



Variation in the oxygen consumption of freshwater bivalve *Lamellidens Marginalis* (Lamarck, 1819) due to ganglionic extract injection during summer season.

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Abstract

Anticipating the significance of neuroendocrine control on the metabolic activities of freshwater bivalves, we observed the role of cerebral ganglionic extract injection on respiratory physiology of freshwater bivalve mollusc *Lamellidens marginalis* (Lamarck, 1819) from backwater of Godavari River. During summer season, the adult bivalve mollusc, *Lamellidens marginalis* (85-90 mm in shell length) were subjected to a) control (normal) (b) injection of a cerebral ganglionic extract of same species to intact individuals for 8 days. The rates of respiration in bivalves from two groups (i.e. control and experimental) were measured on 2nd, 5th, and 8th day. The study revealed that, the rate of oxygen consumption was significantly decreased in cerebral ganglionic extract injected group on the 2nd day. The rate of oxygen consumption also showed significant increase in cerebral ganglionic extract injected group on 5th day. The rate of oxygen consumption showed significant decrease on 8th day in ganglionic extract group.

Key Words- *Lamellidens Marginalis*, Oxygen, Ganglionic Extract

Introduction

In some marine and freshwater systems, bivalve molluscs are dominant filter-feeders that make up most of the biomass and exert control over ecosystem structure and function (Dame, 1996; Strayer et al., 1999). It has been known that the diet of suspension feeding bivalves consists mainly of phytoplankton (e.g. diatoms, flagellates) together with other sources of food such as bacteria and detritus debris (e.g. Parrish et al., 1998; Budge et al., 2000). However, the diet varies at different stages of the life history of the bivalve, owing in part to ontogenetic changes in feeding. According to the classification of Vokes (1980), the living freshwater bivalve molluscan fauna is a primarily represented by three superfamilies Unionacea, Corbiculaeae and Dreissenaceae. The freshwater mussels are falling under Unionacea are documented by the members of families - Margaritiferidae and Unionidae. The family Unionidae is relatively large family in which *Lamellidens marginalis* belong. The freshwater mussels (Order Unionoida) are distributed worldwide in lotic and lentic habitats. As filter feeders, freshwater mussels are

ecologically important; they control seston, recycle nutrients, and provide a trophic link between primary producers and predators (Nalepa, Gardner & Malczyk, 1991).

The rate of oxygen consumption is an integral metabolic index, which allows us to determine physiological state of the organism under various ecological conditions. Oxygen consumption by edible mussels as well as other mollusks depends on a number of internal and external factors. Internal (developmental stage, the corresponding body weight, or sexual cycle stage) and external factors (geographic latitude, season, temperature oscillations, feeding conditions, water saturation with oxygen, and tidal conditions) affect the rate of oxygen consumption (Thompson and Bayne, 1972; Bayne *et al.*, 1973; Braiko and Dereshkevich, 1978; Famme, 1980; Hamburger *et al.*, 1983; Sukhotin, 1988). Naturally, oxygen consumption rate depends on growth conditions of mollusks. Bivalves play a key role in many coastal ecosystems due to their high filtration capacity and culture density (Smaal *et al.*, 2001; Zhou *et al.*, 2002).

Materials and Methods

The adult freshwater bivalve, *Lamellidens marginalis* (85-90 mm in shell length) were collected from back water of Godavari River near Kaygaon, during summer season. After brought to the laboratory the shells of the bivalves were cleaned with brush and washed with water to remove the mud and fouling fungal and algal biomass and they were acclimatized for 24 hr. in laboratory conditions. No food was given to the animals during laboratory acclimatization and subsequent experimentation. After 24 hr. the animals were arranged in two groups, each group containing 10 animals in 10 lit. of water. The first group of animals was served as normal control and other group was experimental with injection of cerebral ganglionic extract. For preparing injection of ganglionic extract 1:1 ice cold distilled water and ethanol (i.e. 10 cerebral ganglia in 1mL ice cold distilled water and ethanol), it was centrifuged and injected (0.2 ml extract/animal i.e. equivalent to 2 ganglia/animal), into the foot (muscular region). The experiment was run for 8 days. The physicochemical characteristics of water used in experiments i. e. temperature, pH, hardness and dissolved oxygen contents of the water were determined on every two days throughout the experimental period. The rate of oxygen consumption of individual animal from each group was determined by modified Winkler's technique (Golterman *et al.*, 1978), in a specially prepared brown coloured respiratory jar of 1 lit capacity. Four closed respiratory jars, each with an inlet and outlet. Five animals from each group were kept in continuous circulation of water inside jar, in order to open their shell valves. Once the animals were opened their valves, the flow of water was cutoff and sample of water from it, was drawn after 1hr. For determination of oxygen consumption, the flesh of the individual animal was taken out carefully from the shell and socked on the blotting paper to remove the excess water. Blotted flesh was then weighed to obtain the wet-weight of the individual bivalve. The oxygen consumed by each animal was then calculated and expressed as mg O₂/l/h/gm wet-weight of the flesh. The mean values of four individual animals from each group were used for statistical analysis. For confirmation of results all the values were subjected to statistical analysis using 't' test (Dowdswell, 1957). Percentage differences were also calculated in experimental group.

Results

The physico-chemical characteristics of the water used in experiments during summer season were - Temperature (24.0C- 28.5.0C); pH (7.7 - 7.95); hardness in terms of bicarbonates (119 - 156.2 ppm) and dissolved oxygen content (5.60 – 6.30 mg/L/h).

