IOSR Journal of Pharmacy and Biological Sciences (IOSR-JPBS)
e-ISSN: 2278-3008, p-ISSN:2319-7676. Volume 10, Issue 3 Ver. II (May - Jun. 2015), PP 105-112
www.iosrjournals.org

Studies on the Pollution Status of the Fresh Water Pond at Sulur, Coimbatore District, Tamilnadu, India

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Abstract: *The toxic effect of Potassium chromate on some biochemical characteristics (total protein, carbohydrate and lipid in gill, muscle, liver and kidney) of the Catla catla fish were estimated. The data showed that the biochemical parameters was declined during all the exposure periods. The biochemical content was reduced by the increase of concentration of the metal.*
Keywords: *Catla catla, Biochemical, LC50 and Toxicity.*

I. Introduction

Contamination of environment with toxic heavy metals has become one of the major causes of concern for human kind. Heavy metals in surface water bodies, ground water and soils can be either from natural or anthropogenic sources (Sorme and Lagervist, 2002). Heavy metal concentrations in aquatic ecosystems are usually monitored by measuring their concentrations in water, sediments and biota (Camusso et al ., 1995), which generally exist in low levels in water and attain considerable concentration in sediments and biota (Namminga and Wilhm,1976).

Heavy metals including both essential and non – essential elements have a particular significance in eco - toxicology, to be toxic to living organisms (Storelli et al., 2005) . The commercial and edible species have been widely investigated in order to check for those hazardous to human health (Begume et al., 2005). Metals occur naturally in the environment at low levels and present in the soil, sediment, water, air and biota. They also enter the environment as a result of human activities because of anthropogenic emissions to the atmosphere, their global distribution and precipitation; the level of metals is increasing worldwide. On a global scale combustion of leaded gasoline continues to be the major sources of lead (Sayadi et al., 2009 and Pacyana, 2005).

II. Materials And Methods

Physico – chemical Analysis :

The physico – chemical analysis of water used for the experiments was carried out using the methods of APHA (2005). Physico – chemical parameters of the tap water used for the present study are as follows. Temperature 26.5±0.7^{o}C, PH 7.1±0.1, Dissolved oxygen 6.3±0.3(mg/l), Total hardness 18.7±1.8(mg/l), Calcium 1.40±1.3(mg/l), Magnesium (60±0.2(mg/l).

Chemicals used for study:

Potassium chromate is a lemon yellow compound that is in the form of a crystalline solid. Molecular formula – (K_2Cro_4) and Molar mass of (K_2Cro_4) =194.1903 g/mol

Procurement and Maintenance:

Bulk of sample of fishes (Catla catla) ranging in weight from 3-4gms measuring 3-5cm in length were procured from the local ponds in Coimbatore city and also from the Aliyar Dam. They were bought to the laboratory in suitable polythene bags containing oxygenated water. The fishes were acclimatized to the laboratory condition for 2 weeks in large cement tank (6'x4'x3') at 24±30^{0}C. The tank was washed using 1% $Kmno_4$ to prevent fungal infection prior to stocking. The fishes were fed with oil cake mixed with rice flour. Fishes of about the same size (5-8gms to 7-10gms) irrespective of sexes were selected for the experiment.

Concentration of median lethal concentration (LC_{50}):

The concentration of the pollutant at which 50 percent of the test animals die during a specific test period of the concentration lethal to one half of the test population is referred to as median lethal concentration (LC_{50}), (Jack de Bruijin et al.,1991).

Batches of 10 healthy fishes were exposed to different concentration of detergent tide to calculate the LC_{50} value. One more set of fishes are maintained as control in tap water to find the

wide range of concentration 10-100mg were chosen and the number of dead and affected fishes in each setup was counted at regular intervals up to 48hrs. The level of dissolved oxygen, P^H, alkalinity and hardness were monitored and maintained constant.

Appropriate narrow range of concentration 10-50mg was used to find the median lethal concentration, using a minimum of 6 fishes, for each concentration. And the mortality was recorded for every 24 hrs up to 90hrs. It was found as 25mg for 48hrs, using Probit analysis method (Finney, 1971). From the stock solution various sub - lethal concentrations were prepared for bioassay study.

