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RESEARCH ARTICLE

STUDY OF HISTOPATHOLOGICAL CHANGES INDUCED BY ENDOSULFAN IN KIDNEY OF ALBINO RATS

Sabiha Khan

Department of Zoology, Govt. College, Ajmer, India

Email: *dr.sabihakhan786@gmail.com*

ABSTRACT:

Endosulfan, a neurotoxic organochlorine insecticide and cypermethrin, a synthetic pyrethroid insecticide used to control pests in domestic, industrial, and agricultural situations. An effective dose (1/3rd , 1/6th of 0.28 ppm/kg-1 LD50) of endosulfan was injected to 4, 5 and 6 week of albino rats and its exposure was studied on histopathology of kidney after 15, 30 and 45 days of exposure. The histopathological changes in renal tissue of rats exposed to endosulfan by interdermal injection showed pronounced changes in the structure of renal corpuscles and caused renal necrosis. The examination revealed nephrotoxic effects on endosulfan treated rats. The effect of this pesticide on oxidative stress and its biodegradation were also explained. This review will be useful for the researchers working in the field of pesticides and will create an awareness regarding its hazardous effect.

Keywords: Endosulfan, histopathology, intradermal, nephrotoxic necrosis.

INTRODUCTION:

Pesticides have become an area of intense research due to its diverse properties and related effects. The demand for pesticide products and the concentration that they make towards agriculture efficiency are clear, but the volume of production indicates that the potential for misapplication and accidental exposure is very high. Besides being beneficial for increased crop yield and in vector control program, it has resulted in the manifestation of several health-related problems. Up to 90% of the pesticides used, never reach the intended targets[1], as a result, many other organisms sharing the same environment as pests due to which humans are accidentally poisoned. Widespread use of insecticides in animal husbandry and agriculture for many years lead to their contamination in the food chain and the environment. [2] Organochlorine and synthetic pyrethroids are extensively used in agriculture to control crop pests and in livestock to control parasites and ectoparasites. [3] Endosulfan is one of the synthetic organochlorine insecticide of the cyclodine group with a mixture of two stereo isomer:α-and β-endosulfan in the ratio of 70:30. It has widespread use in agriculture and forestry to control a wide verity of insect pests and on non food crops such as cotton and tobacco. The chemical is sometimes found to affect non-target organisms including human, in the course of its application. Although endosulfan is reported to be one of the most toxic pesticides in the market today, with its widespread use in agriculture, human are most likely to be exposed to it by eating food contaminated with endosulfan. Population that are usually susceptible to endosulfan include the unborn and neonates, the elderly and people with liver, kidney, immunological haematological or neurological disease[4]. Endosulfan is well absorbed through ingestion, inhalation and skin contact. endosulfan metabolism, with the renal tissue may as well cause cellular injury, hence, damage to the tissue. Once of the renal tissues are damaged, the overall functionality of the kidneys may be compromised. Renal dysfunction may be caused by several diseased conditions and exposure to toxins. Also renal dysfunction of any kind affects all parts of the nephron to some extent, although sometime, either glomerular or tubular dysfunction is predominant. The effect of renal disease on plasma and urine depands on the propotion of glomeruli to tubules affected and on the number of nephrons involved. Since endosulfan is a frequently used pesticide and the incidence of toxic injury to the kidney in relation to its widespread use reported in the literature. [5]

MATERIAL AND MATHOD:

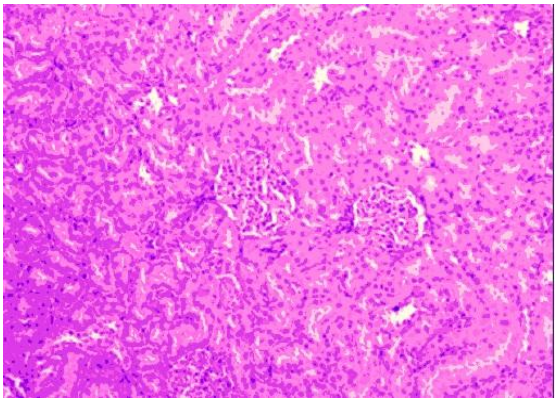
Chemical: The liquid endosulfan (Thioden 35% EC) used in this study was obtained from Northern Minerals Limited agrochemical shop in watt market, Ahmedabad, (Guj.)

