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Protective role of Ascorbic acid on the lead chloride induced alterations in the Ascorbic Acid contents of the fresh water fish, *Channa orientalis* (Schneider)

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ABSTRACT

Fresh water fishes, Channa orientalis were exposed to chronic dose of $PbCl_2$ with and without ascorbic acid. Ascorbic acid content from liver, ovary, kidney and gill were estimated. Remarkable decrease in Ascorbic acid content was observed in lead exposed fishes as compared to control. The groups exposed to heavy metals along with ascorbic acid showed increase in Ascorbic acid content in selected tissues than those exposed to only heavy metal. Pre-exposed fishes to heavy metals showed fast recovery and higher ascorbic acid contents than those which were allowed to cure naturally. The probable role of ascorbic acid is discussed in the paper.

Key Words: *Channa orientalis,* Ascorbic acid (50 mg/l.), lead, Ascorbic acid content, liver, kidney.

INTRODUCTION

Trace metals are biological interest because of their role as micronutrients enter in aquatic organisms. The heavy metal pollutant brings about damage to different organs or disturbs the physiological and biochemical processes within the organism. Various sources of water pollution cause several hazards to several non-target organisms. Similarly, these toxic water pollutants enter into the body of human through food chain.

Ascorbic acid is an “enediol-lactone” of an acid with a configuration similar to that of the sugar L-glucose. The vitamin C is L-ascorbic acid is essential for the normal development while D-ascorbic acid is antiscorbutic. Glucose and hexoses are utilized for the synthesis of ascorbic acid. The depletion in the Ascorbic acid content in intoxicated fishes may be due to the higher affinity of metal compounds. The toxicants produce cumulative deleterious effects not only on particular group of animals but also inhabiting the ecosystem. [1] Studied the ascorbate effect on methyl mercury toxicity in reproductive organs of guinea pigs and found the recovery in the metabolic functions of the reproductive organs. It indicate positive role of ascorbic acid in detoxification. The present study was undertaken to assess the ascorbic acid content from liver and kidney fresh water fish, *Channa orientalis.*

MATERIALS AND METHODS

Medium sized fresh water fishes, *Channa orientalis* were collected from shiven river area Nandurbar Dist. Nandurbar. The physico-chemical parameters of the water for the maintenance of the fishes by methods [2]. The fishes were divided in to three groups A, B and C. Group A maintained as a control. The Group B fishes were exposed to $LC_{50/10}$ dose of Pb^{++} (2.867ppm) as lead chloride for 45 days, while group C fishes were exposed to respective chronic concentration of heavy metal with 50mg/l. of ascorbic acid for 45 days. Fishes from B groups were divided into two groups after 45 days exposure to lead into D &E groups. Fishes of D groups were allowed to cure naturally while those of E groups were exposed to ascorbic acid .Liver, ovary, kidney and gills from A, B and C group fishes after 15, 30 and 45 days of exposure and from D and E groups after 5 and 10 days of recovery were

removed and dried at 80 ºC in the oven till the constant weight of dry tissues were obtained from dry tissue powders. Ascorbic acid contents were estimated by using Hydrazine reagent [3].

RESULTS AND DISCUSSION

The data obtained regarding the physico-chemical properties is given in Table No.1 while the ascorbic acid contents in different tissues after exposure to lead with and without ascorbic acid and during recovery are given in the Tables 1.1 to 1.4. After chronic exposures to $PbCl_2$, ascorbic acid contents in the different tissues of *Channa orientalis* were found to be depleted ascorbic acid contents. The changes in the ascorbic acid contents of a tissue due to heavy metal stress indicate the changes in the activity of the organism. It reflects in the utilization of their biochemical energy to counteract the toxic stress. In the presence of ascorbic acid (50 mg/l.) the ascorbic acid content depletion is less as compared to those of lead chloride intoxificated fishes.

