LIPID PROFILE IN FRESHWATER FISH *PUNTIUS SARANA SARANA* (HAMILTON - BUCHANAN) FROM INDUSTRIAL POLLUTED RIVER PAWANA, MAHARASHTRA, INDIA

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Abstract: Fish body provides lipid food of high calorific value are of enormous nutritional importance from the point of view of quality as well as quantity. An effort has been made to find out the effects of industrial pollution on lipid content in various organs of freshwater fish *Puntius sarana sarana* (Hamilton –Buchanan) For present study fish was collected from three polluted and controlled nonpolluted sites of river Pawana. The lipid contents from various organs like gill , liver, kidney muscle, and ovary were estimated in all three seasons i.e. winter, summer and monsoon. There was significant decrease in lipid content in various organs, during all seasons with increased industrial pollution stress. As compared to control more significant decrease in lipid was recorded in muscle (63.79%, $P < 0.01$) followed by liver (60.78%, $P < 0.001$), kidney (59.70%, $P < 0.01$), gill (55.31%, $P < 0.01$), gill (73.77%, $P<0.001$) followed by muscle (64.53%, $P<0.01\%$), kidney (60.27%, $P< 0.01$), liver (32.16%.P,<0.01) and ovary (22.54%, $P < 0.05$). The importance of the current study is indicating the lipid content of target tissue get mobilized under toxic influence of industrial effluents in all seasons.

Key words:, *Puntius sarana sarana* , industrial pollution and lipid content

Introduction

Fishes are the rich sources of proteins, carbohydrates, fats, vitamins (A, D and E), calcium, iron and many other minerals. The lipid content of fish is a factor that determines the quality of the fish and hence its price. A number of parameters govern its variation; these include species difference, diet of fish, selective mobilization and distribution of lipid in the fish body, salinity and temperature of water. Pollutants in water influence the lipid content in fish. Changes in lipid content in various fish organs after exposure to various pollutants is well documented. Jagatheeswari (2005) found that lipid level in liver and intestine of fish *Cyprinus Carpio*, were seem to be decreased with increased concentrations of phosalone in 2, 4 and 6 days. Rae and Rao (1981) concluded that, the decreased level of lipid is related to meet the additional energy required under stress. Katti and Sathyanesan (1983) studied on lead nitrate induced changes in lipid and cholesterol levels in the fresh water fish, *Clarius batrachus*. They found that brain, testis and ovary showed decrease in cholesterol and lipid levels whereas the liver showed an elevation of both. Jha (1999) reported that, detergents inhibit lipid synthesis and started mobilization of stored lipids. Arun et. al. (2000) analysed iron and zinc induced changes in lipid content of the muscle and gill of fishes. Deshpande (2000) reported decrease in lipid content of various organs, after acute and chronic exposure of the fish *Labeo rohita* exposed to Pyrethroids. Kamble (1999) also studied the effect of endosulfan on lipid content of gill, liver and muscle of *Sarotherodon mossambicus*.

In Pune district (Maharashtra), Pawana river is the one which is more concerned with industrial effluent from hundreds of small and large scale industries at Pimpri-Chinchwad township and MIDC. Muley and Patil (2006) reported that river Pawana is highly contaminated at downstream with industrial effluents and domestic sewage while flowing through heart of Pimpri-Chinchwad town coupled with industrialization. Therefore attempts have been made in the present investigation to understand the impact of industrial pollution on lipid content in fresh water fish Puntius sarana sarana.

MATERIAL AND METHODS:

The catfish *Puntius sarana sarana* (Hamilton –Buchanan) from Pawana River were collected from four sampling stations (A, B, C and D) selected on total 53 km stretch of river in such a way so as to include the effluent discharge points from Pimpri-Chinchwad industrial area..

Sampling Stations, Location and Status

[A] Pawana dam (Lohgad) : Upstream located 6 km after origin of river. It is free from industrial pollution and considered as control.

[B] Parandwadi: 20 km downstream of A. Rural area. River receives village waste, agricultural waste and effluents from few industries.

[C] Chinchwad-Kalewadi bridge: 16 km downward of B. Located in heart of Pimpri - Chinchwad town. River receives industrial waste from Akurdi, Nigdi and Chinchwad MIDC.

[D] Pimpale-Gurav: 6 km downstream of C. Located downstream of River & easternpart of Pimpri-Chinchwad town. Receives industrial waste from Pimpri and Bhosari MIDC.

