The study of iron levels and hazard quotient (HQ) on muscle of farmed carp fish from Khuzestan, south west of Iran

V. Karimi Sari, A. Askary Sary*

Department of Fishery, Faculty of Agriculture and Natural Resources, Ahvaz Branch, Islamic Azad University, Ahvaz, Iran

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Abstract

The aim of this study was to determine the concentration of iron and Hazard quotient (HQ) in muscle of the farmed carp fish, common carp (Cyprinus carpio), grass carp (Ctenopharyngodon idella), big head carp (Aristichthys nobilis) and silver carp (Hypophthalmichthys molitrix) from Khuzestan. Fish sampled was prepared from the Azadegan warm water fish culture center. Iron concentration measured by wet digestion and atomic absorption spectrometer Perkin Elmer 4100. The results showed that the highest iron concentrations between fish muscle was on big head carp equal to 18.16 mg/kg dry weight and was significantly different (P <0.05) with grass carp. Hazard quotient in fish were in big head HQ=0.65, Common carp HQ =0.63 grass carp HQ= 0.55 and silver carp HQ =0.61. Hazard quotient in all samples was less than one and so fish nutrition no risk in terms of the amount of iron in the human body.

*Corresponding Author: A. Askary Sary askary_sary@yahoo.com
Introduction

Increasing population, the development of industry and agriculture, the use of different types of fertilizers and pesticides has led to the high volume of wastewater and various chemicals, especially heavy metals are into aquatic systems (Wicker and Gantt, 1994). The research of the uptake of heavy metals in aquatic organisms due to the increasing impact of human activities and the influx of these metals in the aquatic environment has intensified. Heavy metals due to their role in biological processes as micronutrient (iron, zinc, copper, cobalt, etc.) or non-essential and toxic elements (Hg, Cd, Pb) are considered. Accumulation of metals in fish location, feeding behavior, food levels, ages, sizes and metal shelf life depends on the activities of the regulatory body Hemostasis. Iron is a heavy element abundance spread all over the world. The amount of iron in the body of the fish is about 0.005% of body weight (Oksuz et al., 2011).

Iron deficiency in fish, like other animals that can cause microcytic anemia and hypochromic paleness due to anemia and shrink the size of red blood cells and also lack of vitamin B6 decreases iron absorption. Iron salts may be a lot of eating disorders. It might even be insoluble iron phosphate minerals, vitamins and trace elements, and thus attract fish disease caused by the deficiency of vitamins and minerals (Chen and Chen, 2001).

Iron is an importance essential element in human nutrition in a number of biologically important proteins such as cytochrome hemoglobin and present also in the oxide-reducing enzymes. The minimum daily requirement of iron is 7 to 14 mg is estimated depending on age and sex. Pregnant women may need more than 15 mg daily. Human need 10 mg iron in daily and should be considered. Iron in building red blood cells have a crucial role and is an important component of hemoglobin makes its deficiency leads to a condition called anemia hypochromic microcytic can be in fish. There is no way to control the body and removes iron, so eating too much can lead to accumulation of excess iron (Schumann, 2001). Liver damage resulting from the iron can acute or chronic about 90 percent of iron poisoning immediately 48 hours after swallowing happens. The results of the damage from the necrosis high channels in the stomach intestinal - blood vessels in the conclusion of intestinal, necrosis around is returned in the liver cells, lung bloodshed and external secretions ten curtains heart damage to the liver cells with and cells or tears observed in the volatile, cell. The limit of iron in the Food and Drug Administration (FDA) is 0.05 (Chen and Chen, 2001).

The role of iron in human nutrition and aquaculture is necessary to research.

