Original Article

Biochemical and Histopathological Alterations of Oreochromis Niloticus Fish Related to Heavy Metals in Lake Nasser, Egypt

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ABSTRACT

Introduction: Lake Nasser is the one of the longest man-made lakes in the world. The surface area and water level of the lake are depending mainly on the annual flow of flood water comes from the Blue Nile from the Ethiopian highlands, it is a major source used for drinking irrigation, fisheries and other domestic purposes.

Material and methods: Fish samples were collected from five stations in lake Nasser including Khor Forgond, Khor Toushka west, Khor Ahmer, Garf Hussen and Khor Ebreem during summer 2019. The determination of blood serum glucose, total protein, albumin, total lipids, creatinine, urea, uric acid AST and ALT were carried. Also, the accumulation of iron, manganese, copper, zinc and cadmium in liver, gills and muscle organs of collected Oreochromis niloticus fish from the above stations were determined. In addition to, the same studied organs were histopathologically examined.

Aim of the work: This study aim to investigate the impact of the environmental pollution of Lake Nasser on histology of liver, gills and muscles and biochemical parameters of a commercially important O. niloticus fish and that living in this lake Nasser

Results and Discussion: The results of the present study exhibited increased levels of glucose, lipid, AST, ALT, urea, uric acid and creatinine, while decreased total protein in blood serum of O. niloticus fish samples at Garf Hussen site. Heavy metals accumulations in O. niloticus fish organs at area under investigation were in following descending order: iron> zinc> manganese> cadmium> copper. While, heavy metals accumulations according to organs were in following descending order: liver > gills>muscle. It was found that the metals accumulation in non-edible organ (liver) more than that in edible organ (muscles), the concentration of heavy metals in the studied fish tissues is dependent upon the type organ as well as the type of metal and concentration of heavy metals in water. The accumulation of these heavy metals in the studied fish organs, give rise to histopathological alteration. These alterations including, hemorraghe, hemosidrin, edema, degeneration, necrosis and hyperplasiae, separation in secondary lamellae. We can concluded that fish samples collected from Garf Hussen were more effected than those obtained from other stations.

Conclusion: Oreochromis niloticus samples collected from Garf Hussen were more affected by heavy metals those obtained from other stations. But this impact was still within permissible limit. O. niloticus in lake Nasser is valid for human consumption without any negative effect.

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Key Words: Biochemcal, fish, heavy metals, histopathological, Lake Nasser.

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INTRODUCTION

Lake Nasser was formed as a result of the construction of the High Dam in south of Egypt in the Aswan Governorate. Lake Nasser is the one of the longest man-made lakes in the world. The surface area and water level of the lake are depending mainly on the annual flow of flood water comes from the Blue Nile from the Ethiopian highlands[1]. Generally, it has an area of 5248 km2, the mean depth varied between 21.5 and 25.5 m (maximum 90 m) and the average width is approximately 8 Km[2]. Lake Nasser has many embayment outsides the main channel, called Khors. These Khors have a total surface area of about 4900 km2,

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which representing about 79 % of the total surface area of the whole lake. However, these Khors in volume contain only 86.4 million km3 water, which representing about 55 % of the total lake volume[3]. Lake Nasser is an important source for fish production in Egypt, where the annual average of fish production from Lake Nasser was 19051.5 Ton during season 2016 and 2017[4].

Heavy metals are the most important pollutants in the aquatic ecosystems. They are present throughout the ecosystem and are detectable in critical amounts. Generally, metals enter Lake Nasser from many sources, such as; the water current washes rocks and bottom sediments; dead and decomposing the biota in the lake; fallout of atmospheric particulate matter and human activities, including the treated and untreated wastes discharge to the water body[5].

Fish is an important source of protein to humans and other animals. Thus, fish industry is becoming important jobs to many people and household as well as it is becoming one of the national income[6]. The tilapias are the most common cultured Cichlid species of freshwater fish in Africa and the Middle East[7].

Hematological study plays an important role in the evaluation and monitoring of fish health, pollution stress and disease. Therefore, it is pertinent to study the impacts of pollutants on fishes. The variations of the hematological parameters can be used to detect the impact of pollutants exposure in the environment[8]. Where, the Hematological parameters are affected by several factors including environmental conditions, physiological status, and fish species[9].

Fish are very intimate relation with their environment, and containing on a thin epithelial membrane separates the blood of the fish from the water. Fish are very sensitive to the environmental changes which reflected in their blood components[10,11]. Blood exhibit the pathological changes of toxicity before the onset of external symptoms. Thus, the blood parameters are pathophysiological indicators of the whole body. Therefore, the biochemical characteristics of both blood and tissues are important indices, that can have evaluated the environmental status[12], and important in diagnosing the structural and functional status of fish exposed to toxicants[13]. The changes in the biochemical blood indicate changes in metabolism and biochemical processes of the organism, resulting from the impact of different pollutions types and they make it possible to study the mechanisms of the effect of pollutants[14].

This study aim to investigate the impact of the environmental pollution of Lake Nasser on histology of liver, gills and muscles and biochemical parameters of a commercially important O. niloticus fish that living in this lake.

