Journal of Entomology and Zoology Studies

Available online at www.entomoljournal.com

E-ISSN: 2320-7078
P-ISSN: 2349-6800
JEZS 2016; 4(2): 321-325

Received: 20-02-2016
Accepted: 22-03-2016

Tallat Munir
Department of Chemistry, Kohat University of Science & Technology (KUST), Kohat-26000 Khyber Pakhtunkhwa, Pakistan.

Maimmona Saddique
Department of Chemistry, Kohat University of Science & Technology (KUST), Kohat-26000 Khyber Pakhtunkhwa, Pakistan.

Hameed Ur Rehman
Department of Chemistry, Kohat University of Science & Technology (KUST), Kohat-26000 Khyber Pakhtunkhwa, Pakistan.

Shaista Ramazan
Department of Chemistry, Kohat University of Science & Technology (KUST), Kohat-26000 Khyber Pakhtunkhwa, Pakistan.

Tahir Azeem
Department of Zoology, Kohat University of Science & Technology (KUST), Kohat-26000 Khyber Pakhtunkhwa, Pakistan.

Ijaz Ahmad
Department of Chemistry, Kohat University of Science & Technology (KUST), Kohat-26000 Khyber Pakhtunkhwa, Pakistan.

Correspondence
Ijaz Ahmad
Department of Chemistry, Kohat University of Science & Technology (KUST), Kohat-26000 Khyber Pakhtunkhwa, Pakistan.

Heavy metal analysis in fishes and water of Changhoz dam district Karak, KPK, Pakistan

Tallat Munir, Maimmona Saddique, Hameed Ur Rehman, Shaista Ramazan, Tahir Azeem, Ijaz Ahmad

Abstract
This study was conducted from January 2014 to October 2015 to find out accumulation of heavy metals in fishes and water of Changhoz dam Karak, K.P.K. Pakistan. For this purpose three samples of fishes namely *Hypophthalmichthys molitrix* (silver fish), *Crossocheilus latius* (Dogra) and *Hypophthalmichthys nobilis* (Bighead) from different sides and four samples of water from left/north, right/south, front and outer coming region of changhoz dam were collected during the months of February and March 2015. Heavy metals for which these samples were analyzed were Cadmium, Zinc, Iron, Copper, Nickel and Lead. In *Hypophthalmichthys nobilis* (bighead*)* highest concentration is showed by Iron in region of Scales while Cd and Ni were not detected in any part, other element detected with concentration comparably less to Permissible limit. In *Hypophthalmichthys molitrix* (Silver fish) highest concentration showed by Ni in Abdomen while in other parts Ni along with Cd were not detected, Fe and Pb showed normal range while Zn and Cu showed less concentration than permissible rang. In *Crossocheilus latius* (*Dogra*) highest concentration showed by Pb in scales, Cd not detected in any part while Fe and Zn showed concentration in rang of permissible limit. In water of four side Zn, Cd and Ni showed less concentration other nearly same with permissible limit.

Keywords: Heavy metals, Fishes, Changhoz dam

Introduction
The term "heavy metals" refers to any metallic element that has density greater than $4g/cm^3$. Heavy metals exhibit metallic properties such as ductility, malleability, conductivity, cation stability, and legend specificity. Heavy metals include; Lead (Pb), Cadmium (Cd), Zinc (Zn), Mercury (Hg), Arsenic (As), Silver (Ag), Chromium (Cr), Copper (Cu), Iron (Fe) and the Platinum group elements. Some heavy metals such as Co, Cu, Fe, Mn, Mo, Ni, V and Zn are required in minute quantities by organisms. However, excessive amounts of these elements can become harmful to organisms. Other heavy metals such as Pb, Cd, Hg, and as (a metalloid but generally referred to as a heavy metal) do not have any beneficial effect on organisms and are thus regarded as the "main threats" since they are very harmful to both plants and animals [1]. The fate of heavy metals introduced by human activities, chemical and geochemical processes into the aquatic ecosystem have recently become the subject of widespread concern; These metals may accumulate to a very high toxic levels and cause severe impact on the aquatic organisms without any visible sign [2]. This document is focused on the analysis of heavy metals including Cadmium (Cd), Cupper (Cr), Iron (Fe), Nickel (Ni), Lead (Pb) and Zing (Zn) in fishes and water, of changhoz dam Latamber Karak. K.P.K. Pakistan. Karak district is situated in the south of Kohat district and on the north sides of Bannu and Lakki marwat districts. It is about 123 km away from the provincial capital, Peshawar. Changhoz Dam is situated 4 miles towords west of Latamber Town, in the west of Karak city, District Karak. The dam is surrounded by mountains from eastern and western sides. Changhoz dam is one of the most important dams in the area, which plays a key role in the economy and prosperity of Karak western side's area. Basically it is a rain filled "Barani Dam" Mainly used for irrigation purposes. A canal has been constructed from it which nearly flows throughout the year, but in the month of August and September, it flows with high speed due to heavy rainfall. Apart from irrigation it also meets the nees of drinking water of the people of the area to some extent. Changhoz dam was completed in 2006. It has a total catchment area of about 48 square miles which is equivalent to 3300 Acres. Its height is 140 feet [3].

