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Letter of Appreciation

To,
Dr. B. S. Kamble
Asst. Professor
Department of Zoology
Maharashtra Udaygiri Mahavidyalaya,
Udgir Dist. Lature.

Subject: Letter of Appreciation

Dear Sir,

We are grateful to you for delivering an enlightening lecture to create interest in Zoology on **Mammalian physiology**, at the Department of Zoology, Kai. Rasika Mahavidyalaya, Deoni . We hope to have your positive response in future too.

Thanking you,

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Research Article.....

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Respiratory Metabolism affected by mercuric chloride and aluminum sulfate in freshwater Catfish, *Clarias batrachus*

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ABSTRACT

Industries are the major sources of heavy metal pollution and it is released into water and soil. Heavy metals cause several ill effects to aquatic living organisms and environment (Muneeshkumar *et al.,* 2015). In recent work we present the knowledge and adverse effects of man-made activities such as industrial development throughout the world. Industrial waste contains amount of hazardous metals mix-up with the nearby water bodies and damage to the tissue of fishes and finally causing death. Respiration is one of the most vital physiological parameters on which many of the vital functions like growth as well as reproduction of fishes depends. Respiration is an important physiological body activity for each and every animal. Similar weighted catfishes *Clarias batrachus* were chosen for the study of respiration. They were found in the muddy fields of water which have barbles. The selected fishes were experimented with lethal concentration of both the compounds in the laboratory for two days. Winkler's method was used to measure the respiratory mechanism (Welsh and Smith, 1959). In this investigation it was found that the gradual descending trend of oxygen consumption when exposed to mercuric chloride and aluminum sulfate for 96 hrs. Alterations in oxygen consumption may be due to respiratory distress as a consequence of impairment in oxidative metabolism.

KEYWORDS

Mercuric Chloride, Aluminum Sulfate, *Clarias Batrachus*, Oxygen Consumption

HOW TO CITE THIS ARTICLE

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The problem of pollution of the water where the wastes are usually discharged has increased to a great extent in recent years. Aquatic life is strongly influenced by physical properties of a water body. It is known that heavy metals as well as agro-pollutants are potentially harmful to the aquatic lives. All pesticides applied for the pest control eventually pollute the water resources either in their original chemical form or in some degraded variety. On the other hand, all industries discharge their effluents indiscriminately in the adjoining water areas and frequently cause serious hazards to aquatic life.

Among the aqua fauna, fishes are affected to a significant extent (Muneeshkumar *et al.,* 2015). The consumption of aquatic oxygen in fishes is one of the most important tests to observe the entry of toxicant into the body of fishes. Use of recently developed chemicals and industrial wastes are well known for the adverse effects on the aquatic organisms. The toxicity of metal generally affects the central nervous system and extending towards the stress on physiological status of the fish. This physiological stress and status can be determined by the estimation of biochemical effects.

This change in physiological form causes the increase in the consumption of the oxygen for more work by the body of fish finally which leads to imbalance in the natural status of fish. In aquatic animals particularly in fishes, gills are the main respiratory organ. Water bore toxic contaminants damages initially to gills of fishes. Saroja (1959) literature review found that in aquatic ecosystem when contaminated by toxic pollutants it relates with the concentration of pollutants to which that much attention has not given. In the present study focus was given on respiratory study through oxygen consumption of *Clarias batrachus* when exposed to mercuric chloride and aluminum sulfate with different time period of 24 hrs, 48 hrs, 72 hrs, and 96 hrs.

Materials and Methods

All same sized (180-200 gm) weight of healthy freshwater *Clarias batrachus* test fishes were collected from the fisher man, Nanded. In order to their good settlement they were brought to the laboratory, cleaned by using 0.1% KMno4 to avoid dermal infection. The fishes then were made to settle for or aaclimatized15 days and later they were used for experimental work. The fishes were offered the small pieces of earthworm, rice or wheat flour balls. The fishes were exposed to mercuric chloride and aluminum sulfate concentrations. The respiratory metabolic function was measured by "Winkler's Method" (Welsh and Smith, 1959). For analysis of oxygen content from the sample, dark bottles having inlet and outlet for control separate bottles were used.