MATERIALS AND METHODS

Lake Nasser water is a major source used for drinking, irrigation, fisheries and other domestic purposes, the number of important Khors, highly productive in fisheries, is about 85, of which 48 are located on the eastern side and 37 on the western side. The length of shoreline of Khors is 969.9 km[15].

Sampling sites during summer, 2019

Five sites were chosen for fish sampling to cover the area of investigation. Location of the studied area is shown in (Table 1), during summer 2019.

Table 1: The latitude and longitude of sampling stations at Lake Nasser (GPS).

Site	Features of station	Latitude	Longitude
I	Khor Forgond	22.45778	31.7225
II	Khor Toushka west	22.57139	31.79583
III	Khor Ahmer	22.93444	32.53944
IV	Garf Hussen	23.2910	32.7420
V	Khor Ebreem	23.89667	32.90694

Sampling

During summer 2019, samples of blood, heavy metals and histology in O. niloticus were collected from Khor Forgond (I), Khor Toushka west (II), Khor Ahmer (III), Garf Hussen (IV) and Khor Ebreem (V) of Lake Nasser (Table 1, Figure 1). The fish measured about 20.0 to 30.1 cm and 180.8 to 536.0 g in weight for O. niloticus.

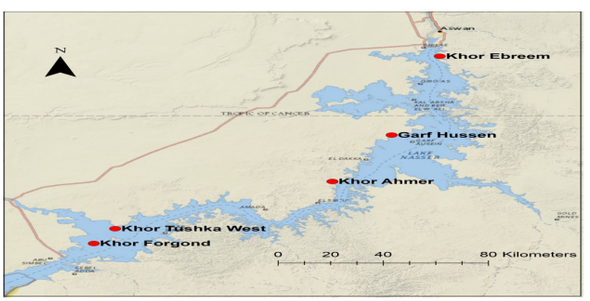

Fig. 1: Map showing sampling stations at Lake Nasser

Heavy metals determination

Heavy metals in fish organ were digested according to the method described by Ghazaly[16], for determination of Cu, Zn, Cd, Fe and Mn, measured using Atomic Absorption Spectrophotometer (Perkin Elmer 3110, USA) with graphite atomizer HGA-600, according to the method described by APHA[17]. The obtained results were expressed as mg/kg dray weight.

Blood analysis

Blood samples were taken by severance of the caudal peduncle of fish and collected into two small sterilized vials. The blood was left to clot and then centrifuged at 3000 r. p. m for 10 minutes to obtain serum. Supernatant serum was obtained using micropipette model (Labystems K 33071) for biochemical studies. The serum glucose concentration was estimated enzymatically according to Trinder[18]. The serum total proteins and albumin were measured colorimetrically

according to the method described by Gornall, Doumas[19,20], respectively. Serum creatinine was determined according to Tietz[21]. While, the concentration of serum urea and uric acid were measured enzymatically according to Tietz[22]. The serum activity of Asparitic aminotransferase (AST) and Alanine aminotransferase (ALT) were determined colorimetrically using readily made kits according to the method described by Reitman[23]. The serum total lipids were estimated to Frings[24].

Histological studies

Histopathological studies were carried using selected organs of the studied fish which were collected during summer 2019. After dissection of the fish, parts of muscles, gills and liver were fixed in 10 % formalin at 4 0C, dehydrated in ascending grades of alcohol and cleared in xylene. The fixed tissues were embedded in paraffin wax and sectioned into five micrometers thick, then stained with hematoxylin and eosin dyes according to Bernet[25]

RESULTS

Biochemical parameters in serum of O. niloticus in different Khors in Lake Nasser

Data in (Table 2) showed that the highest value of serum glucose was recorded in the Garf Hussen followed by Khor Ebreem. While, the results indicate that the total protein values were higher in the serum of O. niloticus samples collected from Khor Forgond and Khor Ahmer than their values from all other stations. On the other hand, the biochemical parameters in serum of O. niloticus collected from Garf Hussen showed the highest values of the kidney function parameters (uric acid, urea, and createnin), total lipid, glucose, and albumin. In addition, the activity of the liver function enzymes, AST and ALT, reflected remarkable increase in blood serum of O. niloticus collected from Garf Hussen compared to those recorded from other stations.

Accumulation of heavy metals in different organs of O. niloticus

Metal concentrations in the muscle, liver and gills samples of O. niloticus at the five localities of the Lake Nasser at Khor Forgand, Khor Tushka west, Khor Ahmer, Garf Hussen and Khor Ebreem during summer, 2019. The annual average of metal concentrations in the samples were in the following order:

iron > zinc > manganese > cadmium > copper.

The concentration of iron in the present study of the muscles fish between 37.819 and 78.675 mg/kg dry wt., average 60.981 mg/kg dry wt., in the liver between 62.731 and 97.605 mg/kg dry wt., while in the gills between 46.339 and 90.246 mg/kg dry wt. in (Table 3). The high concentration of iron in the liver at Garf Hussen station. Fe concentration in the studied tissues was in the following: liver>gills>muscle. The highest value of zinc were recorded in the liver fish at Garf Hussen station (37.207 mg/kg dry wt.), while the lowest value (2.864 mg/kg dry wt.) recorded in muscles at Khor Forgand during summer season in (Table 4). The concentration of Zn in the studied tissues in the following manner: liver>gills>muscle.

