Current Science International Volume : 06 | Issue : 02| April-June|2017
ISSN 2077-4435 Pages: 421-430

Health Risk Assessment of Toxic Heavy Metals and Pesticides Residues of some Raw Animal Foods Collected from Egyptian Market

M. Shahat[1], M.S.Ammar[1], S. M. [2]Ramzy and A.M. Baz[1]

[1]Food Science and Technology Dept., Faculty of Agriculture, AL-Azhar University, Cairo, Egypt.
[2]Food Toxicology and Contaminants Dept., Food Industries and Nutrition Division, National Research Center, Dokki, Giza, Egypt.

Received: 16 April 2017 / Accepted: 17 May 2017 / Publication Date: 15 June 2017

ABSTRACT

Environmental pollution by heavy metals and pesticide residue is a critical problem worldwide affects our health. The aim of this study was to assess metals and pesticide residue contents in five raw animal food samples namely, chicken drumsticks, chicken pane, ground meat, tilapia fish and shrimp in both Cairo and Giza markets. The results showed that investigated heavy metals (Cd, Pb, Cr and Cu) contents range were 0.044 to 0.109 For Cd, 2.96 to 9.42 for Pb, 1.905 to 18.76 for Cr and 2.943 to 9.336 for Cu. According to the values of PTWI of Cadmium the results showed that all tested samples could be considered safe except chicken drumsticks, but regarding Lead all samples are high toxic. Also, the results of Chromium indicated that tested samples except shrimp and chicken drumsticks could be considered unsafe and high toxic. Whereas Copper results indicate that all sample considered unsafe for children but rarely safe for adults except tilapia samples collected from Cairo. Regarding pesticide residues, organochlorine and organophosphorus the results showed that tilapia fish samples only were free from Organochlorine compounds whereas ground meat samples only were free from organophosphorus compounds, while other samples were contain pesticides residue but under the MRL level of both (EC, 2004) and (FAO/WHO, 2016).

Kew words: Chicken drumsticks, Chicken pane, Ground meat, Tilapia fish, Shrimp, Cadmium, Lead, Chromium, Copper, Organochlorine, Organophosphorus.

Introduction

Heavy metals and pesticides residues contamination is one of the major concerns worldwide, which influences the practical and structural integrity of an environment and cannot be avoid their direct and indirect effects on human health. Contamination with heavy metals is a serious threat because of their toxicity, bioaccumulation and biomagnifications in the food chain. These pollutants often have direct physiological toxic effects because they are stored or incorporated in tissues (Abd EI-Salam *et al*., 2013). Uncontrolled pollution levels particularly in developing countries have drawn more attention to the heavy metal problem (Donia, 2015). Trace elements include two categories, essential metals and toxic elements. Essential trace elements include, copper (Cu), chromium (Cr), manganese (Mn), iron (Fe), cobalt (Co), zinc (Zn), molybdenum (Mo), nickel (Ni), magnesium (Mg) and selenium (Se). Which are essential nutrients but become toxic at higher levels which result in metal accumulation (Papagiannis *et al*., 2004). Toxic trace elements namely, arsenic (As), cadmium (Cd), lead (Pb), aluminum (Al), strontium (Sr) and mercury (Hg) are found in the environment have been recognized as a serious concern from long time. There are biologically nonessential, since no known biological function for it and concerned toxic even at very low concentrations (Dural *et al*., 2007; Uluozlu *et al*., 2009). Heavy metals taken in traces, bind with proteins and become nontoxic, but their high concentration, above the body tolerance level, results into severe pathological conditions. Their increased concentration reacts with important cellular components through, covalent and ionic binds which results in damage of cell membrane and destroying the enzymatic functions of the cell (Bruins *et al*., 2000; Iwegbue *et al*., 2008; Emin*et al.,* 2010; Saei-Dehkordi and Fallah, 2011). Absorbed lead accumulates in tissues of the animals and may cause cognitive development problems, increase blood pressure and cardiovascular diseases, Cu is known to cause damage to the liver, Cr long-term exposure can cause damage kidney, liver, circulatory and nerve tissue and Cd can cause

Corresponding Author: M. S. Ammar, Food Science and Technology Dept., Faculty of Agriculture, AL-Azhar University, Cairo, Egypt. E-mail: mohammedammar15@yahoo.com

kidney dysfunctions and reproductive deficiencies (Uluozlu *et al*., 2009; Akoto *et al*., 2009;Diabetal., 2015; Khan *et al*., 2015; Zahran *et al*., 2015). Regarding Egypt, meat, chicken and fish and their products are the major source of proteins to the population and are widely consumed. These foods because of its exposure to heavy metals contamination may lead to health risks, especially in areas with expanding industrial and agricultural activities (Mahmoud *et al*., 2015).

The environmental pollution by pesticides in food arises as an important problem of serious public health hazards which may lead to acute or chronic hepatic toxicity for human being (Hassouba *et al*., 2007; David *et al*., 2008). Acute hepatic and renal toxicity as well as the long term effect of organochlorine and organophosphorus pesticides are responsible for nonspecific symptoms like dizziness, headache, nausea, weakness, disturbance of vision, nervous symptoms, rashes, alternation of genes, disturbances of fertility and promotion or induction of cancer (Hashim, 2002 and Pathuk *et al*., 2009).

