To quantify plasma biochemical parameters of Indian major carps

Author's Name: Dr. Sudha Summarwar and Dr. Deepali Lall
Department of Zoology, S.D. Govt. College , Beawar,
M.D.S. University, Ajmer.

Abstract

The present investigation was planned to quantify plasma protein analytes in Indian major carps from lakes of Ajmer city, Rajasthan. Experimental material incorporated Indian major carps i.e. Rohu (*Labeo rohita*) and Catla (*Catla catla).* A total of 240 fish were incorporated in the study. Out of this, 120 fish type were *Labeo rohita* (Lr) and 120 fish type were *Catla (*Cc). To evaluate the impact of pesticides and their possible damage to aquatic life, water samples and fish were collected from two reservoirs (lakes) of Ajmer city, Rajasthan namely Ana Sagar lake, Ajmer, Rajasthan and Foy Sagar lake, Ajmer, Rajasthan. At each collection site, *Catla catla* fish revealed lower plasma biochemical contents than *Labeo rohita* fish. This exhibited that *Catla catla* fish built up greater degree of stress than *Labeo rohita* fish. In both the category of fish, females revealed lower contents of plasma biochemical than males. This pointed up that females of both the type of fish had developed higher scale of stress. Furthermore, it was found that low-weight male and female fish had larger amount of stress than high-weight male and female fish. Plasma biochemical were significantly ($p \leq 0.05$) lower in low-weight fish than high-weight fish.

Key words: - Plasma biochemical, *Labeo rohita* and *Catla catla.*

Introduction

Competition with traditional agriculture for land and water, wetland destruction, water pollution, and excessive use of marine fish meal and oil could limit aquaculture's potential. Thus, there should be a continuous effort to improve practices and increase in production. Water quality imbalances can kill aquatic animals but more often, cause stress that predisposes fish to disease. Prevention of disease by use of disease-free seed stock and maintenance of good water quality is more cost effective than use of antibiotics and other chemicals to treat diseases. Pesticide proportions in water drastically decreases quality of water for fish. Physiological mechanisms of fish can be modulated to the extent that becomes pathological and proves a great threat to their lives. Asztalos and Nemcsok (1985) exposed Cyprinus carpio to pesticide and evaluated biochemical parameters after different hours of exposure. A significant ($p < 0.05$) decrease in plasma protein and glutamate oxaloacetate transaminase (GOT) activity in gill, liver and kidney were noted.

Kataria and Bhatia (1989) measured lactic dehydrogenase and isoenzyme in the serum of camel. Lactate dehydrogenase is associated with energy metabolism.

Somaiah et al. (2014) explored the effect of organophosphorus pesticide on *Labeo rohita*. Significant changes in total proteins and glycogen levels in tissues were found. The total protein content reduced in various tissues like Liver, kidney and gill.

Ana Sagar and Foy Sagar lakes are important reservoirs of Ajmer city, Rajasthan. Earlier researchers have established the fact that Ana Sagar lake is having pesticides and pollutants arising from the activities like human, agriculture or effluent inputs (Charan et al., 2007 and Jain et al., 2012).

Looking towards the paucity of research on this aspect in Indian major carps, the present investigation was planned to quantify plasma biochemical analytes in Indian major carps from lakes of Ajmer city, Rajasthan.

Material & Method

Experimental material incorporated Indian major carps i.e. Rohu (*Labeo rohita*) and Catla (*Catla catla*). A total of 240 fish were incorporated in the study. Out of this, 120 fish type were *Labeo rohita* (Lr) and 120 fish type were *Catla* (Cc). To evaluate the impact of pesticides and their possible damage to aquatic life, water samples and fish were collected from two reservoirs (lakes) of Ajmer city, Rajasthan namely Ana Sagar lake, Ajmer, Rajasthan and Foy Sagar lake, Ajmer, Rajasthan

