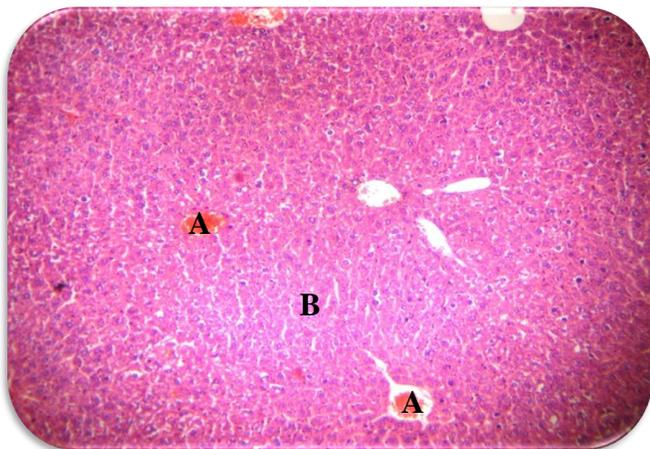


Figure (4): Histological section in the liver of a pregnant mouse fed on a standard ration exposed to MW for 20 minutes shows, congestion central vein (A), necrosis of hepatocytes (B) (HE - 165X)

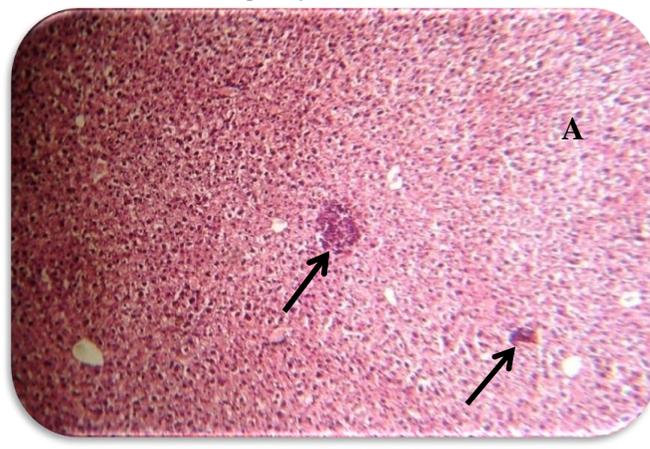


Figure (7): Histological section in the liver of a pregnant mouse fed on standard ration exposed to MW for 20 minutes and treated with ginger extract (1000mg/kg body weight) shows, necrosis of hepatocytes (A), focal infiltration of inflammatory cells → (HE - 90X).

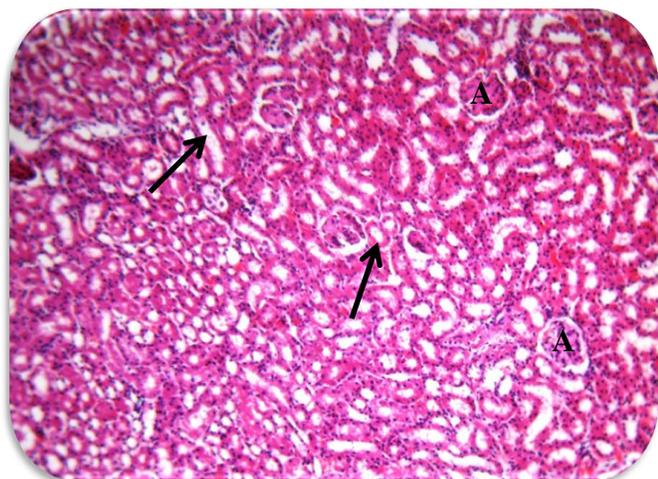


Figure (8): Histological section in the kidney of a pregnant mouse of the control group shows, glomerular tufts (A) renal tubules → (HE - 165X).

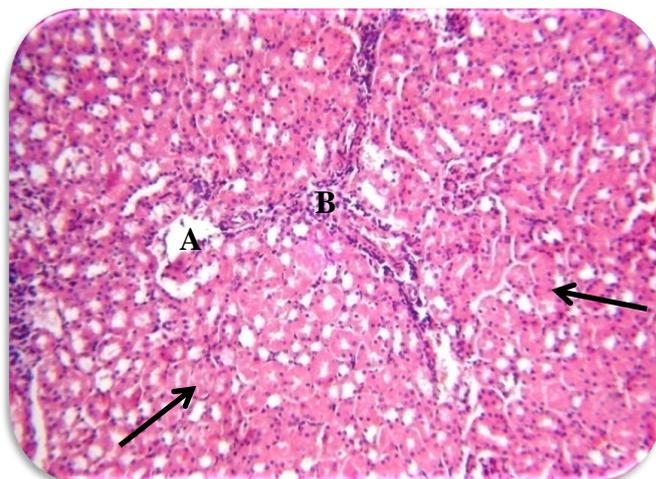


Figure (11): Histological section in the kidney of a pregnant mouse fed on standard ration exposed to MW for 15 minutes shows, shrinkage in glomerular tuft (A), infiltration of inflammatory cell (B) swelling of epithelial cells lining the renal tubules → (HE - 165X)