Meat, chicken and fish may contain high levels of pesticide residues because of lipophilic nature of organochlorine pesticides which increase their tendency to accumulate in the fatty tissues which lead to bioaccumulation and bio-magnification (Doyle, 2004; Gill *et al*., 2010). Because chemical safety is very important aspect of food quality, thus the aim of this research was to examine the presence of four heavy metals (Cr, Pb, Cd and Cr) and organochlorine and organophosphorus pesticides in the selected foods namely, chicken drumsticks, chicken pane, ground meat, Tilapia fish and shrimp and if its levels fell within the provisional tolerable levels for human consumption.

Materials and Methods

Thirty samples from raw different five animal foods (beef meat, chicken drumsticks, chicken pane, tilapia fish, and shrimp) were collected from Cairo and Giza markets, Egypt.

Materials:

Chemicals for standard solution of heavy metals determination:

Standard solution of heavy metals determination of Cu, Cd, Pb and Cr were produced by Merck, Darmstadt, Germany. (2012).

Nitric acid (HNO3) produced by El-Nasr for chemical Industries.

Chemicals for pesticide residue determination:

Standard solution mixed of both Organochlorine and Organophosphorus pesticides were produced by Chem. Service, Inc., USA. Acetonitrile produced by Alfa Chemicals, Egypt. Petroleum Ether (40:60) produced by LAB-SCAN analytical science. A41C11X, Poland. (2013).

Methods:

Heavy metals:

Heavy metals (Cd, Pb, Cr and Cu) were analyzed in collected samples according to the method of (AOAC, 2012). Metals concentrations were measured by Atomic Absorption Spectrophotometer (Perkin Elmer 2380).

Organochlorine and Organophosphorus pesticides:

Organochlorine and Organophosphorus pesticides were determined by the method of (AOAC, 2012), concentrations of pesticides were calculated by using the following equation:

$$\text{Concentration } (\mu g / g) = \frac{Area\ sample \times concentration\ std\ (0.5 \mu g)}{Area\ std \times weight\ of\ sample\ (g)}$$

Results and Discussions

Heavy metals:

Cadmium:

Cadmium toxic effects induced the detoxification in liver and kidney enzymes, which may lead to kidney dysfunction, hepatic injury, lung damage, and hyper tension. Table 1 shows the Cadmium contents of tested animal foods in both Cairo and Giza markets. From the data it could be observed that levels of Cadmium in tested samples are not higher than the recommended provisional tolerable weekly intake (< 7 µg/kg body), since the range of Cadmium in all samples was ranged between 0:0.1mg/kg sample. The results show that Cadmium wasn't detected in raw beef ground meat and shrimp in both markets. The highest Cadmium contents were observed in chicken drumsticks samples since it was 0.084 in Giza market and 0.109mg/kg in Cairo market. The Cadmium content of chicken drumsticks in Cairo market was represent 104% of provisional tolerable weekly intake for child (7 µg/kg body× 15 kg, mean child weight = 0.0105mg) and 22 % for adult (7 µg/kg body× 70 kg, mean adult weight = 0.49 mg), while it was represent 80 % of provisional tolerable weekly intake for child and 17 % for adult in Giza market. These results were lower than that recorded by (Hassanin *et al*., 2014) who determined the cadmium of content in chicken pane, chicken nuggets, chicken sheish tawook and chicken kofta and their results ranged between 0.06 and 0.38 mg/kg. Our results are nearly similar to results which obtained by (El-Sakkary, 2007) who found that mean values of cadmium were 0.15 and 0.06 mg/kg, in examined chicken pane and sheish tawook samples respectively. Our results were far from that obtained by (Sadeghi *et al*., 2015) who reported that Cd in liver, heart and muscles of chicken samples were 0.37, 0.32, and 0.28 mg/kg respectively. Also, (Ismaniza *et al*., 2012) were detected cadmium mean value of 0.034mg/kg in muscle tissues of tilapia which is lower than our results. According to the values of PTWI which revealed in table (1) it obvious that all tested samples could be considered safe except chicken drumsticks in regard to contents of Cadmium.

Table 1: Cadmium content (mg/kg) of raw animal food samples collected from Cairo and Giza supermarkets.

Raw samples	Range	Mean±S.E.[3]	% Estimation as PTWI[1] for		% refused samples [2]
			Child	Adult	
		Cairo			
Chicken drumsticks	0.106-0.112	0.109±0.003	104	22	0
Chicken pane	0.033-0.035	0.034±0.002	33	7	0
Ground meat	Negative	-	-	-	-
Tilapia	0.046-0.058	0.052±0.005	50	11	0
Shrimp	Negative	-	-	-	-
		Giza			
Chicken drumsticks	0.08-0.089	0.084±0.004	80	17	0
Chicken pane	0.04-0.048	0.044±0.004	42	9	0
Ground meat	Negative	-	-	-	-
Tilapia	0.08-0.083	0.081±0.001	78	17	0
Shrimp	Negative	-	-	-	-

[1](PTWI) Provisional Tolerable Weekly Intake µg/kg body weight < 7 as recorded by (FAO/WHO, 2005). Or PTWI for body weight of adult per week= 0.49mg considering 70kg for average body weight. While, for child the level of permitted cadmium not exceeded than 0.105mg concerning the child body weight is 15kg.
[2] According to (FAO/WHO, 2000), (EC, 1881/2006).
[3] Standard Error.