Aquaculture production in the world in 2011 was 62700300 tons (FAO, 2013) production of farmed fish in Iran in years 2012 was 338877 tons and 154565 tons of fish related to warm water fish. Common carp is farm in warm waters most of the countries of the world. The fish omnivore and floor nutrition (FAO, 2013). Common carp culture was 3733418 tons in 2011 year in the world and the third major species of farmed fish production (FAO, 2013). Grass carp property and good growth and Expatriates Iranian waters, the fish fully grass-fed. Culture contain in 2011 year was 4574673 tons in the world and this fish had second rank in farmed fish (FAO, 2013). Big Head one of the most important species of fish carp. Big Head Culture was 2705436 tons in 2011 year in the world and the seventh major species of farmed fish production (FAO, 2013). Silver carp due to cope with the rapid growth of the environment, food, the regime has been introduced in all over the world. Silver carp culture was 5349588 tons in 2011 and is now silver carp is first species of farmed in the world (FAO, 2013).

This study were because the carps fish are importance fish between aquaculture fish.

Fish muscle tissue is one of the most important fish in which the concentration of iron. The food sector and affect on human health (Burger et al., 2006). Hazard quotient is indicators of the pollution and its...
reference (Phuc Cam Tu et al., 2008). With the Hazard quotient can be the potential danger resulting from each of the study for human beings. If result less than 1 (in other words of attracting less than a dose of reference) indicates that the consumption of harmful aquatic acute effect on health (Kojadinovic et al. 2006).

Given the importance of the carp aquaculture fish in the fish tank and the importance of iron in human nutrition the aim of this study was to determine the concentration of iron and Hazard quotient (HQ) in muscle of the farmed carp fish, common carp (Cyprinus carpio), grass carp (Ctenopharyngodon idella), big head carp (Aristichthys nobilis) and silver carp (Hypophthalmichthys molitrix) from Khuzestan.

Materials and methods

Sampling and sample digestion

15 samples of any farmed fish, the common carp, grass carp, big head carp, and silver carp were prepared from the Azadegan warm water fish culture center. The separation of muscle tissue by a blade of steel. For muscle tissue harvested from part of muscle in the upper part of the body (under the ballet trailing) was used. Tissue obtained after the tare was executed in petri dish (glass hours) to the next step in to dry. All samples obtained for 60 to 150 minutes with the temperature 65 C to constant weight and then were removed from the inside. To digest samples was used from the wet method. First 0.5 grams of wet sample shed in a balloon 250 cc and that has been shed 25 cc sulfuric acid concentrations, 20 cc nitric acid 7 molar and 1 cc molybdate sodium solution 2 percent and a number of boiling for regularly and takes place. balloon a cooler and equipping for an hour while reflex operation carried out by the electric oven (Heating Mantle) under the Hood was heated, then the cold, and above the cooler slowly 20 cc mixed concentrated nitric acid and thick per chloric than 1:1 and while the cold water mixed, the heat was given to a white acid vapors fully fade, was cold and that’s balloon, 10 cc distilled water from the top of the cooler slowly. With heating (about 100 minutes) solution quite clear, after the solution to the 100cc balloon and transferred to present volume (Farkas et al., 2003).

Measurement of iron

To measure to iron 10 mL ingested solution adds with 5 mL solutions and pyrimidine karbamat ammonium 5 percent. For 20 minutes samples shaker to the elements in the form of organic metal complex solution. Then samples 2 mL methyl ketones iso, tart butyl and for 30 minutes samples shaker. After 10 minutes in 2500 far away in the minutes will be Centrifuge elements to be transferred to the phase. after the furnace and machine EDL system and optimum apparatus atomic absorption PERKINELMER 4100 model calibration curve with the help of the elements of the elements and modifier matrix by the software 32 Win Lab tradition and the value of these elements in prepared to be measured.

Hazard quotient (HQ) computation

Hazard quotient (HQ) through the following:

\[ DI = \frac{(C_m \times IR)}{BW} \]

where:
- **DI** (Daily intake): the amount of iron in the body in the aquatic consumption (micrograms to kilogram of body weight on day).
- **C_m** (Measured consumption): the average concentration of iron measured in the context of aquatic food (micrograms to gram).
- **IR** (Ingestion rate): seafood daily consumption rates in the study region (fish 30 g and crustaceans 3.75 grams per day)(FAO, 2005., Storelli, 2008).
- **BW** (Body weight): body weight (70 kilograms for an adult).