Fig 1: Map of Changhoz Dam Karak KPK Pakistan

The most important sources of heavy metals in the environment are the anthropogenic activities such as mining, smelting procedures, steel and iron industry, chemical industry, traffic, draining of sewerage, dumping of hospital wastes, recreational activities and agriculture as well as domestic activities. Chemical and metallurgical industries are the most important sources of heavy metals in soils. Conversely, metals also occur in small amounts naturally and may enter into aquatic system through leaching of rocks, airborne dust, forest fires and vegetation [4]. As heavy metals cannot be degraded, they are continuously being deposited and incorporated in water, thus causing heavy metal pollution in water bodies. The presence of heavy metals in soil can affect the quality of food, groundwater, micro-organisms activity, plant growth etc. Increase in population, urbanization, industrialization and agriculture practices have further aggravated the situation [5]. Lead and Cd are considered potential carcinogens and are associated with etiology of a number of diseases, especially cardiovascular, kidney, blood, nervous, and bone diseases. Although Zn and Cu are essential elements, their excessive concentration in food and feed plants are of great concern because of their toxicity to humans and Animals. Cultivation of crops for human or livestock consumption can potentially lead to the uptake and accumulation of these metals in edible plant parts with a resulting risk to human and animal health. Serious systemic health problems can develop as a result of excessive dietary accumulation of heavy metals such as Cd and Pb in the human body, In France it was reported that children living around a former smelter had high blood Pb levels. Another reporter suggested that the high prevalence of upper gastrointestinal cancer rates in the Van region of Turkey was related to the high concentration of heavy metals in the soil, fruit, and vegetables [6]. In the recent years, world consumption of fish has increased simultaneously with the growing concern of their nutritional and therapeutic benefits. In addition to its important source of protein, fish typically have rich contents of essential minerals, vitamins and unsaturated fatty acids. The American Heart Association recommended eating fish at least twice per week in order to reach the daily intake of omega-3 fatty acids. However, fish are relatively situated at the top of the aquatic food chain; therefore, they normally can accumulate heavy metals from food, water and sediments and. The content of toxic heavy metals in fish can counteract their beneficial effects; several adverse effects of heavy metals to human health have been known for long time. This may include serious threats like renal failure, liver damage, cardiovascular diseases and even death and. Therefore, many international monitoring programs have been established in order to assess the quality of fish for human consumption and to monitor the health of the aquatic ecosystem. In the last few decades, the concentrations of heavy metals in fish have been extensively studied in different parts of the world. Most of these studies concentrated mainly on the heavy metals in the edible part (fish muscles). However, other studies reported the distribution of metals in different organs like the liver, kidneys, heart, gonads, bone, digestive tract and brain. According to the literatures, metal bioaccumulation by fish and subsequent distribution in organs is greatly inter-specific [7]. In addition, many factors can influence metal uptake like sex, age, size, reproductive cycle, swimming patterns, feeding behavior and living environment (i.e., geographical location) [8]. Changhoze dam containing varieties of fish species, three of them were selected for our research *Hypophthalmichthys molitrix* (silver fish), *Crossocheilus latius* (Dogra) and *Hypophthalmichthys nobilis* (Bighead).

Silver carp (Hypophthalmichthys molitrix)

The silver carp (Hypophthalmichthys molitrix) is a species of freshwater cyprinid fish, a variety of Asian carp native to China and Eastern Siberia. Pound for pound, more silver carp are produced worldwide in aquaculture than any other species. They are usually farmed in poly culture with other Asian carp, or sometimes Indian carp or other species. It has been introduced to, or spread by connected waterways, into at least 88 countries around the world. The most common reason for importation was for use in aquaculture, but enhancement of wild fisheries and water quality control were also important reasons for importation. The silver carp reaches an average length of 60-100 cm (24-39 in) with a maximum of 140 cm (55 in) 45 kg (99 lb) [9].

