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THE POLLUTANT EFFECTS OF COPPER, ZINC AND LEAD ON THE HISTOLOGICAL PATTERNS OF FISH KIDNEY

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ABSTRACT

The present study displayed the histopathological alterations produced In kidneys of *Sarotherodon galilaeus* fish following exposure to gradually ascending sublethal concentrations of ¼,½, LC_{50} and double LC_{50} for 5 days each.

Kidneys from fish exposed to the low levels of mel ats showed slight changes in the proximal convoluted tubular epithelium which were slightly vaculated and the nuclei of its cells were karyorhectic. Hypertrophy, cloudy swelling and hydropic degeneration of some renal tubules as well as congestion of kidney blood vessels were common among fishes exposed to the medium levels of mat els (½ LC_{50}). Atrophied cellular components of the Bowman's capsules and enlarged Bowman's spaces were also observed in such treated fishes.

In the fish groups exposed to the highest concentrations of zinc and lead, degenerations in the cytoplasm of tubular epithelial cells were so drastic to the extent that the tubules as a whole appeared as if they were ghosts of tubules.

The haemopoietic tissue was reduced in volume in fishes exposed to the LC_{50} of copper. It was crowded with necrotic cells in case of fishes exposed to the LC_{50} of lead. The above histological alterations are sufficient to cause

nephrotoxicity that may lead to impairment in the excretory function of the kidney.

INTRODUCTION

Pollution of the aquatic environment by heavy mel ats from industrial discharges causes hazards to the living animals including fishes. Bryan (1971) r eported that additional quantities introduced from industrial wastes or sewage, destroy the biogeochemical cycle.

Little work has been done on the toxicological effects of some heavy met als to the kidney of fish (Wobeser, 1975; Sipple *et al.*, 1983; Kirubagaran and Joy, 1988 and Wester and Canton, 1988). Early in 1959 , Vogel showed that gold fish treated with 100 mg/l of copper subjected to severe nephrotoxic and neurotoxic effects. Meanwhile, Baker (1969) reporteda that kidney of winter flounder subjected to considerable pathological changes.

Effects of other heavy mat els, such as cadmium (Gardner and Yevich, 1970) and mercury (Wobeser, 1975 and Wester & Canton, 1988), on kidney of fishes had been studied.

Recently, Leino *et al.* (1990) studied the multiple effects of aluminum and acid on the histology of the kidney of brook trout and fat-head minnows. Moreover, hyaline degenerations in kidney tubules were detected in some fish species following toxic additions of mercury (Trump et al., 1975) and exposure to sublethal levels of lead (Sipple *et al.*, 1983). Also,Hemelraad *et al.* (1990) detected changes in the ultrastructure of kidney mitochondria of *Anodonta cygnea* following exposure to heavy met als (cadmium). Likewise, glrahim *et al.* (1997) demonstrated accumulation of heavy met als in tissues of clams.

Other investigators reported that environmental stress resulted in variable histological responses in kidneys of fishes (Hendricks, 1971; Stevens and Bick, 1975; Colville *et al.*, 1983, and Hwang and Wu, 1988).

Nowadays, large number of factories and industrial companies are established near rives and on sides of their tributaries. Effluents, of a considerable bulk, of such projects are poured in these fresh water currents. Therefore, the present investigation was planned to detect and compare the deleterious changes that may be occurred in the kidney of one of the freshwater tilapian fish *Sarotherodon galilaeus* under the effect of different concentrations of either copper, zinc or lead. These heavy mat els were proved to be of toxic form (Portmann, 1970).

MATERIALS AND METHODS

Sarotherodon galilaeus of about 15±1 cm total length and 130±10 gm total weight from both sexes were collected from El-Abassa fish Farm at Sharkia Province. Fishes were maintained in 13 aquaria (10 fish in each) and supplied with continuously aerated fresh water and supplementary food for two weeks in order to acclimatize with laboratry conditions.

Following atomic absorption analysis of water from Nile river near the effluents of factories at industrial areas from three localities (Benha, Helwan and Kafr El-Ziat) the concentrations of copper, zinc and lead were estimated. These concentrations were found to be 6.25, 7.5 and 0.25 mg/L in average, for the three metals, respectively. Starting from these values, gradual increasing series of copper sulphate, zinc sulphate and lead nitrates were applied to calculate the 96 hrs-LC_{50}. The half lethal concentration (LC_{50}) for each mat ael was calculated by graphical straight line interpolation, plotted on a semilog paper (Litchfield and Willcoxon, 1949). The 96 hrs-LC_{50}s were found to be 27, 28 and 0.92 mg/l for copper, zinc and lead, respectivcly.

The first aquarium contained fishes living in non treated fresh water and considered as controls. Fishes of other twelve aquaria were exposed for 5 days to either ¼,½, LC_{50} or double the LC_{50} of copper, zinc and lead. The pH value in order to be adjusted between each aquarium was measured twice/day 7.6-8.4.

Slices from the Kidneys in each case were rapidly fixed in Bouin's fluid, dehydrated, cleared and then infiltrated with paraffin. Sections (6 microns) were stained by Haematoxylin and eosin (Harris, 1900).

RESULTS

The kidneys of *S. galilaeus* are similar in the two sexes. They are not very definite structures but greatly resemble those found in all teleostean fish. The kidneys of *S. galilaeus* are of the mesonephric type. They occur as two elongated brown bodies in the dorsal surface of the body wall above the swim bladder, one on each side of the vertebral column.

Normal histology of fish kidney

The kidney of *Sarotherodon galilaeus* is a compound tubular organ composed of huge number of renal units (nephron). Each one consists of Malpighian corpuscle, proximal, distal and collecting tubules. Inbetween these tubules, there is a haemopoietic tissue forming a connecting matrix. However, Malpighian corpuscle is composed of a well vascularized glomerulus inside the Bowman's capsule. The latter is formed of squamous epithelial cells. Between the glomerulus and the Bowman's capsule, there is a space which called the Bowman's space. The renal (Malpighian) corpuscle leads to the proximal segment through a short neck segment. The proximal convoluted tubules are lined with large cuboidal epithelial cells with a conspicuous eosinophilic brush border. The cytoplasm of these cells is eosinophilic, while their nuclei were basophilic, large, oval and centrally located. Each nucleus possessed a prominent basophilic nucleolus (Pl. I., Fig.1).

