Pollution of Nile fish by some heavy metals at Qena, Upper Egypt

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Abstract

One hundred and sixty five Fresh water fish Tilapia nilotica (115), and Claris Lazera (35), were collected from five districts of Qena governorate, Upper Egypt. The statistical analytical results indicated that Tilapi nilotica and Clarias lazera were contained residues above the permissible limits.There is a significant difference in mean values in the heave metals in the examined districts as well as between T.nilotica and Clarias lazera The sources of the environmental contamination by such heavy metals were discussed.

Introduction

In Alexandria Governorate, Egypt, (**El-Nabawi et al., 1987)** reported that the average Cadmium concentration in the examined muscle tissues of *Tilapia nilotica* caught from Abo-Qir Bay, Edku and Maruit lakes were ranged from 0.018 to 0.023 µg/gram. While mean level of Lead was 0.42 µg/g. the concentration of Copper was 6.9-10.2 mg/kg dry weight. The residue level of copper in *Tilapia nilotica* flesh was 15.4 ppm in fish caught from Idku and Maryut lakes.

Mason and Barak (1990) stated that the flesh of 319 eels from 57 sites in a catchment in Eastern England. Cd. concentration in liver ranged from 0.071 to 1.096 mg/kg. Lead conc. in the flesh of 319 Eels from 57 sites in eastern England. High levels were mostly found around sewage discharges. Lead level in liver ranged from 0.19-1.45 mg/kg.

Egyptian Organization for Standarization and Quality Control (1993). Pointed that maximum level for Cd,Pb,Cu nd Zinc must not exceed 0.1,0.1,20 and 50 ppm,respectively.

Seddek et al. (1996) they investigated five Nile fish species *Oreochromis niloticus*, *Clarias lazera*, *Labeo niloticus*, synodontis and bagrus bayad were collected from fish sources collected from Assiut Governorate, the results revealed that cadmium conc with the mean values of 0.260 µg/gm wet weight, while in *Clarias lazera* muscle the with the mean values of 0.332 µg/g. the average of Lead level is 0.328 ppm in *T. niloticus*, 0.456 ppm in *C. lazera*, 0.846_ppm in *Labeo niloticus*, 0.64ppm in *Synodontis* and 0.12ppm in *Bagrus bayad*. The result revealed that the average of copper level is 4.22, 5.55, 2.16, 3.78 and 1.68 ppm.

Sepe, et al. (2003) determined the concentration of cadmium in sample of six fish species collected along the coast of the Adriatic sea. The concentration of Cd generally low often below the detection limits of analytical methods. The highest values (µg/kg) fresh weights were observed for anchovy 20.2, red mullet 3.1 and mackerel 7.7. The conc. of Lead in Anchovy 45.9 micro gram/kg fresh weight, red mullet 36.0 µg/kg and mackerel 11.4 µg/kg fresh weight.

Celik and Oehlenschlager (2007) estimate Cd content in popular flishery products sold in Turkish super markets. The highest content of Cd found in the frozen anchocvy 494.2 µg/kg while in canned Anchovy fillet had the lowest Cd 25.1 µg/kg.

The present study planned to fullfiled for Detection of heavy metals Cd, Cu, Pb and Zn in muscular tissues of *Tilapia nilotica* and *Clarias lazera* caught from different location at Qena Governorate.as well as comparative studies between the obtained results and the standard limits.

MATERIAL AND METHODS

Collection of samples:

One hundred and sixty five samples of *Tilapia nilotica* (115) and *Clarias lazera* (40) were collected during the year 2006, 20 samples of *Tilapia nilotica* and 10 samples of *Clarias lazera* from Esna, Luxor, Kous and Qena, while 35 samples of *Tilapia nilotica* and 10 samples of *Clarias lazera* were collected from Nag-Hamady.

The fish specimens were individually placed in clean polyethylene bags and immediately taken to the laboratory where they were kept deeply frozen at -20°C until the samples were prepared for digestion and analysis.

Preparation of samples:

According to (**Teeny et al., 1984) and (F.D.A. Pesticides Analytical Manual, 1968**). **A.O.A.C. (1975)**

(C) Methods of sample analysis:

Digestion of samples: Digestion of sample was carried out according to the method obtained by **Finerty et al. (1990)**.

(D) Chemical analysis :

Determination of Cd, Cu, Pb and Zn were carried out in laboratory of biochemestry Department, Faculty of Medicine, Assiut University, by using Atomica absorption/Flame Emission Spectrophotometer Shimadzu-model (AA-630-02.).