3 groups of fishes were exposed to 3.6mg ($1/10^{th}$ of 48hrs LC_{50} value concentration of the detergent for 24,48,72 and 96 hrs respectively). Another group was maintained as control. All the groups received the same type of food and 0^{th} conditions are maintained similarly. At the end of each exposure period, fishes was sacrificed and tissues such as liver, gill, muscle, brain & kidney were dissected and removed. The tissues (10mg) were homogenized in 80% methanol centrifuged at 3500 rpm for 15min and the clear supernatant was used for the analysis of different parameters.

Carbohydrate:

The carbohydrate was estimated by methods of Kemp et al., (1954).

Protein: Total protein concentration was estimated by the methods of Lowry et al., (1951)

Lipid: The lipid was estimated by methods of Richmond, 1973.

III. Results And Discussion

The metals get into the tissues of aquatic animals mainly via their food. In fish, metals can also come via mechanical capture of suspended particles of hydroxides in gills and chemical absorption of ions on the mucous membrane. The present investigation showed that the amount of biochemical contents (carbohydrate, protein and lipid) after exposure to the chemical potassium chromate, are represented in tables 1-12 and figures 1 - 12

The amount of carbohydrate in various tissues (Gill, Muscle, Liver, Kidney) after exposing the fish Catla catla to different periods in 25gms concentration of potassium chromate are presented in tables below 15.85, 16.36, 17.15 and 18.45 mg/dl of carbohydrate are present in the gill tissue after exposure to 24, 48, 72 and 96 hours respectively 17.55, 18.67, 19.48 ml/dl at 24,48,72 and 96hours.

The carbohydrate content in control before exposure of kidney tissue was recorded as 14.55, 15.49, 16.54 and 17.48 mg/dl at 24, 48,72and 96 hour. After exposure to metal the results were observed as 13.51, 14.5, 15.48 and 16.51 mg/dl.

The control value of carbohydrate in liver tissue was recorded as 35.67,36.66 ,37.84 and 39.52 ml/dl, after exposure period the result observed was 33.63,34.43,35.58 and 37.48 ml/dl at 24,48,72 and 96 hours.

The muscle values of carbohydrate in control was noted as 45.73,46.6,47.67 and 48.67 ml/dl, after experimental session the values were recorded as 43.55,44.56,45.44 ml/dl and 46.26during the period of 24,48,72and 96 hours respectively.

The amount of protein content present in various tissues (Gill, muscle, liver, kidney) of fish Catla catla was represented below. The control value of protein in gill tissue was noted as 21.65, 22.77, 23.67and 25.81 mg/dl experiment value analyzed as 19.0, 19.67, 20.6 and 24.33 ml/dl at the period of 24, 48, 72 and 96 hours respectively. The protein value of muscle tissue in control was recorded as 18.63,19.47,20.74 and 21.71, mg/dl after exposure to metal concentration the values are 16.66,17.69,18.48 and 19.54 mg/dl at 24, 48, 72 and 96 hours. The value of protein in liver tissue in control was recorded as 30.47, 32.77, 33.8 and 34.13 mg/dl in the experiment the values are analyzed as 28.59, 30.59, 31.78 and 32.47 mg/dl at 24, 48, 72 and 96 hours.

The protein values of kidney tissue in control as recorded as 20.65, 23.58, 25.76, 26.73 mg/dl the experiment values were observed as 19.59,20.59,23.66 and 24.7 mg/dl at 24,48,72 and 96 hrs.

The concentration of lipid in various tissues (Gill, muscle, liver, kidney) of fish Catla catla on exposure to 25mg of potassium chromate in short term duration was represented below.

The lipid content of gill tissue in control was recorded as 16.67, 15.63, 17.21 and 16.96 mg/dl after experiment the value was observed as 14.68, 13.7, 15.44 and 15.59 mg/dl in the duration of 24,48,72 and 96 hours respectively. In muscle tissue the concentration of lipid in control was recorded as 19.6, 22.65, 23.61 and 25.5 mg/dl after exposure the results are recorded as 24, 48, 72 and 96 hours respectively.

