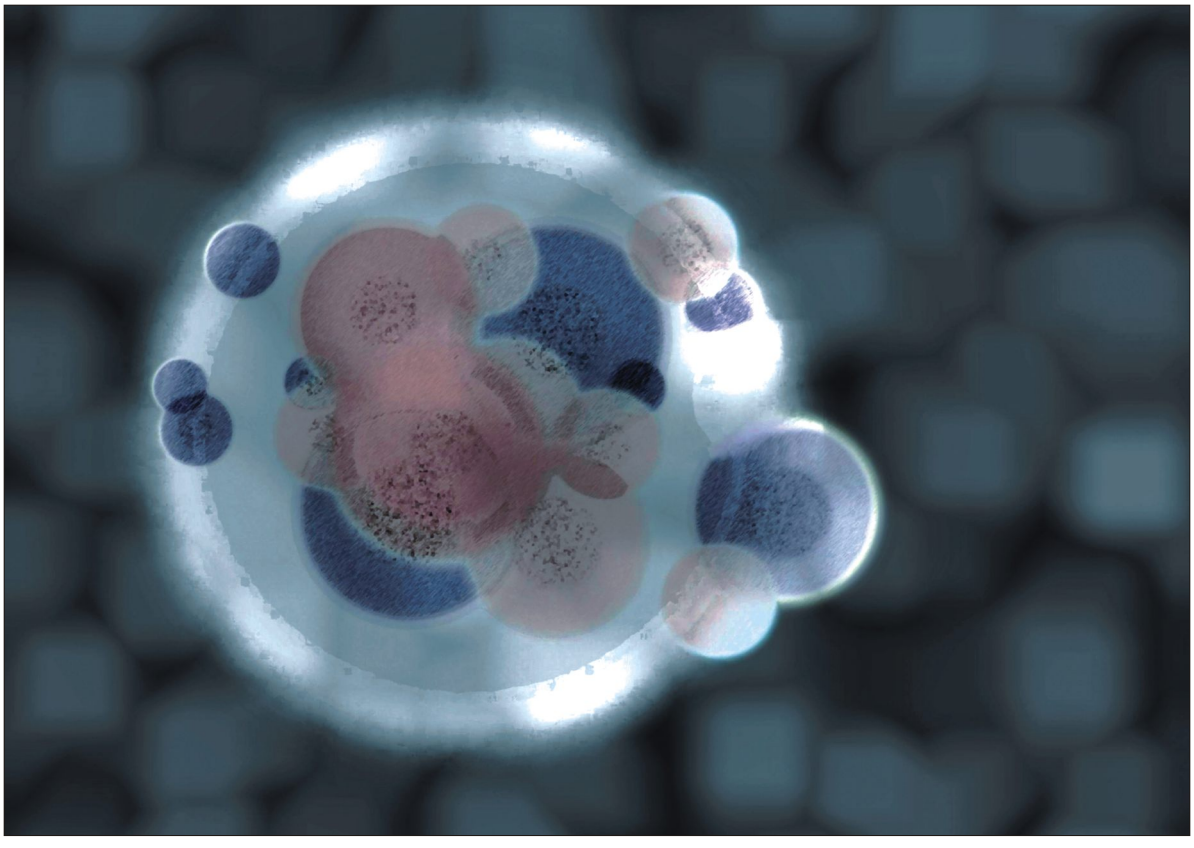

Journal of Biological Sciences

ISSN 1727-3048

science alert

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OnLine Journal of Biological Sciences 1 (5): 414-416, 2001
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Concentration Levels of Heavy and Trace Metals in the Fish and Relevant Water from Rawal and Mangla Lakes

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Abstract: A study was carried out to investigate the quality of drinking water for which water and fish samples of Rawal and Mangla lakes were analyzed for heavy and trace metals by Flame atomic absorption spectrometer. The metals present in the highest concentration were in the order of Fe > Ni > Mn > As > Cu in the water samples of Rawal lake, whereas Fe > As > Cu > Cr > Pb were high in the water samples of Mangla lake. In general, the metals were present in higher concentration in water samples as compared to fish samples caught from both lakes. The higher concentration of various metals in water and fish samples of Rawal lake is probably due to the addition of untreated domestic wastes. The reason for higher concentrations of various metals in the water and fish samples of Mangla lake is due to geological weathering of those areas. On the basis of results obtained we can predict that if present situation of water pollution continues then in the future survival of fish population and other animals will be extremely difficult.

