THE EFFECT OF HEAVY METALS FROM TANNERY EFFLUENTS ON THE FRESH WATER FISH CATLA CATLA AND HEALTH STATUS OF THE CONSUMER IN ERODE DISTRICT.

S.KALAIMANI[1] , S.KOWSALYA[2], DR.C.KANDEEPAN[3]

[1]Assistant Professor and Research scholar, J.K.K.Nataraja College of Arts and Science, Komarapalayam, Namakkal District.

[2]Assistant Professor and Research scholar, J.K.K.Nataraja College of Arts and Science, Komarapalayam, Namakkal District.

[3]Assistant Professor and Head, P.G. and Research Department of zoology A.P.A Arts and culture College, Palani.

Received: June 08, 2018 Accepted: July 21, 2018

ABSTRACT *To study the waste water which are coming from varies industries and hospitals, rural areas that directly affect the aquatic animals and human beings who consume the same. Usually all aquatic animals bear only certain amount of heavy metals beyond the limit this cause harmful effect directly to aquatic animals and indirectly to human beings. Certainly heavy metal levels reached unacceptable levels for human consumption. Because high metal concentrations in tissue can have toxic effects in fish metabolism, it is an important to consider the biological effects of contamination on fish health in the river.*

Keywords: *Hospitals and Tannery, Waste Water, Fish, Heavy Metals.*

Introduction

Metal elements found naturally in aquatic ecosystems due to various processes such as weathering and erosion. According to Mason (1991), there are five major types of toxic pollutants known to man: i) Metals arising from industrial processes and some agricultural applications (lead, copper, nickel and zinc) ii) Organic compounds, originating from industrial, agricultural and some domestic sources (herbicides, PCB's, organ chloride pesticides, chlorinated aliphatic hydrocarbons, organ metallic compounds and phenols) iii) Gases (ammonia and chlorine) iv) Anions (cyanides, fluorides, sulphides and sulphites) Acid and alkali amongst the pollutants contaminating water bodies, metals play an important role (Witeska et al., 1995). To the problems raised by water pollution, especially when it comes to metal pollution (Nussey, (1998). Consequently aquatic organisms are exposed to the elevated levels of metals (Pelgrom et al., 1995a) levels not previously encountered (Nussey, 1998), posing a great threat to aquatic organisms in particular and to the whole ecosystem in general (Zou and Bu, 1994; Zou, 19Metals are present in very low concentrations in natural aquatic ecosystems (Nussey, 1998), usually at the nanogram to microgram per liter level, but recently the occurrence of especially heavy metals in excess of natural loads, has become an increasing concern (Biney et al., 1994; Bennet-Chambers wr al., 1999) for aquatic ecosystem 'health'. Heavy metals are part of a group of elements , whose hydro chemical cycles have been accelerated to a great extent by man (Viljoen, 1999). The most impen ortant heavy metals in water pollution are zinc, copper, lead, cadmium, mercury, nickel and chromium (Abel, 1989; Seymore, 1994; Viljoen, 1999) Heavy metals are often present at elevated concentrations in aquatic ecosystems, due to 1) The rapid growth in population (Biney et al., 1994: Seymore, 1994).2) An increase in industrialization (Biney et al., 1994: Pelgrom et al., 1994)3) The increase of urbanization and socio-economic activities, exploration and exploitation of natural resources. 4) Extension of irrigationand other modern agricultural practices, as well as 5) The lack of environmenta97).

A large number of chemicals are being used by the tanners during process, and thus discharge toxic materials into waters.Due to this,the agricultural lands are also degraded.Uncontrolled release of tannery effluent has increased the health risks to different organisms.(Praveen et al., 2013).The environmental and health risks caused by various pollutants heavy metals are described as under (Lenntech B.V. ,2012).

Materials and methods

Meshnet catch adult catla catla (Carp) (21.1+1.9 cm and 138.4+23.3g). Ten fish from each stations were used for analysis. The sizes and weights of the animals did not vary significantly from station to station (P>0.07). Station I metur Dam was a relatively clean area of the river system because it was north of industrial and agricultural areas and was therefore relatively less affected from contaminated effluents. The other stations, however, receive many industrial and domestic effluents from metur Dam and surrounding areas. Station 2 is located at the site of a small dam built for field irrigation and receive effluents from domestic sources, hospitals and other sources. The other stations are from normal flowing parts of the river (water runs faster in those areas), but they also receive additional inputs from sewage waters.The Animals were brought to the laboratory as soon as they were caught and dissected with clean instruments. The tissues of ten fish of the same species from the same station were pooled to make 3 subsamples. Gill, liver, Muscle and kidney was put in petridishes to dry at 120 C until reaching a constant weight. Dry gill (0.423+0.165 mg), liver (0.307+0.088 mg) and muscle (0.682+0.144 mg) tissue was put into digestion flasks and 4ml percholic acid and 8 ml nitric acid (Merck) were added. The digestion flasks were then put on a hot plate set to 130 C (gradually increased) until all materials were dissolved. Digesters were diluted with distilled water appropriately in the range of the standards, which were prepared from the stock standard solution of the metals (Merck). Statistical Analysis of data was carried out with SPSS statistical package programs. Kruskall-Wallis one way ANOVA was used to compare data among stations.