The collecting tubules are lined with cuboidal cells which are slightly eosinophilic and have spherical nuclei with prominent nucleolus. The lumen of these tubules is wider than that of the proximal and distal ones.

The haemopoietic tissue, located inbetween the renal tubules, is composed of polygonal slightly basophilic cells with spherical nuclei. Few scattered blood corpuscles are seen in this haemopoietic tissue (Pl. I., Fig.1).

Histopthological changes

1- Effect of Copper

¼ LC_{50} of Copper

'In fish exposed to 6.75 mg/L Cu^{2+} (1/4 LC_{50}), the renal tissues were slightly altered. The most obvious histopathologic response recorded was hydropic degeneration of cells of some proximal and distal convoluted as well as tubule The glomerul were crowded with strongly basophilic nuclei (P1. I, Fig 2).

½ LC_{50} of Copper

The kidney from fish lived in the aquaria containing 13.5 mg/l Cu^{2+} showed many histopathological changes which were mainly inflammatory signs. Large spaces were seen around the glomeruli which were atrophied, while the haemopoietic tissue was crowded with infiltrated cells. Cells of some tubules were suffering from more degenerations, and the brush borders of most proximal tubules became shorter (P1. I, Fig. 3).

LC_{50} of Copper

A more progressive picture of the forementioned lesions in the previous concentration was detected in the kidney of fish *(S. galilaeus)* from aquaria containing the sublethal concentration (27 mg/l Cu^{2+}). Different inflammatory were seen in the renal tubular epithelium including hypertrophy and hydropic degeneration of the renal tubules as well as congestion of the renal blood vessels. Cells of the proximal and distal tubules were enlarged and revealing prominent hydropic degeneration, their nuclei were also hypertrophied and appeared more elongated (P1. I, Fig.4).

Double the LS_{50} of Copper

Fish subjected to 54 mg/l Cu^{2+} showing with advanced signs of degeneration in its renal segments. Degenerations in the cells of the distal and

collecting tubules were clear and started near the bases. In the proximal tubules as a whole seemed as if it was a ghost of tubule. The haemopoietic tissue was greatly altered with their cells accumulated and clumped together (P1. I, Fig. 5).

2- Effect of Zinc

¼ LC_{50} of Zinc

The fish exposed to 7 mg/l Zn^{2+} showing kidneys with a rather normal appearance. No clear histopathlogical changes were observed in the nephron constituents (renal corpuscles, neck segment, proximal segment, distal segment and the collecting duct system) (P1. II, Fig. 6).

½ LC_{50} of Zinc

Kidneys from fish held in aquaria containing 14 mg/1 Zn^{2+} showed widened Bowman's space and shrinkage of the glomerular tuft of blood capillaries cells were slightly enlarged. On the other hand, the distal convoluted tubules had a wider lumen than control. The nuclei of the cells lining the proximal and the distal tubules showed normal appearance and had a prominent nucleolus. However, in some renal tubules, there was a hydropic degeneration which we more apparent in the proximal ones (P1. II, Fig.7).

LC_{50} of Zinc

Fish in this group were subjected to 28 mg/l Zn^{2+} (5- days LC_{50}). The proximal tubules showed hydropic degeneration in the whole cytoplasm of their lining cells and it was advanced in their upper regions. On the other hand, degeneration in the distal convoluted tubules was observed at the basal regions of their lining cells. Nuclei of the altered cells were also suffered from pyknosis and some others were karyorrhectic. The haemopoietic tissue in most regions showed an abnormal appearance, where aggregated clumps of cells as well as blood corpuscles with deeply basophilic, pyknotic were also seen on a diffusely reddish ground matrix (P1. II, Fig .8).

Double the LC_{50} of Zinc

The fish exposed to the highest levels of zinc (56 mg/l Zn^{2+}) showed kidneys with severe signs of degenerations in the nephron segments. The nuclei of the glomerular cells were pyknotic, coalesced together and deeply basophilic, while Bowman's space was relatively enlarged. Outside the Bowman's capsules, eosinophilic blood were infiltrated. Extraglomerular amyloid degeneration was also observed.

The proximal tubules showed severe hydropic degenerations and fatty changes, whereas the nuclei were karyorhectic in some cells while other cells revealed nuclear karyolysis. At the same time, the brush border of these tubules as well as the basal laminae were intact and strongly eosinophilic. In fact, the proximal tubules with these pathologic alterations appeared as ghosts of tubules.

The distal convoluted tubules were clearly suffered from degenerations in the basal regions of their lining cells. Nuclei of the latter cells were obviously pyknotic. The spaces occupied by the haemopoietic tissue were greatly restricted due to the dilation of the nephritic tubules. Cells of the haemopoietic tissue were necrotic with pyknotic nuclei (Pl. II, Fig.9).

3- Effect of Lead

¼ LC_{50} of Lead

The fish exposed to 0.23 mg/l Pb^{2+} showed mild changes in the kidney. Occasionally, the glomeruli were normal were confined to the proximal convoluted tubules. These tubules were slightly vaculated and some nuclei of their lining epithelia were enlarged in size and showed karyorhexis. Other tubules were less affected and revealed slight pathologic alterations. The cytoplasm, of the epithelial cells of the renal tubules was slightly eosinophilic, while their nuclei were deeply basophilic (Pl. III, Fig. 10).

½ LC_{50} of Lead

Pathologic alterations in the kidneys of fish inhibated aquarium of 0.46 mg/l Pb^{2+} (1/2 LC_{50}) were more drastic, Degenerations were pronounced specially at the basis of the cells lining the distal segments and tips of that lining the proximal tubules. Nuclei of the epithelial cells in both types of tubules were prevailing different degrees of pyknosis. Cells of the haemopoietic tissue were exhibiting necrotic changes and their nuclei were accumulated together and coalesced in addition to their pyknotic appearance (Pl. III, Fig. 11).