Key words: Water pollution, heavy and trace metals, fish analysis

Introduction

The determination of metal ions concentrations in natural water systems has received increasing attention for monitoring environmental pollution due to the fact that metals are not biodegradable and find their way in food chain through a number of pathways and may accumulate in different organs of human beings or animals (Dewani *et al*., 1997). The metals like cobalt, copper, manganese, zinc, iron and nickel are essential micro nutrients at trace level, but are toxic if present in higher concentrations (Numberg, 1982). Whereas, metals like lead, cadmium and chromium are heavy metals and arsenic is toxic. The higher concentrations of these metals than their permissible limits may affect adversely the living organisms (Din *et al*., 1997).

The Rawal lake is a fresh water reservoir established on seasonal stream/nulla,. The water of this lake is commonly used for drinking purposes by people living in different sectors of Islamabad. As a reasonable storage of water is present therefore, variety of fish species like *Catla catla*, *labeo rohita*, *Wallago attu* and *Mystus seenghara,* are present in the water of this lake. For the last couple of years, due to addition of municipal liquid waste into this lake, the concentrations of metals are increasing. The reason of spread of diseases like diarrohea, hepatitis and other stomach diseases in the Islamabad is due to supply of unhygienic drinking water in this city (Kaleem*,* 1993).

Mangla dam was established on river Jhelum at Mangla. The water of this lake is not only used for drinking and fish farming but also for generation of electricity. Fish species like *Rita rita, Labeo rohita*, *Catla catla*, *Mystus seenghara* and *Wallago attu* are cultured on commercial basis. The available study suggests that the water of this lake is comparatively fresh as compared to Rawal lake. However, significant concentration of trace metals is also present in the water as well as in the edible muscles of fish species growing in water of this lake. It is assumed that increasing concentration of these metals is due to addition of sewage water and geological weathering taking place in river Jhelum (Ashraf *et al*., 1991). Quality of water can be judged only by comparing concentration of various constituents present in water. The analysis of fish or sediments of rivers or lakes are considered as bio indicators on the basis of which level of metal ions in water could be understood (Ambreen, 1993).

The objectives of present investigation are to estimate the level of heavy and trace metals in water and fish from Rawal and Manlga lakes on the basis of which quality of lakes water can be determined which are source of drinking water supply for huge population in different areas of the country.

Materials and Methods

In present study water and fish samples of Rawal and Mangla lake were analyzed with the help of Atomic absorption spectroscopy as reported by Jaffar *et al.* (1998).

Water samples from Rawal and Mangla lakes: Triplicate water samples were collected randomly after every two months from Rawal and Mangla lakes from January-December 1997, acidified with HNO_3 filter and stored at 4°C prior to analysis.

Fish samples from Rawal and Mangla lakes: Twelve fish samples of two fish species (six from each) of *Labeo rohita* and *Mystus seenghala* were collected from Rawal lake during April, 1997.

Similarly twelve fish samples of two fish species *Mystus seenghala* and *Wallago attu* were collected from Mangla lake during April-May 1997.

The fish samples were digested using nitric acid based wet oxidation (Jaffar *et al.,* 1998) The digested samples of fish were analyzed with the help of Flame atomic absorption spectrometer for Cr, Mn, Fe, Co, Ni, Cu, Zn, Cd, Pb and As by method described by Maria *et al*. (1986).

The data were analyzed using analysis of variance procedures as described by Steel and Torrie (1980).

Results and Discussion

The results of analysis of fish along with their relevant water from Rawal and Mangla lakes are given in the Table 1-4. The higher concentrations of heavy and trace metals in the water of Rawal lake were in the order of Fe followed by Ni, Mn, As and Cu., whereas in the water of Mangla lake the

Table 1: Concentration (mg/l) of Selected Metals in Water Samples from Rawal Lake

Sampling period	Metal									
	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Cd	Pb
Jan-Feb	0.121	0.168	1.056	0.057	0.187	0.131	0.085	0.121	0.058	0.107
Mar-Apr	0.124	0.192	1.087	0.059	0.192	0.148	0.098	0.172	0.069	0.121
May-Jun	0.135	1.249	1.108	0.082	1.127	0.164	0.126	0.194	0.121	0.138
Jul-Aug	0.106	1.020	0.556	0.061	1.116	0.108	0.106	0.161	0.093	0.126
Sep-Oct	0.109	1.104	0.758	0.064	1.103	0.105	0.108	0.168	0.104	0.124
Nov-Dec	0.105	1.108	1.095	0.072	1.105	0.109	0.113	0.169	0.109	0.129
Mean	0.117	0.807	0.943	0.066	0.808	0.128	0.106	0.164	0.029	0.124
S.D*	0.012	0.191	0.231	0.020	0.179	0.025	0.014	0.024	0.024	0.010
Limit**	0.05	-	1.0	-	0.05	0.05	0.10	-	0.05	0.05

