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The Correlation between Heavy Metal Residues and Microbial Contamination in Fish

By

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7. English summary

Fish are considered as an important source of high quality animal protein as they contain large amounts of essential amino acids and essential fatty acids. In addition to fat-soluble vitamins, phosphorous and iodine.

Damietta area is a region in Egypt that heavily exposed to pollution. Agricultural sewage coming from surrounding village, and industrial wastes from factories enter the environment.

1-Shatta village, located in Damietta governorate, is characterized by many aquaculture fish farms. The main growing water supply is an extension of the water of Lake Manzala which lies between some Governorates in Eastern Delta, Egypt. It is exposed to constant pollution from different sources, notably the most dangerous one is the untreated domestic human sewage waste, in addition to agricultural and industrial pollution including the presence of garbage recycling factory neighboring this area leading to smoke spreads as a result of garbage burning.

2-The Lake El- Burullus is an important lake, large, shallow, fresh to brackish salt-water lagoon, located on the coastal bulge of the north central Delta region between the Rosetta and Damietta branches of the Nile with a size

English summary

of about 595 hectares. The Lake is located within five districts of Kafr El Sheikh Governorate. The main activities of the Population in and around the lake are fishing, Reed cutting, grazing and agriculture.

The aim of this study was to measure chemical, bacteriological, biochemical changes of fish to determine the pollutants level and their effects on the quality of catfish (*Clarias gariepinus*) and *Oreochromis niloticus* (are two of the most important fish species, widely distributed in Egypt and can persist in a highly polluted habitat and is possible to use as a potential bio-indicator for aquatic environmental contaminants). Therefore, Two sites in Egypt farms were chosen for the research, Damietta (site 1) and Lake Burullus (site 2).

The concentrations of heavy metals (Pb, Cd, Fe, Zn and Hg) were estimated in fish (muscles, gills, liver), sediments and water. Also, bacteriological analysis (total aerobic bacterial count, *S.auerus*, *L.monocytogenes*, *E. coli*, *Salmonellae* and total coliform count) were estimated in fish (muscles, gills, liver). In addition, antioxidant parameter (Superoxide dismutase activity (SOD), malondialdehyde level (MDA), glutathione reductase, catalase, reduced glutathione (GSH), total anti-oxidant activity (TAO), and nitric oxide level). Also, differential leucocyte count (lymphocyte, neutrophil, monocyte, acidophil and basophil). In addition, serum protein, protein electrophoresis, RNA, DNA, RNA/DNA ratio, haemoglobin, WBCs, RBCs, heamatocrite. Finally, estimation of hepatosomatic index, liver water

content, condition factor, moisture, lipid contents and total volatile nitrogen were determined in the fish.

Where, the obtained results showed that the contents of heavy metals in fish were depending on water and sediment contents of these metals. Also, depending on fish organs and sampling sites. Site 1 had greater concentrations of heavy metals Hg, Pb and Cd in water, sediment and tissues. While, Hg was not detected in site 2.

In the antioxidant parameter; there was increased in levels of MDA and nitric oxide, and reduced levels of SOD, GSH, catalase, glutathione reductase and TAO in fish samples of site 1. However, decreased levels of nitric oxide and increased levels of SOD, GSH, catalase, glutathione reductase, MDA and TAO occurred in fish samples of site 2.

The results also revealed that, there was suppression of immune response in site 1. Immune response with these metals provides opportunities for the entry of pathogens and developing of many diseases in fish.

Lipid contents, liver water content and total volatile nitrogen were highly elevated in fish samples of site 1. On the other hand, hepatosomatic index, condition factor, moisture, serum protein, RNA, DNA, RNA/DNA ratio,

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haemoglobin, WBCs, RBCs and heamatocrite were highly decreased in fish samples of site 1.

The differences in protein contents, in fish samples were explained in the electropherograph of different types of protein in serum samples which analyzed by Gel Pro, The analysis showed that the patterns of proteins of serum separated using PAGE was significantly different in *Oreochromis niloticus* and *Clarias Gariepinus* of Damiatta (site 1) than *Oreochromis niloticus* and *Clarias Gariepinus* of El-Borollus (site 2) when compared to that of control.

It was cleared that, the concentrations of heavy metals were detected as the following manner: liver >gills > muscles for (Cd, Zn and Fe) in catfish and tilapia as well as, Pb (in tilapia). While, the concentrations of Pb (in catfish) and Hg (in catfish & tilapia) were detected as the following manner: gills >liver > muscles. The results illustrated that, Fe and Zn levels in site 2 were negatively correlated with (total aerobic bacterial count &total coliform count), and between Cd and total aerobic bacterial count. On the other hand, significant positively correlations were found in site 1 between mercury and (total aerobic bacterial count & *lesteria monocytogen*). No doubt that fish are not safe for human consumption since the heavy metal and bacteriological analysis revealed a public health hazard.

Conclusion and recommendation

From the above mentioned results, the contents of heavy metals, in fish were depending on water and sediment contents of these metals. Also, depending on fish organs and sampling sites. Immune response by these metals provides opportunities for the entry of pathogens and developing of many diseases in fish.

These increasing in heavy metals and pathogenic bacteria affect therefore, on the biological activity of catfish and tilapia, as well as, antioxidant enzymes, nucleic acids and immune response.

Further studies are needed to determine the environmental consequences and human health impacts associated with mercury contamination. High concentrations of heavy metals implicate fish tissues affecting its quality and become a threat to human. So, treatment of these effluents should be carried out before their discharge to the natural water resources.