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FISH AS A MIRROR FOR WATER POLLUTION

(With 10 Tables)

By

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(Received at 5/3/2011)

الأسماك كمرآه لتلوث المياه

عزة السيد على حسان ، راوية سعد محمد العدوي

أجريت هذه الدراسة بهدف معرفة تلوث المياه وانعكاس هذا التلوث على الأسماك النيلية. فقد تم جمع 55 سمكة نيلية و 55 عينة من الماء من خمس مناطق مختلفة وهي نهر النيل بمدينة المنصورة مصرف ميت عنتر خلف مصنع سماد طلخا وامتداده مصرف الطويلة ومصرف بطرة ونهر النيل بمدينة دمياط 11 عينة لكل مصدر. وقد أوضحت النتائج عن وجود زيادة معنوية في المعادن الثقيلة وهي الكادميوم والرصاص والنحاس في عضلات الأسماك والكبد والكلى والخياشيم، كما تم عمل تحليل لعينات المياه المجمعة من هذه المناطق وتبين زيادة معدل تركيز المعادن الثقيلة في المناطق الأكثر تلوثا وهي مصرف ميت عنتر خلف مصنع سماد طلخا، مصرف الطويلة ومصرف بطرة، وأيضا وجدت زيادة معنوية في تركيز الأمونيا، النترات، النتريت، الكلوريدات، السلفات والعسر الكلي في المصارف بالمقارنة بنهر النيل وكان تركيز هذه العناصر في نهر النيل بدمياط أعلى من نهر النيل بالمنصورة وبالنسبة للملاثيون اوضحت النتائج أن الملاثيون وجد في جميع المناطق ماعدا نهر النيل بمدينة المنصورة كما أن مستوى الملاثيون كان أعلى في عينات الماء عن عينات الأسماك. أما عن صورة الدم كان هناك نقص معنوي في كرات الدم الحمراء ونقص في تركيز الهيموجلوبين وزيادة في عدد كرات الدم البيضاء في عينات الأسماك المجمعة من المصار ف بينما كانت طبيعية في عينات الأسماك المجمعة من نهر النيل وبالنسبة لفحص مصل الدم وقياس بعض وظائف الكبد والكلى كان هناك زيادة معنوية في انزيمات الكبد ونقص في البروتين الكلى وزيادة في مستوى الكرياتنين والبولينا في عينات الأسماك المجمعة من المصارف وهذا تم تأكيده بقياس جهاز الجلوتاثيون، وقد كان هناك نقص معنوي في الجلوتاثيون الكلي والمختزل وزيادة في الجلوتاثيون المؤكسد. وبناء على ما سبق يتضح أن تعرض الأسماك في المصارف للملوثات يؤدي إلى تغيرات سلبية كبيرة وتحوير في جهاز الجلوتاثيون إلى الناحية التأكسدية.

SUMMARY

One hundred ten samples from water and tilapia fish from 5 different location, River Nile Mansoura, Met-Annter drainage behind Talkha factory of fertilization, El-Tawilla drainage, Battra drainage and River

Nile Damietta were collected for analysis of heavy metals, malathion in water and fish also analysis of water chemical parameters ammonia, nitrite, nitrate, chlorides, sulphates and total hardness, analysis hepatic glutathione system, some liver and kidney functions and blood picture The results showed highly significant increase of heavy metals and malathion in both fish and, water samples were collected from Met-Annter, El-Tawilla and Battra drainages. Malathion concentration in water was higher than in fish samples regarding to water chemical parameters ammonia, nitrite, nitrate, chlorides, sulphates and total hardness showed highly significant increase in drainages comparing with River Nile, and the presence of these chemicals parameters was higher in River Nile Damietta than in River Nile Mansoura. Meanwhile the results showed shifting of the glutathione system manifested by dropping of total and reduced glutathione in hepatic tissue and increasing of oxidized glutathione in hepatic tissue. Moreover, showed significant increase in serum ALT, AST, creatinine and blood urea, while samples collected from River Nile in Mansoura were within normal level. Concerning to the red blood cell count (RBCs), heamoglobin (Hb) and packed cell volume (PCV) levels were lower than fish collected from River Nile at Mansoura which were in normal ranges. The total leukocytes count were in normal range in fish collected from River Nile Mansoura, in contaray total leukocytic count were increased in other polluted areas. Meanwhile shifting of glutathione system towards the oxidized side pointed to hepatotxic and nephrotoxic as these pollutants consider as an oxidant. The aim of this study was to know the water pollution and the reflection of this pollution on fish. The study concluded that the heavy metals and other pollutants have a very dangerous effect on biochemical parameters and vital organs of fish.