The LC_{50} of Lead

The kidney of the fish subjected to 0.92 mg/l Pb^{2+} (5-days LC_{50}) showed advanced alterations represented by higher degenerative changes in their proximal tubules. Also, the degeneration at the basal areas of the cells lining the distal tubules were more severe than those observed in the previous case. In addition, the haemopoietic tissue was necrotic and reduced in volume, while the nuclei of its cells were clearly pyknotic (Pl. III, Fig. 12).

Double the LC_{50} of Lead

The kidney from fish of this group which exposed to 1.84 mg/l Pb^{2+} (double the LC_{50}) showed many signs of degeneration which was more severe and reached the highest level of deformation. The outlines of the epithelial cells of both proximal and distal tubules were disappeared, and the cytoplasmic degeneration in some cells was complete. However, in such cells the nuclei, in spite of their pronounced pyknosis, still present and persisted karyolysis. The nephric tubules consequently lost their constituent feature and looked as if they were ghosts of tubules. The different renal segments compressed the haemopoietic tissue which was reduced in volume (Pl. III, Fig.13).

DISCUSSION

The kidney of teleost fishes is a compound tubular organ with a massive highly vascular structure containing vast numbers of convoluted tubules

separated from one another by haemopoietic, reticulo-endothelial and internal cells (Hickman and Trump, 1969; Ali, 1978; Beder, 1983; Al- Zahaby *et al.*, 1985 a&b and Ghonemy, 1986).

As regards to the histological structure of the tilapian kidney, in all teleost fish, it was formed mainly of renal units or nephrons, which in turn consisted of Malpighian corpuscle comprised a well vascularized glomeruli, short ciliated neck segment, proximal convoluted tubule with brush borders, an intermediate segment, distal convoluted tubule and collecting duct system.

The neck segment is lined by cuboidal cells possessing cilia, while the proximal convoluted tubules are lined by pyramidal cells with narrow lumen and have brush borders. However the distal convoluted tubules are lined with short columnar cells without brush borders, while the collecting tubules are lined with large cuboidal epithelial cells, possessed a wider lamina. These epithelial cells have a basally located nuclei with prominent nucleoli. These results had been observed also by Beder (1983) in *Clarias lazera*, Al- Zahaby *et al.* (1985a) in *Cyprinus carpio* and Ghonemy (1986) in *Tilapia nilotica*. In between the renal units, an internal tissues formed of polygonal cells and haemopoietic tissues can also be seen. The haemopoietic tissues formed a support matrix for the nephrons of the posterior kidney (Hickman and Trump, 1969).

In the present investigation, *Sarotherodon galilaeus* showed several histopathological alterations, that were related to the exposure to different levels of heavy met als. Accumulation of heavy mat els in kidneys may be an important factor in their injury. However, accumulation patterns of heavy mat els are dependent on both uptake and elimination rates (Gomaa *et al.* ,1995). These met als; copper, zinc, and lead; made differences in the ionic composition of their environment. The most significant changes observed in the kidney were glomerular and renal tubules swelling, hydropic and vacuolar degeneration of the tubular epithelium and congestion of the kidney blood vessels, as well as the presence of pigment granules inbetween the renal tubules and nearest the renal.

corpuscles. The above alterations which were confined to the trunk kidney, are sufficient to cause nephrotoxicity

Kidney, from fish exposed to copper and zinc, showed slight swelling of the epithelial cells lining the proximal convoluted tubule as well as that lining Bowman's capsule. Similar results were observed in the kidney of rainbow trout exposed to methyl mercury (Wobeser, 1975). Newborn guppies exposed for a long period to zinc revealed distended tubules and glomeruli and then kidney tubules were expanded (Grandall and Goodnight, 1963). Swelling and hypertrophy of the proximal convoluted tubules epithelium was also., the histopathologic alterations detected in the kidneys of the rats under the effects of industrial solvent (trichloroethylene) and, in general, stress factors (Rashwan *et al.*, 1988 and Khater *et al.*, 1991). According to Abd- El- Dayem (1990), the swelling of the epithelial cells of proximal convoluted following treatment with benzyl alcohol could be an indication of regenerative changes in these tubules. Swollen cells of proximal and distal convoluted tubules have either obliterated lumena or contain debris of tissues (Adieb *et al.*, 1986).

Amyloid degeneration in kidney tubules was reported in fish subjected to zinc. Nearly similar finding had also been reported in fish following toxic additions of mercury (Trump, *et al.*, 1975), the rodenticide,Warfarin (Fernandez, 1977), and sublethal levels of lead (Sippel et al., 1983).

Moreover, cloudy swelling was a pathologic alteration observed in the epithelial cells lining the nephric tubules, especially the proximals, proceeding hydropic degeneration in copper or zinc toxicity groups.

It seemed likely that cloudy swelling is a common pathologic alteration displayed by the kidneys affected by various substances. It was also described in renal tubules of rats following caffeine or phenacetin (drug) administration (Tadros *et al.* 1985 and Tadros & Mohamed, 1990), respectively, as well as in hen's renal tubules following application of the epileptic drug, diphenyl-hydanation sodium (Tadros and Abdel Halim, 1990).

S. galilaeus that subjected to the highest concentration of zinc and lead, ghosts of proximal tubules with still present pyknotic nuclei were the only demonstrated changes. Similar description was detected by Moussa and Abdel-Ghaffar (1989) in some renal tubules of rats treated with high doses of "Feldene". It was also detected that hydropic degeneration was so severe to the extent that nothing was seen except parts of the cell boundaries and the compressed dark nuclei.

Kidneys of lead-exposed fish showed that the bases of the renal tubular epithelium were sometimes vaculated. There was also a slight degree of enlargement of intercellular spaces of the tubular epithelium. These renal abnormalities were markedly similar to those produced in the isolated tubules of the English sole incubated in potassium-free buffer (Hickman & Trump, 1969) and in the brood stock and fathead minnow (Leino *et al.*, 1990) exposed to acid and aluminum. Similar findings were reported by El-Bouhy *et al.* (1993) in kidneys of fishes exposed to mercury toxicity, where the necrotic epithelium of renal tubules appeared dissociated from their basement membrane.

