

Effect of Profenophos on the biochemical composition of *Catla catla* fingerlings

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Abstract

The fingerlings of *Catla catla* were exposed to sublethal concentrations of profenophos (10% and 30% SLC of 96 hrs LC₅₀) for a period of 10, 20 and 30 days. The alteration in biochemical composition (carbohydrate, protein and lipid) of gill, intestine, kidney, liver and muscle tissues were investigated. In the biochemical study, values of carbohydrate, protein and lipid content showed a gradual decrease with increase in dose of profenophos and exposure periods.

Keywords: *Catla catla* fingerlings, biochemical parameters, Profenophos

Introduction

The use of agrochemicals is essential to control and eradicate pests that cause damage to agriculture crops and increasing food production for the universal population (A1-Mamum, 2017) [1]. Pesticides are classified as carbamates, organochlorine, organophosphorus and pyrethroids based upon their chemical composition. (Pesticide Management Division, 2018) [22]. Pesticides enter aquatic and terrestrial environments through spray drift, surface water runoff, industrial discharge and leaching from agricultural fields. Pesticides are lipophilic and accumulate in the fatty tissues of aquatic organisms and increase in concentration of food chain and reduces the population levels of aquatic organisms such as plankton, fishes and other higher aquatic organisms which are essential for the aquatic food chain.

Globally, serious concerns have been raised about the existence of these toxic agrochemicals in aquatic forms, which can ultimately pose a serious threat to the human society. The nutritional value of fish depends on its biochemical composition. Several authors have reported toxic effects of various pesticides on biochemical composition of different fish species (Prakriti Verma *et al.*, 2014; Padmavathi *et al.*, 2017; Muthukumaravel *et al.*, 2013; Sathick *et al.*, 2019; Paithane *et al.*, 2021; Reshman Yasmin, 2024^[17, 18, 20, 25, 28] and Greeshma Varma *et al.*, 2025^[8]). In the present study an attempt is made to know the effect of profenophos on the biochemical composition freshwater fish *Catla catla* fingerlings.

Materials and Methods

The fish, *Catla catla* fingerlings (weight 5-6g ; Length 5-6cm) were collected from Aqua Farm near Pattukkottai, Tamil Nadu. They were acclimatized for a period of 10 days in large cement tanks. Previously washed with 1% KMnO₄. (Temperature 28 ± 2°C; total hardness 518 ± 23 mg/l ; pH 7.6 ± 0.02 ; dissolved oxygen 5.5 ± 0.3 mg/l and salinity 1.1 ± 0.12 ppt). The water is renewed every 24 hours. The LC₅₀ of profenophos for 96 hour was found out by using profit method (Finney, 1971) [5]. For biochemical studies *Catla catla* were reared in sub lethal concentrations (10% and 30% of 96 hours LC₅₀ 0.26 ppm) for a period of 10, 20 and 30 days. The total carbohydrate, protein and lipids were estimated by Roe (1955), Lowery *et al.*(1951) [15, 26] and Fokh *et al.*(1957) respectively.

Result and Discussion

Result

Carbohydrate

The pesticide, profenophos appeared to cause individually, pronounced dose and time dependent decrease in the carbohydrate content of all tested tissues (Fig.1-5) on day 30, the carbohydrate content of *Catla catla* was found to decrease respectively by 26.31%, 68.01% in gill, 52.52%, 62.62 in intestine, 47.56%, 58.53% in kidney, 47.71%, 70.59% in liver and 47.90% 67.02% in the muscle of fish exposed to 10% and 30% sublethal concentration of profenophos. In the present study, the highest depletion of carbohydrate content was noted after 30 days of profenophos exposure to the 30% sublethal concentration.

