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# Gill and Muscles abrasion associated with exposure to malathion in fresh water fish

***Vishal Rajput, Sukriti Badola and Richa Gaur[1]**

Department of Biochemistry and Biotechnology,

[1]Department of Pharmaceutical Sciences,

SBS University, DEHRADUN (UK) INDIA

*Corresponding Author

E-mail : drvishalrajput6677@gmail.com

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## ABSTRACT

Malathion has a long range of application in agriculture, which leads its accumulation in animal tissues and may influence biochemical balance of aquatic organisms. Present study on fish gills and muscles has remarkable potential in understanding the adverse effect of selected toxicant on the biochemical and structural integrity of tissues. Twelve fingerlings were exposed to $LC_{50}$ (406 ìg/L) concentration of malathion over a period of 96hrs. Periodic exposure of malathion at $24^{th}$, $48^{th}$, 72th and $96^{th}$ hr, resulted in the form of reduction in gills protein content (-13.99%), (-18.56%), (-33.90%) and (48.14%) respectively. On other hand, in muscles similar reductive pattern of protein content was recorded as (-8.25 %), (-26.37%), (-25.82%) and (-43.58%). Such negative protein alterations may be used as potential biomarker for pesticide toxicity in fresh water ecosystem.

Figures : 03 References : 15 Tables : 02

KEY WORDS : Freshwater catfish, Pesticide, Protein, Toxicity.

## Introduction

Use of pesticides has increased worldwide to fulfill the ever increasing need of agricultural yield, as pesticides control the spread of harmful pests. This increased use of pesticides has caused multiple environmental issues negatively affecting the structure and health of ecosystems[8]. Pesticides used to spray on crop, blend in aquatic ecosystem with runoff water flow. Pesticides exhibit a province of toxicity on the fresh water fishes and other organisms, such toxicity may result in the form of metabolic disturbance[12]. Aquatic organisms are highly unguarded against aquatic toxicants as they share same environment in close proximity. Toxicity driven by pesticides, lies in the fact that pesticides not only cumulate in the aquatic environment but accumulate in the metabolism of the organisms. Such accumulation may exhibit in the shape of alterations at various levels of metabolic activities. Malathion has a long range of application in agriculture, which leads its accumulation in animal tissues and presence of malathion also influences the physico-chemical aspects of surrounding waters as well as the biochemical balance[3]. Malathion enters the aquatic system due to its extensive application in agriculture. Malathion exhibits a range of toxicity and causes moderate toxicity in fish at various functional biochemical levels, when its accumulation in surrounding environment increases. Extensive study on fish gills and muscles has remarkable potential in understanding the adverse effect of toxicants on the biochemical and structural integrity of system at cellular level[2]. Noticeable distress in respiration is considered as the initial manifestation of pesticide toxicity. Such toxicity may arise in the form of bioaccumulation of pesticide in the tissues of organism and their further binding with biological constituents of metabolism such as fatty acids, enzymes, iso-enzymes and proteins[10]. Fresh and marine fishes have remarkable potential to cater the need of sensitive bio-indicator and may help in explaining the mechanism of stress caused by toxicants. This area of research still lacks frequent studies, which implicates the interrelated effect of toxicity on the histology, physiology and biochemistry of aquatic ecosystem. To update information regarding aquatic toxicology, a systematic analysis was commenced on *Clarias batrachus*, as sub-lethal concentration of malathion was employed on selected fish to establish potential biochemical biomarker.

## Material and Methods

### Collection of Fish

The healthy samples of *Clarias batrachus* were

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**TABLE-1 : Effect of malathion on protein content in gills of *Clarias batrachus***

| Exposure slot (h) | Control ±SD (mg/100mg wet weight) | Treated ±SD (mg/100mg wet weight) | Percent change |
|---|---|---|---|
| 24 | 24.86±2.56 | 21.38±3.54 | -13.99 |
| 48 | 24.18±3.12 | 19.69±2.85 | -18.56 |
| 72 | 25.48±2.59 | 16.84±2.49 | -33.90 |
| 96 | 24.59±3.48 | 12.75±2.88 | -48.14 |

made available from local support. The samples were transported from collection site in oxygenated polythene bags kept in poly(1-phenylethene) boxes. After reaching the laboratory, samples were immediately shifted into holding tanks of 25 liter filled with well-aerated un-chlorinated water. Samples were examined to check any pathological symptoms and removed if any infected sample was observed. Fishes were fed rice bran *ad libitum* during the course of acclimatization period. Fishes exhibiting healthy and active movements were selected for the study. The stock solution was prepared by dissolving malathion in double distilled water. Samples fingerlings measuring 10.3-12.6 cm in length and weight 18.3-21.7 g were used in experiment and with no sexual distinction. Fingerlings were kept on starvation for 24 hrs prior to exposure. During the course of experiment, holding tanks were cleaned to eliminate residual deposition of the walls. Samples were regularly monitored for any behavioral alteration and fingerling failed to respond to tactile stimulation was considered dead and immediately removed with the help of handled net.

