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Comparative study of acute and chronic exposure of chloramphenicol on total lipid contents in different tissues of model animals, *Lamellidens corrianus* (Lea) and *Parreysia cylindrica (*Annandale and Prashad)

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Abstract

Upon lethal treatment of one of the broad spectrum antibiotics, chloramphenicol against the increase lipid contents in all tested tissues, there was increase in the total lipids content over different durations. Exposure to sub-lethal concentration, the amount of total lipids content, increased. Changes in the lipid metabolism due to lethal concentration of chloramphenicol exposure could reveal the positive impact on the metabolic activities, which would result in increase in lipid contents in both the selected models, *Lamellidens corrianus* and *Parreysia cylindrica.* The acute dose of chloramphenicol given to *Lamellidens corrianus* was 470.37PPM and to *Parreysia cylindrica* was 369.09PPM. The sub lethal concentrations used were 94.07 PPM in case of *L. corrianus* and 73.81 PPM in case of *P. cylindrica* up to 21 days. The total lipid content was estimated after 24 and 96 hours of acute treatment and after 7, 14 and 21 days of chronic treatment in the mantle, gills, foot, ovary, testis, digestive glands and whole body of the bivalves. Upon acute and chronic exposure of chloramphenicol, *L. corrianus* and *P. cylindrica* showed increase in total lipid contents. There was overall increase in lipid contents in different tissues of both the species of bivalves. Ovary and testis showed marked increase against chloramphenicol treatment. Maximum increase in lipid contents was found in ovary after chronic treatment and least by mantle at the same exposure. The increase in lipid contents may be due to the lipogenesis occurring in the ovary for production and emission of gametes.

Keywords: Chloramphenicol, *Lamellidens corrianus*, *Parreysia cylindrica,* lipid contents.

INTRODUCTION

Chloramphenicol is a broad-spectrum antibiotic. The bacterial growth is inhibited by interfering at the translation of protein synthesis. Translation is both a complex and metabolically essential process. Chloramphenicol causes the loss of translational fidelity. It provides an effective treatment for many bacterial infections. The selection of the antibiotic is due to its use in artificial pearl culture during post-operative care to reduce the mortality rate.

Lipid is the most efficient organic reserves of most of the bivalves and other animals [1] along with major structural components of the body tissues. It is therefore essential to study the effect of variables on the lipid content. Starvation resulted in a significant decline of the lipid content and a complete depletion of the triglyceride reserve. Impact of pesticides on the lipid content has been studied by Baumler and Salama, (1976) [2] in the gypsy moth, *Porthretia dispar* and Patil, (1986) [3] in *Mythimna (Psedaletia) separata*. The pesticides are known to inhibit cholinesterase and hydrolases. Dimilin intoxication increased the lipid content [4] in the larvae of *Porthretia dispar*. Giese et al. (1967) [5] observed high lipid contents of the gonad at the time of most active gametogenesis in Pismo clam, *Tivela stultorum*. The major organic reserves, glycogen and lipid, declined in the hepatopancreas of *Scylla serrata* [6] during the period of reproductive activity and inclined in ovary.

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MATERIALS AND METHODS

The freshwater bivalves, *L. corrianus* and *P. cylindrica* were collected from Girna dam, Dist: Nasik, M.S. and were acclimatized to laboratory conditions for 4 days prior to experimentation. During experimentation *L. corrianus* and *P. cylindrica* showing apparent good health and movements were used for investigation. The animals were divided into five batches, two for acute and two for chronic exposures of chloramphenicol and one batch was maintained as control in each case.

Acute exposure to Chloramphenicol

The healthy bivalves, *L. corrianus* were exposed to acute treatment / lethal concentration ($LC_{50/2}$) of chloramphenicol 470.37PPM and for *Parreysia cylindrica* 369.09PPM. The treatment was given for 4 days.

Chronic exposure to Chloramphenicol

The acclimatized *L. corrianus* were exposed to chronic treatment / sub lethal concentration ($LC_{50/10}$) of 94.07 PPM in case of *L. corrianus* and 73.81 PPM in case of *P. cylindrica* up to 21 days. The total lipid content was estimated after 24 and 96 hours of acute

treatment and 7, 14 and 21 days of chronic treatment in the mantle, gills, foot, ovary, testis, digestive gland and whole body of the bivalves.

During exposure period, no special food was provided and the water with required concentration of antibiotic was changed daily in the experimental set and also from control. Control set was provided with dechlorinated water only without addition of chloramphenicol.