Key words: *Fish, water pollution, heavy metals, blood picture.*

INTRODUCTION

Environmental pollution represents a major problem in the world, especially in the developed countries. Egypt is one of such countries, which suffers from biospheres pollution air and water pollution (Mona and Sawsan, 2004).

All water contains natural contaminations particularly inorganic that arise from the geological strata through which the water flows and

to a varying extent anthropogenic pollution by chemicals (Fawell and Nieuwenhuijsen, 2003).

Heavy metals have a great ecological significance due to their toxicity and a cumulative behavior playing a role with aquatic organisms, therefore; the toxic heavy metals become a hazard for mammals De (Gregori *et al*., 1994). Heavy metals are divided into non essential metals, which have no role in the biological processes in human or animal, as lead, cadmium and mercury, while essential metals are needed for human and animal body consumption, are like copper, zinc, manganese and cobalt (Moalla and Pulford, 1995; Gold Frank *et al*., 2001).

Several sources of the environmental pollution of heavy metal including the industrial and agricultural discharge, coal and oil combustion, sewage effluents, some types of plastics, pesticides, lead, cadmium and mercury pollutions in fish and natural sources from rocks and soil (WHO, 1992; Shibamoto and Bjeldanes, 1993; Jehan *et al*., 1999; Abd-El-Hamid *et al*., 2006).

Pesticides as malathions constitutes an important aspect of modern agriculture, the public has been tolerant of their use Aspelin (1998). 85-90% of the pesticides applied in agriculture never reaches their target organisms, but instead are dispersed in the air, water and soil (Repetto and Baliga, 1996).

One of the most serious problems is due to the runoff and drainage in land escapes where pesticides are applied. This may carry residues into drinking water supplies where they are dissolved or lie suspended in water. This, results in the pollution of water where by the quality of the water deteriorates and threatens aquatic ecosystem health (Wakawa, 2008)

Pollution of the environment is either by improper application or due to pesticides persistence in soil, plants, water and animal tissue when these substances pollute lakes, streams, rivers and other water bodies. Malathion is a non-systemic wide spectrum organophosrus insecticide (USEPA, 2000).

Fish occupy one of the foremost places among the food products of animal origin in their nutritive value and this may be attributed to their contents of high biological value proteins, lipids, vitamins and essential fatty acids (Darwish *et al*., 2003; Burger *et al*., 2005) as well as it provides omega-3 fatty acids, which have many health benefits (Patterson, 2002).

Heavy metals in surface water may be run-off from land application, dumped from domestic and industrial sewage, atmospheric deposition of mining practices, improper handling of mining tailings, or as results of corrosion of distribution system materials (Calderon, 2000). Fish are continuously exposed to water, the major sink for many contaminations, such as anthropogenic and other contaminants always impact fish causing serious hazards (Denslow *et al*., 2007). Therefore, the aim of this work is to detecte heavy metal, ammonia, nitrite, nitrates, chlorides, sulphates in water, and malathion in water and fish, some liver and kidney functions, blood parameters, reduced glutathione and total glutathione were also estimated.

