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Histopathological Change of Malathion Toxicity in Liver and Kidney of Male Rabbits

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Abstract

Malathion is a widely used organophosphorous pesticide that a large number of populations are undesirably exposing themselves to severe health risk. This study aims to evaluate the histophological change of malathion in rabbits liver and kidneys. The study was conducted on sixty male rabbits divided into three equal groups, twenty rabbits of each group. The rabbits were treated orally with different dose (5 and 15 mg/ kg/day) according tomalathion dose for thirty days. After treatment organs liver and kidney were collected and slides were prepared for reading under light microscope. Urea presented high level in both group low and high dose compared to control, but creatinine presented high level in high dose group. Histopathological change in the liver were mainly represented by; the slide from group (A) low dose indicated mild toxicity of malathion, normal hepatocytes and blood vessels, mild enlargement in the sinusoids and vacuole formations in hepatocytes comparing with the control rabbit while the slide from treatment group (B) high dose showed moderate damage in hepatic tissue including prominent enlargement of sinusoids, congestion of most blood vessels and fatty vacuole formations. Marked in treatment group (B) high dose, highly degeneration of glomeruli, shrinkage of glomeruli and moderate degradation in tubules, also noticed treatment group (A) low dose showed mild shrinkage of glomeruli and mild degradation in tubules of the kidney were noticed. This study concluded that malathion cause toxic effect in low dose and this effect was brightly appear with prolong exposure.

Keywords: Histopathological, Malathion, Male rabbits, Kidney function.

Introduction

Organophosphorus pesticides have harmful effects on human health through environmental or occupational exposure. Roughly (0.1) of applied pesticides reach the target pests and rest spread through water, soil and food. These pesticides are readily available on the market. Acute poisoning with organophosphorus pesticides is aglobal threat to human health that cause more than (100.000) death a year[1]. The primary affect the nervous system of the exposed organism by inhibiting acetycholinesterase (AChE) and raising acetylcholine level in the cholinergic synapse[2]. Beside cholinergic effects, organophosphorus pesticides include oxidative stress affect metabolic pathways and cause multiple organ dysfunction such as hypoxia and tissues perfusion of liver and heart[3]. The most important mechanism of malathion toxicictyis production of free radicals, because of high reactivity of ROS most cellular components are likely to be targets of oxidative damage, lipids peroxidation , protein oxidation ,GSH depletion and DNA single strand breaks all initiated by ROS excess. As a whole these events ultimately lead to cellular dysfunction and injury[4]. Organophosphorus pesticides act as esterases inhibitors, mainly acetylcholine-esterase inhibitors, resulting in severe effects on central or peripheral nervous system[5]. In another study, after 90 days exposure to mix OP dimethoate, acephate, dichlorvos, and malathion, showed that the histopathological changes covered parenchymatous degeneration of the cells of renal tubules and hyperemia of the cortical part of the kidney, especially of renal glomeruli, as well as infiltrations were noted. In the ultra-structure of the cells of renal proximal tubules, vacuoles with damaged external membrane were observed, as well as swollen and pleomorphic mitochondria[6]. These changes covered parenchymatous degeneration of the cells of renal tubules and hyperemia of the cortical part of the kidney, especially of renal glomeruli, as well as in filtrations were noted. In the ultra-structure of the cells of renal proximal tubules, vacuoles with damaged external membrane were observed, as well as swollen and pleomorphic mitochondria. However, different studies showed that malathion and other pesticides induced liver and kidney histopathological alterations in experimental animals[7].

Materials and Methods

Experimental animals: Sixty male rabbit's age three months and their weights means (950±1.0gm) they were housed in metal cages under standard conditions with free access to drinking water and standard food. All rabbits were handled in accordance with the typical guide for care and use of laboratory

animals in faculty of veterinary medicine, Al-Butana University. They were brought from the Faculty of Veterinary Medicine, University of Al Butana. This experiment was conducted at the Department of Surgery in Veterinary Medicine, Al Butana University.

Ethical Consideration: Permission to carry out the study was taken from the Ethical research committee in faculty of veterinary medicine, Al-Butana University.

Study duration: The experiment started in December, 2020, continued thirty days and ended in January, 2021.

Experimental protocol: The rabbits were initially acclimatized for seven days by putting in their metal cages before started treatment. They were daily allowed for twice meals in the morning and in the evening and free access of water. Rabbit body weights were taken every three days of the experiment period. They divided into three equal groups 30 rabbits in each. Group (A) low malathion dose (5mg/kg/day) rabbits and group (B) high malathion dose (15mg/kg/day) respectively and group (C) received free access to water and food. In both groups, body weights were recorded every three days of study. The administration of rabbit's dose by oral gavages designed thirty days longer, on day thirty one, the rabbits were sacrificed from both groups.