The selected animals were kept in a chamber and sample was collected for the estimation of oxygen. Sufficient time was given to the animal for both control and experimental. Then the samples were collected and analyzed for the oxygen uptake the difference between initial and final oxygen content was determined. The freshwater experimented catfish *Clarias batrachus* showed fluctuation in oxygen consumption uptake and oxygen after treating with mercuric chloride and aluminum sulfate up to 96 hours. The present observation show that due to the effect of mercuric chloride on oxygen consumption of catfish , it was recorded as 2.82, 2.19, 1.71 and 1.05 ml (C.C.) of O_2/ catfish/ hr. at the time of 24, 48, 72 and 96 hrs respectively in experimented group. In control group oxygen consumption was 3.17 ml (C.C.) of O_2/ catfish/ hr. which indicate that the descending order when compare with the normal group. The freshwater fish *Clarias batrachus* showed variations in total oxygen consumption of mercuric chloride and aluminum sulphte up to 96 hours. In present investigation total oxygen consumption of fish to the effect of aluminum sulfate was 2.51, 2.11, 1.71 and 0.98 ml (C.C.) of O_2/ animal/ hr. during 24, 48, 72 and 96 hours respectively in treated group. In control group total oxygen consumption was 2.98 ml (C.C.) of O_2/ animal/ hr. which indicate decreasing trend to compare with normal.

Results and Discussion

The recent observation made here, the effect of mercuric chloride and aluminum sulfate is showed clearly. As a result oxygen consumption was declined due to the more toxic effects of mercuric chloride as compare to aluminum sulfate on physiology of catfish *Clarias batrachus* (Landis *et al.*, 2002). The oxygen consumption was determined by the respiratory study. As per result it was found that the mercuric chloride was more toxic. They have capacity to change the respiratory function of the body of catfish. It changes the normal physiological working in respiration and oxygen consumption rate was reduced. Any change in oxygen consumption of catfish is for the reason that there was change in the aquatic environmental condition. It is often used to determinate metabolic fluctuation. Water contains mercuric chloride showed declined effect in oxygen consumption and rate of oxygen consumption (Agarwal *et al.*, 2000). Oxygen consumption was found to be decreased in all the experimented groups.

The oxygen consumption decreased when time exposure period increased by 24 hours to 96 hours. The mercuric chloride after entering in the respiration system of catfish it became complicated. It varies from metal to metal and also from species to species (Maula Reddy, 1988). It observed that there was oxidative respiratory dysfunction (Delgado *et al.*, 2006). Water pollutions are artificial process responsible for the threat of discharges from various sources (Vatakuru, 2005). The damage of organ depends upon the toxicants and the species of fish.

Table 1. Effect of mercuric chloride and aluminum sulfate on total oxygen consumption of catfish (*Clarias batrachus*)

S. N.	Name of the Compound	Consumption of Oxygen	Normal	Experimental			
				24 hrs	48 hrs	72 hrs	96 hrs
1	Mercuric Chloride	Total O_2Uptake in CC of O_2/Animal/ hr.	3.17+0.34	2.82+2.37	2.19+0.25	1.71+ 0.19	1.05+0.15
2	Aluminum Sulfate	Total O_2Uptake in CC of O_2/Animal/ hr.	2.98+0.34	2.51+0.18	2.11+0.10	1.71+10	0.98+0.16