Crossocheilus Latius (Dogra)

Ventral profile of *Crossocheilus Latius (Dogra)*_elongates body nearly straight between head and pelvic. Head flattened above, snout oval and blunt. Mouth inferior and a frenulum connecting upper lip with lower jaw. Barbells two pairs (rostral and maxillary). Paired fins are horizontally placed and caudal deeply forked in which upper lobs slightly longer than lower. Different body parts have different color such as upper half of body grayish with irregular punctuations and lower half yellowish in color. Dorsal and caudal fin appears yellowish-grey and other fins orange in color.

Bighead carp (*Hypophthalmichthys nobilis*)

The bighead carp (*Hypophthalmichthys nobilis*) is a freshwater fish, one of several Asian carps. It has a large, scale less head, a large mouth, and eyes located very low on the head. Adults usually have a mottled silver-gray coloration. This is a very large species, with a record size of 77.5 kg (170 lb) and a total length of 150 cm (59 in). But most places in the Mississippi River basin, a fish over 40 lb (18 kg) and 43 inches (110 cm) is considered very large. The average length is 24-32 inches (60-82 cm). Bighead carp are popular quarry for bow fishers; the bow fishing, captured in the Mississippi River near Alton, Illinois, in May 2008, is 92.5 lb (42 kg) [10].

Material and Method

Area of sample collection

Fishes collected randomly and water were collected from four "4" sides such as North/left, South/right, front and out coming water of Changhoz dam during the months of February and March 2015 in order to analyze them for heavy metals contamination.

Sample collection

Water samples were collected in plastic bottles and carried to laboratory. Fishes were collected from Changhoz dam with the help of non-local special fisherman using different types of nets and hooks. Fishes were preserved in 5% formalin solution in separate bottles. The samples were collected in sterile polythene bags and kept in the laboratory deep freezer (-20°C) to prevent deterioration till further analysis. We worked on Dry method and a clean washed high quality corrosion resistant stainless knife was used to cut the fish into head, tail, scales and abdomen and was placed in china dishes [11].

Preparation of samples

All these samples were oven dried at 110C for next 24 hour and then these dried samples of fishes were grinded by using pistol and mortar. One “1” gram of each sample was taken by using Analytical balance.

Digestion of samples

Each sample was acid digested using nitric acid and was kept for next 24 hour. Samples in China dish were heated on a hot plate to evaporate excess amount of HNO3 continuing until sample was completely digested and become colourless. The fluid was cooled to room temperature.

Filtration of samples

The digested sample was filtered through Whatman filter paper no. 42 in 100 ml graduated cylinder up to 25 ml so that 25 ml of each sample was prepared. Water samples were directly subjected to analysis and 25 ml of each filtered samples was taken in special plastic bottles along with all samples. These samples of plants, soil, fishes and water were subjected to atomic absorption spectrometer (Perkin Elmer) for being analyzed for metals like Cd, Cr, Zn, Ni, Fe, Cu and Pb. The instrument setting and operational conditions were done in accordance with the manufacturers’ specifications.

Result and Discussion

A survey, was conducted from January 2014 to October 2015, three species belonging to different order were selected from changhoz dam for heavy metals analysis. Different studies were conducted in heavy metal analysis in fishes *Nigat et al.* in (2015), the consumption of highly contaminated foods may prove to be lethal for the human being and can also produce some distressing impact. Therefore, this study is focused on evaluating the trace metal levels in the muscle’s tissue of three commercially important edible fishes i.e., catfish (Sperata seeghala), mullet fish (Mugil incilis) and major carp (Catla catla). Fish samples were purchased once a month from the local fish market of Quetta, Balochistan. The levels of some metals like calcium (Ca), potassium (K), Sodium (Na), Iron (Fe), Manganese (Mn) and Chromium (Cr) in the muscle’s tissues of the fishes were detected by using atomic absorption spectroscopy. The overall result of the present study revealed that the levels of these six metals in the muscles of our three selected species were found in order, K>Na>Ca>Fe>Cr>Mn, respectively [7]. *Momen et al* in (2013), recorded level of the values of all heavy metals in head, abdomen and tail in Labeocalbasu were Cr>Fe>Cu>Zn>Pb, Cu>Cr>Zn>Pb, Cr>Fe>Cu>Zn>Pb, in Labeoboga were Zn>Cr>Fe >Pb>Cu, Cr>Zn>Cu>Fe>Pb, Fe>Cr>Cu>Zn>Pb, in Notopterusnotopterus were Cr>Fe>Zn>Cu>Pb, Cu>Fe>Cr>Zn>Pb, Fe>Cu>Cr>Zn>Pb, in Mastacembelusarmtus were Fe>Cu>Cr>Zn>Pb, Cr>Cu>Fe>Zn>Pb, Cr>Zn>Cu>Pb respectively. It indicate that Pb have the lowest concentration in all the organ of above except in head of Labeoboga fish species. Chromium was found unexpectedly in high amounts but its consumption limits were not set down yet in Labeocalbasu. The mean value for heavy metals were Zn (P0.0003) mg\Kg- 1 in fish size (both weight and length), respectively in all the four fish species [11].

