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RESEARCH ARTICLE

EFFECT OF ACUTE AND SUBCRONIC EXPOSURE OF LEAD ACETATE AND NICKEL CHLORIDE ON SOME OF THE HAEMATOLOGICAL PARAMETERS IN TWO FRESHWATER FISH SPECIES FROM SAUDI ARABIA

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ABSTRACT

Heavy metals, nowadays are the major environmental problems which deteriorate the natural phenomenon of all the living beings of the ecosystem. The present investigation was carried out in two freshwater fishes, *Cyprinus carpio* and *Oreochromis niloticus* exposed to Lead acetate and Nickel chloride to determine the lethal concentration (L_C50) for 96 hour. The 96h L_C 50 for both the species was computed as 14.35 mg/L *(O.niloticus*) and 16.75 mg/L (*C.carpio*). The same fishes were treated with sub-lethal concentrations for determining the hematological parameters. All the variations in parameters were dose dependent and were in parenthesis. The experiment was carried out for four weeks and observed that erythrocytes count, hemoglobin and the hematocrit value increased gradually with exposure time while the leukocytes count decreased. Serum protein and serum glucose were found to be affected significantly. Lead acetate seems to be more effective than the nickel chloride.

INTRODUCTION

Toxic discharge to the environment through various sources is hazardous and deteriorates the aquatic ecosystem (Singh and Kumar, 2009 and Shamsi, 2014). The suitability of water for a particular use depends on the type and amount of some specific impurities which might be in the form of heavy metals discharge from the industries present around that will in some way affect the whole community of the aquatic fauna and flora. Waste management hierarchy has made for recycling the waste material for improving the quality of water. This water quality standard has been proposed by anumber of agencies; including Environmental Protection Agency (EPA) of USA, World Health Organization (WHO) which are beneficiated to fish culture (Singh and Kumar, 2009). Lead as an immunotoxicant has an adverse effect on human and animal health as neurological dysfunction (Nordberg *et al.,* 2007 and Al-Kahem *et al.,* 2011). Mobarak, (2008) pointed out that exposure of low level of lead produce a neuro-behavioural deficit reduced the fertility and delay in sexual maturity. Recently, notable report have indicated that lead can cause neurological, gastrointestinal, reproductive, circulatory, immunological, histopathological and other physiological disability in animals (Berrahal *et al.,* 2007; Abdallah *et al.,* 2010; Mobarak and Sharaf, 2011 and Al-Kahem *et al.,* 2011).

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Blood parameters are often measured by the clinical diagnosis of fish physiology is applied to determine the sub-chronic effects of pollutants because of their contamination in the environment. According to Al-Akel *et al.* (2010) shown that the toxicants in the aquatic environment, change the water quality from which the physiological changes occurs and affect the health and other Biological activities of the human beings and the aquatic fauna and flora as well. Fish live in a very intimate contact with aquatic fauna, and are therefore very susceptible to physical and chemical changes which may alter the blood quality and their components as well (Wilson and Taylor, 1993; and Vosyliene, 1999). The present study, therefore, assessed the hematological parameters of the cyprinid fish *Cyprinuscarpio* and the nilefish *Oriochromis niloticu s*exposed to Lead and Nickel as a comparative study.

MATERIALS AND METHODS

Healthy and freshly collected fish species of *Oreochromi sniloticus* (weight, 65.5±1.00 g and mean length, 10.0±1.5 cm) and *Cyprinus carpio* (mean weight, 85.5±1.00 g and mean length, 14.7±1.2 cm) were collected and acclimatized in the Laboratory condition in two different big aquarium with oxygenation under a photoperiod of 12hL: 12hD for two weeks before starting the experiment. The water condition like, Temperature, pH, Dissolved Oxygen and hardness analysed weekly which were 21.5±1.0 C^0; 7.8±0.45; 6.8 mg/L and 210.5±6.5 mg/L as Calcium Carbonate ($CaCO_2$) respectively. On completion of two weeks as acclimatization period, the