MATERIALS and METHODS

Sampling

Water

- A total of fifty five water samples were collected from five different regions in Dakahlia Governorate from River Nile in Mansoura, Met Annter Drainage behind the fertilization factory of Talkha, Tawilla drainage, Bettra drainage and from River Nile in Domiitta City. Eleven samples were collected from each region
- The technique of water sampling was carried out according to HACH (2003) for determination of ammonia, nitrite, nitrate, chlorides, sulphates and malathion.

Fish

- Fifty five Tilapia fish were collected from five different regions from River Nile in Mansoura, Met Annter Drainage behind the fertilization factory of Talkha, El-Tawilla , Battra drainages and River Nile Damietta
- The collected fishes were placed in polyethylene bag and transported to the laboratory in ice box. The tissue samples from liver, kidney and muscles were taken from the dissected fish and stored in the deep freezer at -20C^{o} for heavy metals evaluation.

Blood

- **Whole blood:** About 0.5-1 ml whole blood was collected in small plastic vials containing a suitable amount of dipotassium salt of ethylene Diamine Tetra Acetic acid (EDTA) as anticoagulant. Samples were examined for evaluation of blood picture (Total leucocytic count (TLC), hemoglobin (Hb). Total Erythrocytic count (TEC) and packed cell volume (PCV) according to Stoskopf (1993).

- **Blood serum:** About 2ml blood were collected in plastic centrifuge tube and left to clot at $4C^0$ after that, it placed to be centrifuged to separate the blood serum. The separated serum was used in biochemical determination of serum alanine aminotransferase (ALT) Young, (2001), serum aspartate aminotransferase (AST) Reitman and Frankel, (1957), serum total protein was measured according to Doumas *et al*. (1981), blood urea according to Patton and Crouch, (1977) and creatinine (Husden and Ropaport, 1968).

Chemical examination

- Determination of Ammonia (NH_3)

  Ammonia concentration in examined water samples was determined by using "The Direct Nesslerization Method" previously described by APHA, (1985).

- Determination of Nitrite (NO_2)

  Level of nitrite in the examined water sample was estimated by APHA, (1998).

- Determination of Nitrate (NO_3)

  Concentration of nitrates in the examined water sample was determined by "Brucine Method" according to APHA (1960).

- Determination of Chlorides (Cl_2)

  Chlorides in examined water sample were estimated by "Argentometric Method" described by (APHA, 1998).

- Determination of sulphate (SO4)

  Concentration of sulphate in the examined water sample was determined by APHA (1998).

- Determination of heavy metals

  Preparation of examined water samples was carried out according to APHA (1985), where the water sample was filtered through 0.45µ what man filter. The required volume 100 ml of filtrate was collected in clean glass bottle. Preserved by 0.3ml of nitric acid and kept in refrigerator. Determination of copper (Cu), lead (Pb) and cadmium (Cd) in surface water was carried according to the methods prepared by Polpraset (1982); Sprenger *et al*. (1987).

- Determination of malathion

  Samples were prepared for malthion detection according to the method described by Jadhav *et al*. (1992).

- Determination of Copper, Cadmium and lead

  Samples were taken from fish tissues, and then were digested according to the method described by Heckman (1970); Greig *et al*.

(1982). Tissue samples were measured by using atomic absorption spectrophotometer according to Capar (1977).

- Determination of hepatic reduced Glutathione
  The amount of GSH in the supernatant obtained after the centrifugation of liver homogenate at 3000 rpm for 30 minutes was determined by using the method of Richardson and Murphy (1987).
- Determination of hepatic total Glutathione (GSH and GSSH)
  Total Glutathion was determined enzymatically according to DTNB-GSSG reductase recycling assay for GSH and GSSG as described by Anderson (1985).
- Determination of hepatic oxidized Glutathione
  Oxidized glutathione (GSSG) was determined after the reduced glutathione concentration was subscripted from the total glutathione concentration.
- Statistical analysis of variance (ANOVA) and t-test was carried out following the method described by Kirkwood (1989).