Copper concentration of muscles fish in the present study between 0.051 to 0.087, 0.124 to 0.169 and 0.065 to 0.130 mg/kg dry wt. in muscles, liver and gills, respectively in (Table 5). Cu concentration in the studied tissues was in the following manner: liver>gills>muscle. The concentration of manganese in the present study of the muscles fish between 0.291 and 2.241 mg/kg dry wt., in the liver between 1.478 and 2.243 mg/kg dry wt., while in the gills between 0.437 and 1.572 mg/kg dry wt. in (Table 6), Mn concentrations in the tissues of the studied fish were in the following order: liver > gills > muscle.

The Cd concentrations in the muscles, liver and gills of the five stations (0.326-0.750 mg/kg), (0.323-0.960 mg/kg dry wt.) and (0.375-0.942 mg/kg dry wt.), respectively in (Table 7). Cd concentrations in the tissues of the studied fish were in the following order: liver > gills > muscle.

The histological alterations

Several histopathological alterations were observed in liver, gills and muscles of O. niloticus fish obtained from five stations during the period of study.

Liver

The histopathlogical alterations observed in liver of O. niloticus fish samples obtained from five studied stations during the period of study including degeneration (D) in hepatic cells, congesion (Cn) in blood sinusoid, anastemosis (A) and hemorraghe (Hr) in blood vessels for samples obtained from Khor Forgond (Figure 2. I). Degeneration (D) in hepatic cells and dilation (Di) in blood vessels for samples obtained from Khor Toushka west (Figure 2. II). Degeneration (D) in hepatic cells, congesion (Cn) in blood sinusoid. vessels for samples obtained from Khor Ahmer (Figure 2. III). Degeneration (D) and necrosis (N) in hepatic cells, dilation (Di) and hemosidrin (Hn) in blood vessels for samples obtained from Garf Hessen (Figure 2. IV). Degeneration (D) in hepatic cells, congesion (Cn) in blood sinusoid and dilation (Di), hemorraghe (Hr) and hemosidrin (Hn) in blood vessels for samples obtained from Khor Ebreem (Figure 2. V). (H&E), in (Figure 2).

Gills

The histopathlogical alterations observed in gills of O. niloticus fish samples obtained from five studied stations including hemorraghea (Hr) primary lamellae, hyperplasiae (Hp) & separation (S) in secondary lamellae for samples collected from Khor Forgond (Figure 3. I). Degeneration (D) and necrosis (N) in primary and secondary lamellae for samples collected from Khor Toushka west (Figure 3. II). Hemorraghe (Hr) and necrosis (N) in primary lamellae and hyperplasiae (Hp), separation (S) & bumb tip (Bb) in secondary lamellae for samples collected from Khor Ahmer (Figure 3. III). Hemorraghe (Hr) & hemosidrin (Hn)

in primary lamellae, hyperplasiae (Hp), secondary lamellae and fusion (Fu) in 1ry & 2nd lamellae for samples collected from Garf Hessen (Figure 3. IV). Hemorraghe (Hr) & necrosis (N) in primary lamellae, currling (Cr) & hyperplasiae (Hp) in secondary lamellae for samples collected from Khor Ebreem (Figure 3. V). (H&E), in (Figure 3).

Muscles

The histopathlogical alterations observed in muscles of O. niloticus fish samples obtained from five studied stations including hemorraghe (Hr), hemosidrin (Hn) and edema (E) in muscles fibre for samples collected from Khor Forgond (Figure 4. I). Degeneration (D) and edema (E) in muscles fibre for samples collected from Khor Toushka west (Figure 4. II). Degeneration (D), necrosis (N), edema (E) and hemorraghe (Hr) in muscles fibre for samples collected from Khor Ahmer (Figure 4. III). Degeneration (D), necrosis (N) and edema (E) in muscles fibre for samples collected from Garf Hessen (Figure 4. IV). Degeneration (D), necrosis (N), edema (E) and hemorraghe (Hr) in muscles fibre for samples collected from Khor Ebreem (Figure 4. V). (H&E), in (Figure 4).

