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Organochlorine pesticides and trace metals contamination in some marketable fish in Egypt

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Abstract

The existence and distribution of some organochlorine pesticides (OC) and trace metals , in muscles of popular marketable fish in Egypt (*Oreochromis niloticus* , *Bagrus bagad* and *Mormyrus niloticus*) from four selected governorates (Helwan , El- Giza , Cairo and El Qalubia) were determined, during winter (January) 2010 . The data indicated that the number of detected pesticides varied according to fish species and the location . In general, the pesticides residue abundances showed in fish muscles in the following order : *Bagrus bagad >Tilapia niloticus* > *Mormyrus niloticus* . The highest number of pesticides was found in fish muscles from El- Qalubia governorate and the lowest found in fish muscles from Cairo governorate. The detected organochlorine pesticides were below the maximum permissible limits with few exceptions . The results of trace metals indicated that trace metals in muscles of studied fish present in the following order : Zn > Hg > Ni > Fe > Pb > Mn > Cd . The accumulation of heavy metals in fish muscles was found in the following order : *Bagrus bagad* > *Mormyrus niloticus* > *Tilapia niloticus* . Copper and Manganese concentrations in fish muscles were below the permissible limits , whereas the other metals (Zn ,Hg, Ni, Fe Pb and Cd) exceeding the permissible limits. We can concluded that fish muscles from marketable fish from the studied governorates were contaminated with relatively low levels of pesticides and high levels of trace metals and should pose a health risk to consumers. A recommendation and suggestions to intensive plan for monitoring water quality of River Nile regionally and seasonally . Strict application of the legislations concerning the protection of the River Nile and the environment, according to the laws 48/1982 and 4/1994.

Keywords: Organochlorine pesticides, Trace metals, Contamination, Marketable fish. Egypt.

1. Introduction

Fish are widely consumes in many parts of the world by humans because it has high protein contents and low saturated fat which contains Omega fatty acids known to support good health (Ikem and Egiebor,2005) . In spite of , fish are constantly exposed to chemicals in polluted and contaminated waters but fish have been found to be good indicators of heavy metals and pesticides contamination in aquatic systems because they occupy different tropic levels (Burger *et al* ., 2002) . Organochlorine and trace metals are among biosphere pollutants of global concern , because of their ability to bioconcentrate and bioaccumulate by aquatic organisms such as fish (Mdegela *et al* ., 2009) . Rivers and lakes are excessively contaminated by heavy metals , organic compounds and hydrocarbone release from domestic , industrial and agricultural effluents . Organochlorine pesticides (OC) are halogenated organic compounds classified as: dichlodiphenyle ethan , hexachlorocyclohexanes (HCH),cyclodienes (heptochlor , heptachlorepoxide) and chlorinated benzene. They are characterized by high persistence , low polarity , low aqueous solubility , and high lipid solubility (lipophilicity) and as a results they have a potential to bioaccumulate in fatty tissues of aquatic organisms ((Kasozi *et al*., 2006) .

Although, Egypt is the largest pesticide market in Arabian countries and the fourth largest importer of pesticides among developing countries (Yamashita *et al* .,2000), there are no regular monitoring programs in Egypt for identification and determination of pesticides in the environment . Some studies and surveys(Abd allah and Ali ,1994 ; Abd allah *et al* ., 1998 *;* Yamashita *et al* ., 2000 *;* Zidan *et al*., 2002 *; El* Nemr and Abd allah 2004 *;* Saad *et al*.,2008) indicate current use of organochlorine pesticides for agricultural and pests control in Egyptian aquatic environment .

The effect of heavy metals on human health and the environment is of great interest today , especially for aquatic food products (Sasmaz and Yaman , 2006) .

Heavy metals can be classified as potentially toxic (arsenic , cadmium , aluminum , lead , mercury) , probably essential (nickel , vanadium , cobalt) and essential (copper , zinc , selenium) (Munoz and Camara , 2001) . Toxic element can be very harmful, even at low concentration , when ingested over a long time period . The essential metals can also produce toxic effects when the metal intake is excessively elevated (Celik and Oehlenschlager, 2007) . The heavy metals discharged into aquatic environment can damage both aquatic species , diversity and ecosystem . The accumulated levels of trace metals in the living organisms are depended to species , the size of the individuals, tissues and organisms as well as types of metals (Ozturk , 1994). Heavy metals and pesticides pollutants in the aquatic environment has long been recognized as a serious environmental concern . In the rivers and lakes pollutants are potential accumulated in aquatic organisms and sediments , and subsequently transfer to man through the food chain (Tuzen,2003) .