selected 10 fishes in different aquarium with a capacity of water 30L/aquaria were kept. A stock solution of the two chemical were prepared and diluted to the test water to get the required concentrations. These fishes were exposed to 96 hrs. The dead fishes were immediately removed and their number was counted. The value of L_C50 for 96 hrs for both the fishes was calculated by the method of Finney, 1971. Earlier the same method was applied by several other workers (Al-Akel and Shamsi, 2000; Ahmad, 2012 and Shamsi, 2014). A control set was also run parallel with the same number of fishes and with the same quality of water but without using the toxicants. The experiment was run in triplicate .The water was aerated and the feeding was stopped.

After finding the L_C50 for both the fish species with Lead and Nickel, the fishes were exposed to four different sub-lethal concentrations like, 2.0, 4.0, 6.0, 8.0mg/L with *Oreochromis niloticus* and 3.0,6.0,9.0 and 12.0 mg/L with *Cyprinus carpio*. For analyzing the hematological parameters another two sets of experiment with 200 fishes were distributed into 12 groups. 15 fishes for each group were treated to different concentrations of lead acetate and nickel chloride separately with a control set parallel with for comparison. The fishes were feed once daily to satiety. Two fishes from each aquarium were removed after every week, blood samples were collected in heparinized vials by cutting the caudal peduncle. Blood of these two fishes were pooled to get enough quantity of blood. Samples of clotted blood were discarded. Hemoglobin was estimated by Cyano-methaemoglobin method using diagnostic hemoglobin kit (Kit no. 527-A-Merck).

Hematocrit values were determined by micro-hematocrit centrifuge in glass capillaries, using the micro-hematocrit reader (Hawksley and Sons, England). RBC and WBC were counted by using Neubar-hematocytometer after diluting the blood with Dace's and Turk's solution respectively.

The remaining blood sample was centrifuged (5000 rpm/10 minutes at 4˚C and the collected plasma was stored at -20˚C till analysed. Glucose, Total Protein were analysed using their respective kits (Biomerieuk, France). For statistical analysis, the one-way analysis of varience (ANOVA) was applied to test the significance of difference among the different values. If the P value is less than 0.05, it was considered statistically significant.

RESULTS AND DISCUSSION

In our previous report which have already been published (Shamsi, 2014) regarding the toxicity (L_C 50 for 96 hours) of the foresaid chemicals were computed as, L_C 50 for 96 hours in *Oreochromis niloticus* with lead was 11.65 mg/L and with Nickel it was 19.95 mg/L while in *Cyprinus carpio*, with lead was 13.45 mg/L and with Nickel it was 21.70 mg/L respectively. The difference in toxic potential of these two metals to different species can be related to the differences in susceptibility and the tolerance related to its accumulation, bio transformation and excretion (Johnson and Toledo, 1993; Ahmad 2012) Generally, the toxicity varied with respect to species, size of the fish and the duration of exposure (Oh *et al.,* 1991; Dutta *et al.,* 1995 and Ahmad 2012). Changes in hematological parameters and serum chemistry (Serum Protein and Serum Glucose) in the control and the exposed group of both the species are characterized in (Table 1 and Table 2) respectively which are gradually decreased and increase significantly.

Table 1. Variations in Haemological profile of *O. niloticus* after exposure to 96 hour with Lead and Nickel. Data observed in Triplicate