RESULTS

The present data revealed that fish samples collected from polluted regions. It were significantly high heavy metal concentration comparing with samples collected from River Nile Mansoura, as shown in Tables 2, 3, 4 and 5. Regarding to chemical constitutes of ammonia, nitrate, nitrite,sulphate, chloride, total hardness collected from polluted regions our results showed highly significant increase ($P<0.001$) Table 6. Malathion was detected in all examined water and fish samples from different locations except River Nile Mansoura. $P<0.001$ as shown in Table 7. Concerning blood parameters; results revealed significant decrease in total RBCs, haemoglobin and packed cell volume, while there was highly significant increase in WBCs ($P<0.001$) as showen in Table 8. Liver and kidney functions tests revealed significant decrease of total protein, increase of ALT, AST, creatinin and blood urea $P<0.01$, $P<0.05$ and $P<0.001$ respectively Table 9. Total glutathione and reduced glutathione analysis in fish hepatic tissue revealed significant decrease, ($P<0.05$, $P<0.001$ and $P<0.01$,) while oxidized glutathione showed significant increase ($P<0.05$) as shown in Table 10.

Table 1: Physical analysis of water and heavy metals concentration in samples of water collected from different locations.

parameter / location	Temperature C^0	Oxygen ppm	pH value	Salinity g/l	Cadmium (Cd) PPm	Lead Pb PPm	Copper (Cu) PPm
River Nile (Mansoura)	23±2	8.15±0.61	7.25±0.42	0.15±0.02	0.048 ±0.006	0.009 ±0.0003	0.067 ±0.005
Met-Annter drainage	24±2	5.9±0.24	9.12±0.83	1.325±0.08	0.098 ±0.006***	0.89 ±0.04***	1.48 ±0.22***
Tawilla drainage	22±2	6.5±0.35	8.11±0.52	1.162±0.04	0.065 ±0.003*	0.26 ±0.06**	0.92 ±0.07***
Battra drainage	22±2	7.2±0.38	7.85±0.49	0.973±0.06	0.078 ±0.004**	0.089 ±0.005*	0.75 ±0.06**
River Nile Damietta	21±2	7.9±0.42	7.65±0.53	0.646±0.03	0.082 ±0.005**	0.065 ±0.003*	0.83 ±0.06***

*** P<0.001 ** P<0.01 P<0.05

Permissible limit of heavy metals in water according to WHO (1993) Cadmium 0.003 mg/l , Lead 0.01 mg/l Copper 2 mg/l

Table 2: Mean level of heavy metal concentration in organs of Nile Tilapia collected from Met-Annter drainage comparing with samples collected from River Nile Mansoura.

organ / heavy metal	Samples of fish organs collected from River Nile Mansoura				Samples of fish organs collected from Met-Annter drainage			
	Muscle	Liver	Kidney	Gills	Muscle	Liver	Kidney	Gills
Cadmium(Cd) ppm	0.035 ±0.008	0.062 ±0.017	0.037 ±0.013	0.036 ±0.007	0.145 ±0.023*	0.172 ±0.022***	0.140 ±0.019*	0.115 ±0.012
Lead (Pb) ppm	0.027 ±0.004	0.038 ±0.003	0.033 ±0.005	0.029 ±0.007	1.560 ±0.047***	1.780 ±0.038***	1.260 ±0.056**	1.320 ±0.037***
Copper (Cu) ppm	0.42 ±0.019	0.380 ±0.024	0.0270 ±0.007	0.038 ±0.006	2.648 ±0.089***	0.962 ±0.34***	0.994 ±0.110***	0.984 ±0.063***

*** P<0.001 ** P<0.01 P<0.05

Permissible limit of heavy metals in organs of fish is according to WHO, 1992, Cadmium is 0.05ppm, Lead is and Copper is 0.5ppm.