**Biochemical markers**

Twelve fingerlings completed the course of experiment, exposed to $LC_{50}$ (406 ìg/L)[15] concentration of malathion over a period of 96hrs. Separate untreated control group was also maintained in identical conditions. Fingerlings were dissected at every $24^{th}$h, dissected gills and muscles were extracted. Further tissues were examined for determination of biochemical biomarkers as protein content, wet weight tissue were used and analyzed at 2-4$^0$C under the guidance of standard protocols[9].

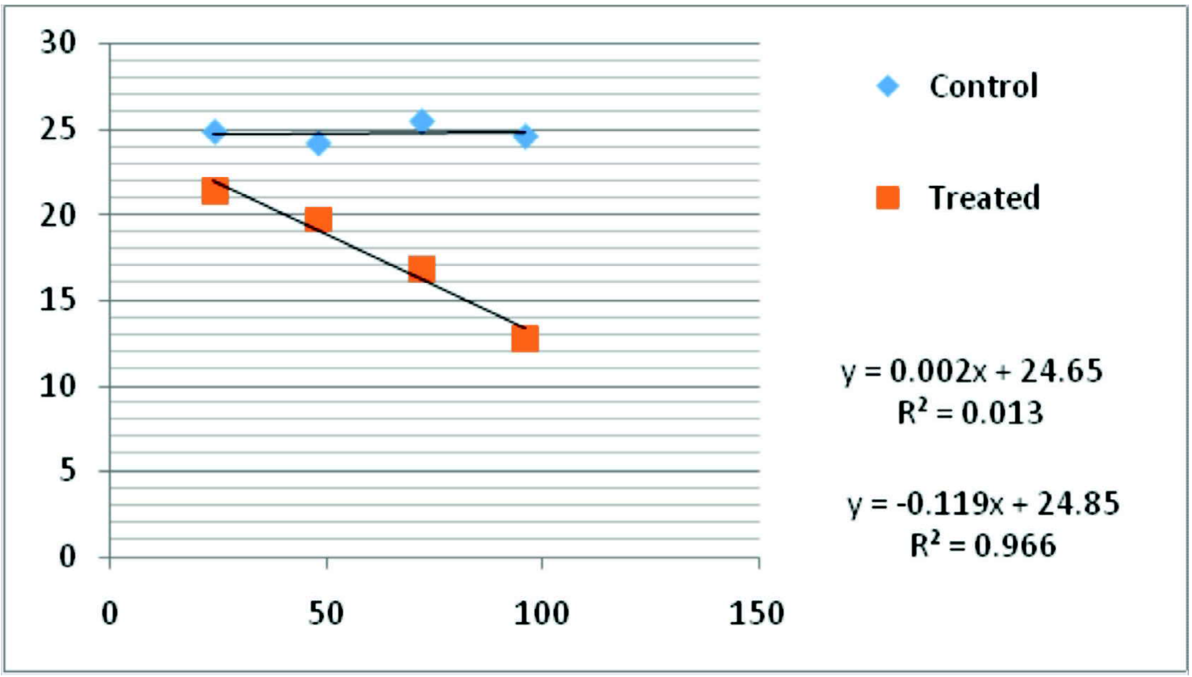



**Fig. 1 : Effect of malathion on protein content (gills) at $24^{th}$, $48^{th}$, 72th and $96^{th}$ hr of exposure on *Clarias batrachus***

**TABLE-2 : Effect of malathion on protein content in muscles of *Clarias batrachus***

| Exposure slot (h) | Control ±SD (mg/100mg wet weight) | Treated ±SD (mg/100mg wet weight) | Percent change |
|---|---|---|---|
| 24 | 19.28±5.38 | 17.69±3.42 | -8.24 |
| 48 | 20.74±4.72 | 15.27±6.84 | -26.37 |
| 72 | 19.67±3.65 | 14.59±3.87 | -25.82 |
| 96 | 20.33±4.65 | 11.47±2.56 | -43.58 |

## Result and Discussion

### Protein content

#### Gills

Data assembled in Table-1 exhibit the Protein content in gills of *Clarias batrachus* exposed to sub-lethal dose of malathion. The protein content in the gills of selected fish recorded as 21.38 mg/100mg at 24$^{th}$ hr of exposure, 19.69 mg/100mg at 48$^{th}$ hr of exposure, 16.84 mg/100mg at 72$^{nd}$ hr of exposure and 12.75 mg/100mg at 96$^{th}$ hr of exposure at sub-lethal level, exhibiting a decrease of -13.99 %, -18.56%, -33.90% and -48.14%, respectively.