1.Total plasma proteins

Standard Reinhold procedure as per the description given by Oser (1976) was used to estimate total proteins in plasma. After dilution the plasma was made to react with a special biuret reagent. Colored solution was observed. Light absorption of the colored solution was carried out at 545-560 mμ wavelength in a spectrophotometer (Systronics) employing a biuret blank. Total plasma protein was computed as described below:

Calculation

Total plasma proteins, gdL^{-1} =

$$\frac{\text{OD of plasma} - \text{OD of plasma Blank}}{\text{OD of standard} - \text{OD of standard Blank}} \times \text{g \% protein in standard}$$

Then the value was converted to gL^{-1}(SI unit).

2. Plasma glucose

It was estimated by standard Folin-Wu procedure as described by Oser (1976). After preparation, protein free filtrate of plasma was taken, and it was boiled with alkaline copper solution in a clean Folin –Wu tube. Formation of cuprous oxide was there. It was then made to react with solution of phophomolybdic acid. Blue colour was observed. Spectrophotometer was set to record the optical density. Wavelength was set at 420 mμ. The standard curve was obtained by using following data:

Plasma glucose, $mmolL^{-1}$	2.20	3.30	4.40	5.50	6.60	7.70
Optical Density	0.06	0.153	0.222	0.282	0.38	0.42

Result & Discussion

1. Plasma proteins

Mean± SEM values of plasma proteins of male and female fish i.e. *Labeo rohita* (Rohu, Lr) and *Catla catla* (Catla, Cc) collected from different areas of Ana Sagar lake (site 1, site 2, site 3, site 4 and site 5) and Foy Sagar lake are presented in table 1. In each gender, fish were further grouped as low-weight (LW) and high weight (HW). The data are based on 20 observations each as specified in the section of materials and methods.

The mean values of plasma proteins from each site revealed significant differences ($p\leq0.05$) among themselves. Fish collected from Ana Sagar site 4 revealed significantly ($p\leq0.05$) lowest values of plasma proteins as compared to rest of the other sites. This revealed that maximum oxidative stress was developed in the fish collected from Ana Sagar site 4. A link of plasma proteins contents was observed with the water pH also. Extremely higher or lower pH impinged on plasma proteins status of fish of both genders. This also existed in the values of plasma proteins of fish collected from different areas.

Plasma proteins content were related to be linked with the pH of water samples from where the fish were collected in the exploration. Alterations in the pH of water samples indicated pollution in the water. It divulged that pollution of the water altered the biochemical status of fish of both the types i.e. *Labeo rohita* and *Catla catla*. It appeared that pH of water, presence of pollutants in water, plasma proteins and antioxidant status of fish were having association.

The mean values of plasma proteins obtained in the present investigation in the fish from Ana Sagar site 1 were taken as control values. The average pH of water samples from this site was 7.00. On the basis of available control values, it was concluded that the mean values of plasma proteins of both the types of fish divulged changes in metabolic status. Somaiah et al. (2014) explored the effect of organophosphorus pesticide on *Labeo rohita*. Significant changes in total proteins were found. Blahova et al. (2014) evaluated biochemical parameters after exposure to herbicide in common carps. Most experimental fish revealed significant changes in total protein.

Effect of pesticides on the values of proteins in fish was observed by earlier scientists (Narra,2016). A decrease was reported. Findings of the present exploration disclosed that stressful condition in water pool could be the motive for lower plasma proteins contents leading to vast changes in energy levels.

2. Plasma glucose

Mean± SEM values of plasma glucose of male and female fish i.e. *Labeo rohita* (Rohu, LR) and *Catla catla* (Catla, CC) collected from different areas of Ana Sagar lake (site 1, site 2, site 3, site 4 and site 5) and Foy Sagar lake are presented in table 1. In each gender, fish were further grouped as low-weight (LW) and high weight (HW). The data are based on 20 observations each as specified in the section of materials and methods.