Table 3: Mean level of heavy metal concentration in some organs of Nile Tilapia collected from El-Tawilla drainage comparing with samples collected from River Nile Mansoura.

organ / heavy metal	Samples of fish organs collected from River Nile Mansoura				Samples of fish organs collected from El-Tawilla drainage			
	Muscle	Liver	Kidney	Gills	Muscle	Liver	Kidney	Gills
Cadmium(Cd) ppm	0.035 ±0.008	0.062 ±0.017	0.037 ±0.013	0.036 ±0.007	0.113 ±0.026***	0.132 ±0.012**	0.098 ±0.012***	0.088 ±0.016
Lead (Pb) ppm	0.027 ±0.004	0.038 ±0.003	0.033 ±0.005	0.029 ±0.007	0.875 ±0.07***	0.925 ±0.023***	0.765 ±0.011***	0.935 ±0.027***
Copper (Cu) ppm	0.42 ±0.019	0.380 ±0.024	0.0270 ±0.007	0.039 ±0.006	0.788 ±0.032***	0.621 ±0.06**	0.667 ±0.014***	0.598 ±0.029***

*** P<0.001 ** P<0.01

Permissible limit of heavy metals in organs of fish is according to WHO, 1992, Cadmium is 0.05ppm, Lead is 0.5ppm and Copper is 0.5ppm.

Table 4: Mean level of heavy metal concentration in some organs of Nile Tilapia collected from Battra drainage comparing with samples collected from River Nile Mansoura.

organ / heavy metal	Samples of fish organs collected from River Nile Mansoura				Samples of fish organs collected from Battra drainage			
	Muscle	Liver	Kidney	Gills	Muscle	Liver	Kidney	Gills
Cadmium(Cd) ppm	0.035 ±0.008	0.062 ±0.017	0.037 ±0.013	0.036 ±0.007	0.103 ±0.012***	0.121 ±0.018	0.092 ±0.009	0.83 ±0.008
Lead (Pb) ppm	0.027 ±0.004	0.038 ±0.003	0.033 ±0.005	0.029 ±0.007	0.715 ±0.016***	0.788 ±0.020***	0.652 ±0.018***	0.702 ±0.012***
Copper (Cu) ppm	0.42 ±0.019	0.380 ±0.024	0.0270 ±0.007	0.039 ±0.006	0.667** ±0.023	0.595** ±0.014	0.625** ±0.018	0.0582 ±0.004

*** P<0.001 ** P<0.01

Permissible limit of heavy metals in organs of fish is according to WHO, 1992, Cadmium is 0.05ppm, Lead is 0.5ppm and Copper is 0.5ppm.

Table 5: Mean level of heavy metal concentration in some organs of Nile Tilapia collected from River Nile Damietta town comparing with samples collected from River Nile Mansoura.

organ	Samples of fish organs collected from River Nile Mansoura				Samples of fish organs collected from River Nile Damietta			
heavy metal	Muscle	Liver	Kidney	Gills	Muscle	Liver	Kidney	Gills
Cadmium (Cd) ppm	0.035 ±0.008	0.062 ±0.017	0.037 ±0.013	0.036 ±0.007	0.120 ±0.013	0.091 ±0.010	0.060 ±0.015	0.059 ±0.008
Lead (Pb) ppm	0.027 ±0.004	0.038 ±0.003	0.033 ±0.005	0.029 ±0.007	0.654 ±0.014**	0.593 ±0.016**	0.515 ±0.08**	0.502 ±0.04**
Copper (Cu) ppm	0.42 ±0.019	0.380 ±0.024	0.0270 ±0.007	0.039 ±0.006	0.635 ±0.012**	0.822 ±0.013***	0.514 ±0.018**	0.576 ±0.09***

*** P<0.001 ** P<0.01

Permissible limit of heavy metals in organs of fish is according to WHO, 1992, Cadmium is 0.05ppm, Lead is 0.5ppm and Copper is 0.5ppm.

Table 6: Chemical constituents of water samples collected from different locations.