#### Muscles

Reduction in protein content was recorded in muscle of the fish treated sub lethal concentration of malathion. Table 2 exhibits the protein content in muscle of selected fish reported as 17.69 mg/100mg at 24$^{th}$ hr of exposure, 15.27 mg/100mg at 48$^{th}$ hr of exposure, 14.59 mg/100mg at 72$^{nd}$ hr of exposure and 11.47 mg/100mg at 96$^{th}$ hr of exposure, at sub-lethal dose, reporting reduction of -8.25 %, -26.37%, -25.82% and -43.58%, respectively. All the data were Statistically analyzed with 't' test at sub-lethal concentration of Carbendazim and found significant ($p<0.05$) at the completion of dosing period.

On the basis of findings, it is evident (Figs. 1-3) that malathion is toxic and may alter the biochemical equilibrium of test organism. Protein content in gills and muscle of catfish after the treatment of toxicant exhibit positive and linear correlation regarding the concentration and exposure time of toxicant. This negative biochemical

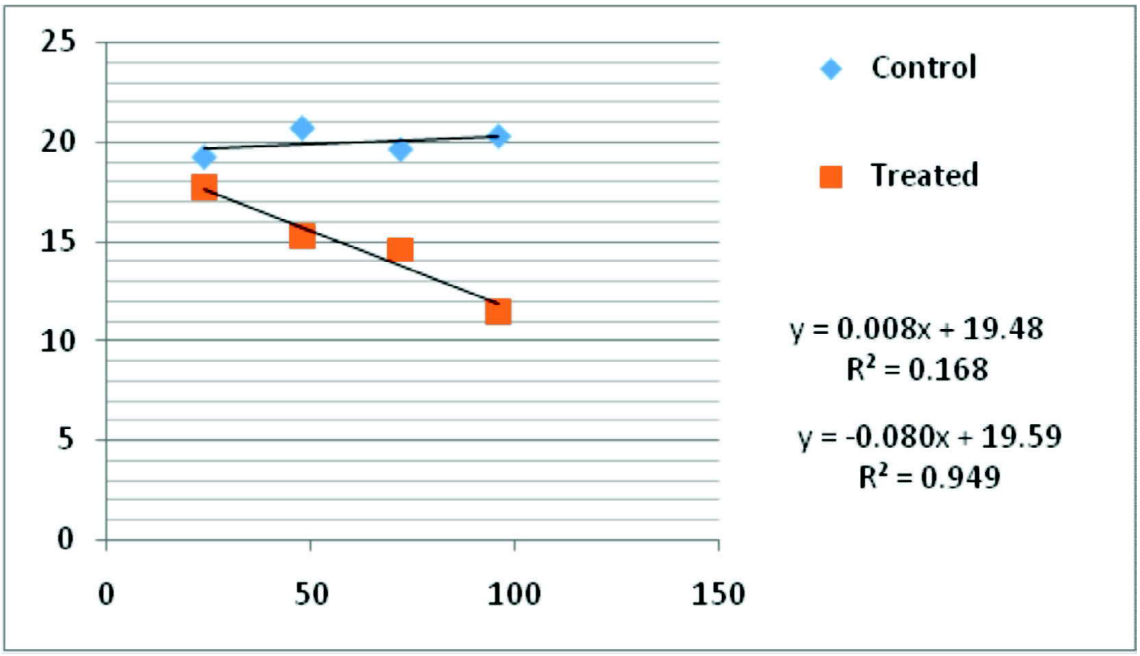
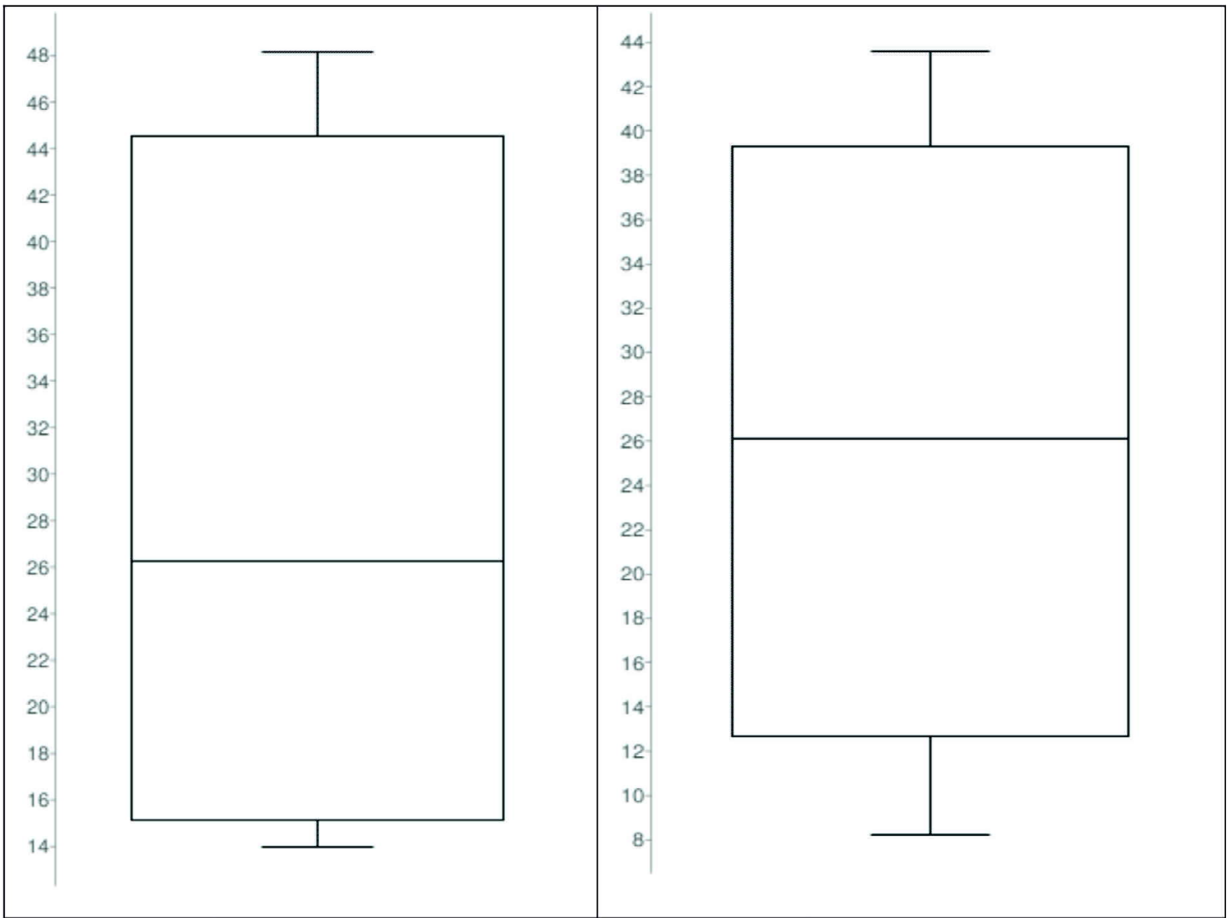