Lead:

Lead poisonous has neurotoxic effect, cellular inactivation, binds to gastrointestinal enzymes, and renal systems (Emin*et al.,* 2010). Table 2 shows the contents of Lead in tested raw animal food

samples collected from both Cairo and Giza. The data show that lead contents are higher than higher than the recommended provisional tolerable weekly intake (25 µg/kg body weight). The lead contents range in tested samples animal samples were ranged from 2.96 to 9.42 mg/kg sample, the highest contents were present in chicken drumsticks samples of chosen cities with mean of 9.42 mg/kg, and the lowest present in beef ground meat with mean of 2.96 mg/kg. In regard to PTWI for Lead all samples are high toxic. These results are lower that reported by (Elsharawy *et al*., 2015) who recorded that lead content in breast, thigh, liver and gizzard chicken samples were 250, 260, 310 and 300mg /kg respectively. But these results were significantly higher than that obtained by (Azza *et al*., 2015) who reported that Lead concentration in beef meat was 0.082 mg /kg. Also we can easily notice the difference between our results and the study of (Zahran *et al*., 2015) who reported that lead contents in asses beef meat and sausage collected from different stores in Egypt, was ranged between0.45 to 2.81 mg / kg.

Also our results were in the line with (El Gendy *et al*., 2015) who recorded Pb levels were2.133, 1.70 and 2.33 mg/kg in gills, exoskeleton and muscles of the shrimp caught from Jazan, Saudi Arabia, respectively.

Table 2: Lead content (mg/kg) of raw animal food samples collected from Cairo and Giza supermarkets.

Raw samples	Range	Mean±S.E.[3]	% Estimation as PTWI[1] for		% refused samples [2]
			Child	Adult	
		Cairo			
Chicken drumsticks	9.34-9.50	9.42±0.0799	2510	538	100
Chicken pane	7.48-7.80	7.64±0.159	2037	436	100
Ground meat	4.78-4.96	4.87±0.089	1298	278	77
Tilapia	4.74-4.89	4.81±0.075	1282	274	100
Shrimp	5.353-5.96	5.65±0.303	1506	323	100
		Giza			
Chicken drumsticks	3.18-3.23	3.20±0.025	853	182	0
Chicken pane	4.846-4.90	4.87±0.027	1298	278	0
Ground meat	2.92-3.00	2.96±0.034	789	169	0
Tilapia	8.38-8.50	8.44±0.060	2250	482	100
Shrimp	4.206-4.30	4.25±0.047	1134	243	33

[1] (PTWI) Provisional Tolerable Weekly Intake µg/kg body weight < 25 as recorded by (FAO/WHO, 2005). Or the PTWI for lead is 0.025mg/kg body weight, which is equivalent to 1.75mg for person weighing 70kg, and 0.375mg for child weighing 15kg.

[2] According to (EOS, 1993), (EC, 1881/2006).

[3] Standard Error.

Chromium:

Table 3 shows the contents of Chromium in tested raw animal food samples collected from both Cairo and Giza. The results show that the level of Chromium in tested raw animal food samples higher than the recommended level (200 µg/kg body weights), since the Chromium content of tested samples was ranged from 1.905 to 18.76mg/kg sample. The data in table 3 show that Chromium does not detected in chicken drumsticks. The highest Chromium contents were observed in tilapia sample of both chosen cities with mean of 18.76 mg/kg. These results were similar to that obtained by Sadeghi *et al*. (2015) who intended that the Chromium (Cr) concentrations in different chicken tissues namely liver, heart and muscle were 3.87, 3.77 and 2.27 mg/kg respectively. On the other hand the results are much lower than that reported by Khalafalla *et al*. (2011) who recorded that the chromium contents of samples from cattle slaughtered in the Beni-Suef abattoir in Egypt included muscle, liver and kidney were 11.20, 21.85, and 25.49 µg/kg respectively. Also our results are lower than that reported by Zahran *et al*. (2015) for beef meat and sausage samples from different stores in Egypt since chromium content ranged between 0.37 to 2.04with mean 1.30 mg/ kg.

Table 3: Chromium content (mg/kg) of raw animal food samples collected from Cairo and Giza supermarkets.