Levels of pesticides and heavy metals in fish samples have been widely reported in the literature. However there is a limit information about the organochlorine pesticides and trace metals contaminate marketabl fish in Egypt . Therefore, the aim of this study was to assess the content of some organochlorine pesticides and trace metals in muscles of (*Oreochromis niloticus, Bagrus bagad and Mormyrus niloticus*) fishes collected from four public markets in four governorates(Helwan , El Giza , Cairo and El Qalubia) in Egypt .The assessed organochlorine pesticides were cyclodienes compounds (heptachlor, heptachlorepoxide and Aldrin) chloridane, DDT isomers (pp isomers of DDT , DDE and DDD) lindane and Endrin and the trace metals are Cu , Fe , Mn , Zn ,Cd , Ni , Pb , and Hg.

2. Materials and Methods

Fish samples representing of *Oreochromis niloticus*, *Bagrus bagad* and *Mormyrus niloticus* were collected from four public markets in four governorates in Egypt (Helwan , El- Giza , Cairo and El- Qalubia) during winter 2010. Common name length, weight and food of the three fish species presented in (Table 1) .Fish samples were kept frozen at -20 C^0 prior to analysis. White tissues (muscles) were sampled by section from 6 individuals of each fish species and tissues of the same species were mixed to make composite sample . From each composite sample , two replicates samplers were taken.

Multi residue analysis of fish muscles was carried out in pesticides research and Analysis Laboratory in Environmental Poison Research Unit , Faculty of Agriculture , Ain Shams University . The extraction of pesticides residues in fish muscles (25g for each sample) was carried out using acetonitrile –petroleum ether partitioning. Clean up was done on florisil column with three mixtures (6,15 and 50% diethylether in petroleum ether) for elution as described by Anonymous (1990) . Gas Chromatography apparatus [GC (SHIMADZU,12-A)] provided with FID (Flam Ionization Detector) and ECD (Electron Capture Detector) detectors was used for identification of the pesticides residue in fish muscles (ppm). The operating condition for the GC were as follows :

Temperature: oven temp program 180 -250 C^0 (2 C^0/min).

Gas pressure : carrier gas N^2 1.5

Attenuation : 10x5 . The detection limits were (0.01 ppm) for studied organochlorine compound .

For trace metals analysis 20 g. from each composed samples were taken and dried at 105C^0 for 48 hr. and then grounded to a fine powder . The dried samples were digested according to the method of (Ghazaly , 1988) . 1 g . dry powder was digested in a solution of nitric acid and perchloric acid AR grade (5 ml+5ml) until the sample becomes clear . After cooling the solution was filtered and the filtrate mad up of a known volume (50 ml) with deionized distilled water .The concentrations of trace metals Cu, Fe , Mn , Zn , Cd , Ni , Pb and Hg were determined using SHIMADZU – flame Atomic Absorption Spectrophotometer(AA-6800) and the results were expressed in mg/kg dry wt. in muscles .

3. Results

3.1. Pesticides residues in fish muscles

The residue level of organochlorine pesticides in muscles of studied fish species (*O. niloticus* , *B . bagad* and *M . niloticus)* are presented in Table (2) from Helwan and El – Giza governorates and Table (3) from Cairo and El- Qalubia governorates .

In Helwan governorate, detectable levels of aldrin , endrin were identified in the muscle of *O . niloticus* , *B . bagad* and *M . niloticus* , their concentration were (0.01 , 0.02 and 0.01)for aldrin and (0.04 , 0.06 and 0.027) for endrin mg/kg wet. wt. respectively . In Giza governorate residue of heptachlor, pp'-DDT and pp'-DDE were found in the muscles of *O . niloticus* , *B . bagad* and *M. niloticus* reaching (0.05 , 0.08 and 0.02) for heptachlor , (0.025 , 0.03 and 0.02) for pp'-DDT and (0.055 , 0.06 and 0.045) for pp'-DDE mg/kg wet wt . , respectively .