**Hazard quotient include**

\[ HQ = \frac{DI}{RfD} \]

(Phuc Cam Tu et al. 2008),

HQ: Hazard quotient.

RfD (Reference dose): doses of reference or a total of
attracting daily limit pollution (miligram to kilograms per day).

Iron reference doses for food is 10 (micro gram to a kilogram of body weight per day) (EPA, 1997).

With the calculation of Hazard quotient might be the potential risks arising from the consumption of each of the species under study for human beings. The result of this formula if HQ is less than 1 indicates that the consumption of harmful aquatic acute no effect on health (Kojadinovic et al., 2006). One-way analysis of variance ANOVA used to data analyzes.

**Results**

The highest concentration of iron muscle between the farmed fish was in Big head muscle (18.16 mg/kg in dry weight, which was meaningful difference only with silver carp (P< 0.05). In fig1 results related to the concentration of iron in different cultivated fish.

![Iron concentration](image)

**Fig. 1.** Iron concentration(mg/kg dry weight) in farmed fish.

The highest hazard quotient of iron muscle between the farmed fish was in Big head (HQ= 0.65) which was meaningful difference only with silver carp of (P< 0.05). In fig1 results related to the hazard quotient of iron in different cultivated fish.

**Discussion and conclusions**

The research results the highest concentration of iron muscle between the farmed fish was in Big head muscle, which was meaningful difference only with silver carp (P< 0.05). Difference ecology, the activities of the fish and metabolic fluctuations in the pollution of water, food, can be important factors in the accumulation of heavy metals are considered. According to the results of this study, it seems the heavy metal concentrations of water in the environment important impact factors in the accumulation of iron, steel, in the form of muscle research so that the difference with regard to nutrition regime is a significant difference between farmed fish in the concentration of iron in their muscle (P≥ 0.05)due to the high concentration of iron in big head fish muscle, probably because of animal feed plankton have migrated pole-ward and intensive activity metabolic this month, according to a report on Krishnamurti and Nair 1999, one of the causes of the accumulation of heavy metals in fish, a carnivore pelagic intensive activity metabolic (Krishnamurti and Nair, 1999).

![Hazard quotient](image)

**Fig. 2.** Hazard quotient (HQ) in farmed fish muscle.

In the fish, due to the fact that the affairs of the chain of food nutrition(Oksuz et al., 2011) and the main food in the way out of the water environment production (plants in the land due to the fact that the heavy elements are less than plants, the level of a land of heavy elements are). The results of the research on heavy metals chromium, copper, zinc, lead and cadmium in three species of fish common carp, silver and the grass carp in the lagoon Anzali station, it was concluded that the lowest percentage of the accumulation of elements of the fish of that is a vegetarian dedicated(Chen and Chen, 2001).the results of this study showed with regard to the per capita consumption of fish in Iran was 10.2 kilograms (FAO, 2013)and the concentration of iron in fish muscle studied the fish consumption in the study of any danger of iron to human nutrition in the aquaculture exist in other words in all HQ < 1, although the concentration of iron in fish muscle research global standard of higher standard, FDA in
connection with the concentration of iron in aquaculture 0.5 milligrams per kg (Chen and Chen, 2001) and it is possible to fish there are problems, but since the fish have lower blood (about 1.4 body weight percent) over warm (about 8 body weight percent) and the main rally site in the body of a combination of complex are (with animal proteins, and the most important of these proteins and hemoglobin, fruits) more than 90 percent of iron body in combination with a protein 75 percent and hemoglobin with 7 percent with myoglobin), so generally aquaculture, a source of iron to warm to feed animals are not human (Pavelieva et al., 1990). HQ between different species in the different research and its highest related to big head fish. Since HQ on a function of the concentration of iron in aquaculture, muscle in this study the causes of the different in the case of research for the same reasons to be different iron rally in different species.

References


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