Raw samples	Range	Mean±S.E.[3]	% Estimation as PTWI[1] for		% refused samples [2]
			Child	Adult	
		Cairo			
Chicken drumsticks	2.293-2.41	2.35±0.059	78.4	16.8	100
Chicken pane	7.306-7.45	7.38±0.073	245.0	52.7	100
Ground meat	6.446-7.00	6.72±0.277	224.1	48.0	100
Tilapia	16.826-16.95	16.90±0.065	563.0	120.0	100
Shrimp	1.840-1.97	1.90±0.065	63.5	13.6	100
		Giza			
Chicken drumsticks	Negative	-	-	-	-
Chicken pane	8.88-9.00	8.94±0.060	298.0	63.9	100
Ground meat	4.95-5.21	5.08±0.129	169.0	36.3	100
Tilapia	18.52-19.00	18.76±0.237	625.3	134.0	100
Shrimp	2.28-3.27	2.77±0.491	92.6	19.8	100

[1] (PTWI) Provisional Tolerable Weekly Intake for Chromium is ≤ 200 µg/kg body weight as recorded by (FAO/WHO, 2016). Or the PTWI for Chromium is 0.2mg/kg body weight, which is equivalent to 14mg for person weighing 70kg, and 3mg for child weighing 15kg.
[2] According to (FAO, 1983).
[3] Standard Error.

Our results are higher than that obtained by Sharmeen *et al*. (2014) who recorded chromium contents for mozambique tilapia (*Oreochromis mossambicus*) muscles ranged between 0.177 and 0.546 mg/ kg. Also the results were higher than that reported by Ibrahim *et al*. (2016) for tilapia (*Oreochromis niloticus*) since they recorded that chromium level was 0.20 mg/kg. Regarding to PTWI for Chromium all samples except shrimp and chicken drumsticks could be considered unsafe and high toxicity.

Copper:

Overdoses of copper, causes liver oxidative damage, and hepatic granular degeneration. Table 4 shows the content of Copper in tested raw animal food samples collected from both Cairo and Giza. The results show that the levels of in tested raw animal food samples were lower than the recommended level (90 µg/kg body weight). The data show that Copper content in samples collected from Cairo market for chicken pane, ground meat and tilapia was 6.61, 6.49and 9.336mg/kg respectively which are higher than the comparable samples which collected from Giza market sample since its contents were 2.94, 4.95 and 6.24 mg /kg respectively. On the other hand tilapia and shrimp samples collected from Giza were had higher Copper contents than other samples collected from Giza which represent 6.246 and 5.5mg / kg respectively. The highest Copper content was observed for tilapia samples of chosen cities with mean of 9.336 mg/kg while the lowest Copper content was recorded for chicken drumsticks with mean of 2.943 mg/kg. These results were higher than that obtained by Hassanin *et al*. (2014) who recorded copper concentrations in chicken pane, chicken nuggets, chicken sheish tawook and chicken kofta 1.31, 1.68, 1.24and 2.17mg/ kg respectively. Also our results were higher than that obtained by Elsharawy *et al*. (2015) who recorded low copper residual levels in breast, thigh, liver and gizzard samples, 0.15, 0.26, 1.16 and 0.350 mg /kg sample respectively. Also, Azza *et al*. (2015) recorded low copper residue in beef meat 0.11mg/kg. Also, our results were higher than that obtained by (Emara *et al*., 2015) who reported that copper contents in Nile tilapia were ranged b between 4.31 – 7.26 µg/g dw sample. The results of copper contents for shrimp were higher than that obtained by Olgunoğlu, (2015) who determine that copper contents of shrimp in Turkey were ranged between 1.357 and 2.099 mg/ kg. It was important to assess that our results still lower than which reported by Ismaniza *et al*. (2012) who found that the concentration of copper in black tilapia was ranged between 0.17 to 20.8 mg/kg sample. Regarding to PTWI for Copper in tested samples all sample considered unsafe for child but rarely safe for adults except tilapia samples collected from Cairo.

Table 4: Copper content (mg/kg) of raw animal food samples collected from Cairo and Giza supermarkets.

Raw samples	Range	Mean±S.E.[3]	% Estimation as PTWI[1] for		% refused samples [2]
			Child	Adult	
		Cairo			
Chicken drumsticks	3.82-4.00	3.91±0.09	361	56	0
Chicken pane	6.22-7.00	6.61±0.39	441	94	100
Ground meat	6.19-6.80	6.49±0.30	432	93	100
Tilapia	9.13-9.54	9.33±0.20	622	133	100
Shrimp	3.44-4.00	3.72±0.27	248	53	0
		Giza			
Chicken drumsticks	2.88-3.00	2.94-0.057	196	42	0
Chicken pane	4.90-5.00	4.95±0.050	330	71	0
Ground meat	3.94-4.00	3.97±0.038	265	57	0
Tilapia	6.17-6.32	6.24±0.070	416	89	100
Shrimp	5.40-5.60	5.50±0.010	367	79	100

[1] (PTWI) Provisional Tolerable Weekly Intake µg/kg body weight ≤ 90as recorded by (ATSDR/USDA, 2004), (FAO/WHO, 2016). Or the PTWI for Copper is 0.09mg/kg body weight, which is equivalent to 6.3mg for person weighing 70kg, and 1.35mg for child weighing 15kg.
[2] According to (EOS, 1993), (EC, 2006).
[3] Standard Error.

Pesticides:

Organochlorine pesticides:

Organochlorine pesticides have strong potential to cross placental barriers even in minute concentration and cause serious neonatal damage. (Jurewicz and Hanke, 2008). The data in table 5 show that chicken drum sticks in Cairo market contains one compound of Organochlorine pesticides which its content found to be 0.0015 mg/kg, while drumsticks in Giza market was found to contain five compounds of Organochlorine pesticides, namely, δ BHC, Heptachlor, Dieldrin, P.P-DDD and Endosulfan Sulfate with levels of 0.0012, 0.0033, 0.0011, 0.0086 and 0.0051 mg/kg respectively which also are under the MRL of both (EC, 2004) and (FAO/WHO, 2016).