In Cairo governorate , heptachlorepoxi was detected in muscle of *B . bagad* and *M . niltoticus* reaching 0.034 and 0.01 mg/kg wet wt. respectively . Aldrin was detected only in the muscle of *O . niloticus* (0.13 mg/kg wet wt .) pp'-DDT and pp'-DDE were detected in the muscles of *O. niloticus* and *B . bagad* reaching (0.30 , 0.54) and (0.02 ,0.04) mg/kg wet wt . , respectively . In El-Qalubia governorate . heptachlor, pp'DDT , lindane and endrin were detected in the muscles of *O . niloticus* , *B . bagad* and *M. niloticus* reaching (0.8 , 0.88 and 0.05) , (0.44 , 0.52 and 0.3) , (0.5 , 0.75and 0.2) and (1.6 , 2.8 and 0.05) mg/kg wet wt . respectively . Heptachlorepoxe was detected only in the muscle of *B . bagad* and *M . niloticus*.

Chloridane was not detected in all studied fish muscles from all governorates.

In general the organochlorine pesticided residue was found in the fish muscles in the following decreasing order *B. bagad* >*O . niloticus* >*M. niloticus.*

Table 1. Common name , length , weight, food and scientific name of three fish species studied

Common name	Length (cm)	Weight (g.)	Food	Scientific name of Species
Bolti nile	13-16.5	56-81	Algae, weeds and epiphytic diatoms.	*Oreochromis niloticus*
Bayad	24-32	176-268	Small fish, insect and chrustace.	*Bagrus bagad*
Anoma	21-28	107-210	small shrimps worms vegetation	*Mormyrus niloticus*

Number of fish used (n) = 6 for each species

Table 2. Organochlorine pesticides residue (ppm)wet wt . in fish muscles collected from Helwan and El-Giza governorates.

Organochlorine pesticides residues	Helwan			El-Giza		
	O. n	*B.b*	*M.n*	*O. n*	*B.b*	*M.n*
Heptachlor	N.D	ND	ND	0.05	0.08	0.02
Heptachlorepoxe	N.D	ND	ND	ND	ND	ND
Chloridane	N.D	ND	ND	ND	ND	ND
Aldrin	0.01	0.02	0.01	ND	ND	ND
Pp'-DDT	ND	ND	ND	0.025	0.03	0.02
Pp'DDE	ND	ND	ND	0.055	0.06	0.045
Pp'-DDD	ND	ND	ND	ND	ND	ND
Lindane	ND	ND	ND	0.02	ND	ND
Endrin	0.04	0.06	0.027	0.01	ND	ND

O.n : Oreochromis niloticus *B. b*: *Bagrus bagad* *M. n : Mormyrus niloticus*
ND: not detected or the residues are existed in amounts below the limit of detection (0.01ppm).

Table 3. Organochlorine pesticides residue (ppm)wet wt. in fish muscles collected from Cairo and El-Qalubia governorates.

Organochlorine Pesticides Residue	Cairo			El-Qalubia		
	O. n	*B.b*	*M.n*	*O. n*	*B.b*	*M.n*
Heptachlor	N.D	ND	ND	0.80	0.88	0.05
Heptachlorepoxe	N.D	0.034	0.01	ND	0.05	0.01
Chloridane	N.D	ND	ND	ND	ND	ND
Aldrin	0.13	ND	ND	ND	ND	ND
Pp'-DDT	0.30	0.54	ND	0.40	0.52	0.3
Pp'DDE	0.02	0.04	ND	0.07	0.12	ND
Pp'-DDD	ND	ND	0.02	0.58	1.0	ND
Lindane	ND	ND	ND	0.50	0.75	0.2
Endrin	ND	ND	ND	1.6	2.8	0.05

O.n : Oreochromis niloticus *B. b*: *Bagrus bagad* *M. n ; Mormyrus niloticus*
ND: not detected or the residues are existed in amount below the limit of detection (0.01ppm).

