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Effect Of Aqueous Solutions Of Pomegranate Peel, Garlic And *Coriandrum Sativum On* Some Heavy Metals From Grey Mullet (*Mugilcephalus*).

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ABSTRACT

Water and grey mullet (Mugil cephalus) samples collected from Mediterranean Sea, Manzalh Lake, and a private fish farm were contaminated with Cd, Hg and /or Pb. The Pb concentration was at highest in the Lake water; whereas, Cd and Hg levels were the highest in the farm water. Generally, the level of water Pb was higher than water Cd than water Hg, respectively.There were significant differences among tested sampling locations, as well as the treatment period in concentration of the three heavy metals tested in the fish samples. Lakes fish samples were the highest in Pb concentration, but farm samples were the highest in Cd levels. However, Hg level in the sea fish samples was the highest. Also, there were significant differences among treatment agents in the Pb and Hg levels in the fish flesh. Since, pomegranate significantly reduced the level of the three heavy metals than the other two agents. Moreover, prolonged treatment period (20 and 30 min.) generally reduced the heavy metals level, particularly Pb and Cd. it is possible to recommend the importance of soaking fish before cooking in the water extract of pomegranate peel (1 g pomegranate powder/100 g fish) for 20 or 30 minutes to reduce the concentration of these dangerous pollutants in fish flesh and make them safe for human consumption.

Keywords: Mullet, sampling locations, pomegranate peel, garlic, coriander.

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INTRODUCTION

Egyptians prefer to consume fish than white meat (poultry, such as ducks, geese, pigeons and chickens) and red meat (from farm animals, such as beef, buffalo, camels, goats and sheep). The Egyptians consumed about 1.8 million tons of fish annually [1]. Although the local fish production in 2014 was 1481182 tons [2] so, Egypt imports fish to overcome supply shortages [1].

Damietta governorate is characterized by its diverse fisheries. It has fresh water fisheries (Nile River), brackish (Manzalh Lake) and maritime (Mediterranean Sea). Therefore, the population of Damietta consumes fish weekly [3].

Fish is an important food for human because it is a good source of biological animal digestible protein, unsaturated fatty acids especially omega3 fatty acids, vitamins and minerals [4-6], But fish may transmit some harmful or toxic substances to humans [7] especially with the increase in population and the development of industrialization and poor industrial, sanitary and agricultural discharge, the aquatic environment is exposed to different types of pollutants, the most dangerous heavy metals.[8- 12], It is known that heavy mineral content in the soil is affected by the sampling location [13] This pollution is transferred to the fish and accumulates in them and then moves to the human [14,15] Because of both the importance of fish and the gravity of heavy metals in stability, toxicity and bioaccumulation, heavy metals have received considerable attention in the study of aquatic ecosystems [16] .

Grey mullet (Mugilcephalus)is one of the most popular fish species in most of the Mediterranean basin countries including,Egypt.M. cephalus is a saltwater fish , as well as it can be cultured in fresh water with heavier yield than from marine water, with a greater return than marine water [17, 18] reported that the concentration of heavy metals varies according to the sampling sites [19,20].

EXPERIMENTAL

General

This study was carried out under the cooperation between Department of Home Economics, Zagazig Faculty of Specific Education, Zagazig University and Department of Animal Production,Mansoura Faculty of Agriculture, Mansoura University during 2017 – 2018.

Collection of Samples

Water Samples

Three water samples from each location [the Mediterranean Sea (from Gamsaelbalad About 500 meters from the land) , Manzalh Lake (pond of gait el nasara) and fish farm (Hassan Ghanemfarm-El Deba)] from Damietta governorate , were collected during July 2017. The water was frozen, then Lead, cadmium and mercury were measured in these samples. The average for each source was then calculated.

Fish Samples

Samples of grey mullet (M.cephalus) collected from Mediterranean sea (average weight 200g) during June 2017, Manzalh Lake (average weight 200 g), and fish farm (average weight 250 g) in Damietta governorate (three samples of fish from each source) during July 2017.

Preparation of Fish Samples

- Fish samples were cleaned by removing the scales, gills and eviscerated by removing the complete gut. The fish samples were divided into three groups(according to its sampling location)to be treated with three agentsfor preparing fish before cooking, being commercial powder of: Pomegranate (*Punicagranatum*) peel (external and internal skins),
- Garlic (*Allium sativum*) lobules,

- Coriander (*Coriandrumsativum*) seeds (Chinese parsley).

These natural agents were purchased from the local market for spices and medical herbs in powder forms. Fish from each sampling location were rather divided into four parts, the first part was not soaked in the preparing solutions, whereas the second, the third and the fourth parts were soaked in the preparing solutions with concentrations of 1g powder (of each of the tested natural preparation agents) / 100 g fish for 10, 20 and 30 minutes, respectively, After the treatment, the fish were frozen to be easier to cut the tissues for heavy metal analysis.