Results

The concentrations and associated standard deviations of cadmium, lead, copper, chromium and nickel in the gill, liver, muscle, kidney of (Carp) from 2 stations in the meturDam are shown in Tables 1 & 2 e, along with the results of statistical comparisons of tissue metal concentrations. Figure I shows sampling stations in the Cadmium concentrations varied significantly ($P<0.05$) from station to station except in the muscle of Catla Catla (Carp.) (Table I a). (Station 2 generally showed the highest cadmium concentrations. Lead concentrations varied significantly from station to station, except ($P>0.05$) in the gill of Catla Catla (Carp.) (Table I b). The highest lead concentrations were found in samples from station 2, except in the muscles. Copper concentrations varied from station to station only in the gill and liver of Catla Catla (Carp.) (Table 1 c). None of the stations consistently showed the highest copper concentrations. Mean copper concentrations were higher in the gill of Catla Catla (Carp.) Variations in chromium concentrations were significant only in the gill and liver of Catla Catla (Carp.) (Table 1 d). station 2 showed the highest chromium concentrations in the tissues except in the muscle and gill of Catla Catla (Carp.).

Nickel concentrations varied significantly from station to station in the gill tissue of all fish species (Tanle 1 e). Station 2 showed the highest nickel concentrations. Mean nickel concentrations were highest in the gill and liver tissue of Catla Catla (Carp.)

Table – 1a Mean concentration (mg metal/g d.w) aassociated standard deviation of cadmium in the Gill, Liver, Kidney and Muscle tissue of Catla Catla (Carp.) caught at five stations in the kaveri River.

Station	Gill	Liver	Muscle	Kidney
1	2.30+0.20	1.37+0.35	1.23+0.35	1.15+0.25
2	2.14+0.41	2.62+1.04	0.83+0.35	0.82+0.11
3	1.80+0.05	1.30+0.43	0.96+0.12	0.88+0.10
4	2.16+0.21	0.95+0.14	0.87+0.20	0.65+0.15
5	1.46+0.32	1.11+0.48	0.64+0.15	0.93+0.17
Mean	1.97+0.38	1.50+0.80	0.92+0.20	0.92+0.25
P Value	<0.07	<0.07	<0.07	NS

Table – 1b Mean concentration (mg metal/g d.w) associated standard deviation of Lead in the Gill, Liver, Kidney and Muscle tissue of Catla Catla (Carp.) caught at five stations in the kaveri River.

Station	Gill	Liver	Muscle	Kidney
1	15.50+1.63	7.93+2.51	10.21+3.20	9.22-3.10
2	17.13+3.73	15.92+3.63	7.12+0.90	5.13-0.80
3	11.22+0.69	7.90+3.86	6.87+1.42	6.66-1.40
4	14.26+1.83	6.75+0.64	6.64+1.89	6.65-1.79
5	13.14+4.37	7.83+3.20	4.33+0.75	4.12-0.65
Mean	14.22+3.17	9.43+4.39	7.07+1.93	7,04-1.53
P Value	NS	<0.07	<0.07	<0.07

Table – 1c Mean concentration (mg metal/g d.w) associated standard deviation of Copper in the Gill, Liver, Kidney and Muscle tissue of Catla Catla (Carp.) caught at five stations in the kaveri River.

Station	Gill	Liver	Muscle	Kidney
1	7.53-0.03	51.61-31.0	6.54-5.25	6.50-3.25
2	7.42-1.75	62.23-27.7	3.43-1.20	3.47-1.13
3	6.21-1.01	11.82-8.24	6.22-0.16	6.23-0.12
4	6.21-0.75	11.4-6.97	4.54-0.67	3.58-0.42
5	7.40-1.35	14.32-7.50	4.77-0.48	4.79-0.48
Mean	7.02-1.07	32.19-27.6	5.13-2.37	5.12-2.17
P Value	NS	<0.07	<0.07	NS

Table – 1d Mean concentration (mg metal/g d.w) associated standard deviation of Chromium in the Gill, Liver, Kidney and Muscle tissue of Catla Catla (Carp.) caught at five stations in the kaveri River.

Station	Gill	Liver	Muscle	Kidney
1	1.81-0.31	0.23-0.35	0.54-0.90	0.36-0.82
2	6.10-3.09	2.30-0.87	0.82-0.31	0.83-0.20
3	2.39-0.63	1.20-0.40	0.77-0.40	0.58-0.04
4	2.65-1.43	0.62-0.56	0.57-0.17	0.38-0.15
5	5.75-1.56	0.53-0.37	0.35-0.08	0.36-0.08
Mean	3.75-2.36	1.03-0.90	0.60-0.43	0.62-0.22
P Value	<0.07	<0.07	<0.01	NS

Table – 1e Mean concentration (mg metal/g d.w) associated standard deviation of Nickel in the Gill, Liver, Kidney and Muscle tissue of Catla Catla (Carp.) caught at five stations in the kaveri River