In the present study *Hypophthalmichthys nobilis* have highest iron Fe in scales lead Pb in head zinc in scales copper in tail respectively while cadmium and nickel are not detectable in fish species *Hypophthalmichthys nobilis.* In *Hypophthalmichthys molitrix* the highest concentration of copper in tail, iron in tail, nickel in abdomen, zinc in scales and lead in head respectively while cadmium not detectable. In *Crossocheilus latius* the highest concentration of copper in head, iron in abdomen, nickel in head, zinc in head, lead in scales while cadmium is not detectable. In water of changhoz dam north\left consists highest level of leads, right\south within the range and front consists highest levels of nickel and iron while out coming region consists copper, iron and zinc in highest concentration shown in tables.

Table 1: Heavy metals concentration (mg/kg) in four body parts (head, abdomen, tail and scales) of *Hypophthalmichthys nobilis* (Bighead) fish collected from the water of changhoz dam (mean value ± standard)

Heavy metal	Head	Abdomen	Tail	Scales
Cu	0.059±0.022	0.085±0.009	0.089±0.007	0.077±0.020
Fe	3.027±0.041	2.642±0.066	3.098±3.098	25.84±0.106
Zn	1.184±0.018	0.579±0.004	1.328±1.176	2.150±0.114
Pb	4.801±0.648	4.104±0.563	3.215±0.107	3.089±0.329
Cd	ND	ND	ND	ND
Ni	ND	ND	ND	ND

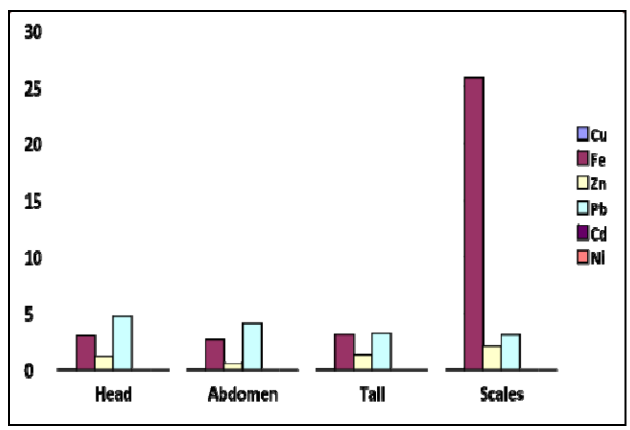

Fig 1: Concentration of heavy metals in fish sample selected fram changhoz dam Karak

Figure 1 represents the level of six selected heavy metals (Ni, Cu, Zn, Pb, Fe and Cd) in the fish species of changhoz dam, in which the Fe have the highest level in all metals in the scales of *(Hypophthalmichthys nobilis (Bighead)).* The recorded level of the values of all heavy metals in head, abdomen and tail and scales of *(Bighead)* are: In Head region Pb>Fe>Zn>Cu>Cd=Ni, in Abdomen Pb>Fe>Zn>Cu>Cd=Ni, in Tail region Pb>Fe>Zn>Cu>Cd=Ni and in scales Fe>Pb>Zn>Cu>Ni=Cd respectively.