The concentration of lipid in liver tissue the control was noted as 17.14, 17.8, 18.45 and 18.2 mg/dl at 24, 48, 72 and 96 hours respectively. The amount of lipid present in kidney tissue was noted as 14.61, 15.7, 18.33 and 18.44 mg/dl, after experiment it was tested as 12.55, 13. 69, 13.62, and 14.41 mg/dl at 24, 48,72 and hours respectively. The concentration of carbohydrate in various tissues (gill, muscle, liver and kidney) of fish Catla catla on exposure to potassium chromate for long term duration (10, 30, 90) was represented below.

The amount of carbohydrate of gill tissue in control was noted as 40.63,39.39 and 40.46 mg/dl, after experiment it was analyzed as 38.55,33.56 and 37.34 mg/dl at long term duration of 10,30 and 90 days respectively. In control the carbohydrate values of muscle tissue was recorded as 31.71, 34.62 and 38.49 mg/dl, after exposure it was tested as 27.65, 28.52 and 32.74 mg/dl at 10, 30 and 90 days.

In liver tissue the value of carbohydrate in control was noted as 34.71,38.42 and 41.55 mg/dl the experiment values were recorded as 31.69,32.73mg/dl at 10, 30 and 90 days respectively.

The values in control for kidney tissue were noticed as 34.69, 38.66 and 42.11 mg/dl, the experiment values are recorded as 32.51, 36.43 and 37.63 mg/dl.

The protein content gill tissue in control was observed as 26.72, 31.48 and 33.52 mg/dl after experiment the values were recorded as 22.62, 28.59 and 32.59 mg/dl at long term duration if 10, 30 and 90 days. The amount of protein in various tissues (Gill, Muscle, Liver and kidney) of fish Catla catla on exposure to potassium chromate was indicated below (the long term duration of 10, 30 and 90 days). The protein concentration of muscle tissue in control was noted as 25.45, 29.45 and 32.47 mg/dl, after experimental session the values are recorded as 23.43, 26.69 and 28.44 mg/dl at 10, 30 and 90 days. In control the concentration of protein Liver tissues was observed as 26.83, 28.63 and 30.6 mg/dl, the experimental reading was noticed as 25.39, 26.57 and 25.33 mg/dl at 10, 30 and90 days. The values of protein in kidney tissues of control sample was recorded as 27.54,24.54 and 28.56 mg/dl, after exposure the readings are noted as 22.59, 21.97 and 25.44mg/dl at 10,30 and 90 days. The lipid concentration in various tissues (Gill, muscle, liver and kidney) of fish, Catla catla on exposure to potassium chromate at long term duration(10,30 and 90 days) was shown below. The values of lipid in Gill tissue in control sample was tested as 41.51, 44.58 and 45.48 mg/dl, after experiment it was observed that 39.51, 42.39 and 41.56 at long term duration of 10, 30 and 90 days. The concentration of lipid of muscle tissue in control was recorded as 41.7,44.76 and 46.58 mg/dl and after experimental session the values are 37.61, 41.83 and 45.46 mg/dl at 10,30 an 90 days. The values of lipid in lipid tissue in control sample was noted as 43.6, 45.91 and 47.58 mg/dl, after exposure the values are found to be 39.67, 41.33 and 40.55 mg/dl at 10, 30 and 90 days. In kidney the concentration of lipid in control sample was noticed as 39.59, 42.0 and 40.55 mg/dl, in the experiment the values are observed as 38.62, 40.98 and 41.79 mg/dl at 10,30 and 90 days. Heavy metal contamination may have devasting effect on ecological balance of recipient environment and diversity of aquatic organism (Forambi et. al., 2007). These heavy metal pollution posses a great threat to fishes. When fishes are exposed to great elevate level of metal in polluted aquatic ecosystem, they tends to take these metals up from their direct environment (Hoo et. al., 2004).