Liver and kidney tissues collection: Collected organs were washed thoroughly with 0.9% normal saline to remove any trace of blood. Fat tissues adhered to the organs were also removed carefully and afterwards organs were sliced into small tissue pieces using a surgical scalpel for allowing easy penetration of the chemicals inside the tissue. The dissected tissue was treated with Bouin's fluid (fixative) for 16-18 hours and subsequently washed under running tap water for one hour until complete removal of most of the Bouin's fluid from the tissues.

Tissues storage and preparation for histopathology: Followed by washing, dehydration of the tissues was conducted by immersing the tissue in a series of gradually increasing concentrations of alcohol (50%, 70%, 80%, 95% and absolute alcohol) and embedded into paraffin wax for making blocks. The block was to be trimmed by removing of wax from the surface of block to expose the tissue. Sectioning of the tissue was performed by using a microtome (RM 2255; Leica Instruments, Nussloch, Germany). The microtome was preset to cut the tissue as thicknesses around 6µm. Blocks small ribbons of tissue sections were placed on microscopic slide with help of warm distill water containing few drops of Mayer's albumen and deparaffinized with xylene solution. Hematoxylin and eosin yellow solution was used to stain the tissue for preparing permanent slide according to Hosseini *et al*.[3].

Reading of slides: Histopathological change was observed under 10x and 40x of a light microscope (BX51, Olympus, Tokyo, Japan) with the guidance of a histologist. The images of the examined tissues were acquired.

Statistics analysis: Data were analysis was performed using Statistical Package for Social Sciences (SPSS) version (16) USA, data are reported as means±SD and percentage. Statistical significance was considered as ($p \leq 0.05$).

Results and Discussion

The results of malathion treatments caused highly significant increased ($p \leq 0.05$) urea and creatinine in low and high malathion dose in male rabbits, as compared with their control rabbits Table-1,2. This results in agreement with Abdel Daim *et al*[8], reported that an elevated level of urea in blood is correlated with an increase protein catabolism in the mammalian body. An elevation of its level in the blood is thus an indication of impaired kidneys function[9]. The slide from treatment group one (low dose) indicated mild dilation in sinusoids, normal hepatocytes and blood vessels, but shows lipid vacuoles, while rabbit of treatment Group two. High dose showed moderate damage in hepatic tissue including enlargement of sinusoids and moderate congestion of blood vessels. Malathion is an oxidant and impair enzymatic antioxidant defences, malathion in rat liver most probably disrupt membrane lipids through oxidative stress[10]. Our result was in agreement to Rezg *et al*[11], who established that macro vesicular steatosis, apoptotic nuclei, granulovacuolar dystrophy lesions, and peri centrilobular vasodilatation in the liver of rats were malathion caused after about one month of low-dose exposure. Also the result was agreement with Hosseini, *et al*.[3]. Their study conducted similar hepatotoxic changes in their experimental animals with the use of Malathion. Histopathological changes in the kidneys occurred in all animals. Histopathological study on the kidney of control rabbit showed regular structure with capillaries, tubules and glomerulus. In the case of treatment group one (low dose) showed mild shrinkage of glomeruli and mild degradation in tubules. Treatment group two (high dose), showed highly degeneration of glomeruli, Bowman's capsules and associated tubules structure, shrinkage of glomeruli and moderate degradation in tubules was also noticed. These changes were nearly appeared of the same degree in those rats treated with Malathion at concentration level of 1mg/kg, except for the sinusoidal cell activation which became of moderate degree and the hepatic lobules showed marked peripheral cytosolic hydrop with vacuolated cytoplasm of the hepatocytes. The renal change increased in severity and frequency with the increase in duration of exposure[12].

Table-1: Comparison of malation toxicity on renal profile between control group and low dose group.

Variables	Control group	Low dose	P value
Urea(mg/L)	37.9 ± 1.4^{a}	42.6 ± 2.6^{b}	0.01
Creatinine(mg/dl)	1.3 ± 0.3^{c}	1.6 ± 0.7^{c}	0.05

N=30 male rabbits. Means±SD with row have common subscript letter were non significantly different, but with different letter were significantly different.

Table-2: Comparison of malation toxicity on renal profile between control group and high dose group.

Variables	Control group	High dose	P value
Urea (mg/L)	37.9 ± 1.4^{a}	47.6 ± 1.8^{c}	0.01
Creatinine (mg/dl)	1.3 ± 0.3^{c}	2.3 ± 0.7^{d}	0.05

N= 30 male rabbits. Means±SD with row have common subscript letter were non significantly different, but with different letter were significantly different.