The fishes pre-exposed to heavy metals salts showed fast recovery in the ascorbic acid level in the presence of ascorbic acid than those allowed to cure naturally. Ascorbic acid has a coenzyme or cofactor necessary for normal functioning of cellular and sub-cellular structures necessary for the synthesis of collagen. The antioxidant role of ascorbic acid protects the tissue from the syperoxide radical generated, due to different toxicological effects.

Lead may exert toxic effects of physiological, biochemical dysfunction affect the structure and functions of various organs and tissues, but those in the kidney are the most insidious[4].The high levels of ascorbic acid found in the ovaries have been considered a reflection of the endocrine function of the organ (Levine and Morita, 1985). Wedemeyer (1969) observed that the stress-induced release of cortisol occurred concomitant with a decrease in the ascorbic acid in the kidney of *salmonids*. [5] have reported in gills and hepatopancreas the ascorbic acid content decreased in both the levels of pesticides. [6] studied the decrease in ascorbic acid in different tissues of *Lamellidens corrianus* and *Parreysia cylindrica* after the exposure of antibiotics. [7] Found the decrease in ascorbic acid in different tissues of the snail, *Bellamya (Viviparous) bengalensis* after the exposure to mercury, arsenic and lead. [8]) studied the ascorbic acid contents of different body parts in relation to reproduction and observed the high ascorbic acid level during gametogenesis in the gonads and hepatopancreas, during gametogenic period in bivalve, *Pareysia cylindrica*.

Ascorbic acid reduced lead level in liver [9]. Ascorbic acid complexes lead in vivo acting as potential chelating agents and seem to alleviate lead induced vit. deficiency and metabolic disturbances [10]. [11] Reported, ascorbic acid reduces the level of lead in bone, liver and kidney during lead exposure in rats. Lead poisoning in the kidney of rats was prevented of by calcium and ascorbic acid supplementation [12].Vitamin C not only confers protection against lead toxicity, also perform therapeutic role against such toxicity, [13]. Prolonged administration of the aqueous leaf extract of *Citrus sinensis* did not show any signs of toxicity in Wistar rats. The extract actually acted like an immune stimulator, an antioxidant and hypoglycaemic agent [14]. Administration of pefloxacin and antioxidant vitamins caused a significant decrease in AST and ALT which may due to the detoxifying effects of the antioxidant vitamins on the liver, thereby ameliorating the damage effect of pefloxacin. These further reduce the cellular inflammatory reactions of the hepatocytes which may have initiated leakage of enzyme into circulation [15].

In the present investigation, decrease in the ascorbic acid content in various tissues of *Channa orientalis* was observed after chronic exposure to lead chloride. The ascorbic acid content was more in heavy metal salts with ascorbic acid exposed fishes as compared to those exposed to only heavy metal salts. The fishes showed fast recovery of tissues ascorbic acid in presence of ascorbic acid than those allowed to cure naturally.

Table No- 1: Physico-chemical parameters of water used for experimentation

Temperature	25·1 ± 3·2^{0}
PH	7 · 6 0 ± 0 · 3
Conductivity	140 ± 15.7 µ mho$^{-cm.}$
Free Co2	3·34 ±1· 3ml$^{1.}$
Dissolved O2	6·3 ± 1·1ml^{1}.
Total Hardness	204 ± 12·0mg $^{-1}$.
Total Alkalinity	585·6 ± 32.8 mg $^{-1}$.
Magnesium	31·67 ± 2.9 mg $^{-1}$
Calcium	30·46 ± 3.06 mg $^{-1}$
Chloride	107·92 ± 16.34 mg $^{-1}$.