Parameter (in Parenthesis)	Lead (mg/L)					Nickel (mg/L)				
	Control	2.00	4.00	6.00	8.00	Control	2.00	4.00	6.00	8.00
Irythrocytes (Cells x 10^6 /mm^3)	1.680 ±0.003	1.720 ±0.004	1.778 ±0.011	1.815 ±0.177	1.954 ±0.175	1.740 ±0.004	1.790 ±0.005	1.910 ±0.011	1.990 ±0.011	2.025 ±0.001
Leucocytes (Cells x 10^3/mm^3)	39.516 ±0.006	38.660 ±0.005	36.900 ±0.006	34.250 ±0.004	32.500 ±0.059	38.510 ±0.005	36.875 ±0.008	34.500 ±0.009	32.680 ±0.015	30.78750 ±0.019
Haemoglobin (g/100ml)	7.82 ±0.25	7.95 ±0.20	8.20 ±0.05	8.90 ±0.15	9.0 ±0.22	8.25 ±0.26	8.20 ±0.25	8.95 ±0.15	9.25 ±0.45	9.60 ±0.01
Haematocrit (%)	30.90 ±0.19	31.20 ±0.09	33.50 ±0.15	39.00 ±0.25	36.15 ±0.20	32.50 ±0.19	34.60 ±0.42	38.50 ±0.25	39.00 ±0.10	39.50 ±0.10
Serum Protein (mg/100 ml)	46.50 ±2.00	42.80 ±0.39	41.00 ±0.40	39.45 ±0.45	36.50 ±0.50	42.50 ±0.25	40.10 ±0.24	39.00 ±0.39	38.25 ±0.40	35.40 ±0.45
Serum Glucose (mg/100ml)	65.20 ±0.41	68.10 ±0.35	72.65 ±0.45	78.40 ±0.58	80.35 ±0.60	70.15 ±0.35	74.20 ±0.40	78.40 ±0.60	82.50 ±0.10	85.50 ±0.45
Triglyceride (mg/100ml)	1.71 ±0.009	1.50 ±0.015	1.38 ±0.011	1.28 ±0.018	1.05 ±0.050	1.65 ±0.01	1.45 ±0.04	1.25 ±0.01	0.95 ±0.25	0.65 ±0.32

Table 2. Variations in Haemological profile of *C. carpio* after exposure to 96 hours with Lead and Nickel. Data observed in Triplicate

Parameter (in Parenthesis)	Lead (mg/L)					Nickel (mg/L)				
	Control	2.00	4.00	6.00	8.00	Control	2.00	4.00	6.00	8.00
Irythrocytes (Cells x 10^6 /mm^3)	1.450 ±0.002	1.675 ±0.004	1.80 ±0.007	1.99 ±0.010	2.02 ±0.025	1.65 ±0.005	1.75 ±0.002	1.85 ±0.002	1.90 ±0.012	1.95 ±0.022
Leucocytes (Cells x 10^3/mm^3)	36.66 ±0.005	35.50 ±0.002	32.40 ±0.004	30.50 ±0.001	29.20 ±0.019	38.50 ±0.008	37.40 ±0.010	36.60 ±0.025	33.33 ±0.010	30.90 ±0.002
Haemoglobin (g/100ml)	7.75 ±0.18	7.80 ±0.20	8.50 ±0.21	9.10 ±0.19	9.25 ±0.19	8.80 ±0.22	8.90 ±0.25	9.10 ±0.35	9.25 ±0.35	9.90 ±0.40
Haematocrit (%)	32.50 ±0.17	34.0 0.19	35.50 ±0.20	36.00 ±0.25	37.80 ±0.30	33.80 ±0.91	32.50 ±0.22	32.50 ±0.25	30.15 ±0.20	28.50 ±0.29
Serum Protein (mg/100 ml)	48.50 ±0.24	47.00 ±0.25	46.50 ±0.30	44.50 ±0.40	42.35 ±0.45	46.50 ±0.32	46.00 ±0.33	41.50 ±0.38	41.50 ±0.39	40.00 ±0.40
Serum Glucose (mg/100ml)	72.50 ±0.35	74.00 ±0.30	76.00 ±0.49	79.00 ±0.45	80.50 ±0.42	79.00 ±0.32	80.00 ±0.39	84.50 ±0.40	86.35 ±0.46	94.25 ±0.50
Triglyceride (mg/100ml)	1.68 ±0.010	1.60 ±0.010	1.58 ±0.001	1.50 ±0.015	1.40 ±0.019	1.70 ±0.110	1.65 ±0.112	1.95 ±0.112	1.95 ±0.145	2.0 ±0.245

Generally, toxicants exposure exerts an adverse effect on the hematopoietic organs which alters the blood parameters and are suitable tools for evaluating the effects of chemicals (Cyriac *et al.,* 1989 and Roche and Boge, 1996). These findings are concordant with the present investigation.