Lipid Analysis: Fresh specimens of *Puntius sarana sarana* were collected from the four sampling stations of river in three seasons. The fishes after collection were packed in ice and immediately brought to the laboratory. The gills, muscle, liver, kidney and ovary were dissected, blotted, weighed and used for lipid estimations. Total lipid was estimated by Barnes and Black-stock (1973). The experiment was repeated three times and mean values were expressed as mg/100 mg wet weight tissue. Three replicates were subjected for statistical analysis for comparison of mean to find out significant differences among control (A) and polluted groups (B, C and D).

The values obtained for the lipid analysis were expressed as mean and standard deviation (SD). Statistical differences were analysed by two tailed 't' test, 'P' values less than 0.05, 0.01 and 0.001 were accepted as significant. All statistical analysis of the data was calculated by using standard methods (Snedecor, 1946 ; Glover and Mitchell 2000).

Result:

Industrial pollution caused alterations in lipid content of gill, muscle, liver, kidney and ovary of *Puntius sarana sarana* in three seasons are shown in Table 1

Control group-

The lipid content in different body parts of *Puntius sarana sarana* were in the order of liver > ovary > kidney > muscle > gill. In liver, ovary and kidney level of lipid content was high in summer and low in monsoon while in gill and muscle it was high in winter and low in monsoon.

The lipid content in all the body tissues of fish was decreased considerably, under the toxic influence of industrial pollution, in all seasons.

In monsoon (fig.1), in polluted group B, there was non-significant decrease in lipid content in muscle (12.04%) followed by ovary (9.16%), kidney (1.49%), liver (0.83%) and gill (0.0%). In polluted group C. significant depletion in lipid was in kidney (43.28%, $P < 0.01$), followed by muscle (36.50%, $P < 0.05$), gill (27.65%, $P < 0.05$) and ovary (22.54%, $P < 0.05$), while non-significant depletion was found in liver (9.16%). In polluted group D, as compared to control severe depletion in lipid was in muscle (63.79%, $P < 0.01$) followed by kidney (59.70%, $P < 0.01$), gill (55.31%, $P < 0.01$), ovary (36.27%, $P < 0.01$) and liver (31.66%, $P < 0.05$) respectively.

Table-1: Effect of Industrial pollution on total lipid content in various organs of the fish *Puntius sarana sarana*. (*mg*/100mg wet tissue)

Tissue	Group	Total lipid		
		Monsoon (Aug/Sept)	Winter (Dec/Jan)	Summer (April/May)
Gill	Control (A)	1.88 ± 0.183	3 ± 0.207	2.49 ± 0.069
	Polluted B	1.88 ± 0.249 -	2.64 ± (-12) NS	2.28 ± 0.12 (-8.06) NS
	Polluted C	1.36 ± 0.183 (-27.65) *	2.28 ± 0.317 (-24) *	1.72 ± 0.249 (-30.64) *
	Polluted D	0.84 ± 0.12 (-55.31) **	1.96 ± 0.183 (-34.66) *	1.4 ± 0.249 (-43.54) *
Muscle	Control (A)	2.32 ± 0.183	3.56 ± 0.138	3.16 ± 0.183
	Polluted B	2.04 ± 0.24 (-12.04) NS	2.8 ± 0.366 (-21.34) *	2.64 ± 0.24 (-16.45) NS
	Polluted C	1.473 ± 0.192 (-36.50) *	2.52 ± 0.207 (-29.21) *	2.24 ± 0.183 (-29.11) *
	Polluted D	0.84 ± 0.207 (-63.79) **	2.08 ± 0.069 (-41.57) **	1.68 ± 0.12 (-48.3) **
Liver	Control (A)	4.8 ± 0.12	5.24 ± 0.302	6.12 ± 0.12
	Polluted B	4.76 ± 0.138 (-0.83) NS	5.08 ± 0.069 (-3.05) NS	5.96 ± 0.249 (-2.61) NS
	Polluted C	4.36 ± 0.183 (-9.16) NS	4.68 ± 0.207 (-10.68) NS	5.28 ± 0.12 (-13.72) *
	Polluted D	3.28 ± 0.249 (-31.66) *	4.36 ± 0.183 (-16.79) *	4.8 ± 0.24 (-21.56) *
Kidney	Control (A)	2.68 ± 0.277	3.6 ± 0.12	4.12 ± 0.249
	Polluted B	2.72 ± 0.069 (+1.49) NS	3.16 ± 0.183 (-12.22) *	3.92 ± 0.301 (-4.85) NS
	Polluted C	1.52 ± 0.183 (-43.28) **	2.44 ± 0.138 (-32.22) *	2.68 ± 0.183 (-34.95)**
	Polluted D	1.08 ± 0.12 (-59.70) **	2.2 ± 0.138 (-38.88) **	2.56 ± 0.183 (-37.86) **
Gonad	Control (A)	4.08 ± 0.12	4.72 ± 0.183	6.32 ± 0.183
	Polluted B	3.64 ± 0.183	4.32 ± 0.207	6.12 ± 0.24