Statistical analysis

The statistical analysis in this study was carried out according to **Snedecor and Cochran (1968).**

Results

Table (1): Statistical analytical results of cadmium levels (ppm) ** of tilapia nilotica caught from Qena province

	Cd				Lead				Cu				Zinc				Value No.
	Mean	S.E	Min	Max	Mean	S.E	Min	Max	Mean	S.E	Min	Max	Mean	S.E	Min	Max	
N.Hamady	0.34	0.025	0.12	0.66	0.53	0.08	0.07	2.00	1.53	0.15	0.47	3.25	6.47	0.52	2.86	13.71	35
Qena	0.32	0.05	0.08	1.00	0.69	0.17	0.07	2.5	1.44	0.19	0.60	3.00	9.38	0.57	5.71	13.80	20
Kous	0.42	0.03	0.14	0.67	1.12	0.21	0.25	3.5	1.11	0.14	0.50	2.75	10.05	0.60	5.72	15.50	20
Luxor	0.39	0.03	0.12	0.66	0.60	0.08	0.17	1.50	1.03	0.11	0.50	2.50	9.26	0.69	5.14	16.00	20
Esna	0.34	0.03	0.12	0.66	0.47	0.08	1.10	0.30	0.95	0.11	0.50	2.50	8.60	0.40	4.42	12.60	20

*** S.E. =standard error of mean**

**** Wet weight**

Table(2): Analysis of varience (ANOVA) comparing of Cadm, Lead, Cuppr and Zinc levels (ppm) wet weight in the examined T.V in differential districts of Qena province.

Source of variance	D.F				Sum Squares				Mean squares				F Ratio*				F Preb			
	Cd	Lead	Cu	Zn	Cd	Lead	Cu	Zn	Cd	pb	Cu	Zn	Cd	pb	Cu	Zn	cd	pb	cu	zn
Between groups	4	4	4	4	0.14	5.91	6.65	218.83	0.04	1.48	1.66	218	1.38	3.92	3.25	7.19				
Within groups	110	110	110	110	2.88	41.49	56.72	837.39	0.03	0.38	0.51	7.61								
Total	114	114	114	114	3.02	47.30	62.92	1056.2									0.24	001	0.01	0.01
B.g																				

- **Menas are rignifcaully different at 0.05 level.**

Table(3): Statistical analytical results of Cd, Pb, Cu and Zu levels (ppm) ** in Claries lazera caught from different districts of qeua province

	Cd				Lead				Cu				Zinc				Value No.
	Mean	S.E*	Min	Max	Mean	S.E*	Min	Max	Mean	S.E*	Min	Max	Mean	S.E*	Min	Max	
N.Hamady	0.45	0.09	0.08	0.83	0.26	0.05	0.1	0.56	0.47	0.08	0.15	0.94	3.90	0.50	1.96	7.00	10
Qena	0.37	0.06	0.09	0.66	0.31	0.09	0.09	0.97	0.49	0.08	0.19	1.00	3.58	0.25	2.44	5.00	10
Kaus	0.41	0.07	0.06	0.73	0.28	0.06	0.13	0.62	0.40	0.06	0.19	0.75	2.90	0.21	2.06	4.00	10
Luxor	0.34	0.05	0.07	0.53	0.37	0.08	0.13	1.00	0.35	0.08	0.14	0.87	2.69	0.15	1.62	3.20	10
Esna	0.26	0.05	0.06	0.46	0.27	0.05	0.1	0.60	0.39	0.10	0.12	0.99	3.33	0.40	1.42	5.71	10

*** S.E.= standard error of mean.**

**** Wet weight**

Table(4): Analysis of varience (ANOVA) comparing of Cd, Pb, Cu and Zn levels (ppm) wet weight in the examined Clarias lazera in differential districts of Qena province.

Source of variance	D.F				Sum Squares				Mean squares					
	Cd	Pb	Cu	Zn	Cd	pb	Cu	Zn	Cd	pb	Cu	Zn	Cd	
Between groups	4	4	4	4	0.20	0.07	0.13	9.71	0.05	0.018	0.03	2.42	1.15	
Within groups	45	45	45	110	1.93	2.07	3.18	48.31	0.04	0.05	0.07	1.07		
Total	49	49	49	114	2.13	2.15	3.31	58.03						

*** Means are not riginficent**

Table(5): Statistical analytical for the least significance (LSD) between heavy metals in Tinilica and clazena and different district.

