

The effect of temperature on the respiration of the fresh water bivalves, *Lamellidens marginalis*, from Godavari river, Nanded

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ABSTRACT

The respiration rate of fresh water mussel, *i.e. Lamellidens marginalis*, edible fresh water bivalve mollusk. Mussels are able to move slowly by means of the muscular foot. They feed and breathe by filtering water through extensible tubes called siphons, a large muscle filters. *Lamellidens marginalis* is a species of freshwater bivalve in the Unionidae family. *Lamellidens marginalis* was monitored during the experimental manipulation of temperature. The oxygen consumed for one hour was measured at water temperatures ranging from 10° C to 25° C. The animals were acclimated to different temperatures in the temperature bath. The total oxygen consumption and rate of oxygen consumption per unit body weight along with shell was studied by Winkler's Method. The results showed that the rate of oxygen consumption increased by increasing temperature *i.e.* from 10° C to 25°C.

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Key Words : Temperature effect, Oxygen consumption, Fresh water bivalve, *Lamellidens marginalis*.

INTRODUCTION

Temperature is considered as a major environmental factor influencing most physiological rates, including those involved in the energy balance, such as feeding, excretion and respiration among bivalves (Bayne, 1976; Gabbott and Bayne, 1997). The temperature affects the metabolic activities of animals. The temperature affects on the dissolved oxygen concentration in the water so the ability to maintain a relatively constant uptake of oxygen under conditions of low oxygen availability is important for organisms that may encounter low dissolved oxygen frequently in their environment (Herried, 1980). In general, life activities occur within a range of about 0°C to 45°C. However, most animals live within much narrower limits. The effects of temperature on the metabolism of poikilotherms are elucidated through studies on oxygen consumption in relation to thermal stress of animals to wide geographical areas occurring at different latitudes. The effects of temperature on physiological processes studied for several species of bivalves (Melody, 1979; Mane, 1975; Vedpathak *et al.*, 1987; Widdows and Bayne *et al.*, 1991).

The economically important molluscan *i.e. Lamellidens marginalis* used as food source of man and it fulfill the human need of food to some extent in our country. But since last decade, the natural environment

is being disturbed due to global warming which results in the change in climatic temperature. The increasing temperature in climate affects the rate of oxygen consumption in fresh water bivalves. If the rate of oxygen consumption is not maintained at low levels of dissolved oxygen, anaerobic metabolism, which is inefficient with respect to energy production, may be activated in the tissues (Gade and Grieshaber, 1986). This ability to maintain oxygen consumption in water of reduced dissolved oxygen has been studied by number of investigators in bivalves (Wang and Widdows, 1993; Taylor and Brand, 1975; Sheldon and Walker, 1989). These studies indicate that the extent of metabolic regulation depends upon the environmental temperature.

The freshwater bivalves (*Lamellidens marginalis*) was selected for experimentation. It is abundantly available in Godavari river, Nanded. The present investigations were subjected to effect of temperature on fresh water bivalve. The purpose of this study was to determine the effect of temperature on the oxygen consumption of freshwater bivalves, *Lamellidens marginalis*.

RESEARCH METHODOLOGY

The freshwater bivalves, *Lamellidens marginalis* used in the present study were collected from the

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Godavari river, Nanded and were brought to the laboratory. The fresh water molluscan (*Lamellidens marginalis*) 45-50 g wt. was selected for the experimentation.

All the collected animals were brought in to the laboratory and washed to remove fouling biomass and acclimatized in the laboratory condition for 4-5 days before the experimental period. After acclimatization period the animals were subjected to different temperatures in temperature bath at 10⁰ C, 15⁰ C, 20⁰ C, 25⁰ C for one hour. The respiratory metabolism was studied by modified Winkler's method (Welsh and Smith 1959). The temperature of control set was 22⁰ C. The set designed by Saroja (1959) was used to determine the oxygen consumption, specialized respiratory chamber was used which was black colored glass both facilitated by inlet outlet, and control openings. After talking all precautions an animal was kept in airtight respiratory chamber by paraffin wax and initial water sample was collected. The animal was allowed to stay in the chamber for one hour and at the end, the final sample was collected. By this method oxygen consumption in initial and final water sample was determined and the difference between the two readings was the amount of oxygen consumed by animal during one hour. The same method was employed for the experimental set.

RESEARCH FINDINGS AND ANALYSIS

The rate of oxygen consumption is studied by several researchers in mussels (Mc. Mahon, 1983; Matthews and Mahon, 1999; Stickle *et al.*, 1989). The fresh water bivalve *Lamellidens marginalis* showed variations in total oxygen consumption and rate of oxygen consumption when exposed to different temperatures as compared to control. Initially the total oxygen consumption and rate of oxygen consumption decreased and later with increase in temperature increased. The temperature of control set

was 22⁰ C.

As per observations, the total oxygen consumption at different temperatures at 10⁰ C= 0.494, 15⁰ C= 0.534, 20⁰C=0.793, 25⁰C=0.876 whereas the rate of oxygen consumption at 10⁰ C= 0.0105, 15⁰ C= 0.0113, 20⁰ C=0.0163, 25⁰C=0.0182 (Table 1). It has been reported that oxygen consumption represents the physiological state of metabolic activity and may be an indicator of metabolic stress. The environmental factor *i.e.* temperature affects the oxygen consumption of freshwater bivalve *i.e.* *Lamellidens marginalis*.

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Table 1: Total oxygen consumption and rate of oxygen consumption at different temperatures

Sr. No.	Temperature in ° C	Total oxygen consumption CC of O ₂ / animal /hr.	Rate of oxygen consumption CC of O ₂ /g/hr/wt.
1.	22 °C(Control)	0.812 ± 0.0028	0.0165 ± 0.0090
2.	10 °C	0.494 ± 0.0020	0.0105 ± 0.0002
3.	15 °C	0.534 ± 0.0024	0.0113 ± 0.0001
4.	20 °C	0.793 ± 0.0027	0.0163 ± 0.0003
5.	25 °C	0.876 ± 0.0023	0.0182 ± 0.0001

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