	(-9.16) NS	(-8.47) NS	(-3.16) NS
Polluted C	3.16 ± 0.183	3.88 ± 0.249	2.72 ± 0.138
	(-22.54) *	(-17.79) *	(-9.49) *
Polluted D	2.6 ± 0.183	4.12 ± 0.069	5.12 ± 0.301
	(-36.27) **	(-12.71) *	(-18.98) *

Each value is the mean of three observations.
± S.D. Values are significant at P < 0.05*, P < 0.01**, P < 0.001***;
NS – Non Significant

Fig 1. Industrial pollution caused alteration in lipid content of *p.sarana s.* in monsoon

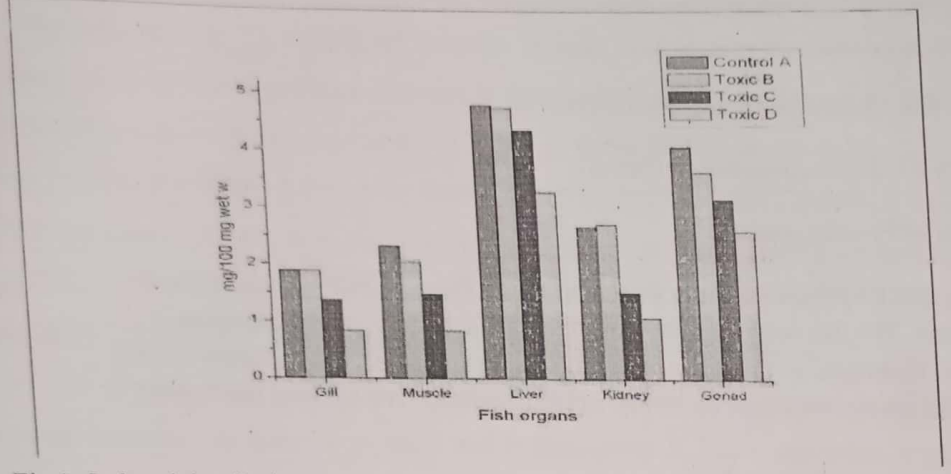


Fig 2. Industrial pollution caused alteration in lipid content of *p.sarana s.* in winter

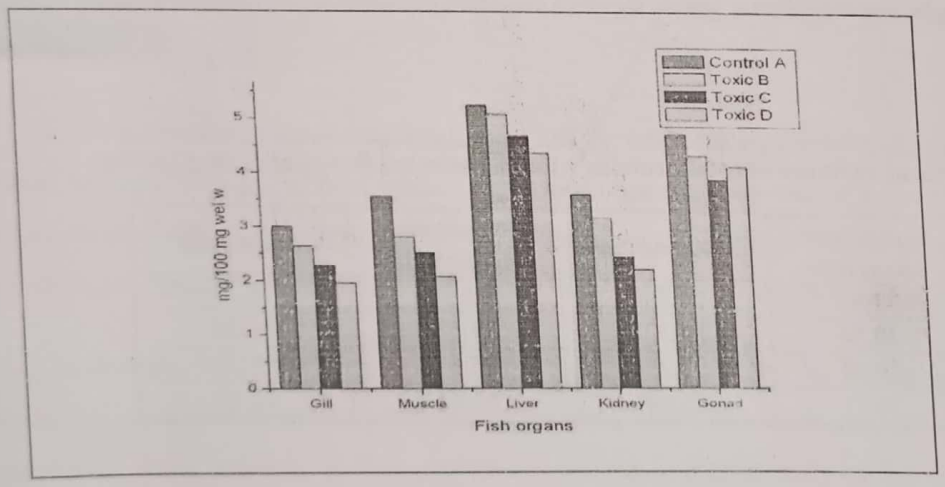
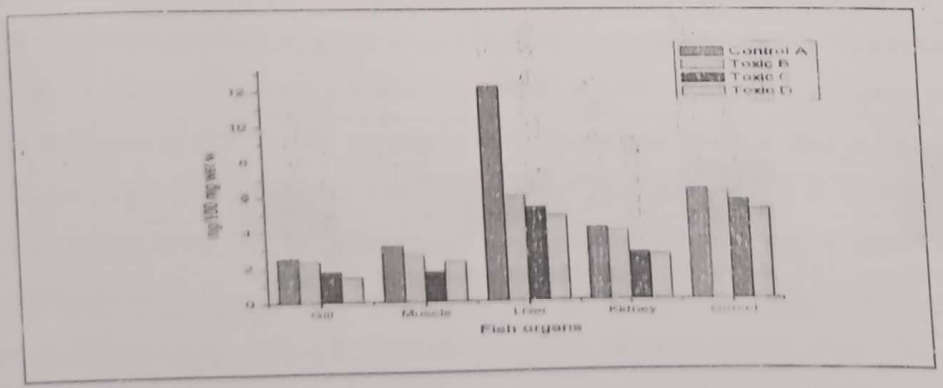