Parameter / Locations	Ammonia (mg/l)	Nitrite (mg/l)	Nitrate (mg/l)	Chloride (mg/l)	Sulphates (mg/l)	Total hardness $CaCo_3$ (mg/l)
Nile River Mansoura	0.12 ±0.02e	0.08 ±0.004e	1.41 ±0.07e	24.22 ±1.15e	33.23 ±3.21e	50.12 ±3.53e
Met-Annter drainage	1.498 ±0.08a***	1.22 ±0.05a***	5.56 ±0.42a***	122.49 ±9.25a***	312.5 ±18.16a***	220.35 ±16.22a***
El-Tawilla drainage	0.525 ±0.06b***	0.493 ±0.05b***	3.566 ±0.83**	88.25 ±9.56c***	111.34 ±8.25b***	150.43 ±10.55b***
Battra drainage	0.320 ±0.015c***	0.365 ±0.03c***	2.43 ±0.62c	95.24 ±11.61b***	99.44 ±6.12c***	111.65 ±7.88c***
River Nile Damietta	0.210 ±0.03d*	0.148 ±0.03d*	1.61 ±0.05d	55.60 ±5.23d*	60.18 ±6.11***	70.14 ±5.72d

*** P<0.001 ** P<0.01 *P< 0.05

Means with the same letters in the same row are not significantly different

Table 7: Malathion concentrations in water and fish samples from different locations.

Malathion location	Malathion in water	Malathion in fish
Met-Annter drainage	0.387 ±0.015***	0.114 ±0.016***
El-Tawilla drainage	0.472 ±0.018***	0.121 ±0.018***
Battra drainage	0.256 ±0.012	0.115 ±0.012***
River Nile Damietta	0.075 ±0.018	0.021 ±0.005

***P<0.001

Table 8: Mean value of blood pictures of fish collected from different locations

Location / Blood picture	River Nile Mansoura	Met-Annter drainage	El-Tawilla drainage	Battra drainage	River Nile Damietta
Total RBCs ($X10^6$/µl)	1.87 ±0.09a	1.45 ±0.08e**	1.63 ±0.06c*	1.58 ±0.08d**	1.78 ±0.07b
Haemoglobin (gm/dl)	7.43 ±0.51a	5.03 ±0.30d**	5.89 ±0.55dc**	6.12 ±0.48c*	6.92 ±0.020
Packed cell volume %	22.11 ±0.86a	16.54 ±0.72d***	16.92 ±0.76d***	18.18 ±0.82c**	20.21 ±0.94b
Total WBCs ($X10^3$/µl)	29.26 ±1.21e	39.11 ±0.92a***	38.24 ±0.79b***	36.75 ±0.82c**	34.12 ±0.73d*

*** P<0.001 ** P<0.01 *P< 0.05

Means with the same letters in the same row are not significantly different.

Table 9: Some liver and kidney functions of fish from different locations

Location Serum	River Nile Mansoura	Met-Annter drainage	El-Tawilla drainage	Battrea drainage	River Nile Dameitta
Total protein	4.83 ±0.28a	3.52 ±0.21c**	3.75 ±0.32c**	3.40 ±0.38c**	3.92 ±0.43b*
ALT	9.12 ±0.53d	13.24 ±0.61a***	12.32 ±0.41b***	12.11 ±0.58b***	11.48 ±0.43c**
AST	280.75 ±1.22d	297.60 ±2.62a***	290.84 ±2.40b**	295.44 ±2.20a***	288.54 ±1.94c
Creatinin	1.22 ±0.07c	2.62 ±0.09a***	2.30 ±0.06a***	2.27 ±0.04a***	1.68 ±0.02b
Blood urea	3.20 ±0.11d	5.75 ±0.31a***	5.39 ±0.28a***	5.18 ±0.22b***	4.20 ±0.20c*

*** P<0.001 ** P<0.01 *P< 0.05

Means with the same letters in the same row are not significantly different

Table 10: Glutathione system in hepatic tissue in fish (µmole/gm protein)

