

Impact of the Pesticide Dimethoate 30% EC on the Haematological Parameters of Fresh water fish, *Labeo rohita*

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Abstract: The main source of freshwater pollution can be attributed to discharge of untreated waste,dumping of industrial effluent and run off from agricultural fields.The haematological characteristics of fishes are an integral part of evaluating their health status.However the diet composition,metabolic adaptation and variation in fish activity are the main factors responsible for the change in haematological parameters of fish.Biochemical indicators of environmental contamination have potential use as sensitive and early warning indicators of long-term detrimental effects. Appropriate narrow range of concentrations 0.1 to 0.5ppm was used to find the median lethal concentration,using 10 fishes for each concentration and mortality was recorded for every 24hrs upto 72 hrs.The LC₅₀ value is 0.398 ppm for 72hrs.10 fishes were exposed in each experiment and blood was collected from gills and caudal region.The blood samples was tested for haematological parameters.All the parameters were found to be decreased except WBC,lymphocytes and eosinophils when compared to control.**Keywords**-eosinophils, haematology, lethal concentration, *Labeo rohita*,WBC.

I. Introduction

Water pollution is a worldwide phenomenon and one of the most serious problems confronting mankind.The growth of human civilization and ever increasing population required more demand for food,comfort and infrastructure,which has lead to the manifold expansion of industries,agriculture and continous process of urbanization.Both developed and developing countries that are progressing rapidly in the field of agriculture,technology and industry are introducing various kinds of harmful substances into the environment and thereby facing serious challenge in the form of environmental pollution([1]).

A variety of agricultural chemicals such as fertilizers,insecticides,pesticides,fungicides, herbicides and other biocides are used to control crop pests and diseases to boost agricultural production([2]). These agrochemicals find their way through different routes into the adjoining water bodies such as rivers,ponds,ditches,paddy fields and other low lying areas,adversely affecting the ecological balance leading to unwanted mortality of the aquatic biota,in general fishes and their food organisms.

Water pollution problems related to agrochemicals have been taken categorically into consideration and it has been found that use of agrochemicals in the crop fields is liable to change the abiotic and biotic characters of the aquatic media,leading hazards to the aquatic flora and fauna.Fishes belonging to different taxonomic group are adopted variously depending on different prevailing ecological conditions.The blood composition of the fish could be used as one of the indices to indicate their well being.The fluctuations in the blood constituents in fishes are subjected to change in temperature,ecological conditions,food habits,chemical and environmental stress.

II. Materials And Methods

The toxicant Dimethoate 30% EC (organophosphorous) has been used for the present study.It is white in colour and is in liquid form. It is a systemic insecticide against aphids,jassids,thrips etc., of cotton,paddy, maize and groundnut.It is an organophosphorous pesticide,having excellent pest repellent property.It is primarily irritant to skin eyes and respiratory tract and also affect the normal metabolism.

Fishes were maintained in a large tank and acclimatized to laboratory conditions for 21 days.Water was changed daily to maintain the oxygen content and to remove the excreta of fishes.Fishes were maintained at room temperature and fed with wheat bran daily at least one hour prior to the replacement of the tank water.Feeding was stopped two days prior to the experiment in order to keep the animal more or less in the same state of metabolite requirement.

Batches of 10 healthy fishes were exposed to different concentrations of Dimethoate 30% EC to calculate LC₅₀ value.One more set of fishes are maintained as control in tap water.To find the wide range of concentration 1 to 5ml of Dimethoate 30% EC were chosen and the number of dead or affected fish in each set up was noted at regular intervals of 24hrs.The tanks were aerated with electrically operated aerator.Appropriate

narrow range of concentrations 0.1 to 0.5ppm was used to find the median lethal concentration using 10 fishes for each concentration and mortality was recorded for every 24hrs upto 72 hrs.It was found as 0.398 ppm for 72hrs.