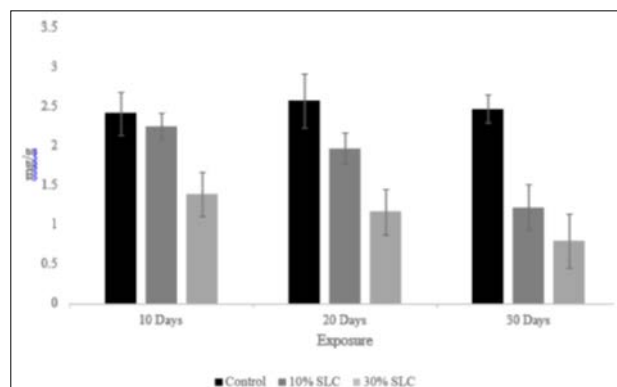


Fig 1: Levels of carbohydrate in gill of *Catla catla* exposed to sublethal concentrations of profenophos

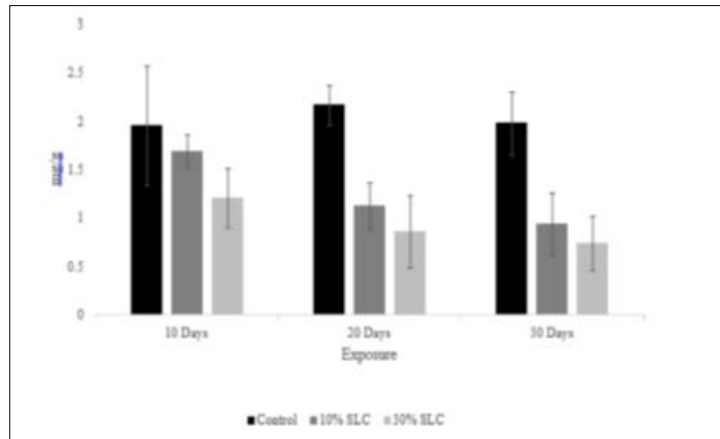


Fig 2: Levels of carbohydrate in intestine of *Catla catla* exposed to sublethal concentrations of profenophos

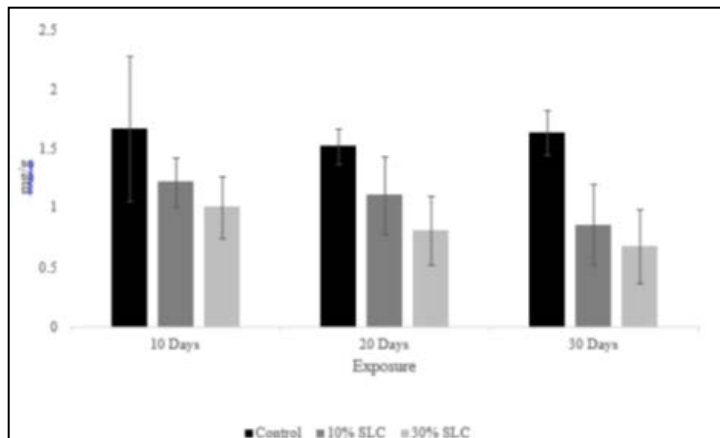


Fig 3: Levels of carbohydrate in kidney of *Catla catla* exposed to sublethal concentrations of profenophos

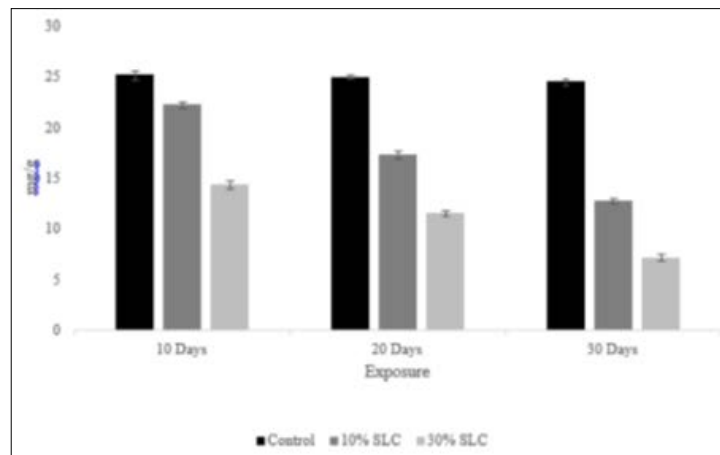


Fig 4: Levels of carbohydrate in kidney of *Catla catla* exposed to sublethal concentrations of profenophos