3.2.Trace metals concentrations in fish muscles

The results of the metals analysis in the muscles of the studied marketable fish species from four governorates are summarized in Tables (4)&(5) . All metals concentrations(Cu , Fe , Mn ,Zn, Cd, Ni ,Pb and Hg) were determined on a dry weight basis . The contents of investigated trace metals in marketable fish samples from Helwan , El Giza , Cairo and El Qalubia were found to be in the range (ND- 6.7 Cu) , (ND-160 Fe) , (ND-14 Mn) , (46-520 Zn) , (2.5-6.5 Cd) , (15.5 -118 Ni) , (ND – 14.9 Pb) and (30 – 194 Hg), mg/kg dry wt. . According to these data, the accumulation rate trends were found in the decreasing order : Zn > Hg > Ni > Fe > Pb >Mn > Cd and Cu . The accumulation of heavy metals in fish muscles was found in the following order *B. bagad >M. niloticus >O. niloticus*

4. Discussion

The extensive use of pesticides in Egypt contributes seriously in the contamination of the environment , especially the aquatic ecosystem which serves as a reservoir for tremendous quantities of there foreign organic chemicals . The exposure of fish to these chemicals is responsible for the great loss of a good source of animal proteins

(Mohamed and Gad 2007) . As the source of water for the studied marketable fish from all the studied governorates is the River Nile (industrial , agricultural and sewage drainage water) , so several organochlorine pesticides and trace metals were detected in fish muscles.

4.1 .Pesticides residues in fish muscles

The present study revealed that the highest levels of organochlorine pesticides were found in *B. bagad* fish while the lowest levels was recorded in *M. niloticus* fish collected from all the studied governorates. The total organochlorine compounds were presented in fish in the following decreasing order *B. bagad* > *O. niloticus* > *M . niloticus* in all studied locations. Marketable fish from El- Qalubia governorate revealed five organochlorine pesticides namely; heptachlor, heptachlorepoxide, lindane , endrine and DDT metabolites(PP'- DDT , PP'- DDE and PP'- DDD) . However marketable fish from Helwan and Cairo have lesser numbers of organochlorine pesticides . Only aldrin and endrin were detected in fish muscles from Helwan governorate . Also Heptachloroepoxide , aldrin and DDT metabolites were detected in marketable fish from Cairo governorate . Chlordane was not detected in all studied fish from four governorates . Highest value of endrin pesticide was recorded in muscles of *B. bagad* (2.8 mg/kg wet wt .) from El Qalubia governorate . With respect to number of studied pesticides fish from El – Qalubia and Giza governorates were more polluted with pesticides than Helwan and Cairo, this is mainly due to environmental condition , level of exposure , nature of pesticides , its solubility , the fish species, fish feeding habitats and its ability to excrete compounds (Edwards , 1973 and Falandysz ,1985). The concentration range of organochlorine pesticides in this studies was within the range of the date obtained by Zidan *et al* .(2002) ; El-Nemer and Abd-allah (2004) ; Mohamed and Gad (2007) and Saad *et al* . (2008).

4.1.1. *Hazard levels*

Since organochlorine compounds pose a potential health hazard , the maximum permissible levels of toxic substances recommended for protection of aquatic biota have been published . The National Academy of Science and National Academy of Engineering (NAS –NAE, 1972) recommended limits of 1000 ng/g for total DDTs and 100 ng/g dieldrin , endrin, heprachlor and chlordane (all as weight concentration in whole body tissues) .Environmental Protection Agency (EPA) (1973) recommended levels of organochlorine pesticides in fish for the protection of piscivores are that DDT should not exceed 1 mg/kg and that of aldrin , dieldrin , ednrin , chlordane and lindane should not exceed 0.1 mg/kg .Food and Drug Administration (FDA) (2001) recommended a level of 0.3 g/kg in fish as maximum acceptable limit for DDT , heptachlor , lindane , endrin and chlordane for human consumption . Food and Agriculture Organization (FAO) (1983) recommended a level of 0.3 g/kg in fish as maximum acceptable limit for DDT , Heptachlor, lindane , endrin and aldrin (FAO, 1983 and Mwevura et al ., 2002) . According to these recommendation , the levels of organochlorine pesticides in all studied biota in this investigation are considered lower than the permissible levels and fit for consumption except fish from El Qalubia governorate . However further monitoring of these contaminants in the aquatic ecosystem is recommended to insure the protection of food source in Egypt .