IV. Tables And Figures

Table : **1** Shows the level of lipid content of gill and Muscle

Organ		24 hrs	48 hrs	72 hrs	96 hrs
Gill	Control	16.67 ±0.67	15.63±0.74	17.21± 0.46	16.96± 0.41
	Experiment	14.68± 0..45	13.7±0.21	15.44±0.89	15.59±0.52
Muscle	Control	19.6±0.78	22.65±0.33	23.61±0.56	25.5± 0.53
	Experiment	17.64±0.78	17.51±0.64	16.7±0.78	16.34±0.47

Significant at 5% level using SPSS statistical package

Table : **2** Shows the level of lipid content of liver and kidney

Organ		24 hrs	48 hrs	72 hrs	96 hrs
Liver	Control	18.64 ± 0.67	19.87 ± 0.74	21.27 ± 0.46	22.61 ± 0.41
	Experiment	17.14 ± 0.45	17.8 ± 0.21	18.45 ± 0.89	18.2 ± 0.52
Kidney	Control	14.61 ±0.78	15.7 ± 0.33	18.33 ± 0.56	18.44 ± 0.53
	Experiment	12.55 ±0.78	13.69 ± 0.64	13.62 ± 0.78	14.41 ± 0.47

Significant at 5% level using SPSS statistical package

Table : **3** Shows the level of protein content of Gill and muscle

Organ		24 hrs	48 hrs	72 hrs	96 hrs
Gill	Control	21.65 ±1.15	22.77 ±0.65	23.67± 0.65	25.81 ± 0.45
	Experiment	19±0.32	19.67± 0.35	20.6 ± 0.35	24.33± 0.35
Muscle	Control	18.63 ±1.63	19.47±0.34	20.74 ±0.34	21.71±0.56
	Experiment	16.66±0.56	17.69±1.18	18.48 ±1.18	19.52±0.67

Significant at 5% level using SPSS statistical package

Table : **4** Shows the level of protein content of liver and kidney

Organ		24 hrs	48 hrs	72 hrs	96 hrs
Liver	Control	30.47 ± 0.35	32.77± 0.87	33.8 ± 0.67	34.13 ± 0.56
	Experiment	28.59±0.21	30.59± 0.65	31.78 ±0.35	32.47 ±0.335
Kidney	Control	20.65±0.34	23.58±0.89	25.76± 0.56	26.73 ±0.67
	Experiment	19.59±0.66	20.59 ±0.98	23.66 ±0.87	24.7 ±0.736

Significant at 5% level using SPSS statistical package

Table : **5** Shows the level of Carbohydrate content of Gill and kidney

Organ		24 hrs	48 hrs	72 hrs	96 hrs
Gill	Control	16.61 ±0.67	17.55 ± 0.62	18.67 ± 0.67	19.48 ± 0.43
	Experiment	15.85 ±0.34	16.36 ±0.45	17.15 ± 0.56	18.45 ± 0.39
Kidney	Control	14.55 ±0.95	15.49 ±0.42	16.54 ± 0.78	17.48 ± 0.75
	Experiment	13.51 ±0.42	14.5 ±0.22	15.48 ± 0.98	16.51 ± 0.67

Significant at 5% level using SPSS statistical package

Table : **6** Shows the level of Carbohydrate content of Liver and muscle

Organ		24 hrs	48 hrs	72 hrs	96 hrs
Liver	Control	35.67 ±0.89	36.66 ± 0.56	37.84 ± 0.95	39.52 ± 0.67
	Experiment	33.63 ±0.76	34.43 ±0.89	35.58 ±0.63	37.48 ±0.43
Muscle	Control	45.73 ±0.66	46.6 ± 0.71	47.67 ± 0.89	48.67 ± 0.65
	Experiment	43.55 ±0.76	44.56 ± 0.85	45.44 ±0.95	46.26 ±0.78

Significant at 5% level using SPSS statistical package

Table : **7** Shows the level of protein content of gill and muscle

Organ		Day 10	Day 30	Day 90
Gill	Control	26.72 ± 0.89	31.48 ± 0.67	33.52 ± 0.56
	Experiment	22.62 ±0.78	28.59 ± 0.54	32.59 ± 0.43
Muscle	Control	25.45 ±0.87	29.45 ± 0.67	32.47 ± 0.45
	Experiment	23.43 ± 0.91	26.69 ± 0.78	28.44 ± 0.67

Significant at 5% level using SPSS statistical package

Table **8** Shows the level of protein content of liver and kidney

Organ		Day 10	Day 30	Day 90
Liver	Control	26.83 ± 0.89	28.63 ± 0.45	30.6 ± 0.56
	Experiment	25.39 ± 0.78	26.57 ±0.45	25.33 ± 0.98
Kidney	Control	27.54 ± 0.67	24.54 ± 0.45	28.56 ± 0.78
	Experiment	22.59 ± 0.45	21.97 ± 0.58	25.44 ± 0.65