Table 2: Heavy metals concentration (mg/kg) in four body parts (head, abdomen, tail and scales) of *Hypophthalmichthys molitrix (Silver fish)* collected from the water of changhoz dam (mean value ± standard)

Heavy metal	Head	Abdomen	Tail	Scales
Cu	0.023±0.015	ND	0.120±0.012	0.105±0.012
Fe	5.417±0.037	6.604±0.068	9.396±0.064	3.938±0.110
Ni	ND	12.47±0.024	ND	ND
Zn	1.565±0.031	0.648±0.035	2.213±0.023	2.512±0.014
Pb	4.924±0.046	3.651±0.257	2.668±0.679	3.105±0.628
Cd	ND	ND	ND	ND

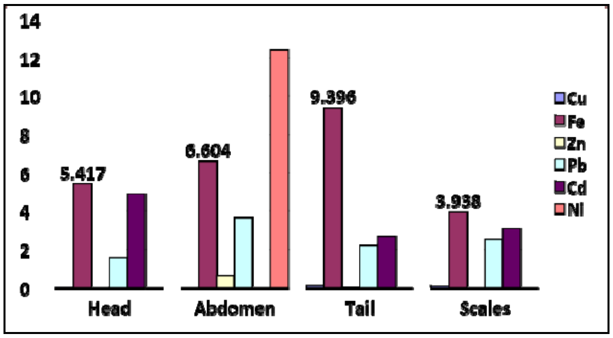

Fig 2: Concentration of heavy metals in fish sample selected from changhoz dam Karak

Figure 2 represents the level of six selected heavy metals (Ni, Cu, Zn, Pb, Fe and Cd) in the fish species of changhoz dam, in which the Ni have the highest level in all metals in the abdomen of *Hypophthalmichthys molitrix (Silver fish).* The recorded level of the values of all heavy metals in head, abdomen and tail and scales of *Hypophthalmichthys molitrix (Silver)* are: In head region Fe>Pb>Zn>Cu>Ni=Cd, in Abdomen Ni>Fe>Pb>Zn> Cu=Cd, in Tail region Fe>Pb>Zn>Cu>Cd=Ni and in scales Fe>Pb>Zn>Cu>Ni=Cd respectively.

Table 3: Heavy metals concentration (mg/kg) in four body parts (head, abdomen, tail and scales) of *Crossocheilus latius* (Dogra) fish collected from the water of changhoz dam (mean value ± standard)

Heavy metal	Head	Abdomen	Tail	Scales
Cu	0.192±0.009	ND	0.088±0.008	0.116±0.021
Fe	2.791±0.057	4.050±0.054	3.416±0.089	1.666±0.125
Ni	2.336±0.052	2.234±0.190	ND	0.186±0.033
Zn	2.638±0.015	2.242±0.0197	2.158±0.019	2.243±0.046
Pb	3.529±0.225	2.933±0.555	2.624±0.0828	5.014±1.211
Cd	ND	ND	ND	ND

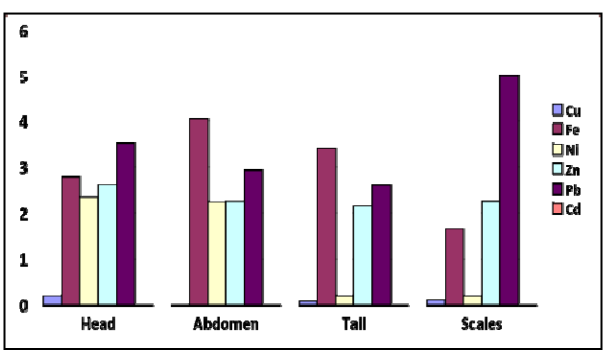

Fig 3: Concentration of heavy metals in fish sample selected from changhoz dam Karak

Figure 3 represents the level of six selected heavy metals (Ni, Cu, Zn, Pb, Fe and Cd) in the fish species of Changhoz dam, in which the Ni have the highest level in all metals in the abdomen of *(Crossocheilus latius (Dogra)).* The recorded level of the values of all heavy metals in head, abdomen and tail and scales of (Silver) are: In Head region Pb>Fe>Zn>Ni>Cu>Cd, in Abdomen Fe>Pb>Zn>Ni>Cu>Cd, in Tail region Fe>Pb>Zn>Cu>Cd=Ni and in scales Pb>Zn>Fe>Ni>Cu>Cd respectively.