4.2. Concentration of trace metals in fish muscles

Contamination of the aquatic environment with toxic elements is increase due to the progressive industrialization (Aboul Ezz *et al.,* 2002). Studies carried out on fish have shown that trace metals may have toxic effects, altering physiological activities and biochemical parameters both in tissues and blood (Gad and Ibrahim 2005; Mohamed and Gad 2008 & 2009) . Since the toxic effects of metals have been recognized , heavy metals in the tissues of the aquatic animals are occasionally monitored (Canli *et al*, 1998). In general the impact of heavy metals on aquatic organisms affected directly or indirectly the populations, nutrition , this leads to hazardous effect on human health (Abdel –Baky *et al.*, 1998) .

Table 4.Concentration of trace metals (mg/kg dry wt.) in fish muscles collected from Helwan and El-Giza governorates.

El-Giza			Helwan			Heavy metals
M.n	*B.b*	*O. n*	*M.n*	*B.b*	*O. n*	
ND	ND	ND	6.2	6.7	6.0	Cu
32	ND	ND	160	150	133	Fe
ND	ND	0.5	ND	8.8	14	Mn
237	133	157	ND	56.2	46	Zn
3.5	3.5	2.5	6.4	6.5	6.0	Cd
29	42	35.5	87	118	112	Ni
2.6	2.5	3.4	12.4	14.9	9.2	Pb
110	55	95	194	118	84	Hg

O.n : *Oreochromis niloticus* *B. b: Bagrus bagad* *M. n : Mormyrus niloticus*
ND: not detected under limit of detection.

Table 5.Concentration of trace metals (mg/kg dry wt.) in fish muscles collected from Cairo and El-Qalubia governorate.

El- Qalubia			Cairo			Heavy metals
M.n	*B.b*	*O. n*	*M.n*	*B.b*	*O. n*	
ND	ND	ND	ND	ND	ND	Cu
24	ND	ND	ND	ND	ND	Fe
0.5	ND	ND	ND	ND	0.5	Mn
520	248	336	332	158	326	Zn
5.5	4.5	5.0	4.5	5.0	4.5	Cd
109	109	59	39	55.5	15.5	Ni
2.7	3.5	ND	3.0	ND	2.5	Pb
170	110	40	40	95	30	Hg

O.n : *Oreochromis niloticus* *B. b*: *Bagrus bagad* *M. n* : *Mormyrus niloticus*
ND: not detected under limit of detection .

The present study showed that copper was not detected in all studied fish collected from Cairo , Giza and El-Qalubia governorates , but it was detected in the fish muscles collected from Helwan . The highest value was found in *Bagrus bagad* (6.7 mg/kg) and the lowest value (6.0 mg/kg) found in *O. niloticus* . The absent or decrease copper concentration in muscles of the studied fishes is mainly due to decrease copper concentration in water where , 90 % of Cu in water was complexes by dissolved organic materials and suspended matter (El- Haddad 2005) . Different authors (Abdel-Satar and Elewa 2001; Abdo 2004 and Al- Afifi 2006) reported that copper concentration in the Nile water or its branches ranged between (0.0-4.4 mg/L) . The concentration of copper in the muscles of studied marketable fish are still below the permissible levels for Cu 30 mg/kg reported by (FAO 1992).

Iron toxicity causes haemorhage, gastrointestinal pain, vomiting, convulsions, liver necroses and death due to hepatic coma (Khallaf *et al*., 1998). Although it is considered a trace mineral , diets lacking in iron can contribute to the deficiency condition known as anemia .The present study showed that the concentration of Fe in muscles of studied fish ranged between (24- 160 mg/kg). The highest value was recorded in muscle of *M. niloticus* from Helwan and the lowest value from El Qalubia governorate. The highest accumulation of Fe in fish muscles attributes to the large quantity of iron in water , this is agreed with the finding of Ghazaly *et al.* (1992) and Bahnasawy (2001). Iron was not detected in all fish samples from Cairo governorate .The concentration of iron in muscles of studied fish exceed the permissible level for Fe (5 .0 µg/g) cited by Adeyeye (1993).