	N.Hamady		Qena		Kous		
	Tilapea Nilatica	Clavia lazera	Tilapea Nilatica	Clavia lazera	Tilapea Nilatica	Clavia Lazera	Tila Nila
Zinc	6.47 ±0.52	3.90 ±0.50	9.38 ±0.57^{N}	3.58 ±0.25	10.05 ±0.60^{N}	2.99 ±0.21^{N}	9.2 ±0.(
Cu	1.53 ±0.15	0.44 ±0.09	1.44 ±0.19	0.44 ±0.084	1.11 ±0.14^{N}	0.40 ±0.06	1.(±0.1
Cadm	0.34 ±0.02	0.45 ±0.09	0.32 ±0.05	0.37 ±0.06	0.42 ±0.03	0.41 ±0.07	0.4 ±0.
Lead	0.53 ±0.08^{K}	0.26 ±0.05	0.69 ±0.17^{K}	0.31 ±0.09	1.12 ±0.21	0.28 ±0.06	0.(±0.(

N: Significant difference against Na. Hamady
Q: Significant difference against Qena
K: Significant difference against kous

DISCUSSION

Cadmium

The results recorde in tables (1 and 2) were nearly parallel to those reported by Seddek et al. (1996) , Celik and Oehlenschlager (2007), they recorded Cd concentration with levels varies from 0.1 to 0.8 ppm. Lower results were reported by **Hamza et al. (1996) Shokrzadeh et al. (2004)**, thery recorded levels varied from 0.01 to 0.09 ppm. Moreover, higher levels were found by **Tariq et al. (1994) Juma et al. (2002)** they recorded levels varied from 2.0-15.8 ppm.

The incidence of Cadmium in *T. nilotica* and *C. lazera* fish. It is shown that one sample (0.9%) of *T. nilotica* and six samples (12%) of *C. lazera* were within the permissible limits. While 114 samples (99.1%) of *T. nilotica* and 44 samples (88%) of *C. lazera* were over the permissible limits which (0.1 ppm) which recommended by **E.O.S.Q.C. (1993)**.

In Table (2) and Table (4) the analysis of variance (ANOVA) was applied for cadmium in *Tilapia nilotica* and *Clarias lazera* in different districts. No significant variation in cadmium residues in different districts.

High incidence of Cadmium may be due to contamination of fish from super phosphate factories in Esna district and sugar cane factories in Kous, Deshna and Nag-Hamady. Sources of cadmium pollution to aquatic environment including the mining company, industrial company, sewage sludge applied to land and phosphate fertilizer. While, the production of phosphate fertilizer is the main source of cadmium in the environment. Moreover that the use of municipal sewage sludge to agricultural soils as a fertilizer could be considered as an important source of Cadmium pollution. Also, in Esna district found two factories for phosphate collection which produce from mines in Sepaia, Qen

Lead

The results present obtained in the present (table) study were nearly harmony to those reported by **Seddek et al. (1996)** ,**Marouf and Dawoad (2006)**, they recorded levels ranged from 0.42 to 0.74. While lower result were reported by **Suppin et al. (2005) Cetik and Oehlenschlager (2007)** they registered levels varied from 0.04 ppm to 76.1 ppb. On the other hand, higher results were recorded by **Adekunle et al. (2004) Saleh (2004).**

The incidence of lead "Pb" in *Tilapia nilotica* and *Clarias lazera* fish. It is shown that two samples (1.7%) of *T. nilotica* and one sample (2%) of *C. lazera* were within the permissible limits (0.1 ppm) recommended by **E.O.S.Q.C. (1993)** while 113 samples (98.3%) of *T. nilotica* and 49 samples (98%) of *C. lazera* were over the permissible limits.

In Table (2) the analysis of variance (ANOVA) was applied for lead in *Tilapia nilotica* concentration in ppm in different districts in Qena Governorate. Results achieved that there were a significant variation in the means of Cadmium in different districts. Moreover,in table (4) ANOVA comparing for lead levels in "ppm" wet weight in the examined *Clarias lazera* in different districts. Result appear no significance between lead residues in different districts.

High levels of lead may be attributed to lead "Pb" could contaminate water from industrial and agricultural discharges, sewage effluents, high ways or motor boat traffic and from mine and smelting operation.

High levels also may be due to the presence of industrial discharge from sugar cane factories, cement factory in Qena and Aluminum factory in Nag-Hamady. Also, pollution of River Nile which lies near the high way and motor cars effluents. In Qena especially Luxor found motor boat traffic which consider the main source of lead pollution.

Copper

Nearly similar observations were recorded by several researchers. **Celik and Oehlenschlager (2004) Celik and Oehlenschlager (2005)**.

The incidence of copper in *Tilapia nilotica* and *Clarias lazera* and the percentage of the examined fish according to the permissible limits of heavy metal levels.It is shown that all samples of *T. nilotica* and *C. lazera*

(100%) were within the permissible limits recommended by **E.O.S.Q.C. (1993)**

In Table (2) analysis of variance (ANOVA) comparing for copper (Cu) level in (ppm) wet weight in the examined *T. nilotica* fish in different districts. Result appear that means are significantly different. In Table (4) analysis of variance (ANOVA) comparing for copper (Cu) level in (ppm) wet weight in the examined *C. lazera* fish in different districts. Result appear no significance. Although copper level in examined fishes was low all fishes were infected but by low degree less than the permissible limits (20 ppm) which recorded by **E.O.S.Q.C. (1993**).