Three groups of fishes were exposed to 0.398ppm(sub lethal concentration for 72 hrs) concentration for 24,48 and 72hrs respectively. Another group was maintained as control at the end of each exposure period,the blood was collected from gills and tail region using syringe and anticoagulants(ammonium oxalate,EDTA)were added and the haematological parameters such as RBC, WBC, Hb, MCV, MCH, MCHC, PCV, platelets, Lymphocyte, Polymorphs and Eosinophil were analysed. The haemoglobin content was estimated by acid hematin method ([3]). Total RBC count and WBC count were counted using an improved Neubaur haemocytometer ([4]). The mean corpuscular volume was calculated by using values of PCV% and the red blood cell counts expressed in μm^{-3} ([5]). The mean corpuscular haemoglobin content was calculated by using the value of haemoglobin content and the red blood cell counts and expressed in pg ([5]). The percentage of mean corpuscular haemoglobin concentration was calculated by using the values of haemoglobin content and the PCV% ([5]). The PCV percentage was calculated employing standard method and formulae ([6]).

III. Results And Discussion

Lethal concentration (LC_{50}) at 72 hrs was found to be 0.398ppm. The amount of RBC in the blood of the fishes exposed to 0.398ppm dimethoate 30% EC for 24,48 and 72hrs was found to contain 1.52, 1.49, 1.41 and mean control was found to be $1.79 \times 10^6 \text{mm}^3$. The amount of WBC in the blood of fishes exposed to 0.398ppm dimethoate 30% EC for 24,48 and 72hrs values were found to contain 5600, 6100, 7800 and mean control was found to be 4200 mm^3 . The level of Haemoglobin in the fish *Labeo rohita* on exposed to 24,48 and 72hrs was found to contain 2.74, 2.3, 2.0 and mean control was found to be 3.10g%. The value of MCV in fishes exposed to 0.398ppm of Dimethoate 30% EC for 24,48,72hrs are found to contain 31.5, 28.4, 29.2 and mean control was found to be $39.5 \mu\text{m}^3$. The amount of MCH in the blood of the fishes exposed to the toxicant found to contain 16.0, 13.2, 11.4 for 24,48 and 72hrs respectively and a mean control was found to be 19.1 pg. The amount of MCHC in the blood of the fish exposed to Dimethoate 30% EC was found to contain 17.6, 14.8, 13.5 for 24,48 and 72 hrs of exposure and a mean control were found to be 19.8 g/dL.

The amount of PCV in the blood of the fish exposed to 0.398 ppm of the toxicant found to contain 8.08, 7.8 and 6.8 for 24,48 and 72hrs of exposure respectively and mean control was found to be 8.7%. The amount of platelets in the fish, *Labeo rohita* exposed to 0.398 ppm of the toxicant Dimethoate 30% EC found to contain 34,000, 29,800 and 24,000 for 24,48 and 72hrs respectively and mean control was found to be $37,900 \text{mm}^{-3}$. The amount of Lymphocyte in the fresh water fish, *Labeo rohita* exposed to 0.398 ppm concentration of the toxicant was found to be 28, 35, 38 and 47% for control, 24,48 and 72hrs of exposure respectively. The amount of Neutrophils in the blood of the fish exposed to 0.398 ppm concentration of the pesticide was found to be 69, 61, 58 for 24,48 and 72 hrs of exposure respectively and mean control was found to be 69%. The amount of Eosinophils in the blood of the fish, *Labeo rohita* exposed to 0.398ppm of the toxicant was found to be 4.0, 4.0, 4.0 in 24,48 and 72 hrs of exposure and mean control was found to be 3.0%.