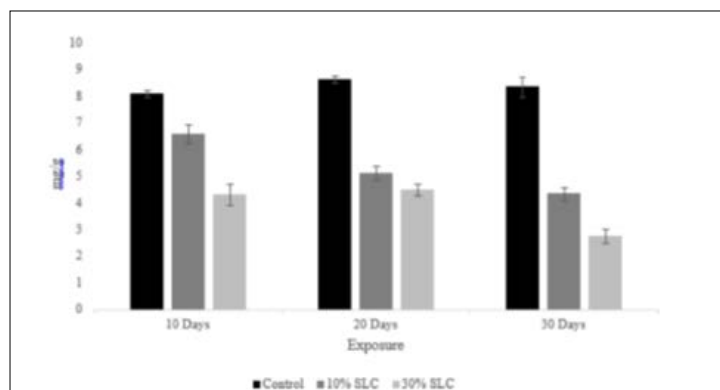


Fig 5: Levels of carbohydrate in muscle of *Catla catla* exposed to sublethal concentrations of profenophos

Protein

Decrease in protein content was noted in all tissues of *Catla catla* exposed to the sublethal concentrations of profenophos. (Fig 6-10) The maximum decrease in protein content was observed in the tissues of fish exposed to the

10% and 30% sublethal concentrations of pesticide reared for 30 days. 61.38 and 76.97% in gill, 49.90 and 62.53% in intestine, 57.46 and 75.60% in kidney, 59.05 and 76.26% in liver and 66.64 and 83.68% in muscle respectively.

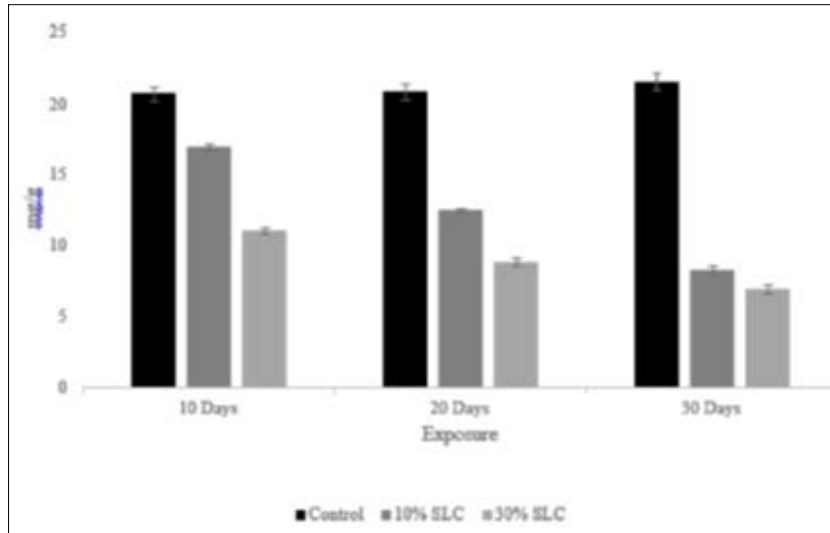


Fig 6: Levels of total protein in gill of *Catla catla* exposed to sublethal concentrations of profenophos