Table 5: Pesticide residue (Organochlorine) content (µg/g) from Cairo and Giza supermarkets

Pesticide (OC)	Raw samples from Cairo super markets					Raw samples from Giza super markets					MRL[1] mg//kg	MRL[2] mg/kg
	Chicken drumsticks	Chic-ken pane	Ground meat	Tilapia	Shrimp	Chicken drumsticks	Chicken pane	Ground meat	Tilapia	Shrimp		
δ BHC	ND	ND	ND	ND	ND	0.0012	ND	ND	ND	ND	0.1	-[b]
Heptachlor	ND	ND	ND	ND	0.0083	0.0033	ND	0.002	ND	0.002	0.01	0.2
Aldrin	ND	ND	0.014	ND	ND	ND	ND	ND	ND	ND	0.05	0.2
Heptachlor epoxide	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01	0.2
r- chlordan	ND	0.011	ND	ND	ND	ND	ND	ND	ND	0.011	0.2	--[c]
α- chlordan	ND	0.0034	ND	ND	ND	ND	0.0031	ND	ND	ND	0.2	--[c]
Endosulfan 1	ND	ND	ND	ND	ND	ND	0.0031	0.022	ND	0.024	0.5	[a] 0.2,0.03
P.P.DDE	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.3,0.5[a]	5,0.3[a]
Dieldrin	ND	0.014	0.0052	ND	ND	0.0011	ND	0.0035	ND	0.0035	0.05	0.2
Endrin	ND	ND	0.012	ND	ND	ND	ND	ND	ND	ND	0.01	0.1
P.P-DDD	ND	ND	ND	ND	ND	0.0086	ND	ND	ND	ND	5,0.3[a]	5,0.3[a]
P.P-DDT	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	5,0.3[a]	5,0.3[a]
Endosulfan Sulfate	ND	ND	ND	ND	ND	0.0051	ND	ND	ND	ND	0.5	[a] 0.2,0.03
Methoxychlor	0.0015	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.01	0.01

[1] Maximum Residue Levels (EC, 2004).
[2] Maximum Residue Levels (FAO/WHO, 2016).
[a] First value for Meat and second for poultry. [b] Did not mention. [c] Did not mention the samples of current study

Regarding chicken pane the results in table 5 shows that chicken pane samples collected from Cairo market were contain three Organochlorine compounds namely, r- chlordane, α- chlordane and Dieldrin with levels of 0.011, 0.0034 and 0.014 mg/kg respectively while the comparable samples collected from Giza market were found to contain two compounds namely, α- chlordane, and Endosulfan 1 with levels 0.0031mg/kg for each, it obvious that Organochlorine compounds contents in both markets are under the MRL level of both (EC, 2004) and (FAO/WHO, 2016).

The results also show that Ground meat samples collected from Cairo market are contain three Organochlorine compounds namely, Aldrin, Dieldrin and Endrin with levels of 0.014, 0.0052 and 0.012 mg/kg respectively, whereas the sample collected from Giza market are contain two compounds namely, Heptachlor, Endosulfan 1 and Dieldrin with levels of 0.002, 0.022 and 0.0035 mg/kg respectively, the levels of Organochlorine compounds in ground meat samples collected from both markets are under the MRL level of both (EC,2004) and (FAO/WHO, 2016), but Endrin in ground samples collected from Cairo market is slightly higher than the MRL level of (EC, 2004).

The results showed in table 5 shows that Tilapia samples were free of Organochlorine compounds in both markets.

In regarding to Shrimp, the samples collected from Cairo market are contain only, Heptachlor with level of 0.0083mg/kg, while samples that collected from Giza market are contain four of Organochlorine compounds namely, Heptachlor, r- chlordane, Endosulfan 1 and Dieldrin with levels of 0.002, 0.011, 0.024 and 0.0035mg /kg, also the Organochlorine compounds contents were under the MRL level of both (EC, 2004) and (FAO/WHO, 2016).

Similar results were obtained by Sallam *et al*. (2008) reported the foundation of the following organochlorine pesticides; DDTs, HCHs, lindane, aldrin, dieldrin and endrin, in 90% of investigated meat carcasses in a study in Sharkia Governorate, Egypt, while HCB, toxaphene, and chlordane compounds were only present in less than 10% of the investigated carcasses.

Our result share which recorded by Kiranmayi *et al*. (2016) who detected organochlorine and organophosphorus in beef and mutton, Aldrin 0.023, 0.020, Dieldrin 0.019, 0.022, Endosulfate 0.046, 0.031, Heptachlor 0.040, 0.040, Heptachlor- epoxide 0.037, 0.031, Methyl parathion 0.020, 0.031,

Organophosphorus pesticides:

Table 6 shows that chicken drum sticks in Cairo market are free from Organophosphorus pesticides, while the comparable ones collected from Giza market are contain two Organophosphorus compounds namely, Phorate and Malathion with levels of 0.0024 and 0.017mg/kg respectively which are under the MRL of both (EC, 2004) and (FAO/WHO, 2016).