Animals:

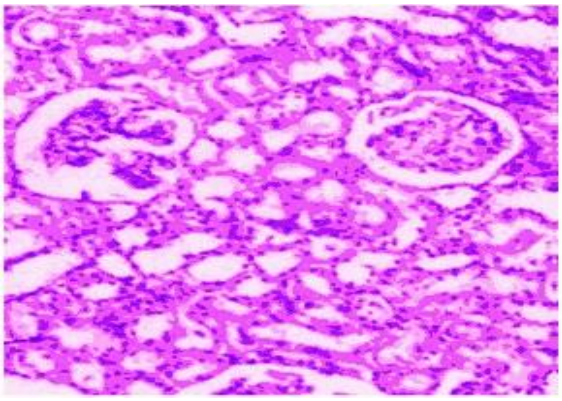
An effective dose (1/3rd , 1/6th of 0.32 ppm/kg^{-1} & sub lethal 0.32 ppm/kg^{-1}) of endosulfan was injected to 4, 5 and 6 week of albino rats respectively and its exposure was studied in histopathology of kidney after15, 30 and 45 days of exposure. Albino rats weighing between 38±40 gm were obtained. They were fed with a standard laboratory diet and tap water. Illumination was 12 h light/dark cycle and room temperature was 25±2°C. The animals were divided into two groups as experimental and control. The experimental rats were exposed to

endosulfan (0.32 ppm/kg^{-1}) for different duration 15, 30 and 45 days of exposure. Untreated animal were used as control. Both treated and control animals were sacrificed after certain intervals. After deeply anesthetizing the animals, the kidney was removed. The kidney of the albino rat was bean–shaped, smooth and possess convex and concave borders. Each of the kidney had dorsal and ventral surface, medial and lateral borders. The lateral border was convex while, the medial border was concave, indented hilus, and an upper and lower pole. The kidney tissue were cut into smaller pieces (5 mm) and immediately fixed in 10% formalin. The blocks were prepared for section cutting with a microtome by paraffin wax embedding method. Sections of 5 to 7 µ thickness were cut and stained with hematoxylin and eosin (H&E) stain. The stain sections were place in xylene for 20 minutes, then clean and mounted in D.P.X. The kidney of the animal exposed to dose of endosulfan showed significant changes, the result of present work showed the pathological symptoms.

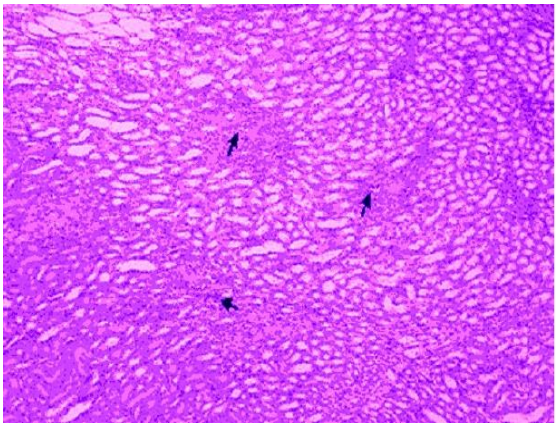
OBSERVATION:



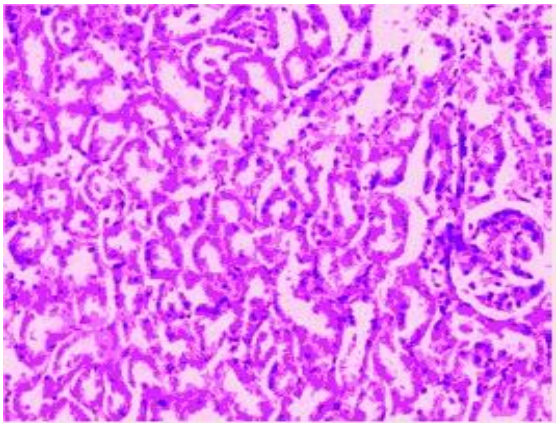
A Control



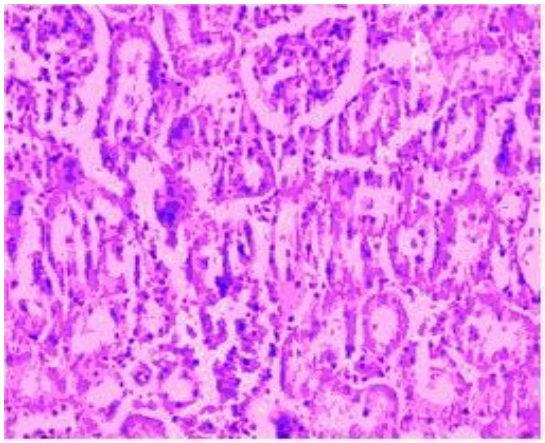
B 15 Days (4 week Rat)