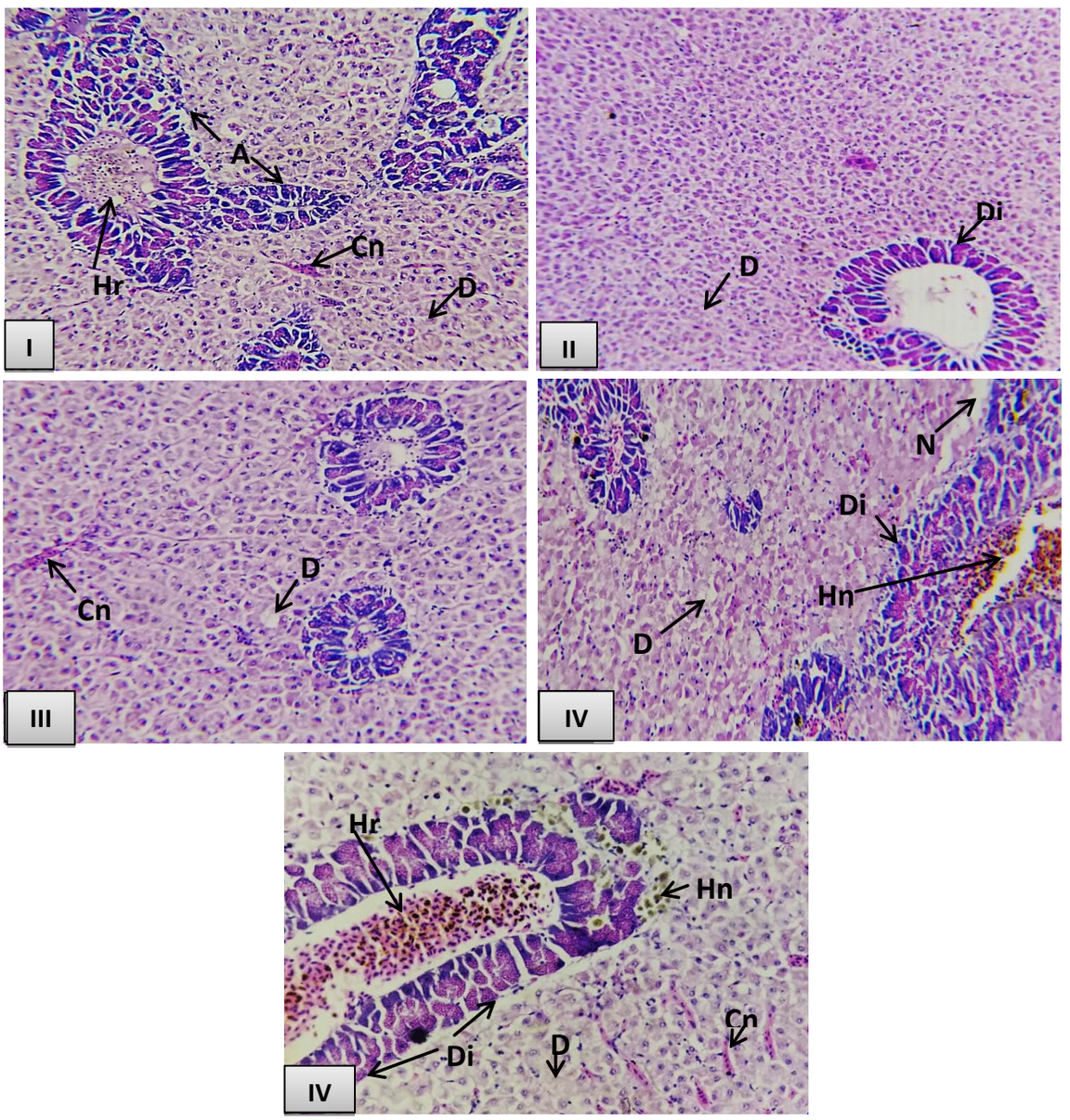

Fig. 2: Showing liver section of Oreochromus niloticus fish obtained from five studied stations; (Fig. 2. I): from Khor Forgond showing: Degeneration (D) in hepatic cells, congesion (Cn) in blood sinusoid, anastemosis (A) and hemorraghe (Hr) in blood vessels, x 400. (Fig. 2. II): From Khor Toushka west showing: Degeneration (D) in hepatic cells and dilation (Di) inblood vessels, x 200. (Fig. 2. III): From Khor Ahmer showing: Degeneration (D) in hepatic cells, congesion (Cn) in blood sinusoid, x 400. (Fig. 2. IV): From Garf Hussen showing: Degeneration (D) and necrosis (N) in hepatic cells, dilation (Di) and hemosidrin (Hn) inblood vessels, x 400. (Fig. 2. V): From Khor Ebreem showing: Degeneration (D) in hepatic cells, congesion (Cn) in blood sinusoid anddilation (Di), hemorraghe (Hr)and hemosidrin (Hn) in blood vessels, x 400. (H&E).