The rate of oxygen consumption significantly decreased (0.2596 ± 0.05062 , 25.95%, $P < 0.01$) on 2nd day from experimental group i.e. ganglionic extract injected group compared to control. On 5th day during experimentation, it is observed that the respiration rate slightly but significantly get increased (0.3305 ± 0.07072 10.01%, $P < 0.05$). While on 8th day ganglionic extract injected group shows significantly less respiration rate (0.1956 ± 0.02807 , 15.10%, $P < 0.01$) compared to its respective control

Fig.1

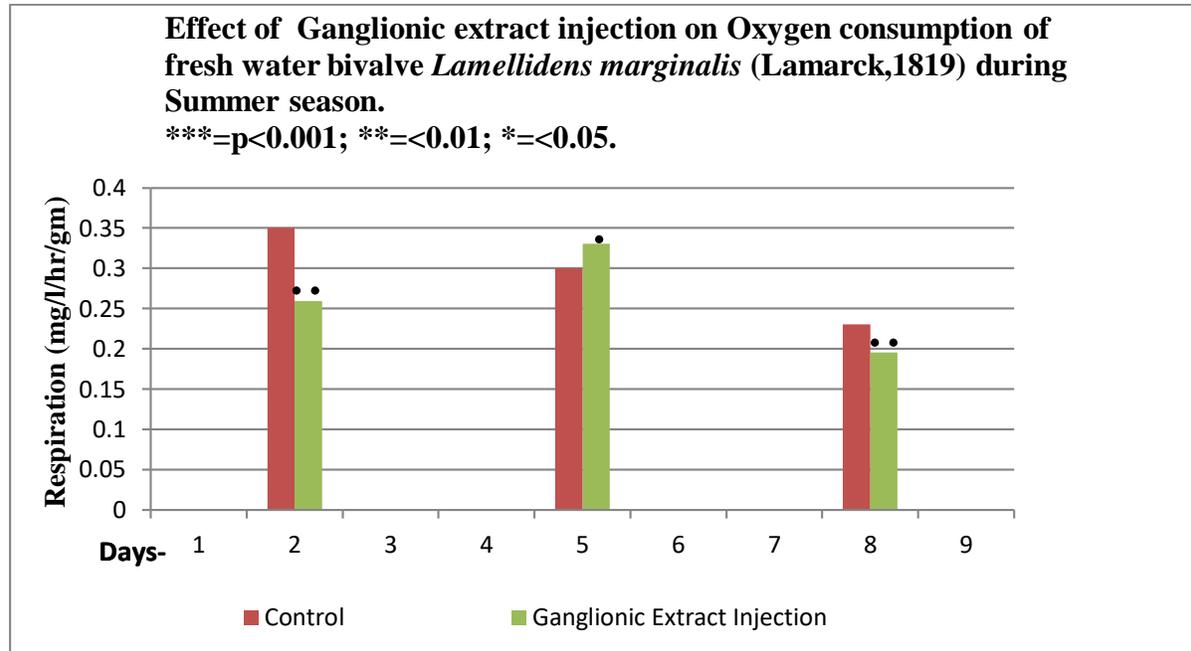


Table.1

Days	Control	Injection of Ganglionic Extract
2 nd Day	0.3506 ± 0.05665	0.2596** ± 0.05062 (25.95%)
5 th Day	0.3004 ± 0.07420	0.3305* ± 0.07072 (10.01%)
8 th Day	0.2304 ± 0.05725	0.1956** ± 0.02807 (15.10%)

Discussion

In the present study on *Lamellidens marginalis*, which is freshwater bivalve, it is observed that ganglionic extract injection which prepared from cerebral ganglia of same species responsible for important changes in respiratory metabolism. On 2nd day ganglionic extract injected group shows significant decrease in utilization of oxygen and on 5th day rate of respiration increased gradually with significance. Whereas on 8th day significant

gradual decrease found as compared to respective controls. The role of cerebral and visceral ganglia in the respiratory metabolism has been reported by Mane et al. (1990) for estuarine clam, *Katelysia opima*, Shinde (2007) for freshwater bivalve, *Lamellidens corrianus* from Godavari River at Kaigaon. Jadhav (2011) studied on *Lamellidens marginalis* from Paithan some reports are available on respiratory physiology of freshwater bivalves mollusc

In freshwater bivalve, *Lamellidens corrianus* (Jadhav et al., 2012), it is possible that surgical bilateral decerebration and injection of their extracts to bilateral cerebralectomised animals as well as injection of hormone to intact animals could have resulted in initiation of the release of large quantities of serotonin and catecholamine as stated by Lubet (1970) in entry may be enhancing the role of non-specific stressors (Gold and Ganong, 1977) or neuroendocrine transducers (Wurtman, 1972), there by indicating the endogenous neurosecretory hormone/hormones involved in regulation of oxygen consumption. This idea gives strength to the fact that the biogenic amines act as neurotransmitters to induce the release of neurohormones from hypothalamic nuclei of vertebrate (Maclead and Lehmeier, 1977) and bivalve mollusk (Mane et al., 1990) these neurohormones are capable of inducing changes in the neurosecretory materials from cells in the cerebral and visceral ganglia of the bivalve shell fishes (Kapoor, 1986). In the present study on *L. marginalis* there might be involvement of secretory substances from the cerebral ganglion in response to injection of cerebral ganglion given to the experimental bivalves to control the respiratory metabolism.

Conclusion

It is concluded that in *Lamellides marginalis* cerebral ganglia possesses factors which controls oxygen metabolism and other important activities via neurosecretion. Biogenic amines play key role in neurosecretion of bivalves as they can be used as neurotransmitters to carry different types of signals to maintain physiological conditions as concluded by Lubet (1970), Kapoor (1986) and Mane et al (1990)

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