Degenerations of the renal segments was a prominent feature detected in kidneys of nearly all the exposed fishes. Degenerations were seen near the bases of the distal convoluted tubules and extending upwards, while those demonstrated in the proximal convoluted tubules were starting in the apical regions of the cytoplasm. In some severe cases, at high concentrations of met als, the cytoplasmic degeneration in the epithelial cells was greatly proceeded. In such cells, the nuclei in spite of their obvious pyknosis, still present and persisted Karyolysis. The nephric tubules were nearly looked as if they were ghosts of tubules. These signs of necrosis and inflammations of the kidney tubules due to heavy mat el toxicity are in consistency with those of Baker (1969), who described vacuolatin and disintegration in the apical portion of the renal tubular cells of copper-exposed flounder, *Pseudopleuronectes americanus*. Vacuolar degeneration of tubular cells and destruction of some of these cells were also observed by Abdel-Latif (1990) in kidneys of *Gambusia affinis* exposed to copper. According to Wester and Canton (1988), histopathological changes in the kidney tubules of guppy and medaka fishes,

exposed to mercury, were characterized by single cell degeneration and necrosis.

Tubular necrosis was recognized by coagulative necrosis of the tubular epithelium with pyknosis of nuclei and exfoliation into the lumen (Schewie *et al.*,

1991). Focal coagulative necrosis of renal epithelium was demonstrated in kidneys of cadmium (El-Bouhy *et al.*, 1993). In such case the renal epithelium was represented by homogeneous eosinophilic cytoplasm with absence of their nuclei. Damage of the kidney units appeared also in the cadmium-exposed fish, *Fundulus heteroclitus* (Gardner and Yevich, 1970). The damage appeared limited to some proximal tubules which exhibited pink staining granular casts with nuclear debris. Others showed various stages of degenerations.

Renal necrosis was also proved to be induced in the kidney of rat by mercury intoxication (Cuppage *et al.*, 1972 and Nada *et al.*, 1981). Such necrosis was characterized by loss of nuclei and coagulative changes in the cytoplasm. The necrosis was also associated with focal dilation of the convoluted tubules.

The haemopoietic tissue was also necrotic and had pyknotic nuclei in lead groups, or infiltrated with clumps of cells in copper groups or restricted and very much reduced in volume and greatly occupied with clumps of cells and blood corpuscles in zinc group. The haemopoetic tissue was also necrotized and very much reduced in copper-exposed flounders (Baker, 1969). El-Bouhy *et al.*, (1993) reported that, the interstitial tissue in the kidney of fishes exposed to cadmium toxicity was depleted of haemopoietic elements and focal haemorrhage was detected among renal tubules. Hyperplastic haemopoietic interstitial tissues with large polygonal basophilic cells were demonstrated in the guppy and medaka fishes following exposure to mercury (Wester and Canton, 1988). Conversely, Adel-Latif (1990) found that the haemopoitic tissue of *Gambusia affinis* larvae exposed to copper was increased pronouncedly around the glomeruli and uriniferous tubules.

Conversely, Wobeser (1975) and El-Bouhy *et al.* (1993) found that, glomeruli of fish subjected to high levels of met al toxicity especially mercury and cadmium, respectively, had contracted and atrophied glomeruli, so the Bowman's spaces were widely dilated. At the same time, glomeruli appeared shrunken in kidneys of trouts from the wost Salim lakes (Galat *et al.*, 1985). Similar findings were also reported by Miettimen *et al.* (1970) in pike and rainbow trout. Also, Kumar and Sirvastiva (1980) observed glomerular shrinkage in *Channa punctatus* after 10 days in an 8% Na Cl solution.

The present attained findings may lead to the suggestion that factories should be prevented from pouring their effluents in rivers and their tributaries. This is because such category is one of the most important aspects of pollution to the fresh water environment and drastic hazardous effects were proved, by results of the present study, to be produced in internal organs of fishes living in such polluted waters.

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LEGEND OF FIGURES
PLATE (I)

Fig.1: A section of the kidney of control *S. galilaeus* showing the nephron sigments; the renal corpuscles, the proximal convoluted tubule (P),the distal convoluted tubule (D) and collecting tubule (ct). (X480).

Fig.2: A T. S of kidney from a fish subjected to copper showing hydropic degeneration of the proximal convoluted tubules (P) and periglomerular edema (arrow).

Fig.3: A T. S of kidney from a fish exposed to copper demonstrating shrinkage of the glomerular tuft of capillaries (G) leading to widening of the Bowmans space, hydropic and vaolar degeneration of the convoluted tubules (ct). The haemopoietic tissue is crowded with infilterated cells . (X240).

Fig.4: A T. S of kidney from a fish subjected to the LC_{50} of copper. Note the reduced volume of the haemopoietic tissues and hypertrophied renal tubules (rt). Epithelial cells of tubulees are hypertrophied and revealing signs of hydropic degeneration.(X480)

Fig.5: A T. S of kidney from a fish subjected to the highest concentration of copper. Degenerative areas are seen at the bases of epithelial cells of distal and collecting tubules while the proximal ones look like ghosts of tubules, Haemopoietic tissue is altered (X240).

PLATE (II)

Histopathology in sections from kidneys of fish exposed to sublethal concentrations of zinc (X480).

Fig.6: A T. S of kidney from a fish, *S. galilaeus*, exposed to zinc. Note the proximal (P), distal (D) convoluted tubules and the haemopoietic tissue (hp) revealing a rather normal appearance.

Fig.7: A T. S of kidney from a fish exposed to zinc showing glomerulus with enlarged Bowmanns space (Bs) and hydropic degeneration in some renal tubules. Note the macula densa (md) of the distal convoluted tubules.