Glutathione system locations	Total glutathione	Reduced glutathione	Oxidized glutathion
River Nile Mansoura	58.42 ±1.62a	53.92 ±1.20a	4.50 ±0.22d
Met-Annter drainage	52.62 ±1.52*	47.73 ±1.12d***	4.89 ±0.24b*
El-Tawilla drainage	53.37 ±1.45c*	48.26 ±1.11d***	5.11 ±0.28a**
Battra drainage	53.85 ±1.61c*	49.02 ±1.16c**	4.83 ±0.25b*
River Nile Domietta	56.30 ±1.74b	51.52 ±1.18b	4.79 ±0.26c

*** P<0.001 ** P<0.01 *P< 0.05

Means with the same letters in the same row are not significantly different.

DISCUSSION

The changes in the physicochemical properties of water samples collected from the different locations reflect the differences in the effluents that discharged to each location such as Agricultural drainage, industrial effluents and waste municipal (Boyd, 1990).

pH values of water from different locations were in normal range. While, there was a slight increase in pH of water of Met-Annter drainage due to industrial, agriculture water drainage and in alkalinity was due to the uptake of free carbon dioxide from water and also precipitation of calcium carbonate (Boyd, 1990; Saeed, 2000).

Polluted water with heavy metals is generally associated with industrial, agricultural and municipal discharges (Haggag *et al*., 1999; Zaghloul, 2000).

In the present study the highest increasing of heavy metal concentration was in water samples collected from Met-Annter drainage because of the presence of factory of fertilization behind this drainage with the mean 0.098-0.89 and 1.48 mg/l for cadmium, lead and copper respectively and the lowest concentration was in the River Nile with the mean 0.048, 0.009 and 0.067 mg/l

For cadmium, lead and copper respectively, so the collected samples from different locations attributed to the differences in the effluents such as waste municipal industrial and agricultural drainage water). This is in agreement with Nagdi and Shaker (1998) who concluded the increasing of heavy metals in drainage water due to the decomposition of the organic matter, use of fertilizers and other chemicals in agriculture.

As heavy metals discharged into water, it enters the food chain bioaccumulation within fish tissue and so to man Ajmal *et al*. (1985). Meanwhile the concentration of studied heavy metals in vital organs and muscles of Nile Tilapia fish showed the highest increase in fish samples collected from Met-Annter drainage with a mean 0.145- 0.172-0.140 and 0.115 ppm and the lowest samples from River Nile Mansoura with the mean0.035 – 0.062 – 0.037 and 0.036 ppm for cadmium, lead and copper respectively as shown in Table 2. This agreed with Zaghloul, (2000).

The highest increase of Cadmium, Lead and Copper in muscle and liver samples were collected from Met – Annter drainage with the means 0.145 0.172 1.560- 1.780 2.648 and 0.962 PPm respectively, while the lowest concentration in muscle and gills of samples collected from Nile River Mansoura with the means (0.035 – 0.036- 0.027 – 0.029 – 0.42 and 0.038) respectively as shown in table 2 Heavy metals

were significantly higher in liver tissue recorded before by Shereif and Moaty, (1995). The highest concentration of studied heavy metal in liver tissue may be due to the major role of liver in the detoxification and protection from heavy metal (Pratap *et al*., 1989).

In this study, the highest ammonia concentration was in samples collected from Met-Annter drainage and having ammonia concentration above recommended by WHO (1993). These are in agreement with Mohamed (2005) who recorded the increase in ammonia concentration in water samples collected from Abu-Za'baal ponds. The lowest ammonia concentration were found in water samples collected from River Nile in Mansoura. The ammonia concentration was found within permissible limits according WHO (1992).

Samples collected from River Nile Damietta having higher ammonia concentration than River Nile in Mansoura that above the permissible limit of ammonia according to WHO (1992). Water samples from drainages have highest concentration of ammonia because ammonia present in high concentration in regions of intensive agricultural activities fertilizer runoff and septic tank which discharges from the soil to the drainages (Yong and Cheng, 2007).