Zinc

The present data were nearly agree with the findings obtained by **Clerck et al. (1988)** Zinc range from 3.2-9.1 mg/kg. **Jaffar et al. (1988)** Zinc in edible part of fresh water fish was ranged from 1.87 to 50.6 mg/kg. **Celik and Oehlenschlager (2004)** Zinc was 8.6 mg/kg. **Celik and Oehlenschlager (2005)** Zinc was 9.73 mg/kg.

The incidence of zinc (Zn) in *Tilapia nilotica* and *Clarias lazera* and the percentage of the examined fish according to the permissible limits of heavy metal levels.It is shown that all samples of *Tilapia nilotica* and *Clarias lazera* 100% were within the permissible limits recommended by **E.O.S.Q.C. (1993)**.

In Table (4) analysis of variance (ANOVA) comparing for zinc (Zn) level in (ppm) wet weight in the examined *Tilapia nilotica* fish in different districts in Qena governorate. Result appear mean are significantly different. While in Table (16) analysis of variance (ANOVA) comparing for zinc (Zn) level in (ppm) wet weight in the

examined *Clarias lazera* fish in different districts in Qena Governorate. Result appear no significance.

It is clear that the mean levels of zinc in all examined fish muscles in different districts in Qena Governorate are lower than the permissible limit (50 ppm) which recommended by **E.O.S.Q.C. (1993)**.

Table (2) and Table (4) show analysis of variance comparing for zinc in different districts in Qena Governorate in samples of *Tilapia nilotica* fishes appear a significant variation in zinc (Zn) residues in the examined fishes in different districts in Qena Governorate, and there is a significant difference against Nag-Hamady and all other districts "Qena, Kous, Luxor and Esna". May be due to sugar cane factory in Deshna which lies south to Nag-Hamady and the oldest sugar cane factory in Nag-Hamady and Aluminum factory also in Nag-Hamady.

In Table (6) the results show statistical analysis for the least significant difference (L.S.D.) between heavy metals in *Tilapia nilotica* and different districts in Qena Governorate which appear. Significant difference against Nag-Hamay districts and all other districts in Qena Governorate in the concentration mean of zinc (Zn). Also significant difference in Copper "Cu" mean concentration in *T. nilotica* between Nag-Hamay and Kous, Luxor and Esna districts. Also between Qena district and Esna in contamination of *T. nilotica* by copper "Cu". also significant difference between Kous and all other districts "Esna, Luxor, Qena, Nag-Hamady" in Qena governorate in concentration of lead "Pb" in *T. nilotica* fish samples. Which may be due to paper factory and sugar cane factory in Kous and motor traffic boat in Luxor which lies south of Kous.

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تلوث الأسماك النيلية بالمعادن الثقيلة بمحافظة قنا، صعيد مصر

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الملخص

تم جمع عدد مائة وخمسة وثلاثون من أسماك البلطى(١١٥)، وأسماك القراميط (٣٥) من خمس مناطق بمحافظة قنا، جمهورية مصر العربية وتشمل: نجع حمادى، قنا، قوس، الأقصر، وإسنا. وتم تحليل العينات للكشف على بقايا عناصر الكادميوم، الرصاص، النحاس والزنك بواسطة جهاز مقياس الضوئى الطيفى بعث اللهب / الإمتصاص الذري . وأشارت نتائج التحليلات الإحصائية إلى أن أسماك البلطى والقراميط تحتوى بقايا المعادن أكثر من الحدود المسموح بها: الكادميوم (٩٩,١%ن ٨٨%) ، الرصاص (٩٨,٣%، ٩٨%)، النحاس والزنك أعلى من الحدود المسموح بها بنسبة ١٠٠%. بالنسبة لأسماك البلطى أتضح أن توجد فروق معنوية فى متوسط عنصر الزنك لمنطقة نجع حمادى والمناطق الأخرى وكذلك إختلافات معنوية للنحاس بين مناطق نجع حمادى، إسنا، الأقصر، قنا وقوس . وكذلك إختلافات معنوية بين منطقة قوس والمناطق الأخرى فى تركيزات الرصاص. توجد إختلافات معنوية بين أسماك البلطى والقراميط فى بقايا تركيزات الرصاص، النحاس والزنك. علاقة المعاملات بين الزنك والرصاص كانت موجبة، بينما العلاقة بين الكادميوم والنحاس كانت سالبة فى أنسجة اسماك البلطى فقط. وقد نوقشت مصادر التلوث البيئى بمثل هذة المعادن.