Fig.8: A T. S of kidney from a fish subjected to the LC_{50} of zinc showing hydropic degeneration of the proximal convoluted tubules (P) and peritubular degeneration of the distal tubules (D). Nuclei of the altered cells are pyknotc *karyorrhectic.*

Fig.9: A T. S of kidney from a fish exposed to the high levels of zinc. Note hydropic degeneration in epithelial cells, amyloid degeneration (A) and vacuolar degeneration of proximal (P) and distal (D) convoluted tubules. Also, pyknotic and *karyorrhectic* as well as karyolytic nuclei are deteced. Numerous proximal tubules are seen as ghosts of tubules.

PLATE (III)

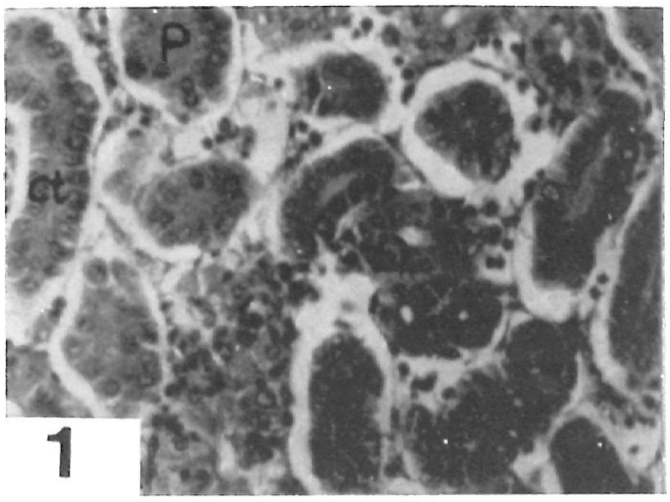
Histopathology of kidneys from fish exposed to sublethal concentrations of lead and stained with haematoxylin and eosin (X480).

Fig.10: A T. S of kidney from fish, *S. galilaeus*, exposed to the low levels of lead showing the proximal (P) and the distal (D) convoluted tubules with slight pathologic alternations. The glomeruli showing obvious swelling with deeply basophilic cells.

Fig.11: A T. S of kidney from fish subjected to lead showing peritubular degeneration (arrow). The nuclei of tubules revealing different stages of pyknosis.

Fig.12: A T. S of kidney from fish subjected to lead showing cloudy swelling and vacuolar degeneration of the proximal (P) and distal (D) convoulted tubules while their nuclei are clearly pyknotic.The hemopoietic tissue is crowded with necrotic cells.

Fig.13: A T. S of kidney from fish subjected to lead demonstrating cellular and nuclear alternations. Note the deformation of the cells lining the renal tubules (rt). The nephric tubules look like ghosts of tubules.



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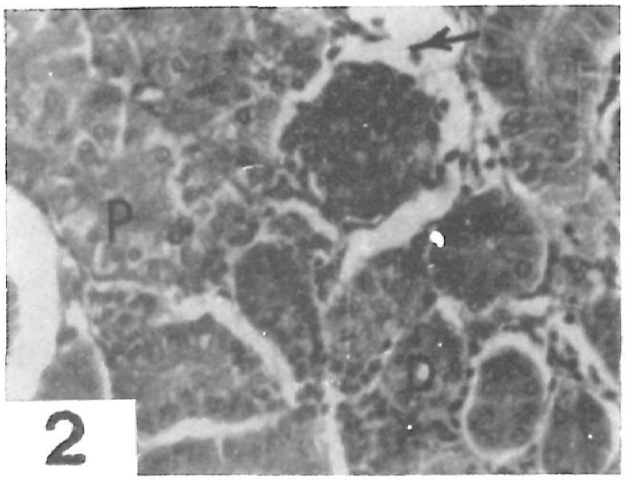

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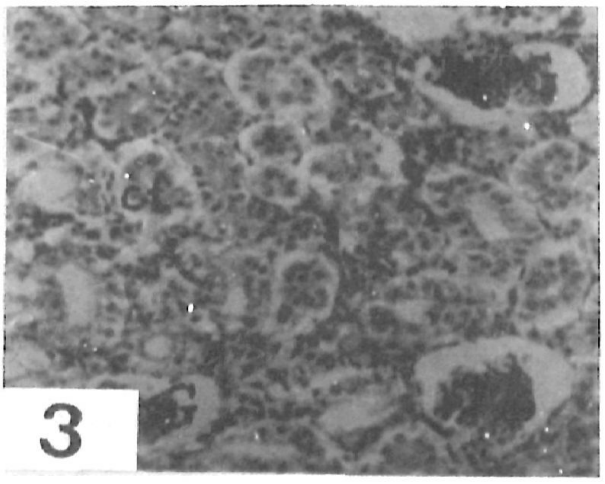

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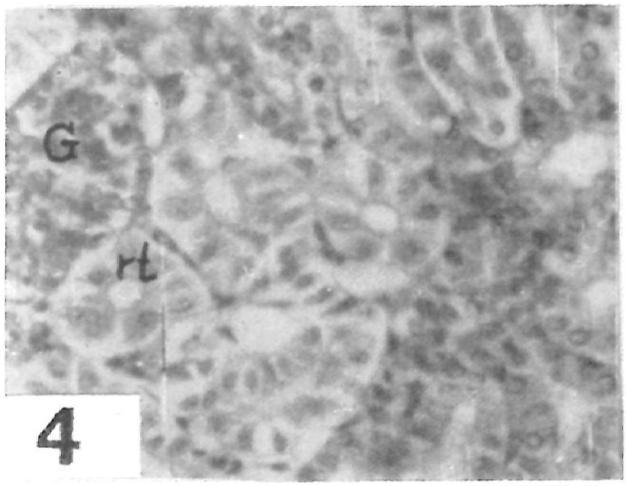