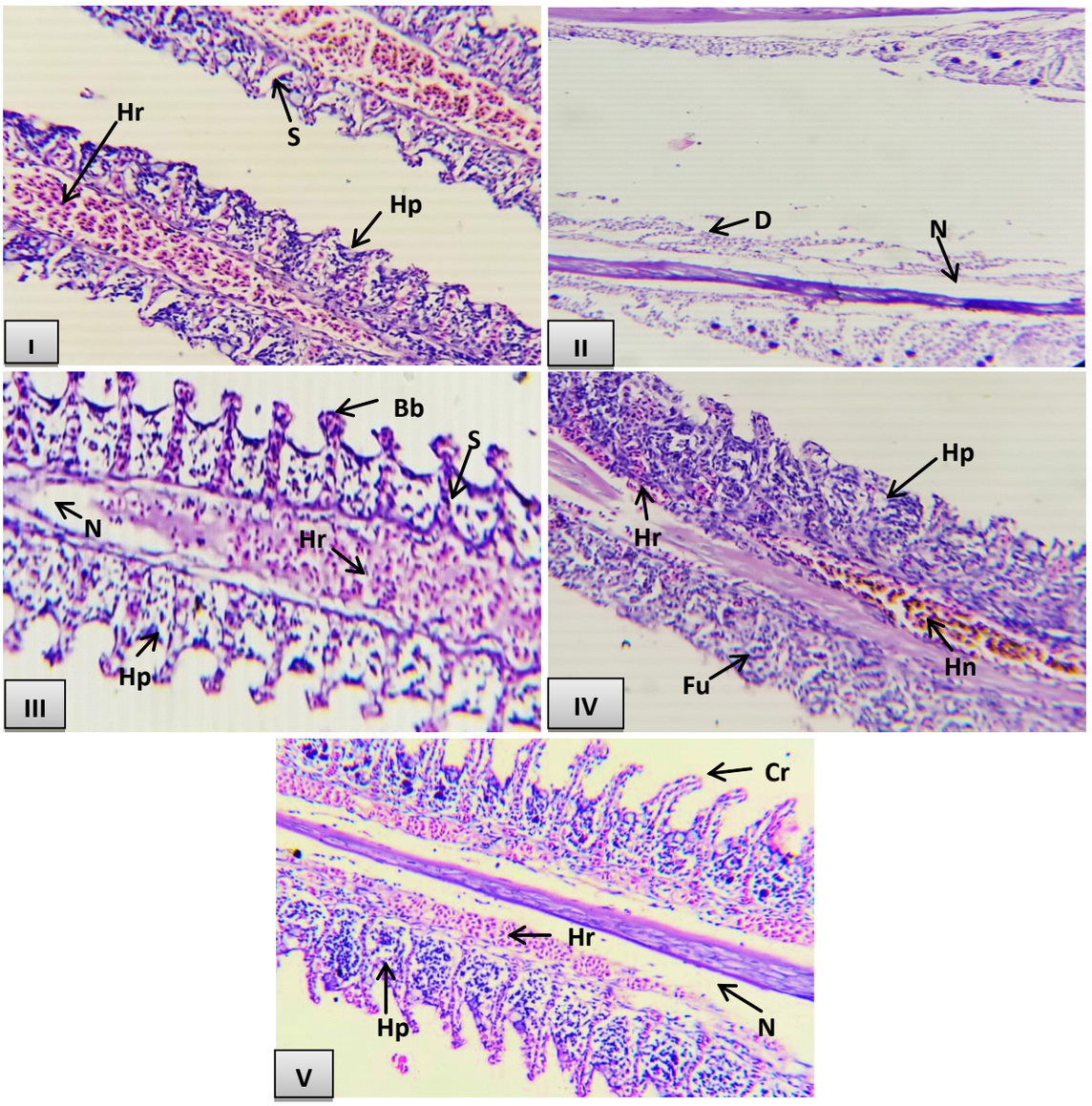

Fig. 3: Showing gills section of Oreochromus niloticus fish obtained from five studied stations; (Fig. 3. I): From Khor Forgond showing: Hemorraghe (Hr) primary lamellae, hyperplasiae (Hp) & separation (S) in secondary lamellae, x 200. (Fig. 3. II): From Khor Toushka showing: Degeneration (D) andnecrosis (N) in primary andsecondary lamellae, x 100. (Fig. 3. III): From Khor Ahmer showing: Hemorraghe (Hr) and necrosis (N) inprimary lamellaeand hyperplasiae (Hp), separation (S) & bumb tip (Bb) in secondary lamellae, x 400. (Fig. 3. IV): From Garf Hussen showing: Hemorraghe (Hr) & hemosidrin (Hn) inprimary lamellae, hyperplasiae (Hp), secondary lamellae and fusion (Fu) in 1ry & 2nd lamellae x 400. (Fig. 3. V): From Khor Ebreem showing: Hemorraghe (Hr) & necrosis (N) in primary lamellae, currling (Cr) & hyperplasiae (Hp) insecondary lamellae x 400. (H&E).