Significant at 5% level using SPSS statistical package

Table : **9** Shows the level of carbohydrate content of gill and muscle

Organ		Day 10	Day 30	Day 90
Gill	Control	40.63 ± 0.89	39.39 ± 0.78	40.46 ± 0.56
	Experiment	38.55 ± 0.78	33.56 ± 0.65	37.34 ± 0.89
Muscle	Control	31.71 ± 0.78	34.62 ± 0.67	38.49 ± 0.65
	Experiment	27.65 ± 0.78	28.52 ± 0.45	32.74 ± 0.55

Significant at 5% level using SPSS statistical package

Table 10 Shows the level of carbohydrate content of liver and kidney

Organ		Day 10	Day 30	Day 90
Liver	Control	34.71 ± 0.89	38.42 ± 0.67	41.55 ± 0.87
	Experiment	31.69 ± 0.98	32.62 ±0.67	36.73 ± 0.76
Kidney	Control	34.69 ± 0.76	38.66 ± 0.98	42.11 ±0.67
	Experiment	32.51 ± 0.56	36.43 ±0.56	37.63 ± 0.76

Significant at 5% level using SPSS statistical package

Table 11 Shows the level of lipid content of gill and muscle

Organ		Day 10	Day 30	Day 90
Gill	Control	41.51 ± 0.89	44.58 ± 0.67	45.48 ± 0.56
	Experiment	39.51 ± 0.98	42.39 ± 0.67	41.56 ± 0.87
Muscle	Control	41.7 ± 0.76	44.76 ± 0.87	46.58 ±0.45
	Experiment	37.61 ± 0.76	41.83 ±0.89	45.46 ± 0.91

Significant at 5% level using SPSS statistical package

Table 12 Shows the level of protein content of liver and kidney

Organ		Day 10	Day 30	Day 90
Liver	Control	43.6 ± 0.78	45.91 ± 0.56	47.58 ± 0.89
	Experiment	39.67 ± 0.89	41.33 ±0.67	40.55 ± 0.94
Kidney	Control	39.59 ±0.89	42 ±0.76	44.68 ± 0.89
	Experiment	38.62 ±0.78	40.9 ±0.95	41.79 ± 0.87

Significant at 5% level using SPSS statistical package

Fig 1 shows level of lipid in gill and muscle (short term duration)

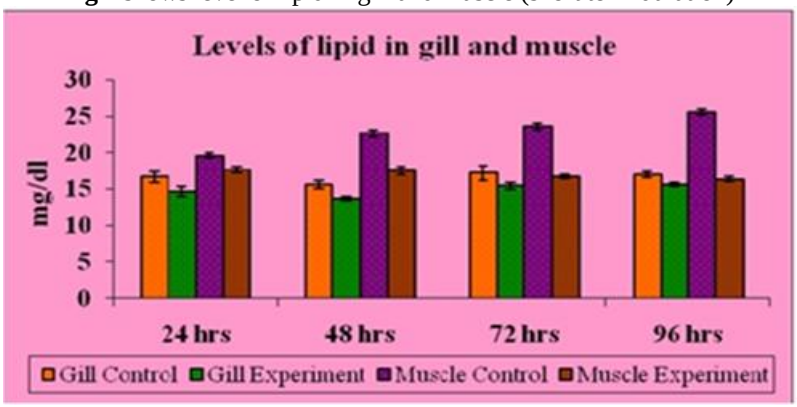


Fig 2 shows level of lipid in liver and kidney (short term duration)

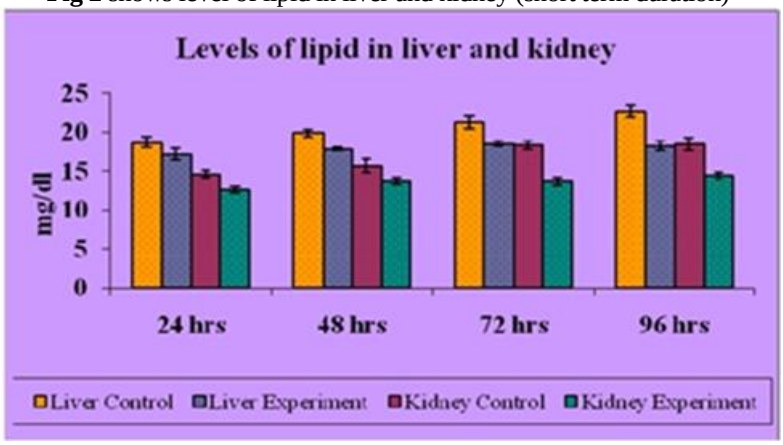


Fig 3 shows level of protein in gill and muscle (short term duration)