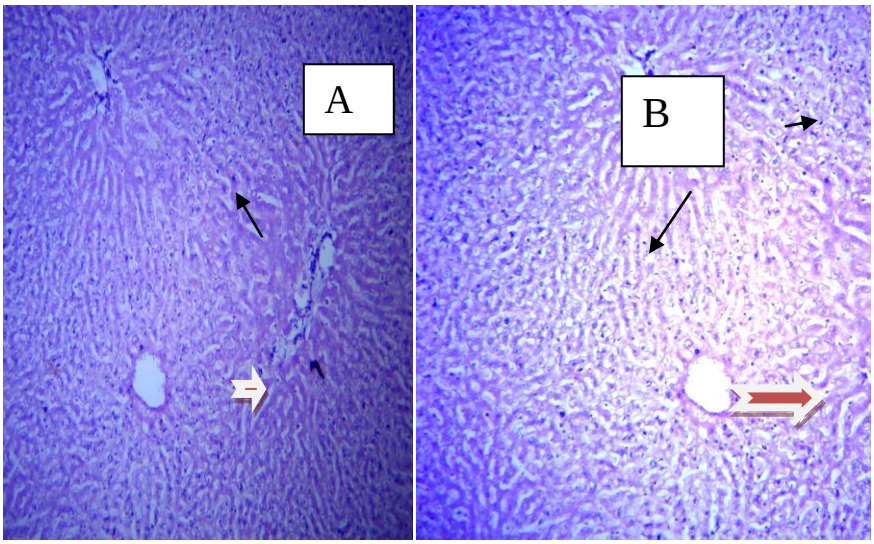

Figure-1: A: Control liver rabbit with well-organized hepatic cell, normal central vain (red arrow) and normal sinusoids (black arrow) H+E, x10 (At the left side). B: Liver of rabbit after of malathion orally administration (5mg/kg). Mild dilation in sinusoids (black arrow), normal central vein (red arrow) normal hepatocytes and blood vessels, but shows lipid vacuoles (long black arrows) H+E, x10 (At the right side).

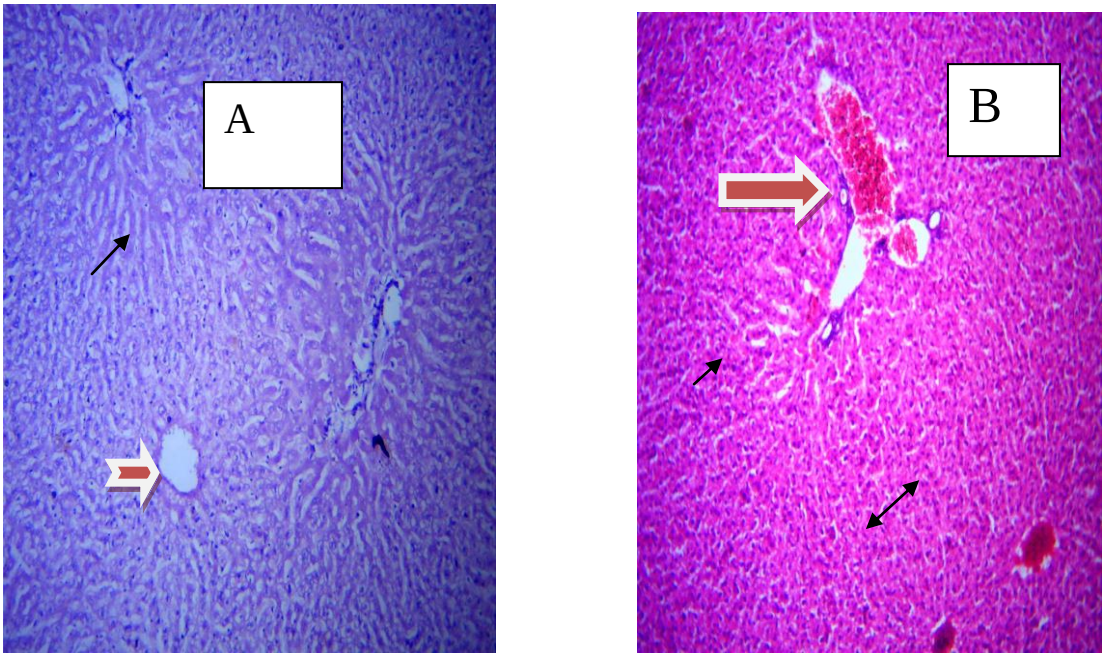

Figure-2: A: Control liver rabbit with well-organized hepatic cell, normal central vain (red arrow) and normal sinusoidsv (black arrow) H+Ex10 (At the left side). B: Liver of rabbit after of malathion orally administration (15mg/kg). Parenchymatous degeneration of hepatocytes (tall black arrow), sinusoids dilation (short black arrow), vessel congestion (red arrow) and lipid vacuoles (pair arrow) H+Ex10 (At the right side).