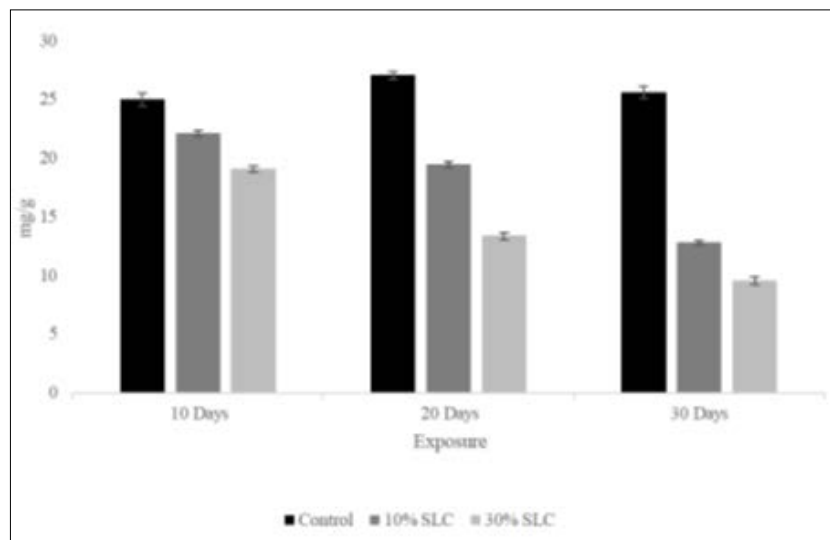


Fig 7: Levels of total protein in intestine of *Catla catla* exposed to sublethal concentrations of profenophos

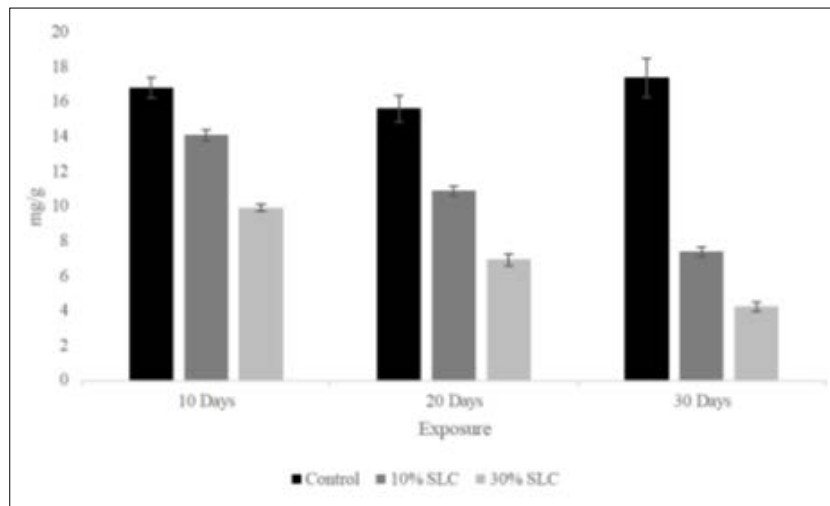


Fig 8: Levels of total protein in kidney of *Catla catla* exposed to sublethal concentrations of profenophos

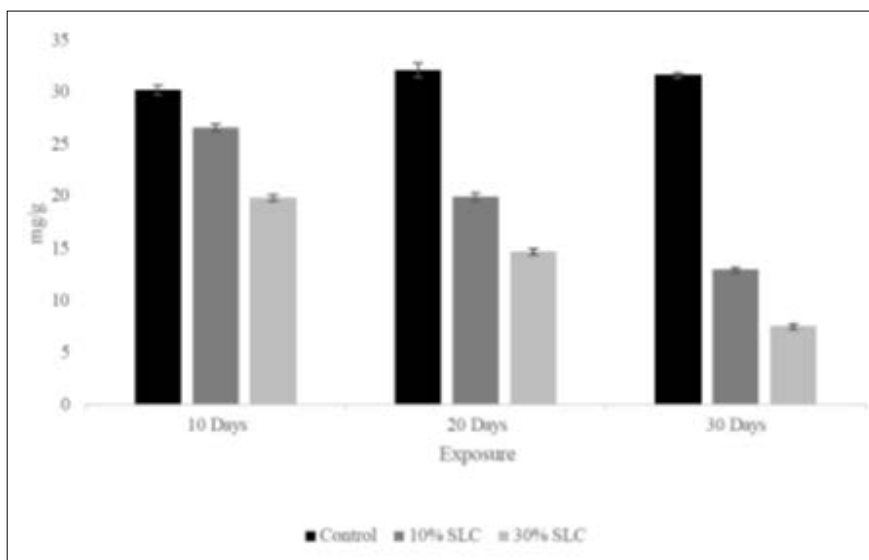


Fig 9: Levels of total protein in liver of *Catla catla* exposed to sublethal concentrations of profenophos