In regarding chicken pane samples collected from Cairo market the data show that its contain two Organophosphorus pesticides namely, Dimethoate and Parathion with concentrations of 0.012 and 0.019 µg/kg respectively while the comparable ones collected from Giza market are contain Disulfoton with concentration of 0.0121 µg/kg which are under the MRL of both (EC, 2004) and (FAO/WHO, 2016).

The results show that ground meat samples collected from Cairo are contain three Organophosphorus compounds namely, Disulfoton, Parathion and Malathion with concentrations of 0.032, 0.0062 and 0.0028 of µg/kg respectively, which are under the MRL of both (EC,2004) and (FAO/WHO, 2016), on the other hand ground meat samples collected from Giza were free from Organophosphorus pesticides.

Regarding Tilapia samples collected from Cairo market the data in table 6 show presence of two Organophosphorus compounds namely, Parathion and Phorate with concentrations of 0.002 and 0.011 µg/kg which are under the MRL of both (EC, 2004) and (FAO/WHO,2016), while the comparable ones collected from Giza market were contain two different Organophosphorus compounds namely, Dimethoate and Diazinon with levels of 0.054 and 0.021 respectively which are under the MRL of (EC, 2004) and nearly equal with the MRL of (FAO/WHO, 2016).

The results show that shrimp samples collected from Cairo are contain Malathion with concentration of 0.0051µg/kg whereas shrimp samples collected from Giza contain Famphur with level of 0.024 µg/kg, which are under the MRL of (EC, 2004).

These results were supported by Aboul-Enin *et al*. (2010) who investigates thee imported chicken and bovine meat versus locally produced ones and recorded higher organochlorine and

organophosphorus pesticide (Heptachlor, Aldrin, Heptachlor- epoxide, Chlordan, Endosulfan, Dieldrin, p.p DDE, Endrin, p.p DDD, p.p. DDT and Diazinon) in local produced chicken and bovine meat as compared to imported ones.

Table 6: Pesticide residue (Organophosphorus) content (µg/g) from Cairo and Giza supermarkets.

Pesticide (OP)	Raw samples from Cairo markets					Raw samples from Giza markets						
	Chicken drumsticks	Chicken pane	Ground meat	Tilapia	Shrimp	Chicken drumsticks	Chicken pane	Ground meat	Tilapia	Shrimp	MRL[(1)] kg/mg	MRL[(2)] kg/mg
Dimethoate	ND	0.012	ND	ND	ND	ND	ND	ND	0.054	ND	1	0.05
Disulfoton	ND	ND	0.032	ND	ND	ND	0.0121	ND		ND	0.05	0.02
Famphur	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.024	0.05	-[(b)]
Methyl Parathion	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.05	--[(c)]
O,O,O-Triethyl phosphorothioate	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	-[(b)]	-[(b)]
Parathion	ND	0.019	0.0062	0.002	ND	ND	ND	ND	ND	ND	0.05	--[(c)]
Phorate	ND	ND	ND	0.011	ND	0.0024	ND	ND	ND	ND	0.05	[(a)] 0.02,0.05
Malathion	ND	ND	0.0028	ND	0.0051	0.017	ND	ND	ND	ND	8	--[(c)]
Diazinon	ND	0.074	ND	ND	ND	ND	ND	ND	0.021	ND	0.1	2,0.02[(a)]

[(1)] Maximum Residue Levels (EC, 2004).

[(2)] Maximum Residue Levels (FAO/WHO, 2016).

[(a)] First value for Meat and second for poultry. [(b)] Did not mention. [(c)] Did not mention the samples of current study

Conclusion

Lead concentration levels in animal foods samples were exceeded the Egyptian standardization limits and suggesting a health risk from lead to the consumers of investigated animal foods in Cairo and Giza markets. According to the values of PTWI, the results show that all tested samples could be considered safe except chicken drumsticks from the content of Cadmium. Also, the results of Chromium indicated that tested samples except shrimp and chicken drumsticks could be considered unsafe and toxic.

The situation with Copper indicate that all sample considered unsafe for child but rarely safe for adults except tilapia samples collected from Cairo.

On the other hand, the results showed that tilapia fish samples only were free from Organochlorine compounds whereas ground meat samples only were free from organophosphorus compounds, while other samples were contain pesticides residue but under the MRL level

References

Abd EI-Salam, N.M., S. Ahmad, A. Basir, A.K. AhteramBibi, A.A. Shad, Z. Muhammad and I. Hussain, 2013. Distribution of Heavy Metals in the Liver, Kidney, Heart, Pancreas and Meat of Cow, buffalo, Goat, Sheep and Chicken from Kohat market Pakistan, Life Science Journal, 10(7s).

Aboul-Enein. A.M., N. Nasr, F.M. AbouElella and E.S. Abdullah, 2010. Monitoring of some Organochlorines and Organophosphorus residues in imported and locally raised chicken and bovine muscles in Egypt.Journal of Applied Sciences Research, 6(6): 600-608.