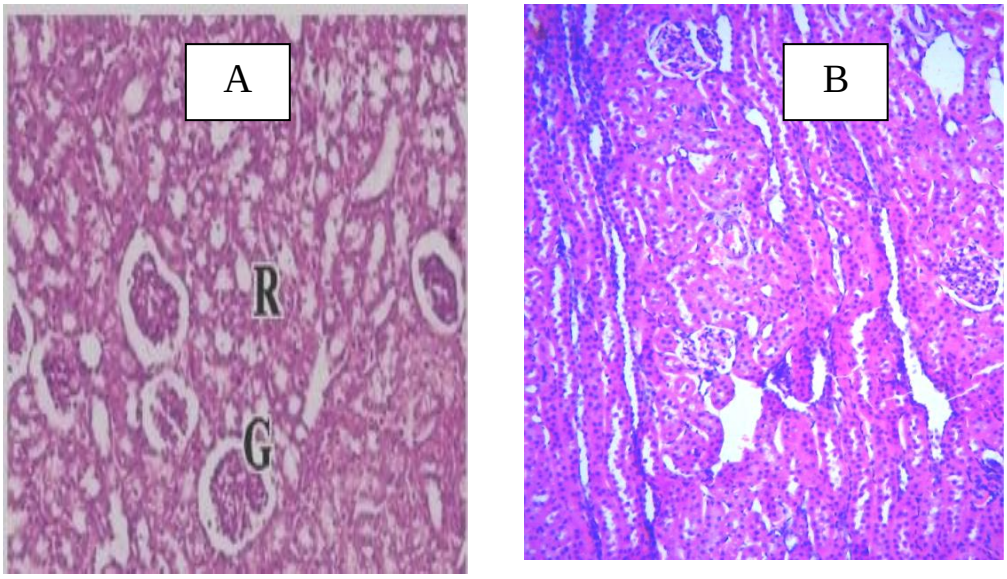

Figure-3: Control and low dose renal rabbit. A: Kidney of rabbit regular structure with capillaries, tubules (R), glomerulus (G). H+E, x10 (at the left side). B: Kidney of rabbit after malathion orally administration (5 mg/kg). Mild parenchymatous degeneration of cells of renal tubules (white arrow) and mild glomeruli shrinkage (black arrow). H+E,×10 (at the right side).

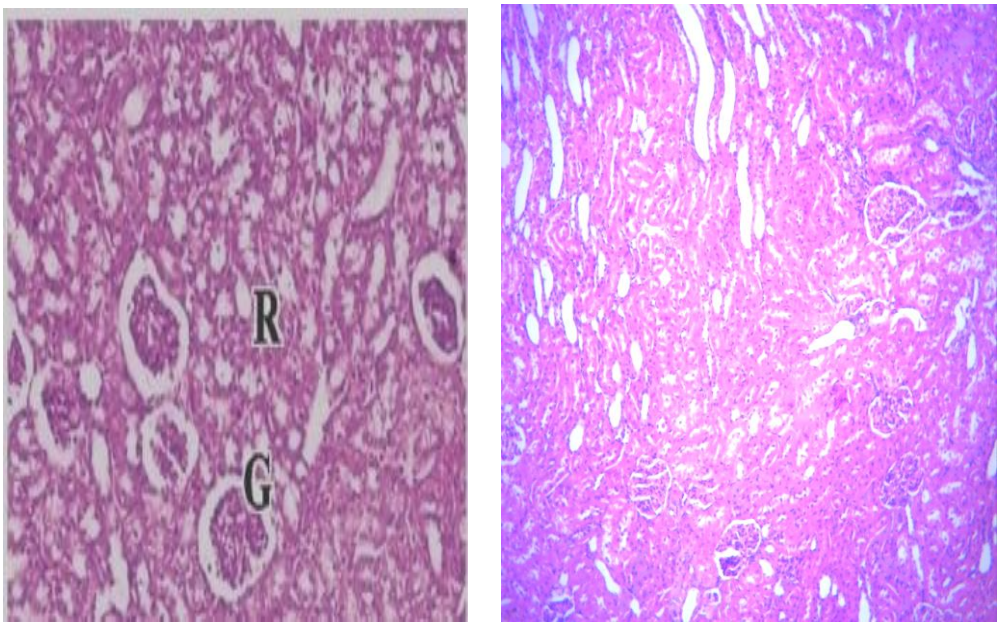

Figure-4: Control and high dose renal rabbit. A: Kidney of rabbit regular structure with capillaries, tubules (R), glomerulus (G). H+E, x10 (at the left side). B: Kidney of rabbit after malathion orally administration (15mg/kg). Moderate parenchymatous degeneration of cells of renal tubules and infiltration between the proximal tubules (black arrow) and moderate glomeruli shrinkage (white arrow). H+E, 10^{x}.

Conclusion

We concluded that malathion cause toxic effect in low dose and this effect was brightly appear with prolong exposure.

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