Station	Gill	Liver	Muscle	Kidney
1	9.50-0.82	4.86-1.50	5.43-1.43	3.45-1.22
2	14.83-6.42	11.10-3.40	6,10-0.70	3.11-0.52
3	8.93-1.08	6.95-3.00	5.50-0.50	3.58-0.30
4	9.70-0.59	5.70-1.47	6.20-3.07	5.21-3.08
5	7.68-1.52	5.30-2.51	2.57-0.57	1.58-0.58
Mean	10.36-3.90	5.18-1.90	5.18-1.94	5.19-1.83
P Value	<0.07	<0.01	NS	NS

Tables 1 (a-e)

Mean concentration (mg metal/g d.w.) and associated standard deviations of cadmium (1a), lead (1b), copper (1c), chromium (1d) and nickel (1e) in the Gill, Liver and muscles tissue of Catla Catla (Carp,) caught at five stations in the metur dam. Results of statistical differences (P value) from station to station are indicated and the total mean concentration of metals in each tissue for each fish species are also given. NA=not significant (P.0.07), NA=not available.

Discussion

Initially we expected that metal concentrations in the tissue of fish from Stations 4 and 5 would be highest as they ware in the south of Mettur dam. Which receives more untreated waste water from the river and surrounding environment. However, fish species from Station 2 displayed the highest metal concentrations in their tissues.According to Mathusudan et al(2003),the excessive Zn in muscle tissue was transferred to other organs in the fish exposed to Zn Contaminated System.Cu and Zn elements could be lethal to aquatic biota and persists in sediments. High end fish eaters are also severly exposed from Hg (Pandey Govind et al 2014). An investigation was carried out to determine the source of high metal input to this station and the results showed that several hospitals as well as domestic sources discharge untreated effluents in the vicinity of station 2. The results of this study indicate that fish can accumulate heavy metals efficiently in areas where direct inputs occur, the literature states that metal uptake from sediment (Goyer, 1991). The fact that fish from Stations 3-5 displayed lower metal concentrations than those from Stations 2 suggests that metals discharged in the vicinity of Station 2 are perhaps precipitated or adsorbed into sediments due to interaction with some other compounds, so that fish at stations 3-5 are not exposed to the metals in water to the same degree as fish living at Station 2. From the results of this study, Station 1

(Mettur dam) appears to be the cleanest part of the river system, probably because it does not receive many pollutants from industrial and domestic sources.

Summary and Conclusion

In this present study it was clear that depending upon the pollutant water which are coming from various industries and hospitals, rural areas that directly affect the aquatic animals and human beings who consume the same. Usually all aquatic animals bear only certain amount of heavy metals when this goes beyond the limit this cause harmful effect directly to aquatic animals and indirectly to human beings.Certain heavy metal levels reached unacceptable levels for human consumption. Because high metal concentrations I tissue can have toxic effects on fish metabolism, it is important to consider the biological effects of contamination of fish health in the river.

References

1. Brezonik, P.L.; King, S.O. and Mach, C.E. (1991). The influence of water chemistry on trace metal bioavailability and toxicity to aquatic organisms. In: Metal ecotoxicology. Concepts and applications. Eds. Newman, M.C and McIntosh, A.W. Lewis Publishers, Michigan.399pp.
2. Mason, C.F. (1991). Biology of Freshwater Pollution, Second Edition. Longman Group UK Ltd., England. 351pp.
3. Munger, C.; Hare, L.; Craig, A. and Charest, P-M. (1999). Influence of exposure time on the distribution of cadmium within the cladoceran Ceriodaphnia dubia. Aquatic Toxicology. 44: 195-200.
4. Pelgrom, S.M.G.J.; Lamers, L.P.M; Garritsen, J.A.M; Pels, B.M.; Lock, R.A.C.; Balm, P.H.M. and Wendelaar Bonga, S.E. (1994). Interactions between copper and cadmium during single and combined exposure in juvenile tilapia Oreochromis mossambicus: Influence of feeding condition on whole body metal accumulation and the effect of the metals on tissue water ion content.
5. Seymore, T. (1994). Bioaccumulation of Metals in Barbus marequensis from the Olifants River, Kruger National Park and Lethal Levels of Manganese to Juvenile Oreochromis mossambicus. M.Sc-thesis, Rand Afrikaans University, South Africa.
6. Wepener, V.; Van Vuren, J.H.J and Du Preez, H.H. (2001). Uptake and concentrationof a copper, lead,cadmium,and zinc mixture in gill, liver and plasma of a freshwater catla catla, Tilapia sparmanii. Water SA. 27 (1): 99-108.
7. Witeska, M.; Jezierska, B. and Chaber, J. (1995). The influence of cadmium on common carp embryos and larvae Aquaculture. 129: 129-132.
8. Lanntech B.V.,High metals, Available at website:www.Lanntech.Co/periodic –chart.htm(2012).
9. Madhusudan S., Fatma L. and Nadim C.2003.Bioaccumulation of Zinc and Cadmicum in few fishes.Indian J.Fish.,50(1): 53-65.