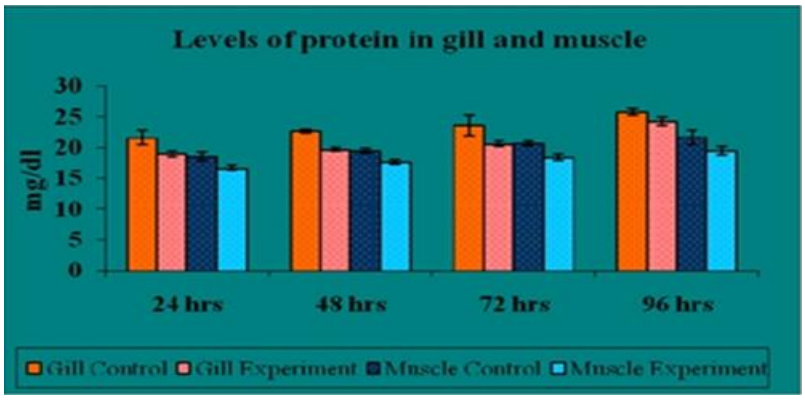


Fig 4 shows level of protein in liver and kidney (short term duration)

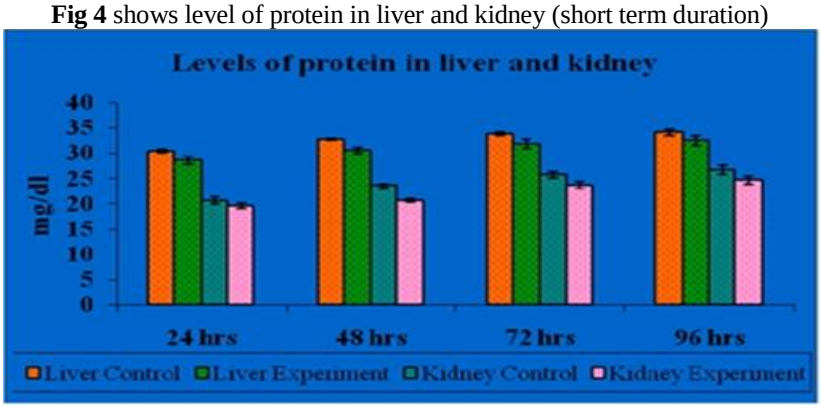


Fig 5 shows level of carbohydrate in gill and Kidney (short term duration)

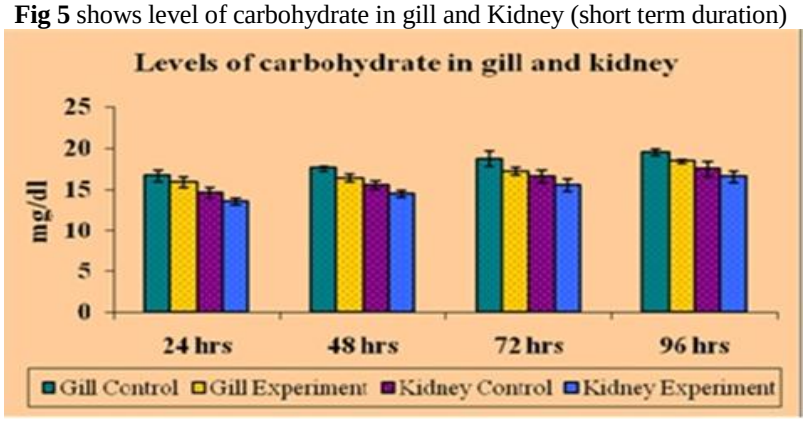


Fig 6 shows level of carbohydrate in liver and muscle (short term duration)