**Fig. 2 : Effect of malathion on protein content (muscles) at 24$^{th}$, 48$^{th}$, 72th and 96$^{th}$ hr of exposure on *Clarias batrachus***




| | |
|---|---|
| Median: 26.23; I$^{st}$ quartile: 15.13 | Median: 26.09; I$^{st}$ quartile: 12.63 |
| II$^{nd}$ quartile: 44.58; Inter quartile: 29.44 | III$^{rd}$ quartile: 39.27; Inter quartile: 26.64 |

**Fig. 3 : Box plot analysis of protein content (gills & muscles) depletion percentage in *Clarias batrachus***

alteration in protein content depends on duration and dose[6,7,11].

Malathion content of *Clarias batrachus* recorded depleted due to pesticide toxicity. Supporting trends were also recorded in other studies on various pesticides. Evidently malathion has been reported to be responsible for the impairment of glycolysis[14]. Noticeable reduction in protein content and phosphocreatine in white muscles was reported in *Salmo trutta* exposed to sub-lethal dose of pesticide[8]. Such depleted levels of protein in aquatic organisms proves their involvement in the endogenous derivation of heat during stress. Sudden depletion of muscle and gills, protein level may have been to fulfill the energy needs of fish under string toxic stress was recorded[12,13]. Such behavior of protein may be considered as a biomarker to malathion toxicity. Supporting tissue protein depletion was recorded in present observation (Tables 1-2), such phenomenon may have been occurred due to the protein utilization in cell repair and organization of tissue[1,5]. Toxic stress of malathion may have been responsible for such reduction of protein content as malathion may bind with biological constitutes of the tissue, such as fatty acids, enzymes, iso-enzymes and protein [4,15].

On the basis of these findings, it may be concluded that protein content under pesticide toxicity in fish may be effectively employed as biomarker for further assessment of toxicological biomonitoring of aquatic environment.

## Conclusion

Malathion is reported to be toxic on *Clarias batrachus* and induced negative alterations in the gills and muscles. Further noticeable metabolic reduction was reported as biochemical constituent protein exhibit negative linear changes. The occurrence of protein alterations may be used as potential biomarker for pesticide toxicity in fresh water ecosystem.

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