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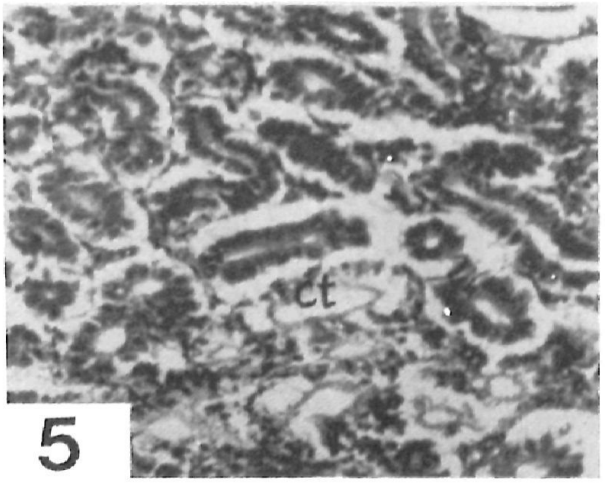

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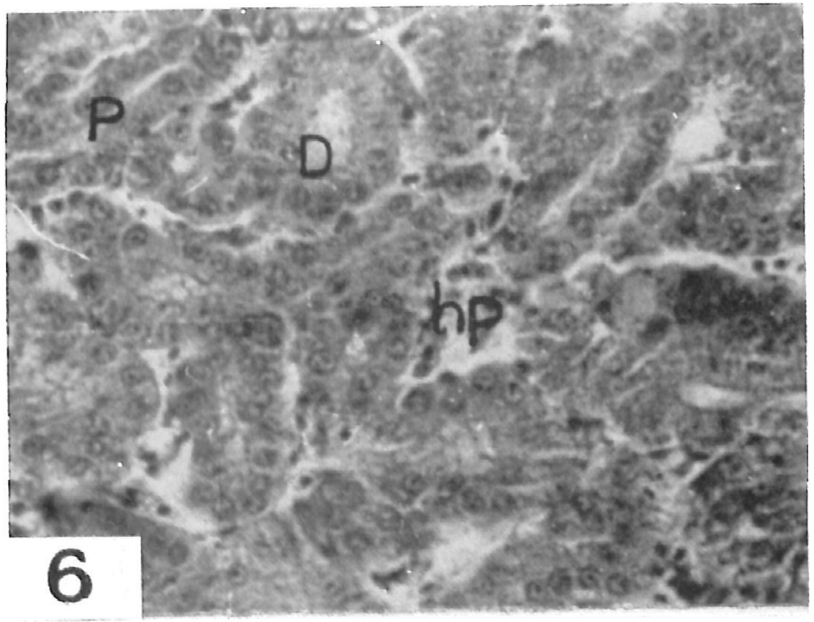
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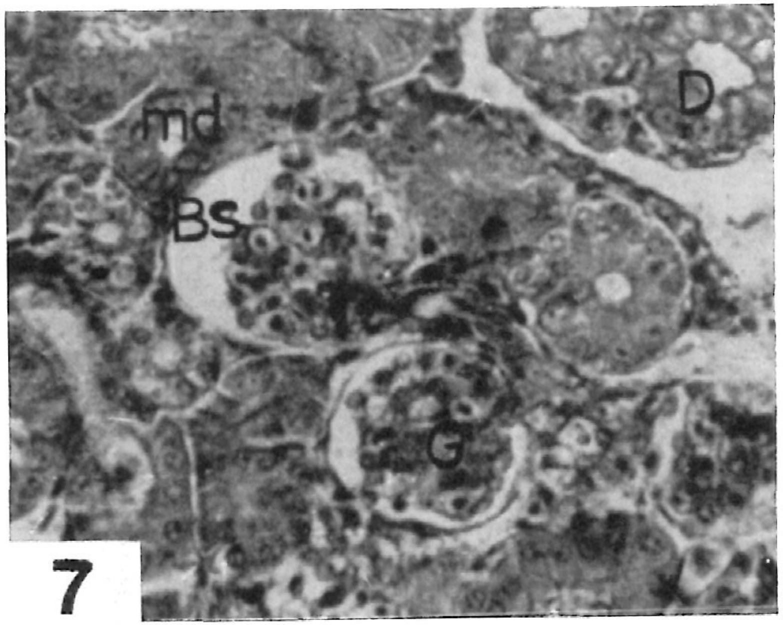
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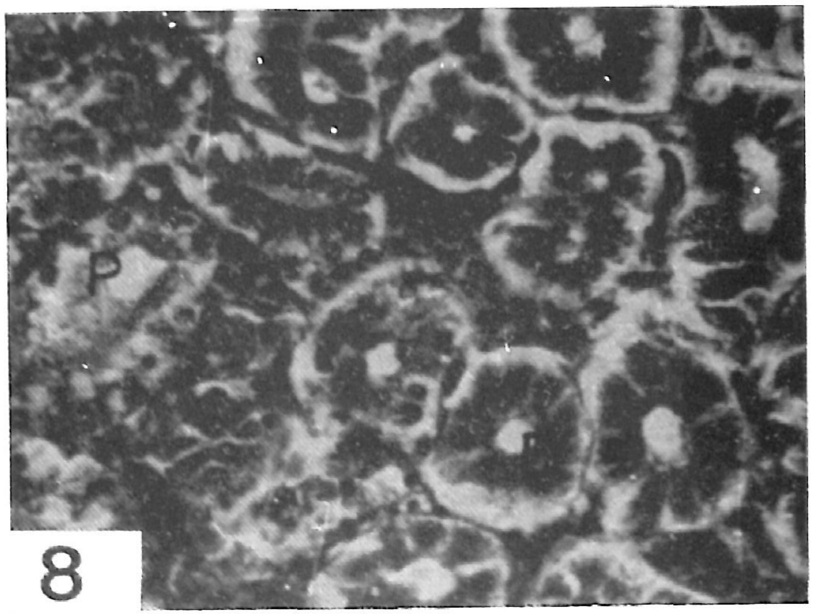
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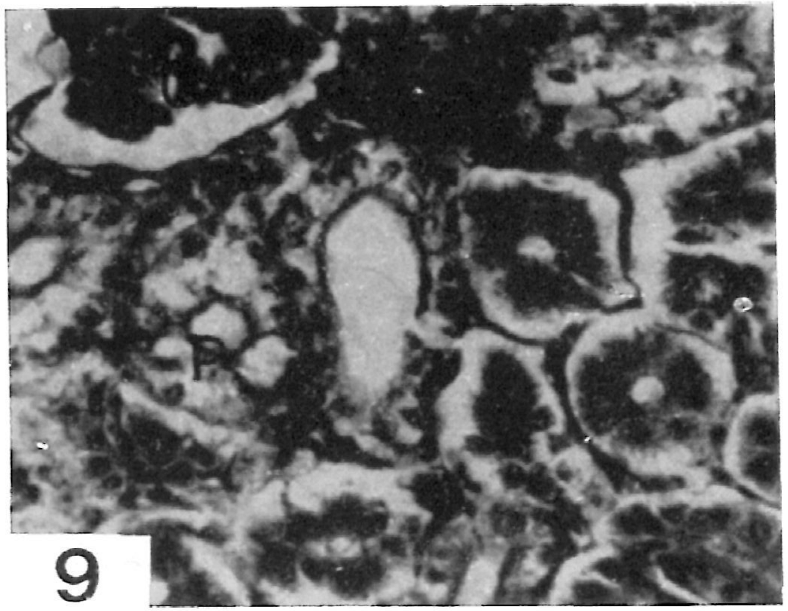
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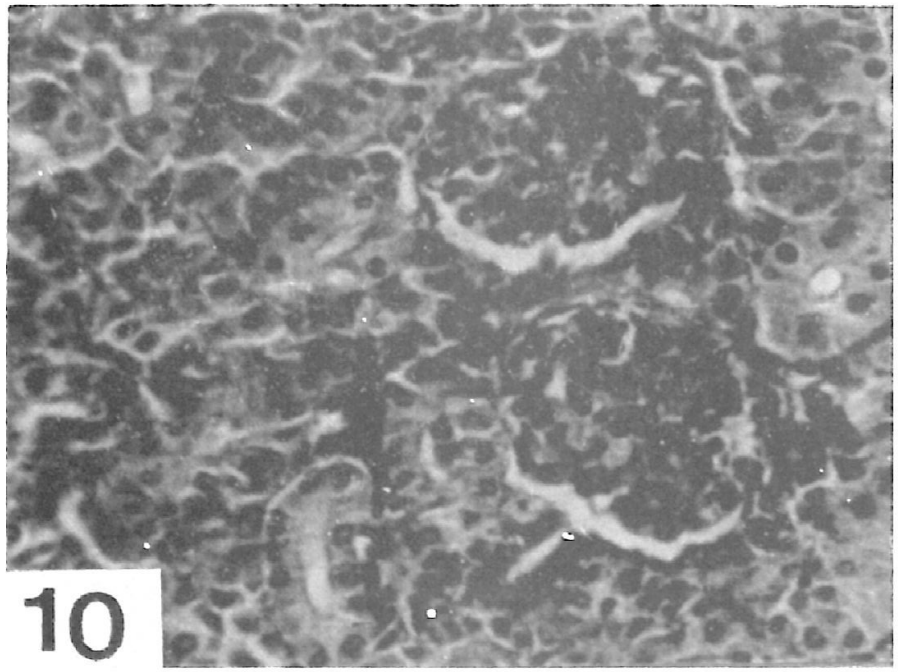