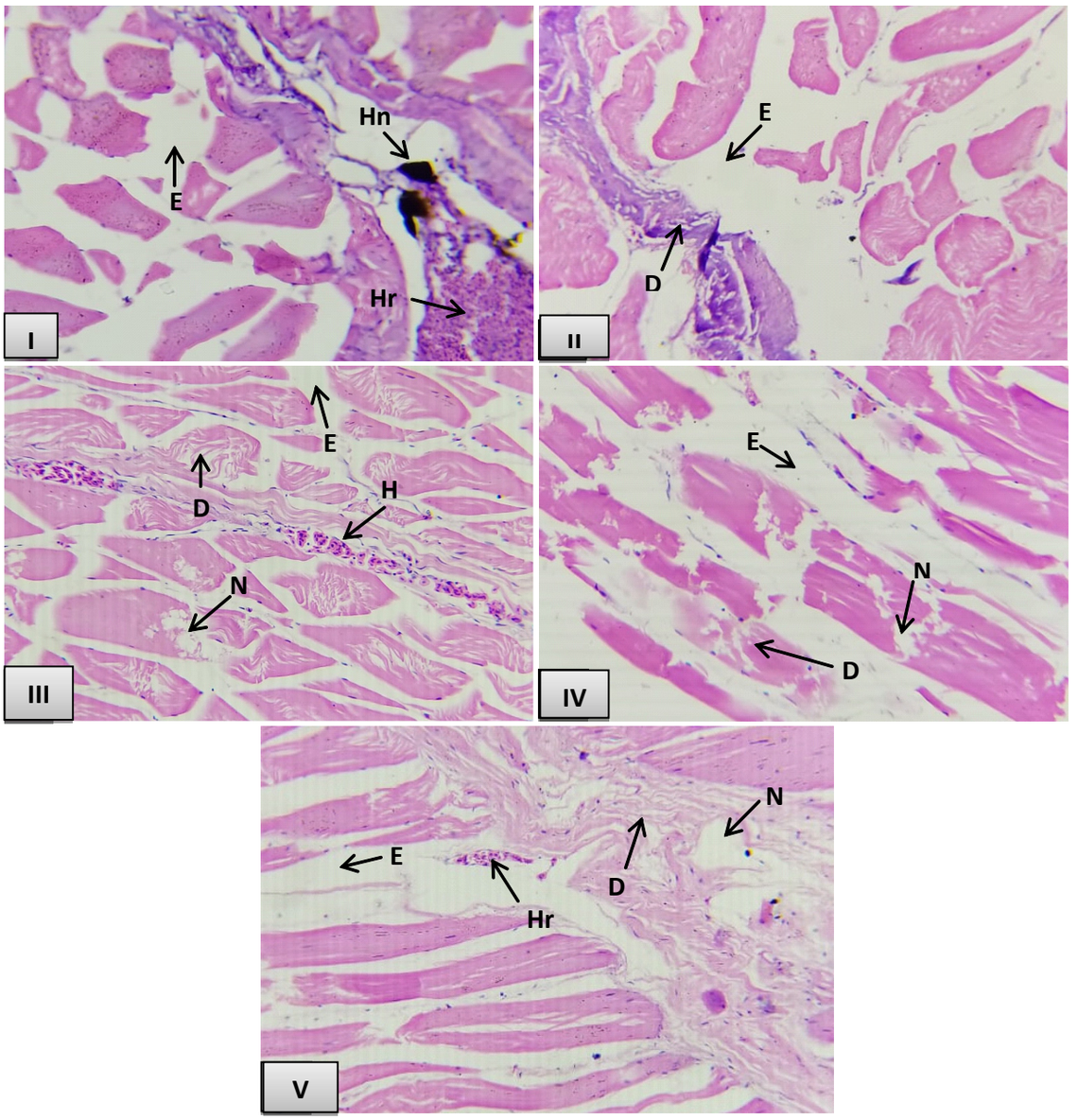

Fig. 4: Showing muscles section of Oreochromus niloticus fish obtained from five studied stations; (Fig. 4. I): From Khor Forgond showing: Hemorraghe (Hr), hemosidrin (Hn) and edema (E) in muscles fibre x 400. (Fig. 4. II): From Khor Toushka showing: Degeneration (D) and edema (E) in muscles fibre x 400. (Fig. 4. III): From Khor Ahmer showing: Degeneration (D), necrosis (N), edema (E) andhemorraghe (Hr) in muscles fibre x 400. (Fig. 4. IV): From Garf Hussen showing: Degeneration (D), necrosis (N) and edema (E) in muscles fibre x 400. (Fig. 4. V): From Khor Ebreem showing: Degeneration (D), necrosis (N), edema (E) and hemorraghe (Hr) in muscles fibre x 400. (H&E).

Table 2: Biochemical parameters in serum of O. niloticus collected from different stations during summer, 2019 in Lake Nasser

	Glucose (mg/dl)	T. protein (g/dl)	Albumin (g/dl)	AST (IU/ml)	ALT (IU/ml)	Urea (mg/dl)	Uric Acid (mg/dl)	T. lipid (mg/dl)	Createnin (IU/ml) (mg/dl
Khor Forgond	91.99±7.5	3.33±0.11	0.97±0.03	30.84±8.0	83.04±7.3	19.35±0.54	1.53±0.24	850.74±47.1	0.358±0.01
Khor Toushka west	105.4±8.5	2.91±0.136	0.90±0.041	46.08±5.88	85.1±2.44	15.15±1.6	2.06±0.32	849.9±42.5	0.437±0.03
Khor Ahmer	107.63±11.3	3.25±0.88	1.07±0.079	45.98±5.4	91.06±6.3	17.56±1.6	4.170±1.09	983.72±50.2	0.562±0.13
Garf Hussen	163.27±20.6	2.60±0.07	1.860±0.06	85.9±11.5	105.82±4.8	19.39±1.4	4.590±0.08	1655.6±61.9	1.32±0.03
Khor Ebreem	121.25±21.2	2.76±0.17	1.45±0.13	43.87±3.6	94.72±1.2	13.16±0.87	2.74±0.16	1245.3±37.4	0.579±0.05

Table 3: Concentrations of iron (mg/kg dry weight) in some organs of fish species collected from Lake Nasser during summer, 2019

Parameter	Station	Muscles	Liver	Gills
Fe	Khor Forgand	54.810	77.596	57.636
	Khor Tushka west	58.531	62.731	56.676
	Khor Ahmer	37.819	70.951	46.339
	Garf Hussen	78.675	97.605	90.246
	Khor Ebreem	75.070	77.356	63.364
	Mean±SE	60.98±7.3	77.3±5.7	62.85±7.3

