Some Heavy Metal Residues In Mackerel And Saurus Fish

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ABSTRACT

A total of 50 random samples, 25 from each of mackerel and saurus with different size were collected from Sharkia province shops.

Fish samples were placed in an ice box and immediately transmitted to laboratory for determination of Hg, Zn, Pb, Cu and Cd residues in fish muscle. They ranged from 0.53 to 0.62 with an average of 0.56±0.01 ppm, 20 to 50 with an average of 34±5 ppm, 0.11 to 0.16 with an average of 0.128±0.009 ppm, 18 to 20 with an average of 18.8±0.37 ppm and 0.10 to 0.30 with an average of 0.18±0.03 ppm in mackerel respectively, while the value in saurus were 0.48 to 0.63 with an average of 0.54±0.03ppm 46 to 52 with an average of 48.4±1.02ppm 0.15 to 0.18 with an average of 0.16± 0.005 ppm 17 to 20 with an average of 18.6±0.50ppm 0.11 to 0.20 with an average of 0.15±0.01ppm respectively. The pollution by Hg in all samples of mackerel exceed the permissible limit but only in 60% in saurus species. The level of Zn in mackerel was within the permissible limit, but 20% of saurus species exceed the permissible limit. On the other hand pollution by Pb revealed that all samples exceed the permissible limit in mackerel and saurus. Level of Cu in all samples of mackerel and saurus was within the permissible limit. The cadmium level revealed 60% exceed the permissible limit, while in saurus species 80% exceed the permissible limit *(1)*.

INTRODUCTION

Fish is considered a good source of animal protein of high biological value, easily digestible and have high nutritional constituents as they contain several minerals and vitamins *(2)*.

Heavy metal residues, is complicated problem due to bioaccumlution and not easily eliminated from the ecosystem. The dissolved metals are taken by marine organisms either through gills, absorption, by body surface or diet *(3)*.

Concentrations of Cd, Cu , Pb and Zn in four groups of a quatic organisms including fish, crab , shrimb and shell fish were ranged from 0.01-2.10, 0.15-77.8, 0.04-0.307 and 8.78-86.3 mg / kg net weight respectively *(4)*.

The mean levels of cadmium and copper in muscle, liver and gill tissues of Cyprinus from the Menzelet Dum were found as 0.77, 091, 1.49 and 0.94, 1.2, 1.05, respectivley *(5)*. The mean levels of Cd in the muscle tissues of *Leuciscus cerphalus* from the Menzeter Dum were found 0.32 ppm, Cd wasn't found in tissues of liver and gill. The mean levels of Cu in the muscle, liver and gill tissues were found as 3.17 1.19ppm and 0.96 ppm., respectivley. The mean levels of the Cd and Cu in muscle and gill tissues of *Acantobrama marmid* from the Sir Dam were 1.28, 2.64 and 0.72, 0.08, respectively, *(6)*.

The Pb and Hg have toxic effects on vulnerable fetuses, persistence in pregnant and breast-feeding mothers which posses similar adverse effects on the central nervous system. The risk of exposure to infants is primarily influence by maternal dietary habits which feed on fish and shellfish whereas the potential of maternal acquisition is higher and lasts longer for Pb than Hg because Pb stored in bone with longer half-live than monomethylmercury acquired from fish *(7)*.

The cadmium is a heavy meatal that accumulates in the body, and its accumulation in the brain damages both neurons and glial cells. Cadmium induced a stroglial toxicity and stroglial death via glutathione depletion *(8)*.

Hg has been found to be a causative agent of various sorts of disorders including neurological, nephrological, immunological,

cardiac, motor, reproductive and even genetic *(9)*.

Some trace elements are essential including copper and zinc and others such as cadmium, lead and mercury have toxic effect on living organisms and are often considered contaminants *(10)*.

Trace elements such as zinc, copper, cadmium, mercury and lead may influence membrane fluidity which are essential for numerous cell functions and even slight changes in membrane fluidity may cause abarrant function and pathological processes *(11)*.

MATERIALS AND METHODS

Collection of Samples

Fifty random samples (twenty five from each of mackerel and saurus of different sizes) were collected from Sharkia province shops . The fish specimens were individually placed in clean polyethylene bags and immediately taken to the laboratory where they were kept frozen until preparing for digestion and analysis.