The two species *Oreochromis niloticus* and *Cyprinus carpio*, exposed to different concentrations of lead acetate and Nickel chloride indicated an increase in RBC count, Hemoglobin concentration and Hematocrit values compared to the control one (Table I and II). It is documented that under stress condition, the fish became hyper active perhaps to get out of the stressful medium and would require an increased amount of oxygen to meet their energy demand and on the other hand, it secreted an increased amount of mucus and coated the gills to get relief from the irritating effect of the toxicants. In this condition, the fish seems to secrete an increased amount of mucus to coat the gill aperture, this reduces the gaseous exchange through the gills which may cause a hypoxic condition (Al-Kahem *et al.,* 1998 and Ahmad 2012). According to the previous informations with different chemicals and in several other fish species in hypoxic condition, there is a stress-mediated synthesis of more hemoglobin and release a new erythrocytes from erythropoietic organs to improve the oxygen carrying capacity of blood (Mustafa and Murad, 1984; Al-Kahem, 1994; Al-Akel *et al.,* 2010). Ahmad (2012) have attributed the increased hemoglobin in Cadmium exposed fish, reduced hyperactivity and impaired gills function. In present investigation the total Leukocytes count was decreased, which might be due to multifunctioning of hematopoietic systems caused by the exposure of such chemicals. Changes in the Leukocytes system manifest in the form of leukocytosis with heterohilia and lymphopenia which are characterstics of leukocytic response in animals exhibiting stress. Al-Kahem, (1995) and Ahmad (2012) reported reduction in the WBC count of the fish exposed to Chromium and Diazinon. Their informations are more or less coinciding with the present work. Jaffer Ali and Rani (2009) have also reported decreased leukocytes count in carp exposed to Diazinonbased pesticide and tilapia exposed to Phosalone, respectively.

REFERENCES

Abdullah, G.M., El-Sayed, S.M. and Abo-Salem, O.M. 2010. Effect of lead toxicity on coenzyme Q levels in rat tissue. *Food Chem.Toxico.,* 48:1753-1756.

Ahmad, Z. 2012 . Toxicity bioassays and effect of sub-lethal xposure of melathion on biochemical composition and haematological parameters of Clariasgariepinus. *African J. Biotechnology,* 11 (34):8578-8585.

Al-Akel, A.S. and Shamsi, M.J.K. 2000. A comparative study of the toxicity of lead and its Impact on the carbohydrate metabolism and some haematologicalparametersof Cichlid fish *Oreochromisniloticus* and cat fish *Clariusgariepinus* from Saudi Arabia. *Toxicol. Environ.Chem.,* 74:19-28.

Al-Akel, A.S., Al-Kahem, H.F., Al-Misned, F., Mahboob, S., Ahmad, A. and Suliman, E.M. 2010. Effects of dietary copper exposure on accumulation, growth and hematological parametersin *Cyprinuscarpio Toxicol. Environ.Chem.,* 92:1865-1878.

Al-Kahem H.F. 1994. Toxicity of nickel and the effects of sub-lethal levels on haematological parameters andbehaviour of the fish *Oreochromisniloticus. J.Univ.Kuwait*(*Sci.*) 21:243-252.

Al-Kahem, F.H., Ahmad, Z., Al-Akel, A.S., Al-Misned, F., Suliman, E.A.M. and Al-Ghanim, K.B. 2011. Toxicity bioassay of lead acetate and effects on its sub-lethal exposure on growth, haematological parameters and reproduction in *Clariusgariepinus. African J. Biotech*, 10(53):11039-11047.

