Heavy metal content in fresh and frozen fishes available in super markets of Cochin

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Heavy metal pollution of aquatic environment is a major concern since the advent of industrial revolution. The source of heavy metals includes direct atmospheric deposition, geologic weathering and discharges of agricultural, municipal or industrial waste. The incidents of heavy metal poisoning which resulted catastrophical effect on human beings across the world is still in history causing concern in the minds of people. Due to bio-magnification of heavy metals along the food chain, the unfavorable effects can increase. The indiscriminate discharge of heavy metals into the aquatic environment due to pollution is directly getting accumulated in the aquatic biota, particularly fish, which is preferred as a main protein source by a huge section of human population. The heavy metals in aquatic ecosystem can alter the growth, physiology, biochemistry and reproduction of the species and can also lead to the death of fish. These toxic elements can be detrimental to humans even at small concentration, if it is ingested over a long duration. As it is difficult to clear out toxic metals from our environment after its entry, it is highly essential to reduce the discharge of industrial wastes to the environment.

Fishes take in metals from the surroundings, directly or indirectly and accumulate in the body depending upon the intake, storage and elimination capacity. There are two categories of metals. The metals like aluminium (Al), cadmium (Cd), lead (Pb), mercury (Hg) and tin (Sn) which have no specific biological functions (Xenobiotics) and are non-essential metals and their toxicity increase with increase in concentration. While the content of essential metals like zinc (Zn), chromium (Cr), copper (Cu), nickel (Ni), cobalt (Co), molebdenum (Mo) and iron (Fe) at higher concentration can become toxic. The presence of toxic metals like mercury, cadmium and lead is included in all food safety regulations across the world countries. The metals like arsenic (As), chromium (Cr) and Nikel (Ni) were also considered in some regulations. In this context a study was carried out to ascertain the hazard level of these metals in the samples of fresh and frozen fishes available in super markets of Cochin. This assumes significance as the marketing channel through super markets is growing rapidly. A total of 45 samples of fishes sold in fresh and frozen condition from different super markets of Cochin were collected for the study. Fresh fish samples include *Lethrinus nebulosus, Nemipterus japonicus, Rastrelliger kanagurta, Lutjanus gibbus* and *Gerres filamentosus*. The frozen fish samples include Pangasius, Indian mackerel and Anchovy.

Table 1. Heavy metal content in fresh and frozen fishes collected from super markets

Heavy metals	No. of samples analyzed	Range (mg/Kg)	No. of samples present
As	45	Nd - 4.650	20
Cd	45	Nd - 0.235	28
Pb	45	Nd - 3.820	9
Cr	45	Nd - 0.493	17
Ni	45	Nd - 0.456	16
Sn	45	Nd - 0.943	16

The content of As, Cd, Pb, Cr, Ni and Sn in the meat of the samples were evaluated using ICP-OES (ICAD 6300 Duo view, Thermofisher, USA) (Table 1). Presence of As in fresh and frozen samples of super market was observed in 44.4% of samples with a maximum of 4.65 ppm which is well below the limit of 76 mg/kg (FSSR, 2011). Cd was detected in the 62.2% of the samples studied, with a maximum value of 0.235 mg/kg which is below the limit of 0.3 mg/kg for fishes (FSSR, 2011). While the Pb content crossed the limit of 0.3 mg/kg (FSSR, 2011) in 13% of fresh and frozen fish sample evaluated with a maximum of 3.82 (*Lutjanus gibbus*) and a minimum of 0.436 mg/kg (Frozen Pangasius). The lead content obtained in the current study is comparatively higher than the reports in fishes in and around markets of Cochin (Sivaperumal *et al.*, 2007). Cr and Ni were present in 37.78% and 35.55% of the samples analyzed, respectively but were very much below the regulatory limits of 12 mg/kg for Cr and 70 mg/kg (USFDA, 1993).

The higher level of Pb (Fig. 1) in the fresh and frozen fishes collected from super markets is pointing towards the risk coming out of high industrial activity to our environment. Stringent regulations and actions are required to regulate the industrial discharges to water bodies.

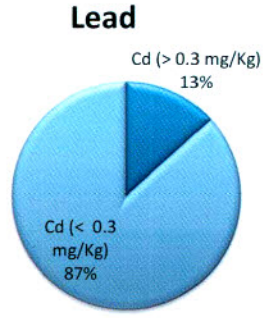

Fig. 1. Contaminaion level of lead in fresh and frozen fishes collected from super markets

Referrences

Food Safety and Standard Regulations, Amendment Regulations (2016) related to limit of Heavy Metals in food. Amendment in the Food Safety and Standards (Contaminants, Toxins and Residues)

Sivaperumal, P., Sankar, T.V. and Viswanathan Nair, P.G. (2007) - Heavy metal concentrations in fish, shellfish and fish products from internal markets of India *vis-a-vis* international standards, *Food Chem.*, **102:** 612-620.

USFDA (1993) - Food and Drug Administration. Guidance Document for Chromium in Shellfish. DHHS/PHS/FDA/CFSAN/Office of Seafood, Washington, DC.

Growth kinetics and enterotoxin production of *Staphylococcus aureus* in fresh fish stored at 30 °C

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Staphylococcus aureus is an enterotoxin producing pathogenic bacterium occurring as commensal flora of humans on nasal cavity and skin surfaces (Alves *et.al.*, 2014). The lack of proper hygienic practices during handling and processing may result in the contamination of fish with *S. aureus*. The most common means of fish to be contaminated with *S. aureus* is through contaminated food contact surfaces or by contact with fish workers who are the carriers of this bacteria. This pathogen has a great importance to the food chain because of the ability of certain strains to produce heat-stable enterotoxins and other virulence factors responsible for Staphylococcal food poisoning (SFP), which is one of the most prevalent food-borne intoxication diseases. Staphylococcal enterotoxins (SE) are formed and secreted during late exponential or