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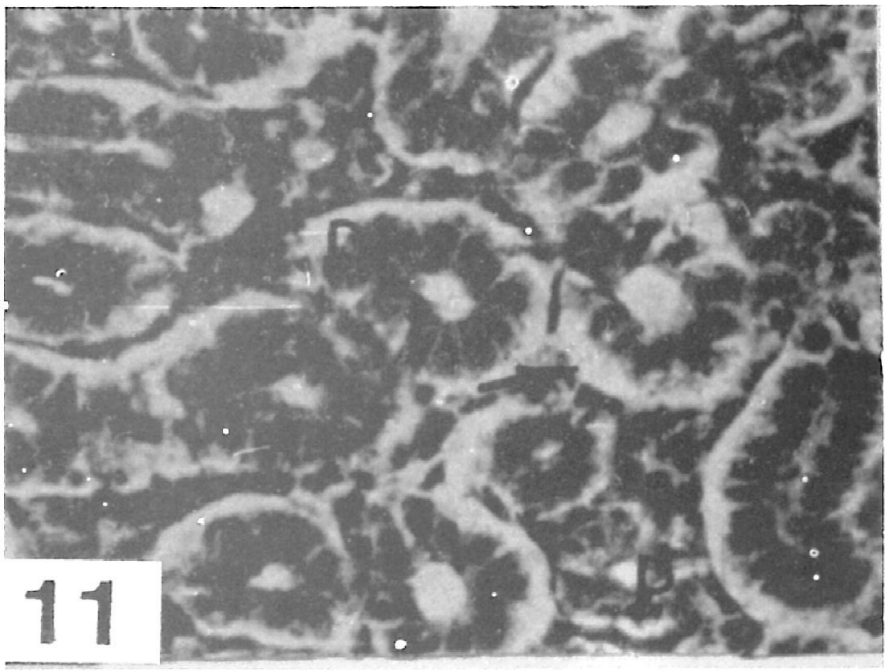

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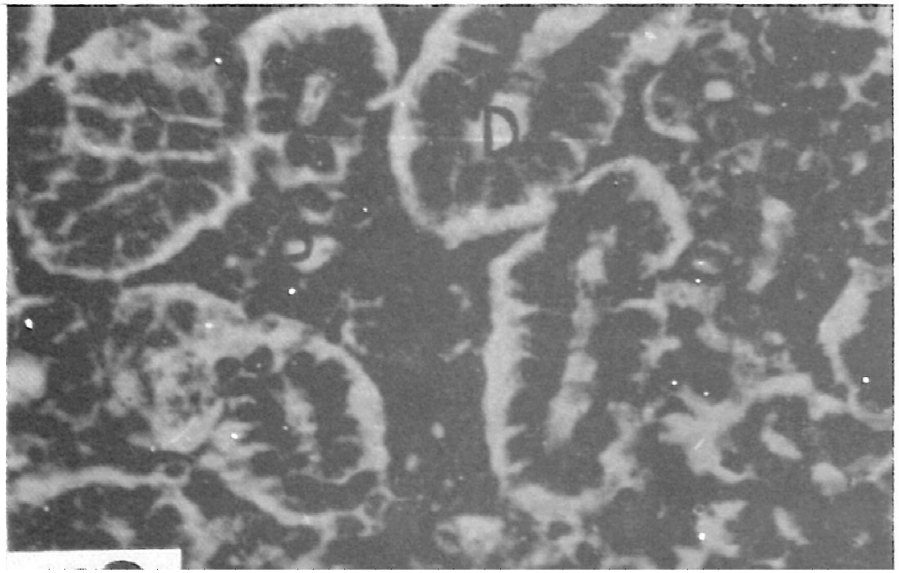