Fig 3. Industrial pollution caused alteration in lipid content of *p.sarana s.* in summer



winter (fig.2), significant decrease in lipid content in muscle (21.34%, $P < 0.05$) was observed in polluted group B. There was non-significant decrease in kidney (12.22%) followed by gill (12.0%), ovary (8.47%) and liver (3.05%). In polluted group C, significant decrease in lipid content in kidney (32.22%, $P < 0.05$) was followed by muscle (29.21%, $P < 0.05$), gill (24.0%, $P < 0.05$) and ovary (17.79%, $P < 0.05$) while non-significant decrease was observed in liver (10.68%). In polluted group D, more significant decrease in lipid was observed in muscle (41.57%, $P < 0.01$) followed by kidney (38.88%, $P < 0.01$), gill (34.66%, $P < 0.05$), liver (16.79%, $P < 0.05$) and ovary (12.71%, $P < 0.05$) respectively, as compared to control group.

In summer (fig. 3), significant decrease in lipid content was recorded in liver (51.3%, $P < 0.001$) in polluted group B. Non-significant decrease in lipid content was also observed in muscle (16.45%) followed by gill (8.06%), kidney (4.85%)and ovary (3.16%), in group B. In polluted group C, significant decrease was in liver (56.86%, $P < 0.001$) followed by kidney (34.95%, $P < 0.01$), gill (30.64%, $P < 0.05$), muscle (29.11%, $p < 0.05$) and ovary (9.49%, $P < 0.05$). In polluted group D, more significant decrease was recorded in liver (60.78%, $P < 0.001$) followed by muscle (48.30%, $P < 0.01$), gill (43.54%, $P < 0.01$), kidney (37.86%, $P < 0.01$) and ovary (18.98%, $P < 0.05$) respectively, as compared to control group.

In general, there was decrease in lipid content of all body organs, in all groups in each season. The percent decrease was more in group C and D than group B, but it was more in group D than group C. This decrease was more in monsoon than winter and summer season. Significant decrease in lipid content in various organs of *Puntius sarana sarana* were in the order of muscle > liver > kidney > gill > ovary.

Discussion:

Lipid in animals are multifunctional, constitute the reserve energy to be mobilized whenever required. In general, seasonal changes in lipid content in various organs of fish was related with maturation, spent and feeding stage of fish. Similar results were showed by John and Hameed (1992). Shankar and Kulkarni (2007) also studied on tissue cholesterol phases of female fresh water fish *Notopterus notopterus*.

In animals, lipid utilization is for one or some of the functions like during the maturation of gametes, drastic environmental conditions, starvation, pollution stress etc. Such role of lipid metabolism in body maintenance under industrial pollution stress can be seen in present study on fish *Puntius sarana sarana*. In general, there was non-significant decrease in lipid content in group B, significant decrease in group C and more significant decrease in group D as compared to control A. Stress response magnitude increases with increase in number of quantity of industrial pollutants from St. B to D as compared to St. A. It was because of rapid utilization of lipid to meet the subsequently increased demand, created by water pollutants. (Rae and Rao, 1981; Kulkarni and Dharwadkar, 1998; Shanthi and Dhanlakhmi 2006). As an explaination of the loss of lipid noticed in this study, it may be suggested that, pollutants inhibited lipid synthesis and started mobilizing the stored lipids either through β-oxidation or through a gradual unsaturation of lipid molecules (Jha and Jha 1995). Katti and Sathyanesan (1983) reported the decreased lipid level in fresh water fish *Clarius batrachus* under the

stress of lead nitrate. Prakash et. al.(2012) has been reported that decrease in serum lipid profile of fish *Hetropneusteus fosilis* after Famfos intoxication.

Conclusion:

The lipid metabolism, provide extra energy to survive under industrial pollution stress was observed in present study on fish *Puntius sarana sarana*. This study concludes that, industrial pollution adversely affect the fish fauna of Pauna river by impairing the lipid metabolism. Fish organs, of *Puntius sarana sarana* can be used as bioindicator model to monitor the toxic effect of industrial pollution in Pauna River.

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