Table 4: Concentrations of zinc (mg/kg dry weight) in some organs of fish species collected from Lake Nasser during summer, 2019

Parameter	Station	Muscles	Liver	Gills
Zn	Khor Forgand	2.869	35.811	21.44
	Khor Tushka west	3.004	28.560	22.988
	Khor Ahmer	4.768	33.696	23.895
	Garf Hussen	4.881	37.207	31.219
	Khor Ebreem	3.362	31.950	26.617
	Mean±SE	3.8±0.4	33.4±1.5	25.2±1.7

Table 5: Concentrations of copper (mg/kg dry weight) in some organs of fish species collected from Lake Nasser during summer, 2019

Parameter	Station	Muscles	Liver	Gills
Cu	Khor Forgand	0.059	0.139	0.065
	Khor Tushka west	0.067	0.126	0.128
	Khor Ahmer	0.073	0.156	0.105
	Garf Hussen	0.087	0.169	0.130
	Khor Ebreem	0.051	0.124	0.123
	Mean±SE	0.067±0.006	0.143±0.008	0.110±0.01

Table 6: Concentrations of manganese (mg/kg dry weight) in some organs of fish species collected from Lake Nasser during summer, 2019

Parameter	Station	Muscles	Liver	Gills
Mn	Khor Forgand	0.291	1.490	0.437
	Khor Tushka west	0.295	1.867	1.232
	Khor Ahmer	0.568	1.478	0.815
	Garf Hussen	2.241	2.243	1.572
	Khor Ebreem	0.770	2.158	1.508
	Mean±SE	0.833±0.3	1.847±0.16	1.112±0.21

Table 7: Concentrations of cadmium (mg/kg dry weight) in some organs of fish species collected from Lake Nasser during summer, 2019

Parameter	Station	Muscles	Liver	Gills
Cd	Khor Forgand	0.326	0.323	0.375
	Khor Tushka west	0.344	0.37	0.367
	Khor Ahmer	0.337	0.536	0.437
	Garf Hussen	0.75	0.96	0.942
	Khor Ebreem	0.726	0.829	0.616
	Mean±SE	0.496±0.09	0.607±0.12	0.547±0.10

DISSECTION

The results of the present study exhibited increased levels of glucose, lipid, AST, ALT, urea, uric acid and creatinine in the blood of O. niloticusfish sample at Garf Hussen site may be due to, heavy metals in water Nasser Lake, also, used GarfHussen site to collect fishes, oil change and petrol financing in Nasser Lake. Similar findings were reported by Zaki[26], who recorded a significant higher levels in these parameters in Nile tilapia may be due to some heavy metals exposure. Higher levels of plasma creatinine and uric acid can be used as rough indicators of glomerular filtration rate and kidney functions[27]. Also, increase of urea and uric acid may be due to sewage[28]. While, decrease of protein at GarfHussen may be due to too much loss of proteins due to changes in kidney or cellular destruction. Also, increased metabolism under toxicant stress it causes decrease of proteins[29]. During stress, fish using protein as source of energy to meet the higher energy needs to detoxify the toxicant[30]. Also, the other reasons for depletion of tissue protein can be due to impaired rate of protein synthesis[31] or decrease in uptake of amino acid into polypeptide chain[32]. Our results showed that the most polluted places were the more protein depleted fish for use in environmental pressures.

Blood glucose level has been used as an indicator of environmental stress to reflect changes in carbohydrate metabolism under stress conditions[33]. The levels of glucose were higher in the blood of O. niloticusfish collected from polluted Khors; due to existence the chemical pollutants such as heavy metals, causing hyperglycemia by activating the glycogenolysis in fish[34] and other pollutants[35]. Also, this can be attributed to the alteration in the activity of

glucose-6-phosphate dehydrogenase and lactate dehydrogenase previously detected by Osman[36]. Through this study, showed that the Khors with high heavy metals increased the glucose level.

In the present work showed a general direction of increase in AST and ALT activities and indicate that the pollutants of water especially GarfHussen site affected the liver cells as evidenced by the changes occurred in serum ALT and AST activities. It has been reported that alterations in enzymes activities in the serum directly indicates major pathologic changes or liver damage[37].

The high accumulation of Fe in liver can be attributed to the large quantities of Fe detected in water, this agrees with the findings of[38]. The present data showed that iron concentrations in fish O. niloticus were higher than permissible level for (30 mg/kg dry wt.) according to FAO[39]. The high accumulation of Fe in fish O. niloticus can be attributed to the large quantities of Fe detected in water, this agrees with the findings[5].

Western Australian Food and Drink Regulations recommended a level of (40 mg/kg) for human consumption[40]. Accordingly, the concentrations of Zn in the muscles of the studied fish are still below the permissible level.

The present data indicate that liver accumulation higher amounts of Cu and this may be due to its capacity to retain Cu. It has been mentioned by Soltan[41], that in fish, the liver is the selective organ for stock of Cu. Similarly,[41,42] found that Cu exhibited its high levels in the liver and the low values in the muscles. The present data showed that concentrations of copper in fish O. niloticus are still lower than the permissible level for Cu (30 mg/kg) recommended by the National Health and Medical Research Council[40].