* Standard Deviation, ** Permissible limit, Source: WHO (1985)

Table 2: Concentration (mg/l) of Selected Metals in Water Samples from Mangla Lake

Sampling period	Metal									
	Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Cd	Pb
Jan-Feb	0.127	0.103	0.087	0.051	0.071	0.142	0.071	0.168	0.067	0.121
Mar-Apr	0.130	0.116	0.192	0.056	0.082	0.168	0.082	0.174	0.071	0.132
May-Jun	0.136	0.122	0.234	0.061	0.094	0.182	0.123	0.194	0.084	0.145
Jul-Aug	0.128	0.106	0.212	0.053	0.067	0.142	0.106	0.153	0.061	0.116
Sep-Oct	0.132	0.109	0.216	0.041	0.080	0.154	0.114	0.184	0.069	0.126
Nov-Dec	0.129	0.107	0.118	0.043	0.068	0.156	0.112	0.174	0.073	0.128
Mean	0.130	0.110	0.177	0.051	0.077	0.157	0.102	0.175	0.071	0.128
S.D*	0.020	0.031	0.059	0.003	0.011	0.016	0.021	0.014	0.003	0.010
Limit**	0.05	-	1.0	-	0.05	0.05	0.10	-	0.05	0.05

*Standard Deviation, ** Permissible limit Source: WHO 1985

Table 3: Trace metals concentration (ug/g wet. wt.,) in muscle of various fish species as function of weight from Rawal lake

Species	Level	Weight of fish (g)	Metal									
			Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Cd	Pb
Labeo rohita	Mean	712	0.116	0.173	2.205	0.202	0.182	0.854	0.836	1.152	0.179	0.161
	S.D*	68	0.031	0.043	0.647	0.041	0.046	0.215	0.215	0.216	0.216	0.036
Mystus seenghala	Mean	697	0.115	0.073	2.247	0.106	0.225	0.118	1.130	0.126	0.118	0.295
	S.D*	67	0.031	0.016	0.452	0.020	0.061	0.028	0.251	0.031	0.027	0.067

*Standard Deviation

Table 4: Trace metals concentration (ug/g wet. wt.) in muscle of various fish species as function of weight from Mangla lake

Species	Level	Weight of Fish (g)	Metal									
			Cr	Mn	Fe	Co	Ni	Cu	Zn	As	Cd	Pb
Mystus	Mean	722	0.359	0.131	2.723	0.126	0.981	1.024	1.147	0.306	0.134	0.308
seenghala	S.D*	69	0.105	0.035	0.682	0.031	0.148	0.241	0.271	0.054	0.026	0.057
Wallago	Mean	720	0.167	0.143	1.403	0.104	0.344	0.274	0.119	0.274	0.116	1.119
attu	S.D*	68	0.049	0.037	0.291	0.012	0.090	0.056	0.031	0.062	0.021	0.132

*Standard Deviation

concentration of metals were in the order of Fe> As > Cu> Cr> Pb (Table 1, 2). Higher concentrations of metals than their permissible limits were found in water samples of both lakes probably due to addition of untreated sewage water particularly from poultry farms and geological weathering taking place in these areas (Gulfraz, 2000).

Our results of metals ions concentration in fresh water lakes were also supported by the results of heavy metals obtained by Mian *et al*. (1998) from water samples of Sohan river, which were also high due to the addition of sewage water. Table 3 and 4 represent the concentration levels of metal in the muscles of 24 fish samples of three fish species harvested from two fresh water lakes. Higher concentration of metals was observed in fish samples which accumulated in the muscles of fish. Higher concentrations of metals in fish samples indicated that water of these lakes were contaminated due to addition of untreated Municipal waste water. The results of metal concentrations for water and fish samples obtained in the present study were higher than the results reported by Saleemi (1993) for water and fish samples of Rawal lake. However, the concentrations of metals obtained in present study were comparable with metal ions concentration in water of Rawal lake reported by Din *et al.* (1997).

The higher concentrations of these metals in fish may result in toxic effects in human being after digestion. It was observed that water as well as edible muscle of fish contained higher concentration of trace metals which were originated from Municipal waste water and geological weathering (Gulfraz, 2000). Therefore, aquatic animals of these lakes are surviving under stress condition of toxic metals. To protect the water and aquatic life in these lakes it is suggested that the practice of adding municipal liquid waste without prior treatment should be stopped.

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