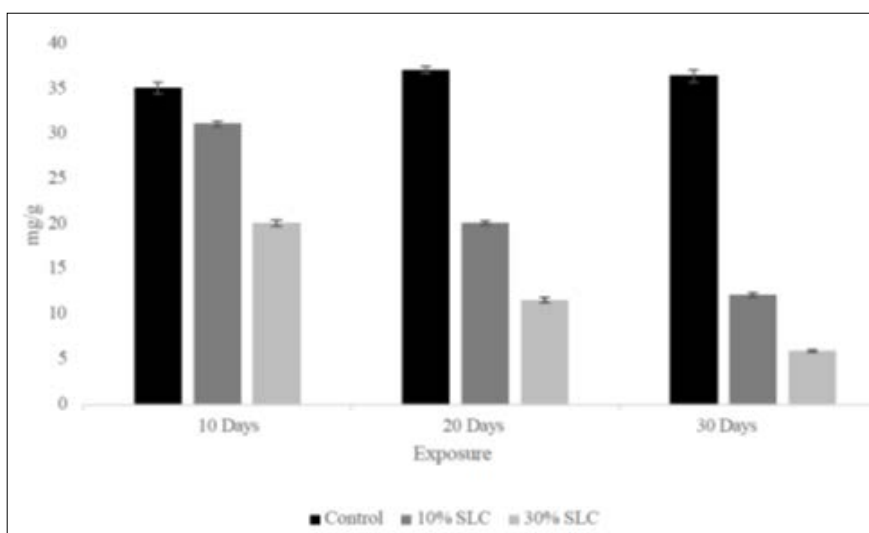


Fig 10: Levels of total protein in muscle of *Catla catla* exposed to sublethal concentrations of profenophos

Lipid

In fish exposed to the sublethal concentrations of profenophos (10 and 30%) for 30 days, the amount of lipid decreased to 38.86 and 60.22 in gill, 43.36 and 51.83% in

intestine, 47.29 and 68.11% in kidney, 38.05 and 63.93% in liver and 30.69 and 70.40% in muscle respectively. In general, the decrease in lipid content was pronounced dose and time dependent. (Fig.11 - 15)

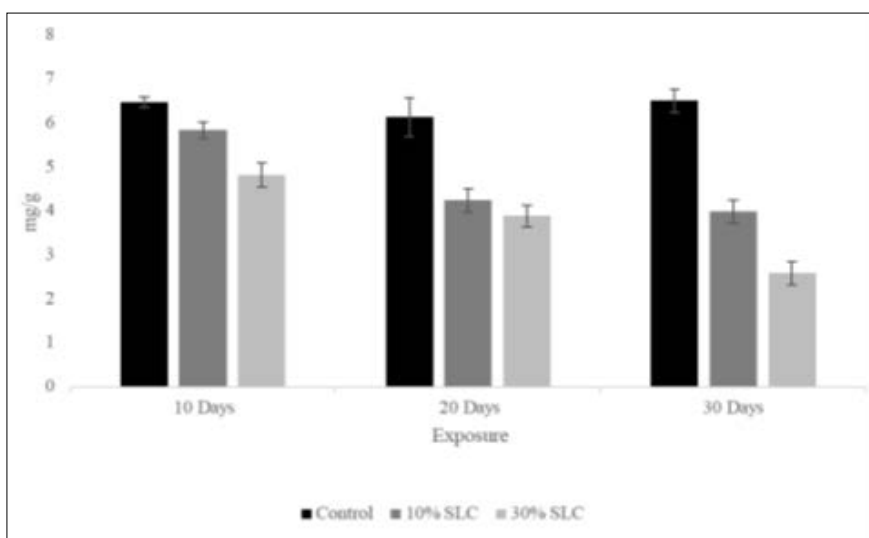


Fig 11: Levels of total lipid in gill of *Catla catla* exposed to sublethal concentrations of profenophos