Fish and Water Analyses

The fish were transported to the laboratory in an ice–box. The experimental fish specimens were cooled for as hot time then kept frozen for one day (till analysis) to avoid any loss of compounds and to be easy to cut the frozen tissues. The fish were taken from the freezer and kept at room temperature until they were partly thawed. The fish was put on a clean plastic plate, the skin was removed using a knife, and then a flesh sample was tweezed from the lower part of the dorsa–lateral tissue [21]**.** The analyses of heavy metals in both water and fish samples were done in the Zagazig University Agricultural Research and Experimental Center , Faculty of Agriculture Central Laboratory using Atomic Absorption Spectrophotometer(AAS, model 2380, from Perkin Elmer Company, USA).

- The sample was cut, weighed (1g) and put in the combustion oven at 500° C for two days (Ney –m-525 series).
- Add 3 ml of freshly prepared (1:1, v/v) pure perchloric acid / pure– nitric acid (both from ARABLAB, P.O. Box 13543, U.A.E., Fax: 3393318, Tel. 3384985) to each sample in the digestion tubes, then placed aside for about one hour until the first reaction subside (thermo Scientific – Ice 3000 SERIES).
- Fully complement the sample after digestion with distilled water to the known size and run.
- So, the sample is ready to estimate the concentration of the elements steps measurement device.
- Open the power and gas pressure regulator.
- Set the item we want to soundings lamp and adjust the wavelength of the element.
- Drawing the curve record on the computer Was it measuring 3 concentrations equipped and information focus.
- The introduction of the sample for measurement, the computer assigns element concentration in the sample as mg / L according to [22, 23].

Estimation

Lead, mercury and cadmium were measured in the treated samples befour and after soaking (after 10, 20, 30 minutes).

Statistical Analysis

The obtained numerical data were statistically analyzed using [24] for analysis of variance (one way as well as factorial). Differences between comparisons among treatment means were made by using Duncan multiple ranges test [25]**.**

RESULTS AND DISCUSSION

Heavy Metals of Fish Rearing Water

Data of the heavy metals analysis in the fish rearing water from the sampling locations (sea, lake, and farm) refere to that Pb concentration was at highest in the lake water followed by the sea water then the farm water. Whereas, Cd was absent from the lake water, but highest level was found in the farm water followed by the sea water. However, Hg level was at highest in the sea water, followed by the farm water and at least in the lake water (Table 1). Generally, the level of water Pb was higher than water Hg than water Cd, respectively.

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Table 1: Mean values* of heavy metals Pb, Cd, and Hg mg / L in the water of Mediterranean Sea, Manzalh Lake, and water of the fish farm at zero time

Source of water	Heavy metals (mg/l)		
	Pb	Cd	Hg
Mediterranean sea	0.376 ±0.008b	0.025 ±0.001 b	0.380 ±0.012a
Manzalh Lake	0.547 ±0.015a	0.000 ±0.000 c	0.001 ±0.000b
Fish farm	0.132 ±0.006c	0.049 ±0.004a	0.009 ±0.000b

*Mean values of three replicate samples ± Standard Deviationa, b and c: means in the same column with different small letters are significantly differ (P ≤ 0.05)

Heavy Metals of *Mugilcephalous*' Tissues:

Data presented in (Table 2) revealed presence of significant differences (P≤0.05) among sampling locations, as well as the zero time in concentration of the three heavy metals in the fish tissues.

Lake fish samples were contaminated with higher levels of Pb> sea > farm samples. Whereas, the farm fish samples were more contaminated with Cd > sea > lake samples. Yet, Sea fish samples reflected the highest Hg concentrations > farm >lakes amples. Regardless to sampling locations and treatment agents, the levels of Pb>Hg > Cd (Table2), lake samples contamination levels took the descending order Pb, Hg, and then Cd, respectively, sea fish flesh samples reflected the contamination levels of heavy metal as Pb, Hg, and Cd . Finally, farm fish flesh samples reflected the descending order of heavy metal contamination levels as Pb, Cd, and Hg.

Table 2: Mean values* of heavy metals Pb, Cd, and Hg (p.pm) in thefish tissues from Mediterranean Sea, Manzalh Lake, and the fish farm at zero time

locatin of fish	Heavy metal(mg/l)		
	Pb	Cd	Hg
Mediterranean Sea	0.547±0.074 ^{b}	0.036±0.009 ^{b}	0.215±0.043 ^{a}
Manzalh Lake	1.304±0.112 ^{a}	0.000±0.000 ^{c}	0.002±0.001 ^{c}
Fish farm	0.278±0.098 ^{c}	0.196±0.071 ^{a}	0.019±0.007 ^{b}

* Mean valuesof three replicate samples ± Standard Deviation a, b and c of small letters in the same column, means there are significant differences (P≤0.05) within the same variable

The treatment generally reduced the heavy metals concentration comparing with zero time before treatment. Moreover, prolonged treatment period (20 and 30 min.) generally reduced (P≤0.05) the heavy metals level, particularly in Pb and Cd **,** Coriander and garlic were not effective in reducing Pb concentration as the pomegranate, while both coriander and garlic remove cadmium completely after soaking for 10 minutes while pomegranate removed Cd with increased period of soaking to 20 minutes. Also, reducing garlic to Hg level was better than the other treatment agents (coriander and pomegranate). Whereas, the increase in the period of soaking in pomegranate led to the removal of Hg, and therefore the effect of pomegranate was better than coriander and garlic.