Nitrite concentrations within samples collected from Met-Annter drainage is the highest which agree with Akoto and Adiyiah (2007), while lowest nitrite concentration were found in samples collected from River Nile in Mansoura and these are in agreement with Okafor and Ogbanna (2003).

Regarding nitrate concentration, the highest concentration was found in water samples collected from drainages while the lowest concentration in water sample collected from River Nile. These are in agreement with Shaaban *et al*. (1993); Samaha (1985).

Concerning chloride concentration all collected samples are within permissible limit of chloride concentration but drainage have higher concentration than River Nile according to (WHO, 1992) these results are in agreement with Wakawa *et al*. (2008).

Regarding sulphate concentration in water, samples collected from Met-Annter drainage showed the highest concentration. These results are in agreement with Dange *et al*. (2005).

The lowest concentration of sulphate was found in water samples collected from River Nile Mansoura and these are in agreement with Wakawa *et al*. (2008).

Total hardness in water samples collected from all drainages were higher than that collected from River Nile as shown in table 6, and

these are in agreement with Shaaban *et al*. (1993). The increasing of total hardness in drainages is due to agriculture drainage water and changes in alkalinity (Boyd, 1990; Saeed, 2000).

In present study malthion was detected in all drainages but not found in River Nile Mansoura. The highest malathion concentrationwas in El-Tawilla drainage. Presence of malathion in drainages and not found in River Nile indicates a runoff of the pesticide from the agricultural land to the drainage canals. Hydrolysis is a major pathway of degradation of malathion in aquatic systems and increase with increasing alkalinity and temperature Malathion concentration were detected in fish samples collected from El-Tawilla drainage Malathion concentration in water was higher than in fish samples as shown in Table 7, (Guerrant *et al*., 1970).

The lowest total protein concentration in serum samples were recorded in fish samples collected from Met-Anntar drainage compared with samples collected from River Nile and other location.

Total protein in serum samples collected from Met-Annter drainage showed the highest decreasing compared with samples collected from River Nile and samples from other locations. This decrease may be due to liver damage. These results were agreed with Abd-Alla *et al*. (2002).

A significant increase in AST/ALT activity in; Met-Annter, El-Tawilla and Battra drainage were recorded. The increase of liver enzymatic activity may be due to hepatic damage resulted from oxidative stress in fish exposed to pollution. This is in agreeing with Hema *et al*. (1987); Zikic *et al*. (2001). Concerning kidney function, it showed an increase in serum creatinine and blood urea, these agree with Hafez *et al*. (2003) who reported an increases in blood urea and serum creatinine in fish collected from polluted locations due to kidney damage.

Haematological studies were carried out for evaluation blood parameters to investigate physiological changes caused by environmental pollutants (Ghazaly and Said, 1995; El-Naggar *et al*., 1998; Haggag *et al*., 1999).

The haematological analysis of blood samples showed significant decrease in RBCs, Hb and PCV valued. Reduction in red blood corpuscles production in the haematopoietic organ under the action of heavy metals accumulated at high concentrations in tissue and due to intrahepatic and intrasplenic haemmorrhage.

Decrease in RBCs may be due to reduction in red blood corpuscles production in the bone marrow under the action of heavy metals. These results agreed with Abbas (1994); Marie (1990). Leucocytosis showed significant increase, which, may be due to release of corticoids into circulation under the effect of heavy metal and may be due to hepatitis and nephrites under the effect of heavy metal accumulated in liver and kidney. These are in agreement with Hafez *et al*. (2003).

In present study there was a decrease in hepatic reduced glutathione and total glutathione mean while there was an increase in oxidized glutathione. In fact depletion of liver glutathione often occurs in liver injuries (Uhling and Wendel, 1992).

CONCLUSION

The increasing oxidized glutathione revealed a negative shifting of GSH/GSSII, which in turn should be a strong evidence of liver injury. All these pollutants mentioned before, resulted in a strong metabolic effect shifting of the glutathione system to the oxidized side that causing hepatotoxic effect in fish.

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