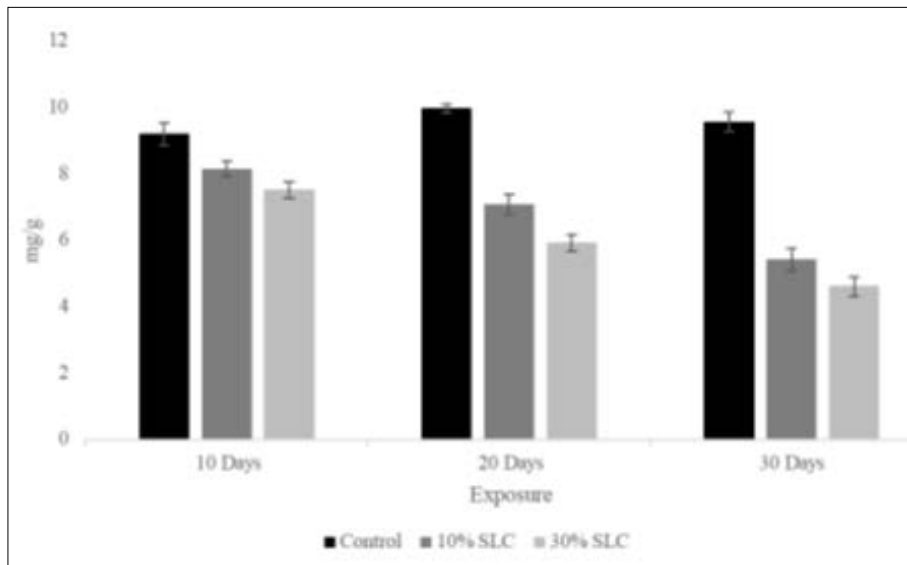


Fig 12: Levels of total lipid in intestine of *Catla catla* exposed to sublethal concentrations of profenophos

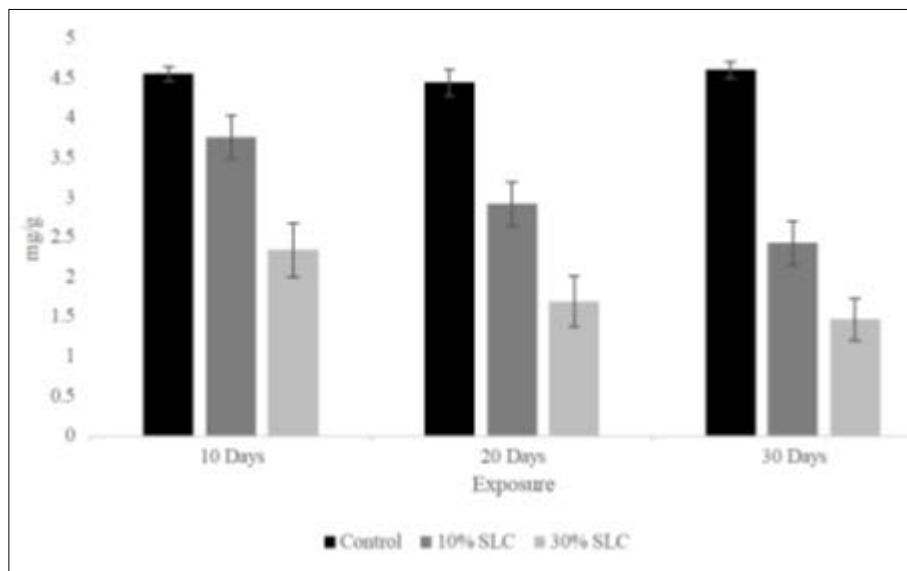


Fig 13: Levels of total lipid in kidney of *Catla catla* exposed to sublethal concentrations of profenophos