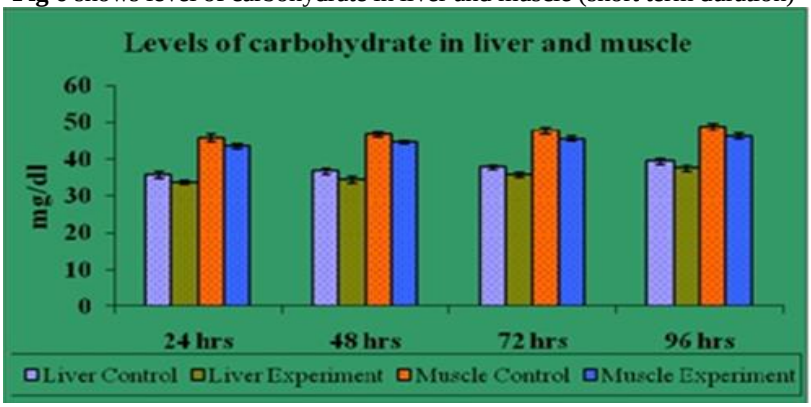


Fig 7 shows level of protein in gill and muscle (long term duration)

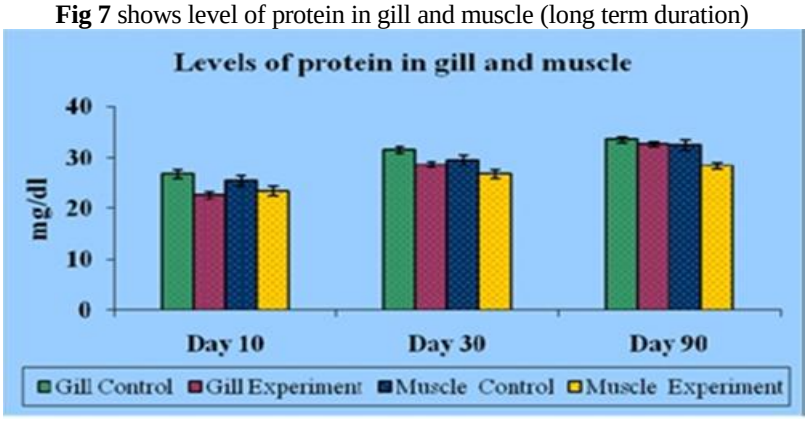


Fig 8 shows level of protein in liver and kidney (long term duration)

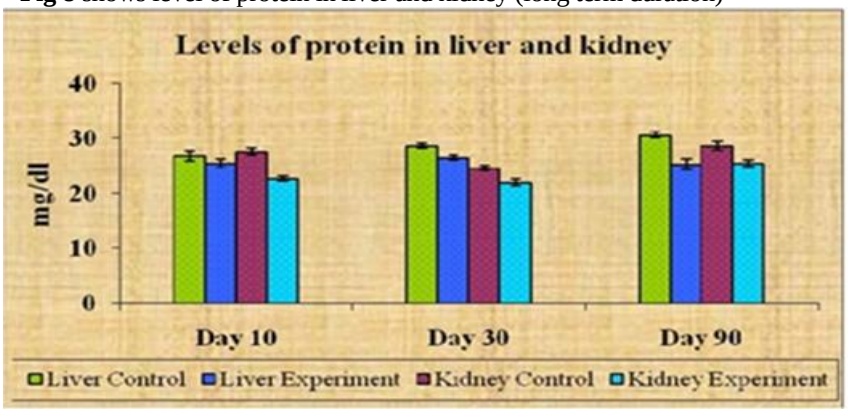


Fig 9 shows level of carbohydrate in gill and muscle (long term duration)

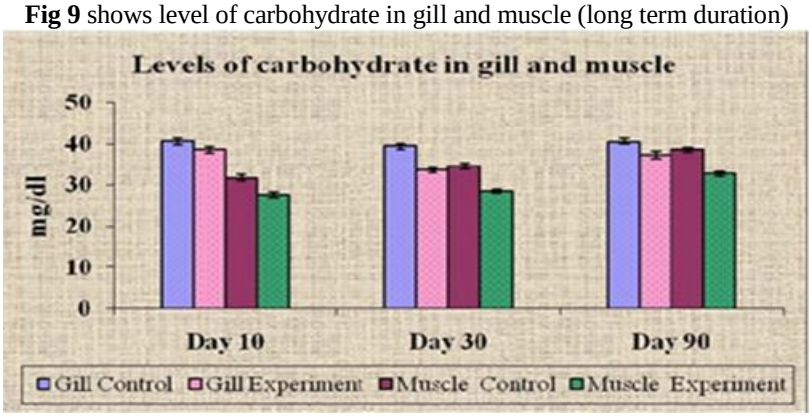


Fig 10 shows level of carbohydrate in liver and Kidney (long term duration)