The mean values of plasma glucose from each site revealed significant differences ($p \leq 0.05$) among themselves. Fish collected from Ana Sagar site 4 revealed significantly ($p \leq 0.05$) lowest values of plasma glucose as compared to rest of the other sites. This revealed that maximum oxidative stress was developed in the fish collected from Ana Sagar site 4. A link of plasma glucose contents was observed with the water pH (Table 1) also. Extremely higher or lower pH impinged on plasma glucose status of fish of both genders. This also existed in the values of plasma glucose of fish collected from different areas.

Plasma glucose content was related to be linked with the pH of water samples from where the fish were collected in the exploration. Alterations in the pH of water samples indicated pollution in the water. It divulged that pollution of the water altered the biochemical status of fish of both the types i.e. *Labeo rohita* and *Catla catla*. It appeared that pH of water, presence of pollutants in water, plasma glucose and antioxidant status of fish were having association. There is dearth of research on this aspect in fish. Impurities in water can influence water pH. Earlier researchers are of the stance that distant pH values than neutral in a water collection area can affect the development of water animals thereby influencing ecosystem badly. Water pH can be used effectively as a crucial indicator of presence of pollutants in water (Inamori and Fujimoto, 1990).

The mean values of plasma glucose obtained in the present investigation in the fish from Ana Sagar site 1 were taken as control values. The average pH of water samples from this site was 7.00. On the basis of available control values, it was concluded that the mean values of plasma glucose of both the types of fish divulged changes in metabolic status.

Blahova et al. (2014) evaluated biochemical parameters after exposure to herbicide in common carps. Most experimental fish revealed significant changes in glucose.

Changes in the environment can bring variations in biochemical parameters. Kumar et al. (2016) explored effect of endosulfan on fish and observed increased glucose. Effect of pesticides on the values of glucose in fish was observed by earlier scientists (Narra,2016). An increase was reported. In present investigation, significant decrease was observed. Sun et al. (2017) found that Panax not ginseng extract addition decreased glucose in fish.

Reference

Asztalos, B. and Nemcsok, J. (1985). Effect of pesticides on the LDH activity and isoenzyme pattern of carp (*Cyprinus carpio* L.) sera. Comparative Biochemistry and physiology part C: Comparative pharmacology. 82(1): 217-219.

Blahova, J.; Modra, H.; Sevcikova, M.; Marsalek, P.; Zelnickova, L.; Skoric, M. and Svobodova, Z. (2014). Evaluation of biochemical, haematological, and histopathological responses and recovery ability of common carp (*Cyprinus carpio* L.) after acute exposure to atrazine herbicide. Biomed. res. int. 2014:980948. doi:10.1155/2014/980948.

Charan, P.D.; Patni, A. and Sharma, K.C. (2007). Pesticide contamination in lake Ana Sagar of Ajmer, Rajasthan. In: Proceedings of Taal, 2007. The 12th world lake conference. 360-365.

Inamori, Y. and Fujimoto, N. (1990). Physical/mechanical contamination of water in water quality and standards. 2

Jain, S.; Sharma, G. and Mathur, Y.P. (2012). Effect of pesticides on hormone and enzyme system of aqua population: a view over Ana Sagar lake, Ajmer. IOSR J. Environ. Sci. Toxicol. Food Technol.1: 24-28.

Kataria, N. and Bhatia, J.S. (1989). Lactic dehydrogenase and isoenzyme in the serum of camel. Indian Vet. J. 66(1): 1016-1017.

Kumar, N.; Ambasankar, K.; Krishnani, K.K.; Gupta, S.K.; Bhushan, S. and Minhas, P.S. (2016). Acute toxicity, biochemical and histopathological responses of endosulfan in Chanos. Ecotoxicol. Environ. Saf. 131: 79-88.

Narra, M.R. (2016). Single and cartel effect of pesticides on biochemical and haematological status of *Clarias batrachus*: A long-term monitoring. Chemosphere. 144: 966-974.