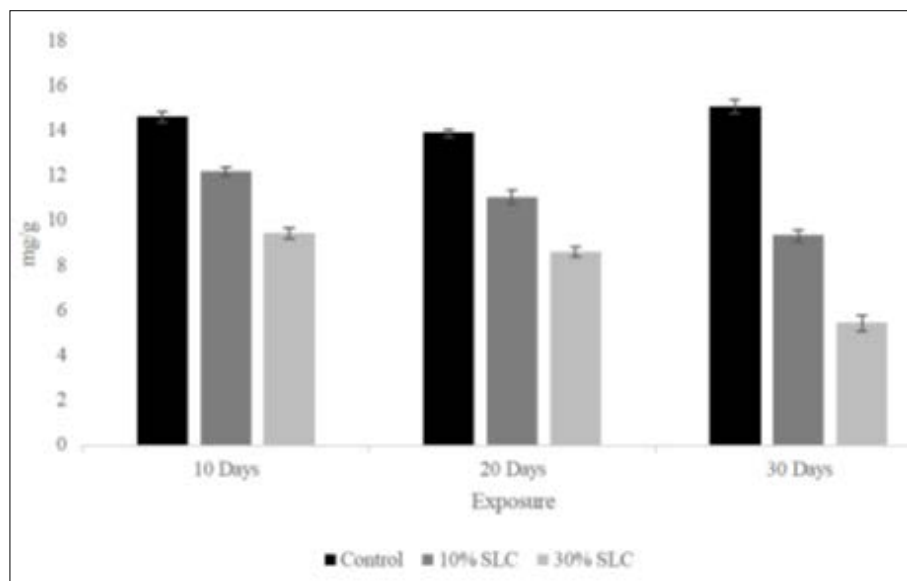


Fig 14: Levels of total lipid in liver of *Catla catla* exposed to sublethal concentrations of profenophos

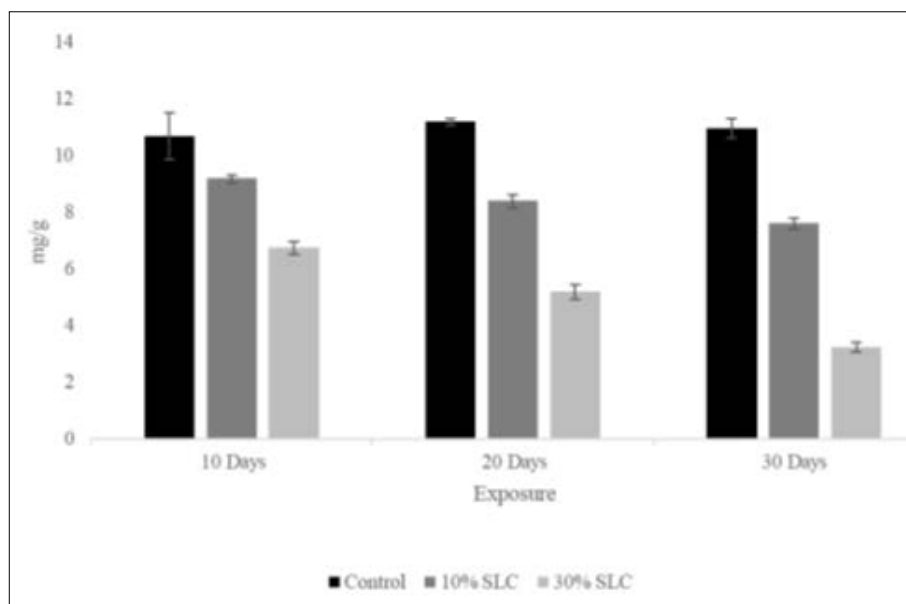


Fig 15: Levels of total lipid in muscle of *Catla catla* exposed to sublethal concentrations of profenophos