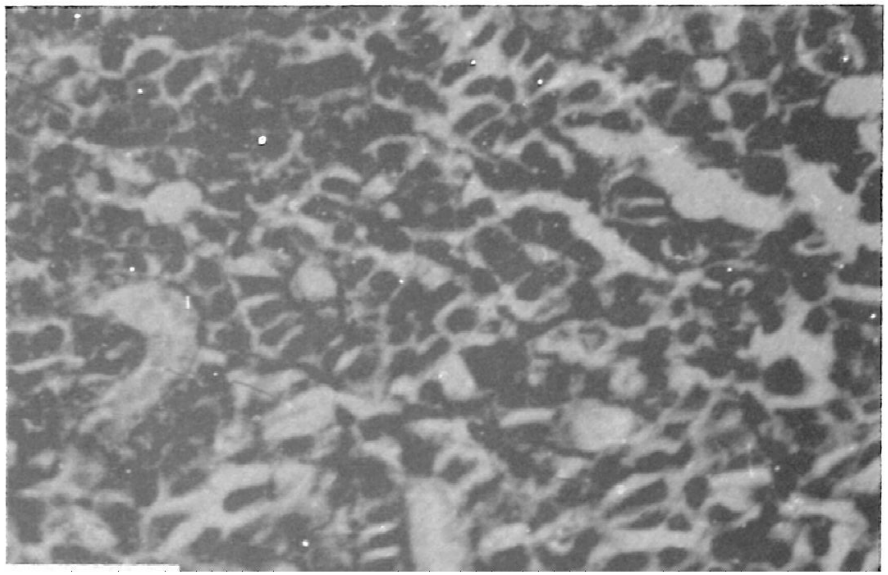

تأثيرات التلوث بالعناصر الثقيلة (النحاس و الزنك و رصاص)على هستولوجية كلية الأسماك

الأحمدى الذهبى ، كامل زكى حميد ، جمال على ، وعمر غنيمى

كلية العلوم جامعة الزقازيق

أصبح من المألوف تلوث المياة العذبة والداخلية بالعناصر والمعادن الثقيلة نظرا" للتقدم الصناعى الذى أدى الى إنشاء العديد من المصانع على ضفاف الأنهار وقرب مصادرها مما يهدد الحياة البيولوجية فى هذه الكتل المائية بالخطر.

وأجريت هذه الدراسة لتحديد أثر مثل هذه الملوثات على أنسجة الأسماك (كلية البلطى الأبيض) ، وفى البداية تم تحديد التركيز النصف مميت لنصف عدد الأسماك، وعرضت الأسماك لتركيزات متزايدة تدريجيا" من النحاس والزنك والرصاص تمثل ربع ونصف التركيز النصف مميت وكذلك التركيز النصف مميت وضعف التركيز النصف مميت، وتركت إحدى المجموعات كمجموعة ضابطة.

وبعد مرور خمسة أيام من التعرض المستمر شرحت العينات وأخذت الكلى وبعد التثبيت والطمر فى الشمع صبغت قطاعات الكلى فى الهيماتوكسالين والإيوسين وأجرى الفحص الميكروسكوبى لدراسة التغيرات الحادثة فى النسيج.

وأظهرت نتائج الدراسة أن التغيرات فى كلى الأسماك التى تعرضت لتركيزات منخفضة من العناصر كانت طفيفة، وبدأ ظهور تحلل فجوى فى بعض خلايا الأنيبيبات الملتفة القريبة، وفى العينات التى تعرضت لتركيزات متوسطة (نصف الجرعة المميتة) ظهر فى كلياتها تضخم فى حجم بعض الأنيبيبات البولية ، وأظهر الكثير من الخلايا انتفاخا" زلاليا" كما حدث تحلل مائى فى بعض الأ نيبيبات، ولوحظ احتقان دموى فى الأوعية الدموية، وتبعه تنخر فى بعض خلايا الوحدات البولية وكذلك فى محفظة "بومان" والكبة.

وفى مجموعة الأسماك المعرضة للنحاس لوحظ تراكم بعض الخلايا الطلائية داخل الأنيبيات الجامعة والقنوات الميزونيفرية واتساع واضح فى حيز محافظ "بومان" ،وبدأ التحلل يظهر فى سيتوبلازم العديد من الخلايا الطلائية المبطنة للأنيبيات البعيدة والأنيبيات الجامعة عند قواعد تلك الخلايا.

وأدى التعرض للتركيزات العالية من الزنك والرصاص إلى تحلل فى سيتوبلازم الخلايا الطلائية المبطنة لكل من الأنيبيات القريبة والبعيدة وكان هذا التحلل عند استخدام ضعف الجرعة النصف ميتة يفقد الأنيبيات شكلها المورفولوجى المميز وبدت مع تواجد بقايا الخلايا وكأنها أشباح أنيبيات.

ومن ناحية أخرى أدت العناصر الثقيلة إلى نقص فى حجم النسيج البين أنيبى للكلية مع تكدسه بالخلايا الغير حليمة. وكانت كل هذه التغيرات الهستوباثولوجية كافية للتدليل على والتحذير من خطورة وأضرار العناصر الثقيلة فى إتلاف نسيج الكلى ومن ثم عطب عمل الكلية وعدم قدرتها على آداء وظيفتها الإخراجية.