After 24 and 96 hours of acute and after 7, 14 and 21 days of chronic exposure, the mantle, gill, foot, testis, ovary, digestive gland and the whole flesh was isolated, blotted to remove excess water and dried in oven at 80 ^{0}C till constant weight was obtained. All tissues were ground separately into fine powdered form and total lipid contents were estimated. The results were expressed in mg per 100 mg of dry tissue. The % variations were also calculated to find out the antibiotic induced stress to the biochemical substances undertaken for study and the test of significance was applied.

Total lipid content was estimated by using Vanillin reagent and cholesterol as a standard.

RESULTS AND DISCUSSION

Tables 1 to 2 indicate changes in total lipid level of different tissues of *L. corrianus* and *P. cylindrica* on acute and chronic exposure to chloramphenicol. The maximum rise depicted in ovarian tissues (52.38 %) and in testis (46.55 %) after chronic exposure of chloramphenicol in *L. corrianus* and least increase in mantle (23.52 %) at the same sub lethal exposure. In case of *P. cylindrica* pronounced increase was 52.82 % in ovary and 41.86 % in testis at the lethal exposures. The sub lethal exposure raises the level in ovary up to 47.78% and also in the digestive gland (42.56 %) suggesting the gonads and digestive gland as important centers for lipogenesis.

Table 1. Impact of Chloramphenicol on lipid content (mg %) of *Lamellidens corrianus* after acute and chronic exposure.

Tissues	24 h		96 h		7 d		14 d		21 d	
	Control	Chlor	Control	Chlor	Control	Chlor	Control	Chlor	Control	Chlor
M	5.086 ±0.2980	5.964 ±0.222 +17.272***	5.120 ±0.2908	6.314 ±0.2880 .+23.333**	4.053 ±0.7695	4.728 ±0.7673 +16.666***	3.609 ±0.2908	4.267 ± 0.5817 +18.256***	4.011 ±0.5037	4.954 ±0.2936 +23.529*
G	5.827 ±0.7695	7.121 ±0.5037 +22.222*	5.654 ±0.2980	7.350 ±0.8728 +30.00*	5.129 ±0.998	5.470 ±0.886 +6.666NS	4.231 ±0.2986	5.003 ±0.5013 +18.256*	5.088 ±0.2866	6.868 ±0.2908 +34.999***
F	5.982 ±0.5817	6.296 ±0.7695 +5.263NS	5.999 ±0.2980	7.298 ±0.8728 +21.666*	5.558 ±0.2908	6.426 ±0.5037 +15.631*	6.677 ±1.007	8.584 ±0.2908 +28.571*	6.059 ±0.2980	7.841 ±1.007 +29.411*
O	14.561 ±1.716	19.159 ±2.332 +31.578**	14.212 ±1.332	21.088 ±0.08728 +48.387***	12.896 ±0.2908	17.302 ±3.771 +34.166NS	11.112 ±0.998	16.457 ±1.716 +48.108*	10.575 ±1.716	16.114 ±1.016 +52.389**
T	13.226 ±0.7695	14.912 ±1.332 +12.753*	12.771 ±1.332	15.718 ±1.716 +23.076*	11.058 ±1.007	15.112 ±0.5013 +36.666**	11.000 ±1.007	15.227 ±0.5013 +38.481***	11.279 ±0.2908	16.529 ±0.8998 +46.551***
F	5.982 ±0.5817	6.296 ±0.7695 +5.263NS	5.999 ±0.2980	7.298 ±0.8728 +21.666*	5.558 ±0.2908	6.426 ±0.5037 +15.631*	6.677 ±1.007	8.584 ±0.2908 +28.571*	6.059 ±0.2980	7.841 ±1.007 +29.411*
WB	8.261 ±1.332	10.165 ±2.195 +23.056NS	17.859 ±2.195	10.871 ±2.786 +38.333*	8.339 ±0.7695	10.584 ±1.332 +26.923*	8.878 ±0.2908	11.616 ±1.332 +30.843*	7.109 ±0.5712	9.309 ±0.5817 +30.956***
DG	9.056 ±1.007	11.003 ±0.2908 +21.505**	8.447 ±0.8753	11.262 ±0.5029 +33.333**	10.288 ±0.2986	11.928 ±1.051 +15.941*	9.356 ±0.7695	11.669 ±1.716 +24.731*	8.511 +0.2908	11.659 ±1.716 +36.999*

M = Mantle; G = Gill; F = Foot; O = Ovary; T = Testis; WB = Whole body; DG = Digestive gland.
Values are expressed as mg/100mg dry weight of tissue. ± indicates standard deviation of three independent replications.
+ Or - indicates % variation over control. Significance: * P < 0.05; ** P < 0.01; *** P 0.001; NS = Non-significant.