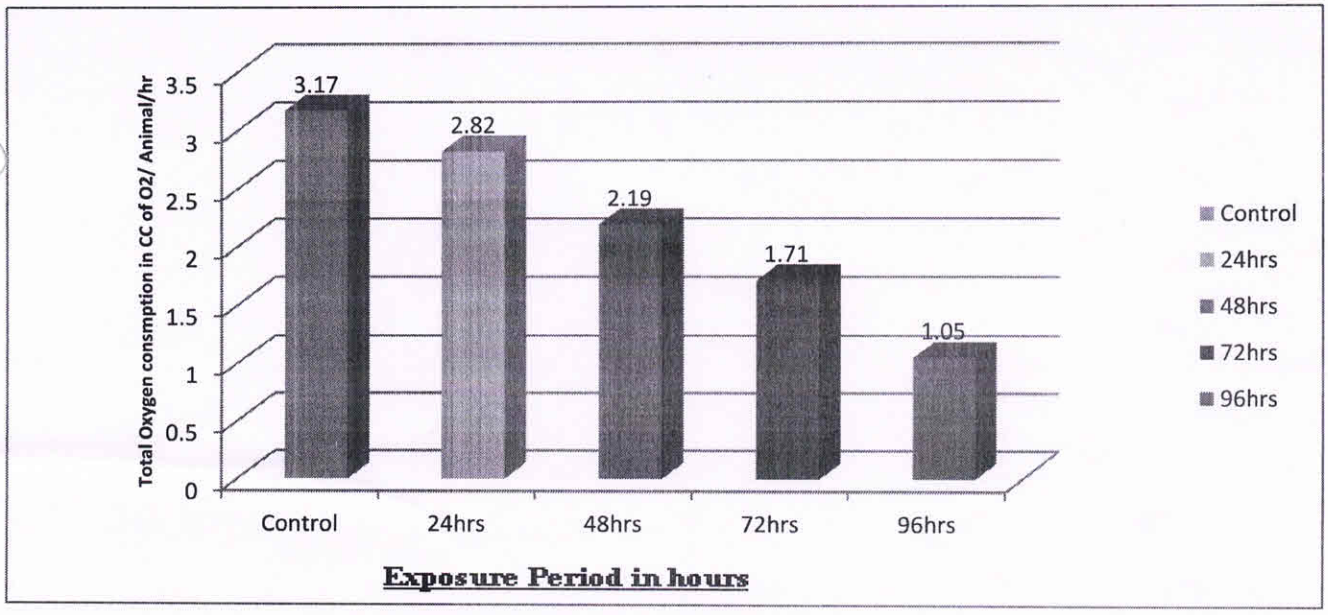

Fig 1. Effect of mercuric chloride on oxygen consumption of catfish (*Clarias batrachus)*