In the present study the maximum Mn level was observed in liver of O. niloticus (2.243 mg/kg dry wt.) collected from station GarfHussen. According to FAO[43], there is not information on the carcinogenicity of manganese within these limits.

The results of Cd were lower than permissible level (0.5 mg/kg dry wt.) except concentration GarfHussen and KhorEbreem station according to FAO[39].

It could be finish that the concentrations of heavy metals in the studied fish tissues is dependent upon the type organ as well as the type of metal and concentration of heavy metals in water. This is in agreement with that reported by Mohamed, El-Moselhy[44,45].

The histopathological alterations in liver, gills and muscles could be a direct result of fertilizers, salts, which are entered some stations to the lake with the drainage water as recorded by Tayel, Mahmoud[46,47]. The cellular degeneration in the studies organs may be also due to oxygen deficiency as a result of the vascular dilation and intravascular hemolysis observed in the blood vessels with subsequent stasis of blood as recorded by Kadry, Bayomy[48,49].

Degeneration and necrosis of the hepatocytes may be due to cumulative effect of nutrient salts or may be due to the acumulation effect of metals and the increase in their concentrations in the liver these results agreed with[50,51], who stated that the liver has an important detoxical role of endogenous waste products as well as externally derived toxins as heavy metals. Hemolysis and hemosidrin pigments may result from rapid and continuous destruction of erythrocytes by breakdown of hemoglobin and convert it into hemosidrin recorded by Ahmed[52]. We can concluded that fish samples collected from GarfHussen were more effected than those obtained from other stations may be due to impact fishing aggregation port and heavy metals.

CONFLICTS OF INTERESR

There are no conflicts of interest

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الملخص العربى

التغيرات البيوكيميائية والنسيجية لسمكة البلطى النيلي وعلاقتها بالمعادن الثقيلة في بحيرة ناصر - مصر

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مقدمة: بحيرة ناصر هي واحدة من أكبر البحيرات الصناعية في العالم. تعتمد مساحة سطح البحيرة ومستوى مياهها بشكل أساسي على التدفق السنوي لمياه الفيضانات التي تأتي من النيل الأزرق من المرتفعات الإثيوبية، وهي مصدر رئيسي يستخدم في ري الشرب ومصائد الأسماك والأغراض المنزلية الأخرى.

الطرق والقياسات: تم تجميع عينات الأسماك من خمس محطات في بحيرة ناصر، هما خور فورجوند ، وخور توشكا غرب ، وخور أحمر، جرف حسين وآخيرا خور إبريم خلال صيف عام ٢٠١٩. تم تقدير نسبة الجلوكوز في الدم والبروتين الكلي ، والألبومين ، والدهون الكلية، والكرياتينين ، واليوريا ، واليوريك اسيد. أيضا تم تحديد تراكم العناصر الثقيلة فى الأسماك AST و ALT والتى تشمل الحديد، المنجنيز، النحاس، الزنك والكادميوم في بعض اعضاء أسماك البلطى النيلى التى تم تجميعها من اماكن الدراسة وتشمل الكبد، الخياشيم العضلات. بالإضافة إلى الفحص الهستولوجى لنفس الأعضاء.

الهدف من العمل: تهدف هذه الدراسة إلى معرفة تأثير التلوث البيئي لبحيرة ناصر على أنسجة الكبد والخياشيم والعضلات والتغيرات البيوكيميائية لأسماك البلطى النيلى التي تعيش في بحيرة ناصر.

العرض والمناقشة: أظهرت نتائج هذه الدراسة زيادة في مستويات الجلوكوز والدهون و AST و ALT واليوريا وحمض اليوريك والكرياتينين، بينما انخفض البروتين الكلي في مصل الدم لعينات الأسماك في موقع جرف حسين. وكان تراكم المعادن الثقيلة في أعضاء الأسماك في المنطقة قيد الدراسة بالترتيب التالي: الحديد> الزنك> المنجنيز> الكادميوم> النحاس. بينما كان تراكم المعادن الثقيلة فى الاعضاء وفقًا للترتيب التالى: كبد> خياشيم> العضلات. وقد وجد أن تراكم المعادن في الأعضاء الغير صالحة للأكل (الكبد) أكثر من تلك الموجودة في الأعضاء الصالحة للأكل (العضلات) ، واظهرت النتائج إن تركيز المعادن الثقيلة في أنسجة الأسماك المدروسة يعتمد على نوع العضو وكذلك نوع المعدن والتركيز من المعادن الثقيلة في الماء.

وبالفحص الهستولوجى للكبد والخياشيم والعضلات وجد ان تراكم هذه المعادن الثقيلة في أعضاء الأسماك ادى إلى وجود تغيرات فى الانسجة خصوصا منطقة جرف حسين.

الخلاصة: نستنتج أن عينات الأسماك التي تم جمعها من منطقة جرف حسين كانت أكثر تأثيرًا عن تلك التي تم الحصول عليها من المحطات الأخرى ولكن فى الحدود المسموح بها. وبالتالي فان أسماك بحيرة ناصر صالح للاستهلاك الآدمي دون أي تأثير سلبي.