Table 4: Permissible limit of heave metals concentration in water according to WHO standards in mg/l

Heavy metal	Permissible limit
Cu	0.2 mg/l
Fe	1.0 mg/l
Ni	0.2 mg/l
Zn	5 m g/ l
Pb	5.0 mg/l
Cd	0.01 mg/l

Table 5: Heavy metals concentration (mg/l) in four side's water (left, right, front and out coming region) collected from changhoz dam (mean value ± standard)

Heavy metal	North/Left	Right/South	Front	Out coming region
Cu	ND	0.002±0.024	ND	0.023±0.001
Fe	2.571±0.138	1.237±0.195	3.443±0.024	3.045±0.016
Ni	ND	ND	12.61±0.049	ND
Zn	0.210±0.018	0.224±0.019	0.200±0.010	0.226±0.002
Pb	2.288±0.187	0.859±0.270	0.764±0.187	1.862±0.524
Cd	ND	ND	ND	ND

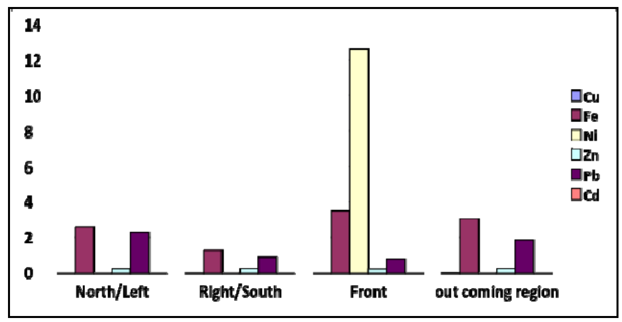

Fig 4: Concentration of heavy metals in four side water sample selected from changhoz dam

Figure 4 represents the level of six selected heavy metals (Ni, Cu, Zn, Pb, Fe and Cd) in four water sample (left, right, front and outer region) of changhoz dam, in which the Ni has the highest level in all metals in front water sample. The recorded level of the values of all heavy metals in left, right, front and out coming region are: In left/north region Fe>Pb>Zn>Cu=Cd=Ni, in right/south Fe>Pb>Zn>Cu>Ni=Cd, in front Ni>Fe>Pb>Zn>Cu=Cd, in out coming region Fe>Pb>Zn>Cu>Ni=Cd respectively.

Conclusion

From the obtained study it may be concluded that all the fishes and water of changhoz dam consists heavy metals which in the range of permissible limit.

References

1. Offor IF, Ehiri RC, Njoku CN. Proximate Nutritional Analysis and Heavy Metal Composition of Dried *Moringa Oleifera* Leaves from Oshiri Onicha L.G.A, Ebonyi State, Nigeria. Journal of Environmental Science, Toxicology and Food Technology. 2014; 8:57.
2. UMAR MA, EBONG MC. Determination Of Heavy

Metals In Soil, Water, Sediment, Fish And Cray Fish Of Jabi Lake In The Federal Capital Territory, Fct, Abuja – Nigeria, International Journal of Research in Pure and Applied Chemistry. 2013; 5:3843.

3. Khan MA, Hasan Z. A Preliminary Survey of Fish Fauna of Changhoz Dam, Karak, K.P.K Pakistan, World Journal of Fish and Marine Sciences. 2011; 3:376.
4. Nazir R. accumulation of heavy metals (ni, cu, cd, cr, pb, zn, fe) in the soil, water and plants and analysis of physico-chemical parameters of soil and water collected from tanda dam koha, Journal of Pharmaceutical Sciences and Research. 2015; 7:91.
5. Suciu C, Cosma M, Todica S, Bolboaca D, Jantschi L. Analysis of soil heavy metal pollution and pattern in Central Transylvania, Int. J. Mol. Sci. 2008; 9:434.
6. Zhuang P. Heavy metal contamination in soils and food crops around Dabaoshan mine in Guangdong, China: implication for human health, Environ Geochem Health, 2009, 707.
7. Nighat D, Nima N, Zubia M, Hameed-UR, Asim U. The Levels of Some Selected Metals in Muscle's Tissues of Three Commercially Important Edible Fishes Collected from the Fish Market of Quetta City in Balochistan Province, Global Veterinaria, 2015; 14:344.
8. Milam C1, Maina HM1, Onyia LU2, Ozoemena PE1. Heavy metal pollution in benthic fishes from Kiri Dam in Guyuk local government area of Adamawa State, Nigeria. African Journal of Biotechnology. 2012; 11:11756.
9. Kolar. Asian Carps of the Genus Hypophthalmichthys (Pisces, Cyprinidae), A Biological Synopsis and Environmental Risk Assessment, 2005.
10. Froese Rainer, Pauly Daniel eds. Hypophthalmichthys nobilis in FishBase, 2005.
11. Momen k. Detection of Heavy Metals in the Selected Edible Fish species from Baran Dam F. R Bannu Pakistan. American journal of pharmacy and health research. 2014, 2(5).