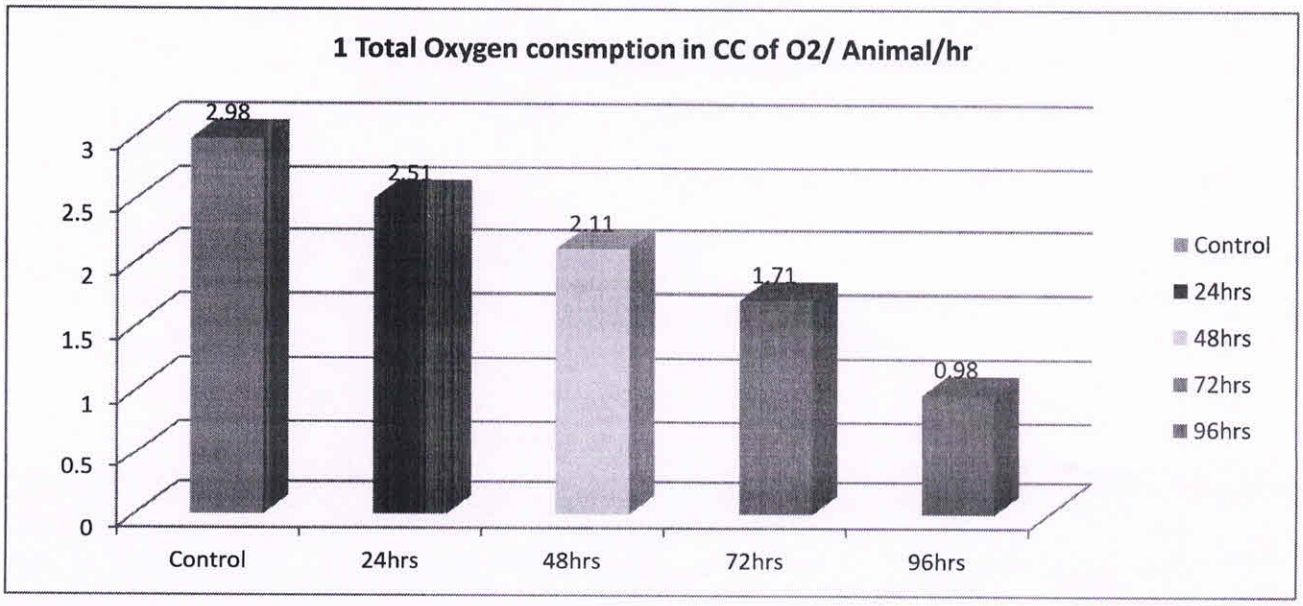

Fig 2. Effect of aluminum sulfate on oxygen consumption of catfish (*Clarias batrachus)*

Results and Discussion

Various toxicants dissolved in water and affect the fresh water aquatic life as well as marine water life (Balaji M., 1991). When freshwater catfishes are exposed to pollutants in water, the oxygen consumption of fishes was found to be decreasing, as a result of depletion of dissolved oxygen content in water. This increase in BOD level, reduction oxygen consumption in *Channa punctatus* when exposed to metasystox (Natarajan, 1981). Another effect of pesticide was noticed that on fresh water fish *Channa punctatus* and reported that rate of respiration declined in the fresh water fish (Ali, 1982).

Verma and Dale (1975) observed that oxygen consumption reduced due to the existence of suspended solid materials in the fresh water which would cause injury to aquatic animal and disturb normal life of fish. Magare and Patil (2000) reported a decrease in the rate of O_2 consumption in *Puntus ticto* exposed to endosulfan. The unusual behaviour of the fish, *Clarias batrachus* in stress condition may be due to obstructed functions of neurotransmitters. The gill opercular movements increased initially to support enhanced physiological activities in stressful habitat and later decreased may be due to mucus accumulation of gill. The toxic stress of pesticides has direct bearing on tissue chemical compounds (Tilak and Yaeobu, 2002). This was also reported by (Chaudhary *et al.*, 2001).

The observed decrease in oxygen consumption by the whole animal may be due to the respiratory distress as a consequence of the impairment of oxidative metabolism. Several authors reported similar decline in whole animal oxygen consumption in different species of fishes exposed to toxicants (Ahmed *et al.*, 1981, Rangaswamy, 1984, Mushigeri *et al.*, 2002). Gills are the major respiratory organs and all metabolic pathways depend upon the efficiency of the gill for their energy supply and damage to these vital organs causes a chain of destructive events, which ultimately lead to respiratory distress (Joice, 2001). In consonance with this, he also reported that the depletion in O_2 consumption was due to the disorganization of the respiratory function caused by rupture in the respiratory epithelium of the gill.

It is also due to the disturbance in mitochondrial integrity and decreased activities of some mitochondrial enzymes (Ravinder, 1988). It is observed that the total oxygen uptake was reduced when exposed to concentration of 1.2 ppm of mercuric chloride. The physiological disturbance of metabolic respiratory activity may be an sign of stress caused due to the pollutants (Newell, 1973). The different workers reported that there was adverse effect of heavy metals on respiratory metabolism of aquatic animals. The Similar changes were also observed by (Chinnayya, 1971, Nagabhushanam, 1972 and Nagbhushanam *et al.*, 1981) there is significant drop in rate of oxygen consumption in fresh water fishes.

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