Decrease in RBC may be due to the disruptive action of pesticides on the erythropoietic tissue, which in turn affected the cell viability. Increased WBC count established leucocytosis, which is considered to be of an adaptive value for the tissue under chemical stress. In the present investigation, maximum decrease in haemoglobin level was recorded after 72 hours exposure of Dimethoate 30% EC. The reason may be release of immature cells from haemopoietic tissue into the blood stream as well as disruption of iron metabolism that lead to a defective haemoglobin synthesis. The significant change in the MCH may be due to the reduction in cellular blood iron, resulting in reduced oxygen carrying capacity of blood and eventually stimulating erythropoiesis. Decrease in MCV values may be considered as an index of RBC destruction. The decrease in MCHC reveals that the loss of Hb is comparatively higher than that of the PCV. The decrease in PCV of the exposed fish may be due to haemolysis of red blood cells by Dimethoate 30% EC leading to significant decrease in haematocrit value results in fish anaemia. Increase in PCV shows the magnitude of shrinking of cell size. Low platelet count, also called thrombocytopenia. It can also be caused by anaemia. The amount of lymphocytes and eosinophils showed an increasing trend while the count of polymorphs decreased. The increase in lymphocyte and eosinophil count is due to the sensitivity of the immune system against the stress condition caused by the pesticide. All haematological parameters except WBC and differential count of eosinophil and lymphocyte were decreased from the control. ([7]) reported a decreasing trend in all the parameters such as RBC, Hb content, ESR% and PCV% suggesting that the Organophosphorous pesticides also induce changes, which give evidence for decreased haematopoiesis followed by anemia induction in test fishes. ([8]) showed a slight decrease in the values of haematological parameters of the *O. niloticus* fed with maltose compared to that fed with control feed. ([9]) reported a significant decrease in the Hb, PCV, MCH, MCHC and increase in MCV, when the fresh water fish, *catla catla* were exposed to the pesticide monocrotophos.

IV. Table

Effect of Dimethoate on haematological parameters in the blood of the fish, *Labeo rohita*

Parameters		Exposure Periods			
		Control	24 Hrs	48 Hrs	72 Hrs
RBC (10 ⁶ /mm ³)	Mean±SD %	1.79±0.015 ^b	1.52±0.012 ^c 15.00↓	1.49±0.014 ^a 16.00↓	1.41±0.016 ^d 21.00↓
WBC (10 ⁶ /mm ³)	Mean±SD %	4200±133.99 ^a	5600±142.89 ^b 21.79↑	6100±152.57 ^c 28.20↑	7800±168.72 ^d 46.15↑
Haemoglobin (gm %)	Mean±SD %	3.10±0.160 ^b	2.74±0.139 ^b 11.60↓	2.32±0.160 ^a 25.80↓	2.02±0.160 ^d 35.48↓
MCV (µm ³)	Mean±SD %	39.5±0.158 ^a	31.5±0.152 ^d 20.25↓	29.2±0.142 ^b 26.07↓	28.4±0.167 ^c 28.10↓
MCH (pg)	Mean±SD %	19.1±0.162 ^b	16.0±0.176 ^c 16.20↓	13.2±0.131 ^b 30.89↓	11.4±0.142 ^d 40.31↓
MCHC (g/dL)	Mean±SD %	19.8±0.163 ^b	17.6±0.167 ^c 11.11↓	14.8±0.141 ^a 25.25↓	13.5±0.143 ^d 31.81↓
PCV (%)	Mean±SD %	8.7±0.49 ^b	8.08±0.158 ^c 7.12↓	7.8±0.149 ^a 10.34↓	6.8±0.162 ^d 21.84↓
PLATELETS (mm ³)	Mean±SD %	37900±194.47 ^a	34200±135.76 ^b 9.76↓	29800±135.76 ^c 21.37↓	24700±207.36 ^d 34.8↓
LYMPHOCYTES (%)	Mean±SD %	28±1.594 ^d	35±1.68 ^c 25.00↑	38±1.43 ^b 35.71↑	47±1.61 ^a 40.42↑
POLYMORPHS (%)	Mean±SD %	69±1.62 ^a	61±1.65 ^b 11.59↓	58±1.62 ^c 15.94↓	49±1.65 ^d 28.98↓
EOSINOPHIL (%)	Mean±SD %	3.0±0.158 ^a	4.0±0.158 ^b 33.30↑	4.0±0.224 ^c 33.30↑	4.0±0.255 ^d 33.30↑

Results are mean (±SD) of five observations.

% = Parenthesis denotes percentage increase/decrease over control.

Means followed by a different subscript are significant at 5% by DMRT.

V. Conclusion

All haematological parameters except WBC and differential count of eosinophil and lymphocyte were decreased from the control. The WBC and lymphocytes were increased in all the exposures. Eosinophil increased in 24 hrs and remained same in further exposures. From the above investigation it can be inferred that the aquatic animals will be adversely affected by the pesticide Dimethoate 30% EC. So we should create awareness among people to use biocides instead of synthetic pesticides and herbicides.

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