Akoto, O.1., F. BismarkEshun, G.1. Darko and E. Adei, 2014.Concentrations and Health Risk Assessments of Heavy Metals in Fish from the Fosu Lagoon. Int. J. Environ. Res., 8(2): 403-410.

AOAC, 2012. Official Methods of Analysis of AOAC international, 19th Maryland, U.S.A.

ATSDR, 2004. Division of Toxicology. Agency for Toxic Substances and Disease Registry, Atlanta, GA. Available from: http://www.atsdr.cdc.gov/toxprofiles., Last accessed on 21-07-2016.

Azza, E.A., T.E. Sania and M.B. Weam, 2015. Study on Hormonal and Heavy metals residues in fresh beef meat. Egypt. J. Chem. Environ. Health, 1(1): 552-562.

Bruins, M.J., P.B. Soeters and N.E. Deutz, 2000, Endotoxemia affects organ protein metabolism differencing during prolonged feeding in pigs. J. Nutr. 130: 3003-3013.

David, A., G. Ukpo, C. Anyakora and J. Unyimadu, 2008. Organochlorine Pesticide Residues in Fish Samples from Lagos Lagoon, Nigeria.American Journal of Environmental Sciences, 4(6): 649-653.

Diab, E.A. and G.R. Donia, 2015. Determination of the Environmental Pollution in Soil, Water, Forage and Goats Blood Serum and their Relation to Liver and Kidney Functions in El-Shorafa Village, El-Saff, Egypt. J. Bio Chem Environ Sci, 10(3): 111-141.

Donia, G.R., 2015. Determination of Some Heavy Elements Residues in Some Organs of Migratory Quail in Relation to Public Health.International Journal of Science and Research (IJSR), 4(10): 2048-2059.

Doyle, J., 2004. Trespass against us: DOW chemical & the toxic Century, Canada. Available at: http://trespassagainstus.com.

Dural, M., M. Goksu and A. Zak, 2007. Investigation of heavy metal levels in economically important fish species captured from the Tuzla lagoon. Journal of Food Chemistry, 102: 415-421.

EC European commission, EU Pesticides database, 2004.http://ec.europa.eu/food/plant/pesticides/eu-pesticides database/public/?event=activesubstance. selection&language=EN

EC, 2006 Commission Regulation (EC) No 1881/2006.Setting maximum levels for certain contaminants in foodstuffs.https://www.fsai.ie/uploadedFiles/Consol_Reg1881_2006.pdf

El Gendy, A., S. Al Farraj and M. El Hedeny, 2015. Heavy Metal Concentrations in Tissues of the Shrimp Penaeussemisulcatus (De Haan, 1844) From Jazan, Southern Red Sea Coast ofSaudi Arabia. J. Zool, 47(3): 671-677.

El-Sakkary, H., 2007.Fast food as a chemical residue hazard. M.V.Sc., Meat Hygiene, Benha Univ. Fac. Vet. Med, Benha Univ.

Elsharawy, N.T.M., 2015. Some Heavy Metals Residues in Chicken Meat and their Edible Offal in New Valley.2 nd Conference of Food Safety, Suez Canal University, Faculty of Veterinary Medicine, 1: 53-60.

Emara, M.M., S.F. Rabie, A.A. Dawah and M. Fathi, 2015. Assessment of Heavy Metals Concentration in Water and Edible Tissues of Nile Tilapia (Oreochromisniloticus) from two Fish Farms Irrigated with Different Water Sources, Egypt, International Journal of Environment, 1: 108-115.

Emin, S., K. Yordanova, D. Dimov, V. Ilieva, A. Koychev, G. Prakova and T. Vlaykova, 2010. Total antioxidant capacity of plasma determined asferrous reducing ability of plasma in patients with copd. Trakia Journal of Sciences, 8: 205-213.

EOS, Egyptian Organization for Standardization,1993. Maximum level for heavy metal contaminants in Food.Es no. 2366.

FAO, 1983. Compilation of Legal Limits for Hazardous Substance in Fish and Fishery Products. FAO Fishery circular, 464: 5-100.

FAO/WHO, 2005. Summary and conclusions of the sixty-forth meeting of the Joint FAO/WHO Expert Committee on Food Additives (JECFA), pp. 7-17. Available at http://www.who.int/ipcs/food/jecfa/summaries/en/summary_report_64_final.pdf

FAO/WHO, 2000. Report of the 32nd Session of the codex committee of the food additives Contaminants.Beijing People's Republic of China.

FAO/WHO, 2016. Manual on development and use of FAO and WHO specifications for pesticides.First edition - third revision.http://apps.who.int/iris/bitstream/10665/246192/1/WHO-HTM-NTD-WHOPES-2016.4-eng.pdf.

Gill, J.P.S., J.S. Bedi and J.K. Sharma, 2010. Pesticide residues in food of animal origin in India and their impact on human health-an overview. Ind. J. Vet. Public Health, 1(1): 49-55.

Hashim, M.F, 2002. Pesticide residues in local processed fish products J. Egypt. Vet. Med. Ass, 62(6c): 7- 13.

Hassanin, F.S., M.A. Hassan, A.M. Mahmoud, E.A. Mohamed, 2014. Heavy metals residue in some chicken meat products.Benha Veterinary Medical Journal, 27(2): 256-263.