Manganese is readily absorbed from the gut or via the integument and availability is reduced in the presence of phytic acid or high levels of dietary calcium (Beveridge and McAndrew, 2000) . The maximum manganese level 14 mg/kg was observed in *O. niloticus* from Helwan governorate and the minimum 0.5 mg/kg was found in *O. niloticus* and *M. niloticus* from Giza ,Cairo and El –Qalubia governorates Tables (4)&(5). According to FAO 1992 and Egyptian Organization for Standardization (1993), there is no information on the carcenogencity of manganese . The National Academy of Science (NAS) (1980) recommended 2.5 – 5 mg /day manganese and the World Health Organization (WHO)(1994) recommended that intake of manganese from food ,water and dietary supplement should not exceed the tolerable daily upper limit of 11 mg/day (National Research Council 1989) .The intake of manganese in our investigated fish samples is well below the tolerable daily upper limit of 11 mg/day except *O . niloticus* from Helwan governorate . Manganese content in literature have been reported in the range of 0.0-4.6 mg/kg in fish muscles from Abu-Zabaal Lakes in El Qalubia governorate (Mohamed and Gad 2005); 4.2 – 12.6 mg/kg in fish muscles from Lake Qarun (Mohamed and Gad 2008).

The major source of zinc pollution are mining swelling and sewage disposal . Zinc is readily accumulated by freshwater fish from both food and water , but internal organs and bones accumulate much higher levels than edible muscles (Phillip and Russo 1978).The present study showed that Zn concentration in the studied fish muscles ranged between (ND-520 mg/kg) .The highest values 520 mg/kg was found in muscles of *M. niloticus* from El-Qalubia governorate and the lowest 46 mg/kg was found in muscles of *O. niloticus* from Helwan governorate . Zinc was detected in all fish samples from four governorates except in *M. niloticus* muscles from Helwan . Zn was the most abundant metal in the muscles of the studied fish species .Stanek *et al.* (2005) reported that Zn has high tendency to accumulate in the muscle . According to FAO (1992) the maximum zinc level permitted is 30 mg/kg and 50 mg/kg consequently, Zn concentration in muscle of studied marketable fish were higher than the permissible levels .Zinc content in literature have been reported in the range 55.8-60 mg/kg in fish species from Lake Qarun (Mohamed and Gad 2008);

13-39 mg/kg in fish species from Rosetta Branch of River Nile (Gad and Yacoub 2009) and 0.1- 70 mg/kg in fish species from Nile delta Egypt (Zyadah ,2005).

The present results showed that cadmium concentration in the muscles of the studied fish, ranged between 2.5 – 6.5 mg/kg. The maximum cadmium level was 6.5 mg/kg in *B. bagad* fish from Helwan governorate and the minimum levels was 2.0 mg/kg found in *O. niloticus* from El- Giza . Cadmium concentration in the muscles of studied fish samples were higher than FAO (1992) and Anonymous (2002) permissible level for cadmium (2.0 mg/kg) . Cadmium content in literature have been reported in the range (ND – 4.0) mg/kg in fish species from Rosetta Branch of River Nile (Gad and Yacoub., 2009) and (0.01-3.9) mg/kg in fish species from Nile Delta Branch (Zyadan, 2005).

Nickel may harmful to the survival and productivity of freshwater fauna, thereby disturbing the natural ecosystem and its food chains (Moore and Ramamoorthy, 1984). Nickel is toxic to algae and fish (Suffern *et al.*, 1981) ,interferes with the detoxification activities of the liver (Mastromatteo 1986) .Sreedevi *et al*. (1992) reported that freshwater fish accumulated significant amount of Ni when exposed to sublethal concentrations.In the present study the concentration of Ni in the muscles of studied fish ranged between 29 -118 mg/kg .The lowest value 29 mg/kg was recorded in muscles of *M. niloticus* from Giza governorate and highest value 118 mg/kg in *B. bagad* muscles from Helwan governorate. There is no information about maximum nickel levels in fish samples in Egyptian Standard . It is reported that maximum nickel level in some food samples is 0.2 mg/kg (Anonymous, 2002). However , the concentration of Ni in the muscles of studied fish were higher than 0.2 mg/ kg.

Lead (Pb) is toxic to aquatic organisms and fish are the most sensitive. Lead dose not accumulate in fish except in case of extreme pollution (Moore and Ramamoorthy 1984) . The concentration of Pb in the muscles of the studied fish ranged between (2.5-14.9) mg/kg . The lowest value was recorded in muscles of *B. bagad* fish collected from Giza and the highest, from Helwan . According to Egyptian Standard (1993) the maximum lead levels permitted for fish tissues (2 µg/g) , consequently, the concentration of lead in the muscles of studied marketable fish is higher than the allowable limit..Lead content of the literature have been reported in the range 8.5-10.5 mg/kg in fish species from lake Qarun (Mohamed and Gad 2008) ; 1.2 – 14 mg/kg in fish species from Rosetta Branch of River Nile (Gad and Yacoub 2009) .