Discussion

In the present study the carbohydrate content decreased in the gill, intestine, kidney, liver and muscle tissues of *Catla catla* exposed to sublethal concentrations of profenophos. Thenmozhi *et al.*(2011) [30] observed a fall in liver and muscle glycogen level in *Labeo rohita* when exposed to pesticide malathion. Padmini Kadam and Rajaram Patil (2015) [19] reported decrease in glycogen content of liver and kidney in *Channa gachua* after exposure of Chlorpyrifos. Padmavathi *et al.*(2017) [18] recorded decrease in carbohydrate content of *Mystus vittatus* exposed to sublethal concentrations of cypermethrin. Rajasekar *et al.* (2021) [24] observed decreased carbohydrate content in the gill, liver, kidney, intestine and muscle of *Channa striata* exposed to monocrotophos. Saphia Ali (2023) [27] reported that in *Barbus luteus*, quantitative variations in the glycogen content of tissues due to parathion exposure. These observations were in conformity with the reports on the fall in muscle, gill, liver and kidney glycogen level in *Rasbora daniconius*, exposed to pesticide, dimethoate (Lokhande, 2024) [14].

Proteins are mainly involved in the architecture of the cell. Since fish have a very little amount of carbohydrates, the next alternative source of energy is the protein to meet the increased energy demand. The depletion of protein content in gill, liver and muscle tissues may have been due to their degradation and possible utilization of degraded products for metabolic purposes. In this present study the protein content of *Catla catla* at sublethal concentration decreased in all exposure periods. Ganeshwade (2011) [7] reported depletion in the protein content in liver of *Puntius ticto* exposed to pesticide dimethoate. Prakriti Verma *et al.* (2014) recorded decrease in protein content of *Clarias batrachus* exposed to sublethal concentrations of Rogor. A significant decrease has been reported in the protein content of the ovary, brain, intestine muscles, gill and liver in *Catla catla*, when exposed to pesticide Azodrin (Janardana Reddy *et al.*, 2016) [9].

A similar decrease in the total protein content has been observed with dimercon in fish, *Labeo rohita* (Janardana Reddy *et al.*, 2016). Paithane *et al.* (2021) [10, 20] noted decrease in total protein content of liver, gill and muscle of *Channa punctatus* exposed to sublethal concentrations of

dimethoate. Paithane *et al.*(2021). Paithane *et al.*(2021) [20, 21] also noted decrease in total protein content of *Puntius ticto* exposed to insecticide dimethoate. Muhammad Amin *et al.*(2022) [16] observed the decreased levels of protein in brain, gills and muscle tissues of *Oreochromis niloticus* exposed to pesticides chlorpyrifos, malathion and lambda cyhalothrin. Greeshma varma *et al.*(2025) [8] observed that the sublethal concentration of chlorphrifos showed a decrease in serum total protein of *Labeo rohita*.

Lipid is an important constituent of animal tissue, which plays a prime role in energy metabolism. In the present study, a gradual decrease in lipid content in various tissues of *Catla catla* after chronic exposure of pesticide profenophos. Joselinfreeda and Venkadesh (2018) [11] observed the effect of phosphamidon on *Labeo rohita* and reported that lipid content was decreased in liver, muscle and intestine. Similar decrease in lipid content level has been observed by Shruti S. Gijare *et al.*(2011) [29] in *Ophiocephalus punctatus* when exposed to cypermethrin. Reshman Yasmin (2024) [25] reported significant decrease in lipid content of *Channa gachua* when exposed to pesticides metacid 50 and dithane M-45 and their mixture. Kashid Tanaji *et al.*(2019) [12] recorded the considerable decrease in total lipid content in liver tissues of *Mystus seenghala* exposed to Methomyl. Reduction of lipid content of *Catla catla* in this study may have been due to the utilization of lipids for energy demand under stress condition.

Conclusion

Results of the present study clearly revealed that the pesticide profenophos can alter the biochemical composition of *Catla catla* fingerlings and it can be used as non specific biomarkers in pesticide contaminated aquatic environment.

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