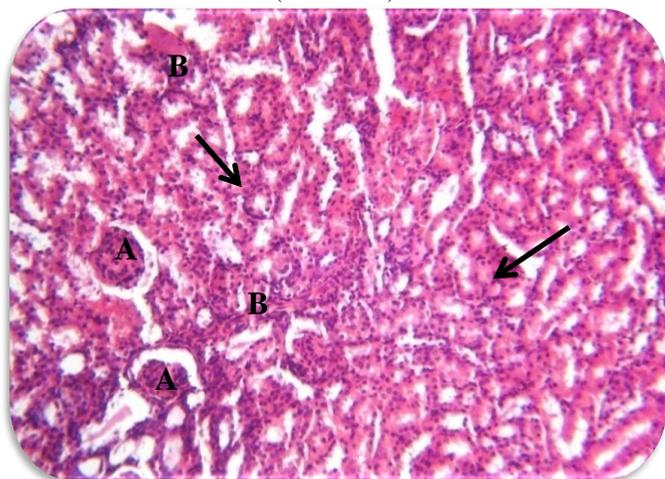


Figure (9): Histological section in the kidney of a pregnant mouse fed on standard ration exposed to MW for 5 minutes shows, shrinkage in glomerular tuft (A), infiltration of inflammatory cell (B) swelling of epithelial cells lining the renal tubules → (HE - 180X).

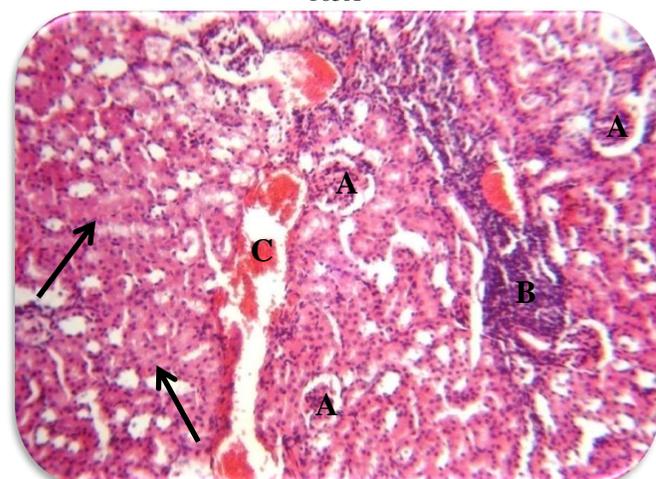


Figure (12): Histological section in the kidney of a pregnant mouse fed on standard ration exposed to MW for 20 minutes shows, swelling in glomerular tuft (A), infiltration of inflammatory cell (B), congestion of blood vessels (C), swelling of epithelial cells lining the renal tubules → (HE - 165X).

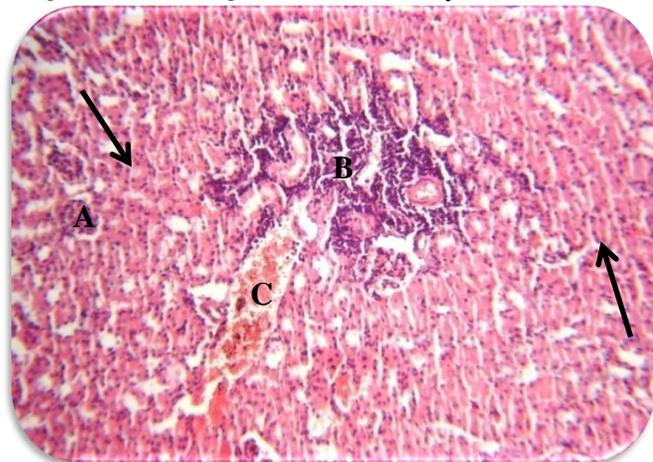


Figure (10): Histological section in the kidney of a pregnant mouse fed on standard ration exposed to MW for 15 minutes shows, swelling in glomerular tuft (A), infiltration of inflammatory cell (B), congestion of blood vessels (C), swelling of epithelial cells lining the renal tubules → (HE - 165X).

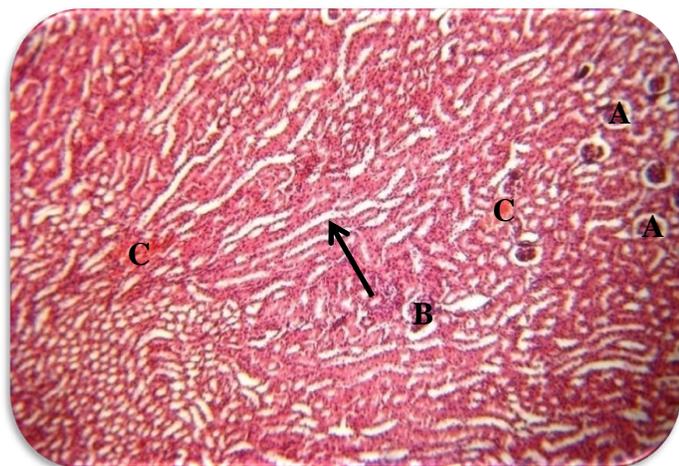


Figure (13): Histological section in the kidney of a pregnant mouse treated with ginger extract (1000mg/kg body weight) shows, shrinkage in glomerular tuft (A), infiltration of inflammatory cell (B), hemorrhage within the interstitial tissue (C), necrosis in epithelial cells lining the renal tubules → (HE - 115X).



Figure (14): Histological section in the kidney of a pregnant mouse fed on standard ration exposed to MW for 20 minutes and treated with ginger extract (1000mg/kg body weight) shows, shrinkage in glomerular tuft (A), hemorrhage within the interstitial tissue (B), expansion in renal tubules → (HE - 145X).

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