Oser, B.L. (1976). Haw's physiological chemistry. Tata McGraw-Hill Publishing Company. Bombay.p. 1016,1045.

Somaiah, K.; Satish, P.V.V.; Sunita, K.; Nagaraju, B. and Oyediran, O.O. (2014). Toxic impact of phenthoate on protein and glycogen levels in certain tissues of indian major carp *Labeo rohita (*hamilton). J. Environ. Sci. Toxicol. And Food Techno. 8(9): 65-73.

Sun, Z.; Tan, X.; Ye, H.; Zou, C.; Ye, C. and Wang A. (2017). Effects of dietary Panax notoginseng extract on growth performance, fish composition, immune responses, intestinal histology and immune related genes expression of hybrid grouper (Epinephelus lanceolatus ♂ × Epinephelus fuscoguttatus ♀) fed high lipid diets. Fish Shellfish Immunol. pii: S1050-4648(17)30684-8.

Table 1: Mean values of plasma glucose and proteins of fishes collected from different areas of Ana Sagar and Foy Sagar lakes

Name of area	Type of fish			Mean ± SEM	
				Plasma glucose mmolL^{-1}	Plasma proteins, gdL^{-1}
Ana Sagar Site 1	LR Overall value (80)			6.20^{b} ± 0.12	4.10^{b} ± 0.02
	LR (80)	M (40)	LW (20)	6.20^{c} ± 0.03	4.00^{c} ± 0.002
			HW (20)	6.60^{d} ± 0.01	4.42^{d} ± 0.003
		F (40)	LW (20)	6.00^{c} ± 0.02	3.80^{c} ± 0.002
			HW (20)	6.40^{d} ± 0.02	4.22^{d} ± 0.002
	CC Overall value (80)			6.10^{b} ± 0.10	3.90^{b} ± 0.001
	CC	M	LW	6.00^{c}	3.80^{c}

	(80)	(40)	(20)	± 0.02	± 0.002
			HW (20)	6.40^{d} ± 0.02	4.20^{d} ± 0.002
		F (40)	LW (20)	5.80^{c} ± 0.02	3.60^{c} ± 0.002
			HW (20)	6.20^{d} ± 0.02	4.00^{d} ± 0.002
Ana Sagar Site 2	LR Overall value (80)			5.80 ^{b} ± 0.11	3.60^{b} ± 0.001
	LR (80)	M (40)	LW (20)	5.70^{c} ± 0.02	3.50^{c} ± 0.002
			HW (20)	6.10^{d} ± 0.03	3.90^{d} ± 0.003
		F (40)	LW (20)	5.50^{c} ± 0.03	3.30^{c} ± 0.002
			HW (20)	5.90^{d} ± 0.03	3.70^{d} ± 0.003
	CC Overall value (80)			5.60 ^{b} ± 0.10	3.40^{b} ± 0.001
	CC (80)	M (40)	LW (20)	5.50^{c} ± 0.03	3.30^{c} ± 0.002
			HW (20)	5.90^{d} ± 0.01	3.70^{d} ± 0.03
		F (40)	LW (20)	5.30^{c} ± 0.03	3.10^{c} ± 0.002
			HW (20)	5.70^{d} ± 0.01	3.52^{d} ± 0.003
Ana Sagar Site 3	LR Overall value (80)			5.50 ^{b} ± 0.10	3.30^{b} ± 0.001
	LR (80)	M (40)	LW (20)	5.40^{c} ± 0.03	3.20^{c} ± 0.002
			HW (20)	5.80^{d} ± 0.03	3.60^{d} ± 0.003
		F (40)	LW (20)	5.20^{c} ±	3.00^{c} ±