Mercury is non essential element, but has highly toxicity to the aquatic organisms and its compounds lead to potential hazards due to its enrichment in the food chain. Hg contamination of our aquatic environment through natural weathering processes and anthropogenic activities is reported to be increasing on a significant scale (WHO, 1990) and results in the accumulation of high levels of Hg in aquatic organisms and fishes (Hakanson *et al* ., 1988). The lowest and highest mercury levels in fish species were found as 30 mg/kg in *O. niloticus* from Cairo governorate and 194 mg/kg in *M. niloticus* from Helwan governorate . The maximum permitted Hg content in the muscles of fish should not exceed 0.5 ug/g wet wt . (WHO 1994). According to the recommendation in the literature, metals concentration in fish tissues given in dry weight can be converted into wet weight by dividing them by factors ranged from

4- 6 (Erdogrul ,2007) . So Hg level in the muscles of the studied marketable fish were more than the permissible limits . Hg contents in the literature have been reported in the range of 12 -34 mg/kg in fish species from Lake Qarun (Mohamed and Gad, 2008).

Finally, we can concluded that, fish samples from markets were contaminated with low level of organochlorine pesticides (below the permissible limits) and high level of heavy metals (exceed the permissible limits). The accumulation pattern of heavy metals were found in studied fish muscles in the following order: Zn >Hg > Ni > Fe > Pb > Mn > Cd and Cu .The difference in the pattern of metals distribution in the three fish species mainly due to the differences in feeding behavior, habitats , ecological need , metabolisms and physiology . Consequently , there was a public health risk from fish consumption and the following recommendation and suggestion showed be taken in order to reduce risk pollution in the River Nile by, intensive plan for monitoring water quality of River Nile, stop of disposing untreated effluent to the Nile and its branches , complete all establishments that sustain projects for treatment of wastes and cultivation of algae , which have the ability to absorb heavy metals and culturing fishes feeding on weeds.

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تلوث بعض اسماك الاسواق فى مصر بالمبيدات الكلورعضوية والعناصر الثقيلة

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يهدف هذا البحث الى دراسة تواجد وتوزيع متبقيات بعض المبيدات الكلورعضوية والعناصر الثقيلة فى عضلات بعض الأسماك الموجودة فى الأسواق المصرية مثل أسماك البلطى النيلى والبياض والأنومة والتى تم جمعها من أربع أسواق رئيسية شعبية فى محافظات حلوان والجيزة والقاهرة والقليوبية فى يناير 2010م . أشارت النتائج الى أن متبقيات المبيدات التى تم الكشف عنها تختلف فى كميتها وعددها حسب المحافظه ونوع السمك . بصفة عامة أوضحت النتائج تواجد متبقيات المبيدات فى الأسماك بالترتيب التالى : أسماك البياض > البلطى النيلى > الأنومة . كانت أسماك أسواق محافظة القليوبية هى الأكثر تلوثا بالمبيدات بينما أسماك اسواق محافظة القاهرةهى الأقل تلوثا. كانت نسبة متبقيات المبيدات فى عضلات الأسماك أقل من الحدود القصوى المسموح به عالميا . إضافة الى ذلك فقد أظهرت النتائج أن تركيز بعض العناصر الثقيلة فى عضلات الأسماك على الترتيب التالى : الزنك> الزئبق> النيكل > الحديد > الرصاص > المنجنيز > الكادميوم و النحاس . أسماك أسواق محافظة حلوان هى الأكثر تلوثا بالمعادن الثقيلة . و إتضح أن تراكم هذه العناصر فى الأسماك كانت على النحو التالى: البياض > الأنومة > البلطى النيلى .كان تركيز النحاس والمنجنيز فى عضلات الأسماك هو الأقرب من الحدود القصوى المسموح بها , بينما باقى العناصر كانت أعلى من الحدود المسموح بها , وهذا قد ينتج عنه خطوره على صحة المواطنين ، وعليه نرى ضرورة وضع برنامج رصد بيئى دورى مستمر لتحديد معدلات التلوث وتطبيق القانون رقم 1982/48 و القانون رقم 1994/4 على مسببى التلوث لحماية نهر النيل والمسطحات المائية .