Table 3 shows that the effect of treatment with soaking in coriander for 30 minutes and as shown from the table coriander reduced the lead in the fish samples from the sea and lake, while removing lead completely from the farm fish samples, The highest percentage of coriander's effect to remove cadmium, where cadmium was reduced in sea fish samples and completely removed from farm fish samples, whereas the lake fish samples did not contain mainly cadmium, while coriander reduced the cadmium ratio in sea fish and farm fish samples and completely removed it from the lake fish samples, the best effect of coriander on Pb and Cd removal was on farm fish samples , while the best effect of the Hg removal was on Manzalh Lake samples .

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Table 3: The removal Percentage of heavy metals Pb, Cd, and Hg in the fish tissues from Mediterranean sea, Manzalh Lake and thefish farm after soaking in Coriander agent at 30 min

Treatments	Location	Pb	Cd	Hg
Coriander agent	Mediterranean Sea	75.87 %	88.89%	85.58%
	Manzalh Lake	94.25%	00.00%	100.00%
	Fish Farm	100.00%	100.00%	68.42%

As shown in (Table 4) garlic has reduced the contamination of heavy metals found in sea fish samples as follows: remove cadmium completely and reduce the percentage of mercury followed by lead r, while the mercury was completely removed and samples ,As for the fish samples of the farm the soak in garlic for 30 minutes has removed completely cadmium pollution and reduce lead contamination followed by mercury . So the garlic reduced lead contamination in farm fish samples > lake fish sampling samples > sea fish samples while the effect of garlic on reducing mercury pollution was on samples of Manzalh Lake fish > sea fish samples > farm fish samples, whereas soaking in garlic 30 minutes removed the contamination with cadmium completely from both the sea and the farm samples. In other words, the best effect of the garlic to remove the contamination of the three heavy metal from fish samples were remove Cd > Hg >Pb .

Table 4: Theremoval Percentage of heavy metals Pb, Cd, and Hg in the fish tissues from Mediterranean sea, Manzalh Lake and the fish farm after soaking in Garlic agent at 30 min.

Treatments	Place	Pb	Cd	Hg
Garlic agent	Mediterranean Sea	71.85%	100%	96.28%
	Manzalh Lake	83.51%	zero%	100%
	Fish Farm	94.96%	100%	73.68%

Table 5 shows that the removal percentage of heavy metals Pb, Cd, and Hg in the fish tissues from Mediterranean sea, Manzalh Lake and the Fish Farm after soaking in Pomegranate agent at 30 min we can note that the pomegranate peel was removed by a large percentage the lead from the fish samples in a general manner, where it was removed completely from the farm fish samples followed by the sea fish samples and then the farm fish samples, Cadmium was also removed completely from farm fish samples and removed by 91% of sea fish samples ,as such pomegranate peel was completely removed Hg from thefarm and lake fish samples but its mercury removal rate from sea samples was lower, On the other hand, the pomegranate peel of the three heavy metals removed from sea fish samples was Pb> Cd > Hg, while the heavy metal removal by pomegranate peel from the lake fish samples was Pb>Hg whilst farm fish samples were not contaminated with Cd , However, we note from the table that soaking fish samples for 30 minutes in pomegranate peel solutionled to the decontamination of the three heavy metals from fish samples of farm.

Table 5: The removal percentage of heavy metals Pb, Cd, and Hg in thefish tissues from Mediterranean sea, Manzalh Lake and thefish farm after soaking in Pomegranate agent at 30 min.

Treatments	Place	Pb	Cd	Hg
Pomegranate agent	Mediterranean Sea	98.90%	91.67%	58.14%
	Manzalh Lake	95.47%	zero%	100%
	Fish Farm	100%	100%	100%

CONCLUSION

The obtained results revealed that, all tested water and grey mullet (M. cephalus), all tested water and fish (Bury) samples collected from different studied locations were contaminated with higher Cd, Hg and/or Pb than the tolerance levels. Treating fish before cooking with some natural agents, particularly with pomegranate peels for 20 – 30 minutes reduced the heavy metals' residues in the fish. Yet, the prophylactics are better than treating, i.e. treating different drainages before turnoff the waste waters into surface water is a must. Also, man must buy his aquatic foods from trustfully sources. There after the role of such natural treating agents could help in reducing the residues of such contaminants.

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