				0.03	0.002
			HW (20)	5.60^{d} ± 0.03	3.40^{d} ± 0.003
	CC Overall value (80)			5.30^{b} ± 0.10	3.10^{b} ± 0.02
	CC (80)	M (40)	LW (20)	5.20^{c} ± 0.03	3.00^{c} ± 0.002
			HW (20)	5.60^{d} ± 0.01	3.40^{d} ± 0.002
		F (40)	LW (20)	5.00^{c} ± 0.02	2.80^{c} ± 0.001
			HW (20)	5.40^{d} ± 0.01	3.22^{d} ± 0.002
Ana Sagar Site 4	LR Overall value (80)			5.25^{b} ± 0.10	3.03^{b} ± 0.02
	LR (80)	M (40)	LW (20)	5.16^{c} ± 0.03	2.91^{c} ± 0.002
			HW (20)	5.54^{d} ± 0.01	3.35^{d} ± 0.001
		F (40)	LW (20)	4.95^{c} ± 0.03	2.73^{c} ± 0.002
			HW (20)	5.35^{d} ± 0.01	3.13^{d} ± 0.002
	CC Overall value (80)			5.05^{b} ± 0.10	2.83^{b} ± 0.02
	CC (80)	M (40)	LW (20)	4.98^{c} ± 0.03	2.74^{c} ± 0.002
			HW (20)	5.32^{d} ± 0.01	3.14^{d} ± 0.001
		F (40)	LW (20)	4.74^{c} ± 0.01	2.53^{c} ± 0.001
			HW	5.16^{d}	2.93^{d}

			(20)	± 0.01	± 0.001
Ana Sagar Site 5	LR Overall value (80)			6.10 ^{b} ± 0.10	3.90^{b} ± 0.02
	LR (80)	M (40)	LW (20)	6.00^{c} ± 0.03	3.80^{c} ± 0.002
			HW (20)	6.40^{d} ± 0.01	4.22^{d} ± 0.003
		F (40)	LW (20)	5.80^{c} ± 0.03	3.60^{c} ± 0.002
			HW (20)	6.20^{d} ± 0.01	4.02^{d} ± 0.002
	CC Overall value (80)			5.90 ^{b} ± 0.10	3.70^{b} ± 0.02
	CC (80)	M (40)	LW (20)	5.80^{c} ± 0.03	3.60^{c} ± 0.002
			HW (20)	6.20^{d} ± 0.01	4.00^{d} ± 0.002
		F (40)	LW (20)	5.60^{c} ± 0.03	3.40^{c} ± 0.002
			HW (20)	5.80^{d} ± 0.01	3.82^{d} ± 0.001
CONTD………………………………					
TABLE CONTD…………………………					
Foy Sagar	LR Overall value (80)			6.00 ^{b} ± 0.11	3.80^{b} ± 0.02
	LR (80)	M (40)	LW (20)	5.90^{c} ± 0.03	3.70^{c} ± 0.001
			HW (20)	6.30^{d} ± 0.01	4.10^{d} ± 0.002
		F (40)	LW (20)	5.70^{c} ± 0.03	3.50^{c} ± 0.001
			HW (20)	6.10^{d} ± 0.01	3.92^{d} ± 0.001

	CC Overall value (80)			5.80[b] ± 0.10	3.60[b] ± 0.02
	CC (80)	M (40)	LW (20)	5.70[c] ± 0.03	3.50[c] ± 0.002
			HW (20)	6.10[d] ± 0.01	3.90[d] ± 0.001
		F (40)	LW (20)	5.50[c] ± 0.03	3.30[c] ± 0.002
			HW (20)	5.90[d] ± 0.01	3.70[d] ± 0.001

Figures in the parentheses indicate number of observations in each case
LR = *Labeo rohita* fish
CC = *Catla catla* fish
M = Male
F = Female
[b] = Significant ($p \leq 0.05$) difference in overall mean values of LR and CC
[c] = Significant ($p \leq 0.05$) difference for LW in a fish type
[d] = Significant ($p \leq 0.05$) difference for HW in a fish type