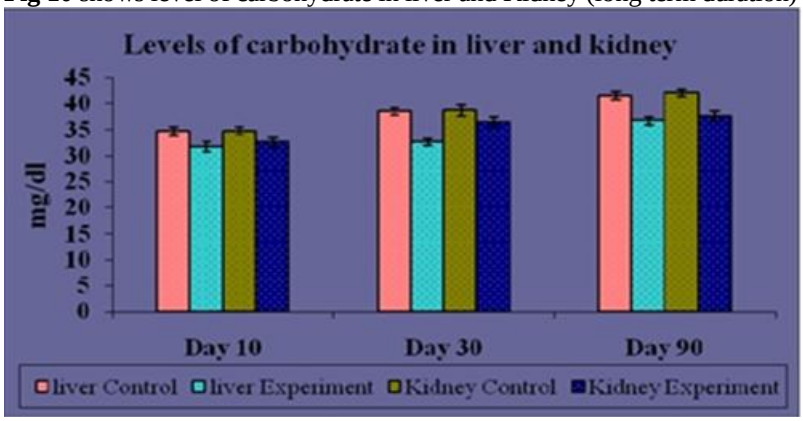


Fig 11 shows level of lipid in gill and muscle (long term duration)

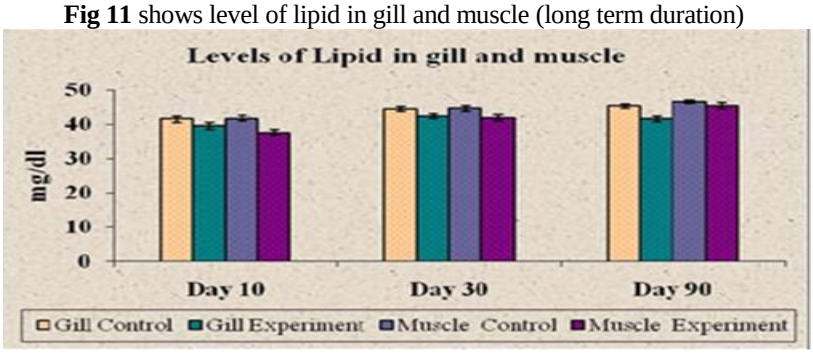
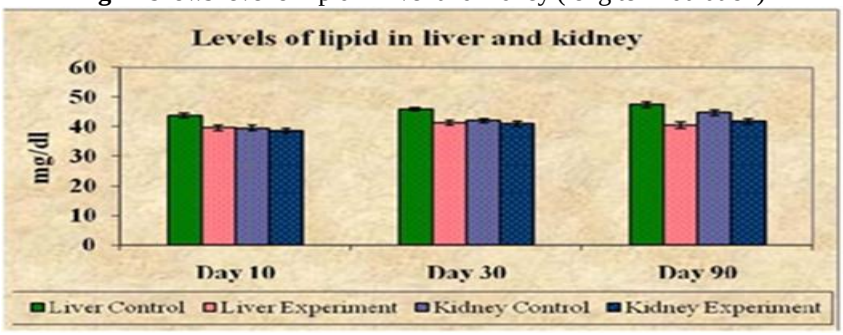


Fig 12 shows level of lipid in liver and kidney (long term duration)



V. Conclusion

Every individual have the responsibility to reduce the pollution of the water sources. People must have awareness in recycling of wastes and eco - friendly heritage. Human activities like dumping of debris and other wastes on the banks of ponds must be strictly prohibited. Regular monitoring of the quality of water bodies is essential. Water a renewable natural resource must be safeguarded.

Acknowledgement

We are more indepted to thank the Tamilnadu Pollution control board and Zoology Research Department, Kongunadu Arts and Science College for the timely help to complete this research study.

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