Hassouba, M.M., M.F. Hashim, and O.M. El-Maghraby, 2007. Hygienic status and prevalence of heavy metals and pesticide residues in frozen meat, chicken and their products in Luxor city.Assiut Vet. Med. J. 53 (114): 91-105.

Ibrahim, A. Th. A., E.T. Wassif and M.S. Alfons, 2016. Heavy Metals Assessment in Water, Sediments and Some Organs of *Oreochromisniloticus* under the Impact of Sewage Water. Journal of Heavy Metal Toxicity and Diseases, 1(4): 1-7.

Ismaniza, I., and M.S. Idaliza, 2012. Analysis of heavy metals in water and fish (tilapia sp.) samples from tasikmutiara, puchong. The Malaysian Journal of Analytical Sciences, 16(3): 346-352.

Iwegbue, C.M.A., G.E. Nwajei and E.H. Iyoha, 2008. Heavy metal residues of chicken meat and gizzard and turkey meat consumed in southern Nigeria. Bulgarian Journal of Veterinary Medicine, 11: 275-280.

Jehan, R.D., M.R.H. Hanaa, and A.M. Ahmed, 2009. Studies on some pesticide residues in frozen beef meat and fresh fish "tilapia nilotica" in qena governorate.Journal of South Valley University for Environmental Researches, 1(1): 1-7.

Jurewicz, J. and W. Hanke, 2008. Prenatal and ChildhoodExposure to Pesticides and Neurobehavioral development:Review of Epidemiological Studies Int. 7 Occup medEnviron. Health, 21(2): 121-132.

Khalafalla, F.A., F.H. Ali, F. Schwagele, M.A. Abd-El-Wahab, 2011. Heavy metal residues in beef carcasses in Beni-Suef abattoir, Egypt.VeterinariaItaliana, 47(3): 351-361.

Khan, M.Z., S. Perween, K. Gabol, I.S. Khan, N. Baig, R. Kanwal and T. Jabeen, 2015. Concentrations of heavy metals in liver, meat and blood of poultry chicken Gallus domesticus in three cities of Pakistan.Canadian Journal of Pure and Applied Sciences, 9(1): 3313-3324.

Kiranmayi, C.B., N. Krishnaiah, M. Muthu Kumar, M. Shashi Kumar, N. Subhashini and T. MadhavaRao, 2016. Multiresidue analysis of pesticides in beef and mutton samples and study on effect of cooking on residual levels of aldrin and dieldrin.International Journal of Science, Environment and Technology, 5(1): 195-203.

Mahmoud, M.A.M. and H.S. Abdel-Mohsein, 2015. Health Risk Assessment of Heavy Metals for Egyptian Population via Consumption of Poultry Edibles. Adv. Anim. Vet. Sci., 3(1): 58-70.

Olgunoğlu, M.P., 2015. Heavy Metal Contents in Muscle Tissues of Three Deep-Seawater Mediterranean Shrimp Specie (Plesionikamartia, Plesionikaedwardsii, Aristeusantennatus). J. Environ. Stud, 24(6): 2553-2557.

Papagiannis, I., I. Kagalou, J. Leonardos, D. Petridis and V. Kalfakakou, 2004. Copper and zinc in four freshwater fish species from Lake Pamvotis (Greece). Environment International., 30(3): 357- 362.

Pathuk, R., R.s. Ahmed, A.K. Tripathi, K. Guleria, C.S. Sharma, S.D. Makhijani and B.D. Banerjee, 2009. Maternal and cord blood levels of organochlorine pesticides, Clin. Biochem, 42: 746-749.

Sadeghi, M.H., F. Jamali-Behnam, A. Zohani, H. Esmaily and A.A. Dehghan, 2015. Determination of Chromium, Lead and Cadmium Levels in Edible Organs of Marketed Chickens in Mashhad, Iran, Journal of Food Quality and Hazards Control., 2: 134-138.

Saei-Dehkordi, S.S. and A.A. Fallah, 2011. Determination of copper, lead, cadmium and zinc content in commercially valuable fish species from the Persian Gulf using derivative potentiometric stripping analysis. Microchemical Journal, 98: 156-162.

Sallam, K.I. and M.A. AlaaEldin, 2008. Organochlorine pesticide residues in camel, cattle and sheep carcasses slaughtered in Sharkia Province, Egypt. Food Chemistry, 108: 154-164.

Sharmeen, R., M. Zaheer Khan, Y. Ghazala and A.G. Syed, 2014. Levels of heavy metals (cadmium, chromium, copper and lead) on water and selected tissues of oreochromismossambicus from different locations of malir river, Karachi. Academic Publishers, British Columbia, 8(3): 3011-3018.

Uluozlu, O.D., M. Tuzen, D. Mendil and M. Soylak, 2009. Assessment of trace element contents of chicken products from Turkey. Journal of Hazardous Materials, 163: 982-987.

Zahran, A.D., B.A. Hendy, 2015. Heavy Metals and Trace Elements Composition in Certain Meat and Meat Products Sold in Egyptian Markets. International Journal of Sciences: Basic and Applied Research (IJSBAR), 20(1): 282-293.