The different factors like age, sex, food supply, seasonal variations etc. influence the lipid content of the organisms. It was observed that the lipid contents increased when the animals came across the stressed conditions. Salama et al. (1976) [4] reported increased lipid content after dimilin intoxication in larvae of *Porthretia dispar*. Coley and Jensen (1973) [7] stated one of the reasons for lipid increase as inhibition of lipase activity after organophosphate treatment. Gabbot (1976) [8] described the transformation of glycogen into lipid through triose phosphate pathway as one of the causes for lipid elevation. Swami et al. (1983) [9] observed the same reason for lipid enhancement in *L. marginalis* after flodit and metacid treatment.

Bhagyalakshmi (1981) [10] in *Oziotelphusa senex senex*, Chaudhari (1988) [11] in *Bellamya bengalensis* and Zambare (1991) [12] in *Corbicula striatella* observed increase in lipid contents after pesticidal stress. The increase in lipid contents may be due to the production of corticosteroids to resist the toxic condition made by different chemicals [7]. The prominent reason to raise the lipid level may be the biotransformation of the other organic constituents like carbohydrates and proteins into lipid and the cease of lipolytic enzyme activity. The results are in accordance with the results of the work of Verma and Tonk (1983) [13] found in *Notopterus notopterus* on exposure of sublethal concentrations of mercury chloride.

The anaerobic or hypoxic conditions also lead toward the lipid synthesis as shown by Hochachka et al. (1973) [14] in molluscs. The effect of starvation (nutritive stress) in *Tapes philippinarum* as studied by Caers et al. (2000) [15] indicated that the clams lost 26 % of their initial total lipid contents.

Table 2. Impact of Chloramphenicol on lipid content (mg %) of *Parreysia cylindrica* after acute and chronic exposure.

Tissues	24 h		96 h		7 d		14 d		21 d	
	Control	Chlor	Control	Chlor	Control	Chlor	Control	Chlor	Control	Chlor
M	4.060 ±0.2103	4.599 ±0.2980 +13.279**	4.039 ±0.1379	4.839 ±0.5037 .+19.823*	3.539 ±0.1375	3.928 ±0.2880 +11.000*	3.418 ±0.879	4.937 ±0.3771 +44.444*	4.235 ±0.210	5.223 ±0.5817 +23.333*
G	5.422 ±0.0791	6.404 ±0.2908 +18.129*	5.361 ±0.2103	6.933 ±1.007 +29.333**	5.849 ±0.079	6.763 ±0.633 +15.635*	6.222 ±0.796	7.219 ±0.581 +16.028*	5.749 ±0.1375	7.258 ±0.7673 +26.263*
F	6.204 ±0.1379	6.715 ±0.5817 +8.250NS	6.229 ±0.2103	7.331 ±0.2908 +17.692***	7.568 ±0.2103	8.364 ±0.5817 +10.526*	8.156 ±0.505	9.186 ±0.0 +12.631*	8.085 ±0.079	9.650 ±1.332 +19.368**
O	13.129 ±0.7688	16.629 ±0.2866 +26.666**	12.497 ±1.332	19.848 ±1.716 +58.823***	10.028 ±0.8179	12.256 ±1.332 +22.222*	9.878 ±0.1375	13.642 ±1.007 +38.107**	8.784 ±0.8179	12.981 ±1.716 +47.789**
T	10.559 ±0.5817	12.124 ±0.5772 +14.823***	10.851 ±0.7719	15.393 ±2.195 +41.866*	9.491 ±0.7695	10.695 ±1.332 +12.688NS	8.022 ±0.5037	9.265 ±0.7695 +15.499*	8.151 ±1.267	9.667 ±0.5053 +18.604*
WB	7.459 ±1.048	8.950 ±1.538 +20.00NS	7.129 ±0.5817	8.277 ±2.035 +30.142NS	8.917 ±0.2936	11.260 ±1.716 +26.285*	6.814 ±0.2936	8.864 ±1.051 +30.090*	6.159 ±0.8179	7.945 ±0.1014 +29.00*
DG	8.602 ±1.332	9.976 ±0.7673 +15.978NS	8.381 ±0.5021	11.597 ±0.8753 +38.384***	8.819 ±0.8179	10.639 ±1.007 +20.647**	7.574 ±0.5035	10.170 ±1.332 +34.285*	5.218 ±0.562	7.439 ±0.2908 +42.568*

M = Mantle; G = Gill; F = Foot; O = Ovary; T = Testis; WB = Whole body; DG = Digestive gland.
Values are expressed as mg/100mg dry weight of tissue. ± indicates standard deviation of three independent replications.
+ or - indicates % variation over control. Significance: * P < 0.05; ** P < 0.01; *** P 0.001; NS = Non-significant.

The results obtained in present study are in agreement of most of the above observations and showed proportionate increase in the lipid contents with the period of exposure to chloramphenicol.

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