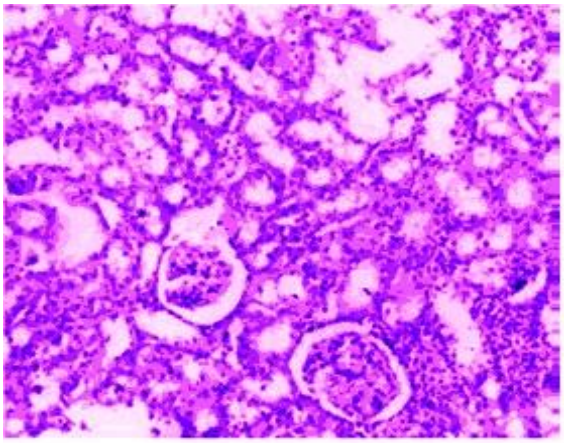
C 15 Days (5 week Rat)



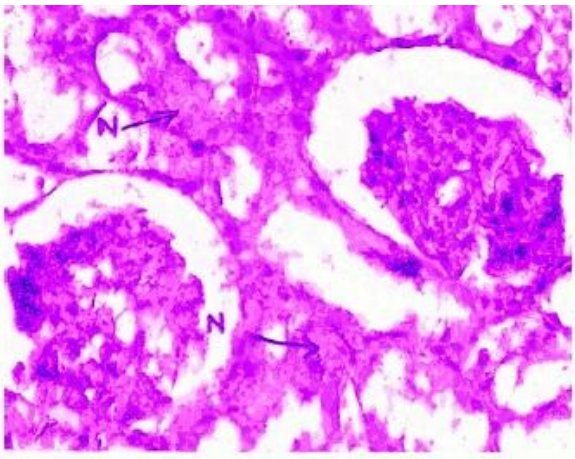
D 15 Days (6 week Rat)



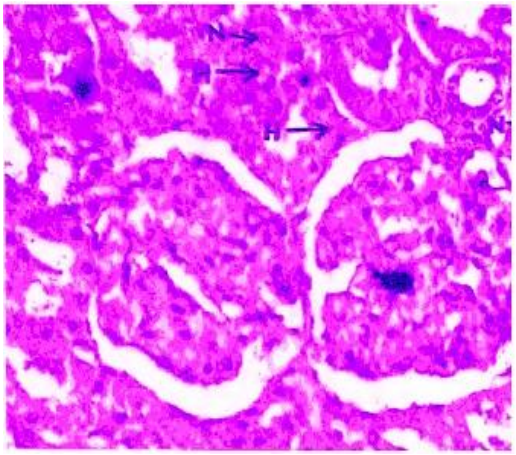
E 30 Days (4 week Rat)



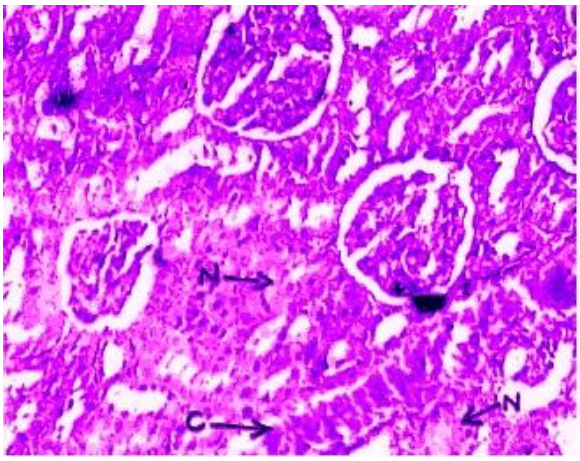
F 30Days (5 week Rat)