Al-Kahem, H.F. 1995. Behavioural responses and changes in some haematological parameters of the cichlid fish, *Oreochromisniloticus* exposed to trivalent chromium. *J. King Abdul Aziz U.niv. Sci*., 7:5-13.

Al-Kahem, H.F., Ahmad, Z., Al-Akel A.S. and Shamsi, M.J.K. 1998. Toxicity bioassays and changes in haematological parameters of *Oreochromisniloticus* induced by Trichlorfon. *Arab Gulf J.Scient.Res*., 16 (3):581-593.

Berrahal, A.A, Nehdi, A., Hajjaji, N.; Gharbi, N. and El-Fazza, S. 2007. Antitoxidant enzymes activities and bilirubin level in adult rat treated with lead. *Comptes.Rendus.Biol.*, 330:581-588.

Cyriac, P.J., Antony, A. and Nambison, P.N.K. 1989. Hemaglobin and hematocrit values in the fish Orieochromismossambicus (Peters) after short term exposureofcopper and mercury. *Bull.Environ.Contamin. Toxicol,* 43:315-320.

Dutta, H.M., Munshi, J.S.D., Dutta, J.R., Singh, N.K., Adhikari, S. and Richmonds, C.R. 1995. Age related differences in the inhibition of brain acetylcholinesterase activity of *Heteropneustesfossilis* (Bloch) by malathion. *Com.Biochem. Physiol*., 111A:331-334.

Finnney, D.J. 1971. Probit analysis .S.Chand and Company Ltd. Ramnagar. Delhi

Jaffar Ali H.A. and Rani, V.J. 2009. Effect of phosalone on haematological indices in the tilapia,*Oreochromi smossambicus. Turk.J.Vet.Anim.Sci.,* 33:407-411.

Johnsson, C.M. and Toledo, M.C.F. 1993. Acute toxicity of endosulfanto the fish *Hyphessobryconbifasciatus* and *Brachydaniorerio Archiv.Environ.Conta.Toxicol.,* 24:151-155.

Mobarak, Y.M. 2008. Review of the developmental toxicity and teratogenicity of three environmental contaminants (Cadmium, Lead and Mercury). Catrina.3:31-43.

Mobarak, Y.M.S. and Sharaf, M.M. 2011. Lead acetate induced histopathological changes in the gills and gigestive system of silver sailfin (*Poecilialatiinna*). *Int. J. Zool.Res.*, 7:1-18.

Mustafa, S. and Murad, A. 1984. Survival,behavioural response and haematological profile of catfish, *Heteropneustesfossilis*, exposed to DDT. *Jap. J. Ichthyol*, 31:55-65.

Nordberg, G.F., Fowler, B.A., Nordberg, M. and Friberg, L. 2007. Handbook on the Toxicology of Metals. 3rd Edn. Avcademic Press, Amesterdam, ISBN-10:0123694132, pp.12-24.

Roche, H. and Boge, G. 1996. Fish blood parameters as a potential tool for identification of stressed caused by environmental factors and chemical intoxication. *Mar. Environ.Res.,* 41:27-43

Shamsi, M.J.K. 2014. Ecotoxicology: Effect of acute and sub chronic exposure to heavy metals (Lead and Nickel) and its impact on carbohydrate metabolism (Glycogen) in fresh water fish species from Saudi Arabia. 5 (6):332-334.

Singh,H.R. and Kumar, N. 2009. Ecology and Environmental Science. Vishal Publishing Co. Jalandhar, Delhi.pp.304.

Vosyliene, M.Z. 1999. The effect of heavy metals on Haematological indices of fish. *Acta.Zool.Lituanica,* 9:76-82.

Wilson, R.W. and Taylor, E.W. 1993. The physiological responses of freshwater rainbow trout, *Onchorynchusmykiss*, during acute exposure. *J.Comp. Physiol*., 163:38-47.

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