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Der Pharmacia Lettre, 2017, 9 [4]:130-134
[http://scholarsresearchlibrary.com/archive.html]

ISSN 0975-5071
USA CODEN: DPLEB4

Heavy Metals in the Environmental and its effects on fish

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ABSTRACT

The heavy metal concentration in fish tissues reflects past exposure via water and/or food and it can demonstrate the Current situation of the animals before toxicity affects the ecological balance of populations in the aquatic environment. Also, heavy metals are known to induce oxidative stress and/ or carcinogenesis by mediating free radicals/reactive oxygen species. In general, metals can be categorized as biologically essential and non-essential. The nonessential metals (e.g., aluminum (Al), cadmium (Cd), mercury (Hg), tin (Sn) and lead (Pb) have no proven biological function (also called xenobiotics or foreign elements), and their toxicity rises with increasing concentrations [3]. Essential metals (e.g., copper (Cu), zinc (Zn), chromium (Cr), nickel (Ni), cobalt (Co), molybdenum (Mo) and iron (Fe)) on the other hand, have a known important biological roles, and toxicity occurs either at metabolic deficiencies or at high concentrations.

***Key words:** Heavy, Metals, Environment*

INTRODUCTION

Most of fish diseases might be occurred as a result of parasitic infection or environmental pollution [1-6] Knowledge of fish parasites is of particular interest in relation not only to fish health but also to understand ecological problems [7].

Aquatic pollution is still a problem in many freshwater and marine environments; it causes negative effects for the health of the respective organisms [8]. The number of studies investigating effects of pollutants and concurrently occurring parasites is still relatively low [9]. However, the effect of environmental pollutants on fish parasites varies depending on the particular parasite and pollutant that interact [10]. Pollutants may affect the immune system of the fish either directly or by change water quality; that in turn may reduce the fish immunity to parasites [11] also, water pollution may accelerate the life cycle of the external parasites and promote their spread [12].

It is well known that certain blood parameters serve as reliable indicators of fish health as many parasites can live in a host, sometimes causing damage to it [13]. Therefore, the changes associated with hematological parameters due to various parasites establish a database, which could be used in diseases diagnosis and in guiding the implementation of the treatment or preventive.

Silver is a trace element of rising interest in the aquatic environment. The continuous development of new applications for silver, mostly as silver nanoparticles, in technology, medicine and consumer products has led to an increasing discharge of silver to the environment with only rarely known consequences to the aquatic environments [14]. Ionic silver has been known to be highly toxic to fish for some decades [15-16], but there are studies indicating that silver nanoparticles may have toxic effects on the aquatic life in even lower concentrations than ionic silver [17].

Lead occurs naturally in the environment. However, most lead concentrations that are found in the environment are a result of human activities. Due to the application of lead in gasoline, an unnatural lead-cycle has consisted. In car engines lead is burned, so that lead salts (chlorines, bromines, oxides) will originate. These lead salts enter the environment through the exhausts of cars. The larger particles will drop to the ground immediately and pollute soils or surface waters, the smaller particles will travel long distances through air and remain in the atmosphere. Part of this lead will fall back on earth when it is raining. This lead-cycle caused by human production is much more extended than the natural lead-cycle, and has caused lead pollution to be a worldwide issue [18]. The high level of lead could be also due to the industrial discharges from superphosphate factories, traffics of high way or motor vehicles as well as the extensive use of agrochemicals such as fertilizers, pesticides and growth promotors [19].

Lead can enter the human body through uptake of food (65%), Water (20%) and air (15%) and cause several unwanted effects, such as: Disruption the biosynthesis of haemoglobin and anaemia, a rise in blood pressure, kidney damage and Miscarriages and subtle abortions, disruption of nervous systems, brain damage, declined fertility of men through sperm damage and diminished learning abilities of children and behavioral disruptions of children, such as aggression, impulsive behavior and hyperactivity. Lead can enter a foetus through the placenta of the mother. Because of this, it can cause serious damage to the nervous system and the brains of unborn children [20].

Industrial and agricultural discharges are considered the primary source of metal poisoning to fish in Egypt [21]. Lead has a tendency to accumulate in tissue and organs of exposed fish resulting in hepatic and renal dysfunction with growth retardation [22]. Consequently, it could induce alterations in hematological and serum biochemical parameters [23] as well as pathological changes in most body organs [24]. Belong to the class of trace elements, namely lead, mercury, chromium, and cadmium. Many of these elements like lead or mercury have been known for their toxic properties for a long time and therefore, at least in richer countries, enormous efforts have been taken to decrease their release into the environment [25].

Main anthropogenic sources for pollution are domestic and industrial emissions through waste streams as well as emissions into the aquatic environment caused by mining, energy producing- and agricultural activities [26]. Four out of the six top contaminants in the world reported by Pure Earth (2015) belong to the class of trace elements, namely lead, mercury, chromium and cadmium.

Cadmium is potentially harmful to most organisms even in very low concentrations [27] and present in aquatic environment and gills increased due to domestic and industrial mining [28].Fish accumulate cadmium to concentration many times higher than present in water[29-30].The relationship between parasitism and pollution is not simple and in essence involves a double edged phenomenon in which parasitism may increase host susceptibility to toxic pollutants or pollutants may result in an increase or decrease in the prevalence of certain parasites[31].

Zinc (Zn) is the second most abundant trace element after Fe and is an essential trace element and micronutrient in living organisms, found almost in every cell and being involved in nucleic acid synthesis and occurs in many enzymes [3]. Additionally, Zn is involved in more complicated functions, such as the immune system, neurotransmission

and cell signaling [32-33]. It may occur in water as a free cation as soluble zinc complexes, or can be adsorbed on suspended matter. Zinc and its compounds are extensively used in commerce and in medicine. The common sources of it are galvanized ironwork, zinc chloride used in plumbing and paints containing zinc [34]. Zinc wastes can have a direct toxicity to fish at increased waterborne levels [35],

Arsenic compounds in the third (III) oxidation state (arsenites) are absorbed fairly rapidly into fish and are more toxic than arsenic compounds in the oxidation state V (arsenates) [36]. Arsenic is actively metabolized in the tissue of fish especially in organs such as the liver and has the tendency to accumulate as reported in different teleost's such as green sunfish [37], rainbow trout [38], Japanese medaka and *Tilapia mossambica* [39-40]. Donohue and Abernathy [41] reported that total arsenic in marine fish, shellfish.

The emission of vanadium into the environment is mostly associated with industrial sources, especially oil refineries and power plants using V-rich fuel oil and coal [42]. Such sources can release appreciable amounts of V and combine to increase natural background levels associated to rock weathering and sediment leaching [43]. Vanadium is essential for normal growth where it has been found to regulate the activity of various enzymes that induce pronounced. changes in metabolic functions. At higher concentrations (>1–10 NM), vanadium becomes toxic to the cells inducing several injury effects at specific target organs, such as liver and kidney, inducing oxidative damage, lipid peroxidation and changes in hematological, reproductive and respiratory systems [44-45].

CONCLUSION

Biomarkers can offer additional biologically and ecologically relevant information – a valuable tool for the establishment of guidelines for effective environmental management. So, it can be stated that fish biomarkers are necessary for monitoring environmentally induced alterations to assess the impact of xenobiotic compounds (i.e. heavy metals) on fish. Also, it is recommended that treatment of all kinds of wastewaters, sewage and agricultural wastes must be conducted before discharge into the aquatic systems. Also, enforcement of all articles of laws and legislations regarding the protection of aquatic environments must be taken into considerations.

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