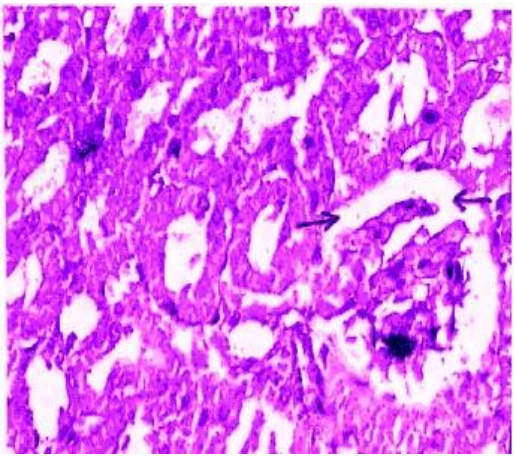
G 30 Days (6 week Rat)



H 45 Days (4 week Rat)



I 45 Days (5 week Rat)



J 45 Days (6 week Rat)

Figure 1; A-J

A Control
B Glumerula was enlarged & some cell of tubular epithelium were swollen
C Tubular epithelium was degenerated
D Hypertrophy of epithelium cell & degeneration changes
E Shrinkage of capillaries in glumerula
F Mild swelling & blurring of cytoplasmic body
G Cell inflammation & infiltration
H Hypertrophy & swelling of epithelial cell
I Enlarged cells in glomerulus and degeneration ofparenchyma
J Desquamated epithelium cell with renal necrosis

RESULT:

The histological structure of kidney tissue of rats in the control group kidneys were reddish-brown in color and were covered by a thin connective tissue capsule that was adherent to sub capsular connective tissue and rats exposed to endosulfan are showed renal cortex area was selected for histological examination with the light microscope, because this area which contain renal corpuscles and associated tubules, showed more pronounced histopathological changes in endosulfan treated animals, compared with the control. These histopathological changes in renal tissue of rats exposed to endosulfan by intradermal injection showed pronounced changes in the structure of renal corpuscle including swelling appearances, increasing urinary space, inflammatory cell infiltration degeneration of glomeruli and associate tubules structure. Also the result of histology of renal tissue obtained for the control rats showed normal renal corpuscles, consisting of a tuft of capillaries. The present study shown that exposure to endosulfan induced severe renal damages, as shown in the histopathological examination coupled with significant changes in kidney function. Kidneys of unexposed animals showed well-demarcated cortex and medulla, and intact capsule with well formed glomerular tuft. Degenerative changes were observed in proximal or distal convoluted tubules; glomerular tuft and Bowman's capsule were normal. Glomerula was enlarged & some cell of tubal epithelium was swollen, tubular epithelium degenerated, Hypertrophy of epithelium cell & degeneration changes, Shrinkage of capillaries in glumerula, Mild swelling & blurring of cytoplasmic

body, Cell inflammation & infiltration, Hypertrophy & swelling of epithelial cell, Enlarged cells in glomerulus, Desquamated epithelium cell with renal necrosis (Fig. A-J). The parenchyma revealed degeneration, desquamation and necrosis. Changes increased with duration of pesticide exposure. These were most severe 45 days post-treatment in indicating complete necrosis of tubular epithelium and hemorrhage was prominent in the glomeruli. Histopathology of tissues revealed mild to marked cellular changes upon administration of pesticides mixture to adult rats. The magnitude of manifestation depended on the health status of experimental animals. Histopathological changes in tissues of animals exposed to various chemical agents have been reported[6-8]. On the contrary, information on such changes under variable health condition is lacking and therefore, the present results cannot be compared with. However, microscopic changes in architectural pattern of tissues in protein-malnourished adult rats upon monocrotophos poisoning, as reported earlier [9], were alleviated in exposed animals when allowed to feed on high protein diet.

CONCLUSION

Not much histological changes were observed in cellular structure of unexposed rats or control. However, widened capsular space, degeneration and necrosis of renal tubular epithelia were noticed in exposed animals under varying health stress conditions. These damaging changes reflected action of toxic metabolites of pesticides under study. Microscopic changes were more pronounced in endosulfan treated animals suffering from protein malnourishment, indicating a severe nephro-toxic effect of chemical agents at the present dosage .The pesticide damage the functioning of kidney necrotized the renal tissue finally causing mortality at higher concentration. Hence its spray in agriculture should be checked.

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