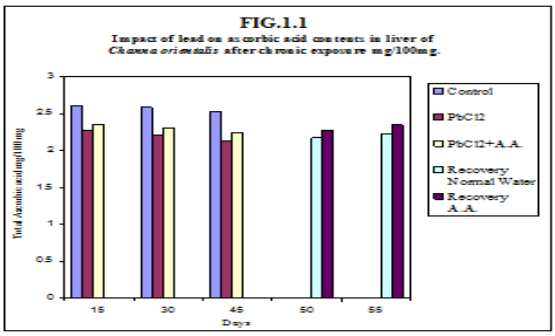
Table 1.1:- **Ascorbic acid contents in the liver of *Channa orientalis* after chronic exposure to $PbCl_2$ without and with ascorbic acid and during recovery (Values represent % in dry wt.)**

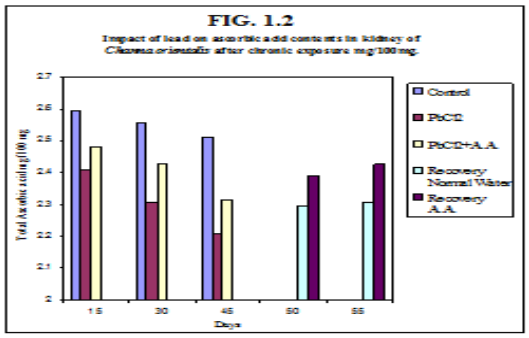
Group	Treatment	15d	30d	45d	50d	55d
A	Control	2.614± 0.01744	2.590± 0.01104	2.537±0.01679	--	--
B	Pb^{++} (2.867ppm)	2.275 ±0.01850*** (-12.96)	2.205 ±0.01737*** (-14.86)	2.136 ± 0.01727*** (-15.80)	--	--
C	Pb^{++} (2.867ppm) + A.A.	2.357 ± 0.01810*** (-9.83)	2.311 ± 0.01148*** (-10.77)	2.247 ± 0.01756*** (-11.43)	--	--
D	Recovery in Normal water	--	--	--	2.173 ± 0.01541$^{\Delta NS}$ [+1.73]	2.236 ± 0.01795$^{\Delta}$ [+4.68]
E	Recovery in A.A.	--	--	--	2.276 ± 0.01430$^{\Delta\Delta}$ [+6.55]	2.350 ± 0.1098$^{\Delta\Delta\Delta}$ [+10.01]

Table 1.2 Ascorbic acid contents in the kidney of *Channa orientalis* after chronic exposure to $PbCl_2$ without and with ascorbic acid and during recovery (Values represent % in dry wt.)

Group	Treatment	15d	30d	45d	50d	55d
A	Control	2.595± 0.01320	2.556± 0.01694	2.512± 0.0184	--	--
B	Pb^{++} (2.867ppm)	2.408 ± 0.01632** (-7.20)	2.307 ± 0.01401*** (-9.74)	2.210 ±0.01569*** (-12.02)	--	--
C	Pb^{++} (2.867ppm) + A.A.	2.481 ± 0.02060* (-4.39)	2.430 ± 0.02347* (-4.92)	2.315 ± 0.01191** (-7.84)	--	--
D	Recovery in Normal water	--	--	--	2.295 ± 0.02127$^{\Delta}$ [+3.84]	2.308 ± 0.01063$^{\Delta}$ [+4.43]
E	Recovery in A.A.	--	--	--	2.390 ± 0.01842$^{\Delta\Delta}$ [+8.14]	2.427 ± 0.1818$^{\Delta\Delta}$ [+9.81]

AA = Ascorbic acid (50 mg/l., ± indicates S.D. of three observations. Values in ( ) indicates percent change over respective control.,Values in [ ] indicates percent change over 45 days of respective B., indicates significance with the respective control.,$^{\Delta}$ indicates significance with 45 days of respective B.,p<0.05 = * &$^{\Delta}$, p<0.01 = ** &$^{\Delta\Delta}$, p<0.001 = *** &$^{\Delta\Delta\Delta}$, ^{NS} and $^{\Delta NS}$ = Not significant.*





CONCLUSION

The ascorbic acid act as an antioxidant and efficient inhibitor against lead chloride.

Ascorbic acid acts as a detoxifier reduces the toxicity of the heavy metals to offer protection to the cell from expansion or abnormalities in their structural features.

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