Digestion of samples

The fozen fish were defrosted then digested according to the recommended method *(12)* in which 2 grams of muscle from each fish sample were digested with 10ml of analysis grade nitric/ perchloric acid mixture (4:1) in a clean acid washed digestion flask.

Initial digestion was performed at room temperature for 3-4 hours, followed by careful heating in water bath at 40 – 45°C for one hour to prevent frothing. The temperature was then raised to 70-80°C with gentle shaking until the digestion was completed (within 3 hours). The resulting digests were allowed to cool at room temperature and diluted up to 20 times with deIonized water, then filtered through whatman paper No. 1-Blank and standard solutions were also prepared and analyzed for quality control purpose.

Heavy metals analysis

Determination of heavy metal concentration was conducted at the central laboratory, faculty of Veterinary Medicine, Zagazig University, Egypt using Buck scientific Atomic absorption spectrophotometer 210 VGP. Equipped with background, corrector, autosampler and recorded Hg, Cd, Pb, Cu and Zn were determined by using . air acetylene flame AAS.

RESULTS AND DISCUSSION

Table 1. Stastistical analysis of heavy metal concentrations (ppm) in examined Mackerel and saurus.

Fish / Element	Mackerel			Saurus		
	Min	Max	Mean+S.E	Min	Max	Mean+S.E
Hg	0.53	0.62	0.56 ± 0.01	0.48	0.63	0.54 ±0.03
Zn	20	50	34±5	46	52	48.4±1.02
Pb	0.11	0.16	0.128±0.009	0.15	0.18	0.16±0.005
Cu	18	20	18.8+0.37	17	20	18.6±0.50
Cd	0.10	0.30	0.18±0.03	0.11	0.20	0.15±0.01

Table 2. Frequancy distribution of heavy metal in fish compared with maximal permissible limits : (n=25).

Element	Premissible ppm according EOSQC *(13)*	Mackerl				Saurus			
		Within permissible		Over permissible		Within permissible		Over permissible	
		No	%	No	%	No	%	No	%
Hg	0.5			25	100	10	40	15	60
Zn	50	25	100	-	-	20	80	5	20
Pb	0.1	-	-	25	100	-	-	25	100
Cu	20	25	100	-	-	25	100	-	-
Cd	0.1	10	40	15	60	5	20	20	80

EOSQC *(13)* organization for standarizition and quality control

Mercury (Hg) : Most cases of mercury poisoning were due to methyl mercury which derived from the diet group fish. The level of Hg in fish increased with increasing fish body weight *(14)*. Table (1) showed that minmum, Maximum and mean level of Hg in examined Mackerel and Saurus were 0.53 and 0.48, 0.62 , 0.63ppm, 56 + 0.01 and 0.54 + 0.03, respectively.

Lower levels were recorded in Egypt, *(15);* in Philippines, *(16);* in Korea *(17);* and in Italy *(18)*; mean while higher levels were reported by several investigators *(19,20,21).*

The Hg is released from mercury containing industrial wast *(22)*. The results in Table 2 declared that all mackerel samples exceed the Maxaimum permissible limits *(13)* while the saurus samples (10 of them) were within the permissible limite and 15 of them exceeded the permissible limit. In this study mackerel have higher Hg level than saurus and this may be due to difference in growth rate.

Zinc (Zn)

Zinc is an essential trace element for man and animal. It has numerous function involving protein synthesis and as aco-factor in the synthesis of DNA and RNA. It also shares in the mobilization of vitamin A from liver to blood circulation as well as enhancement of follicular stimulating hormones *(23)*.

The results achievied in Table 1 revealed that Zn concentrations in muscle tissues of Mackerel were ranged from 20 to 50 with a mean value of 34 $\pm$ 5 ppm, while it ranged from 46 to 52 with a mean average of 48.4 $\pm$ 1.02 ppm in examined muscle of Saurus fish. Nearly similar *(24,25)*; higher *(26)*; lower levels *(18);* were reported.

The result in table 2, showed that all mackerel samples did not exceed the permissible limit, while 80% of saurus sample within the permissible limit of *(13)* and 20% exceed this permissible limit.

The variation between Zn levels in examined fish species could be referred to the difference of degree of pollution in the sites from which fish were collected.

Lead (Pb)

The lead level in fish muscle affected by age due to bioaccumlation of metal in fish muscle higher level induce plumbism in human due to consuming the intoxicated fish which affect the haemotobiotic system, gastrointostinal tract, nervous, renal and neoromuscular systems causing anaemia, abdominal pain, encephalopathy, irreversible nephritis. Lead poilsy and wrist drop phenomenon *(27)*. The results in table 1 showed that the level of lead was ranged from 0.11 to 0.16 with mean 0.128 + 0.009 ppm in

Mackerel, while in Saurus fish was ranged from 0.15 to 0.18 with average of 0.16 + 0.005 ppm nearly similar level were recorded by ***(28, 29, 30, 31, 32, 33, 34, 35)***, higher ***(24,36, 37, 38)*** and lower reported ***(24,39,40,41)***, were cited the results in table 2 revealed that all examined Mackerel and saurus fish exceed the maximum premissible limit which give indication of lead pollution in the aquatic environment.

Copper (Cu)

Copper is an essential element in the body and apart of about thirty enzymes and glycoprotein ***(42)***.

Table 1 revealed that the concentration of Cu in Mackerel was ranged from 18 to 20 with mean 18.8 $\pm$ 0.37 ppm, while in Saurus fish the Minium, Maxium and Mean $\pm$ SE were 17, 20 and 18.6 + 0.50 ppm. Nearly similar ***(31, 35, 43)***, higher ***(15, 24, 34, 37, 44, 45)*** and lower ***(38, 43, 46)*** findings were reported. The obtained results in table (2) showed that all Mackerel and saurus fish not exceed the permissible limite.

Cadmium (Cd)

The biological half life of cadmium about 20 : 40 year and it is reported to cause skeletal disorder referred as itai disease with symptoms that which indicated renal demage, hypertension, teratogenic and carcingenic effects **(47, 48)**.

The results in Table 1 showed that the level of Cd ranged from 0.10 to 0.30 with mean 0.18 $\pm$ 0.03ppm in Mackerel fish, while in saurus fish Minimum, maximum and mean $\pm$ SE were 0.11, 0.20 and 0.15 $\pm$ 0.01 ppm. Nearly similar results were recorded ***(28, 29, 49)***, while higher levels were also reported ***(37, 33)***.

The results in Table 2 showed that about 40% of the Mackerel fish within permissible limite and 60% exceed the limit while in saurus fish 20% within permissble limit and 80% exceed the limit.

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الملخص العربى

بعض بقايا المعادن الثقيلة فى لحوم اسماك الماكريل والمكرونة

علاء المرشدى- كمال الدسوقى –السيد السباعى

كلية الطب البيطرى – جامعة الزقازيق

أجرى هذا البحث على٥٠ عينة (٢٥ من أسماك الماكريل و ٢٥ من أسماك المكرونة) وتم تجميع العينات من مختلف المحلات لبيع الاسماك بمدينة الزقازيق محافظة الشرقية وتم أخذ العينات من عضلات الأسماك لمعرفة نسب بقايا المعادن الثقيلة و الزئبق ، الزنك ، الرصاص ، النحاس ، الكاديميوم

أوضحت النتائج أن المتوسطات كانت كالتالى ٠,٥٦، ٣٤ ، ٠,١٢٨، ١٨,٨، ٠,١٨ فى اسماك الماكريل بينما ٠,٥٤، ٤٨,٤ ، ٠,١٦، ١٨,٦، ٠,١٥ على الترتيب فى إسماك المكرونة وأتضح من هذه النتائج أن التلوث بالزئبق لجميع عينات الماكريل تعدى الحد المسموح به بينما تعدى ٦٠% من سمك المكرونة . أما بالنسبة للزنك فجميع عينات الماكريل تتفق مع الحد المسموح به ولكن ٢٠% من سمك المكرونة تعدى هذا الحد وأوضحت النتاج أن مدى التلوث بالرصاص مرتفع فى البيئة البحرية حيث أن ١٠٠% من أسماك الماكريل والمكرونة قد تعدى الحد المسموح به أما بالنسبة للنحاس فجميع العينات الماكريل و المكرونة تتفق مع المواصفات القياسية فى النحاس ومطابق للمنظمة المصرية للموصفات والرقابة على الجودة أما بالنسبة لعنصر الكاديميوم فى اسماك الماكريل و٤٠% منها (يتفق مع المواصفات و٦٠% أعلى من المواصفات القياسية ولكن أسماك المكرونة ٢٠% منها يتفق مع المواصفات القياسية ٨٠% أعلى من الموصفات وهذا يدل أيضاً على تلوث البيئة البحرية بعنصر الكادميوم ٠