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Effects of temperature on oxygen consumption and biochemical contents in fresh water crab, *Barytelphusa guerini*

M.S. KHAGOKPAM, R.S. OINAM, G.A. KADAM AND R.P. MALI

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See end of the article for authors' affiliations

Correspondence to :
M.S. KHAGOKPAM
P.G. Department of Zoology,
Yeshwant Mahavidyalaya,
NANDED (M.S.) INDIA

ABSTRACT

The influence of temperature on oxygen consumption in whole animal, glycogen and protein content in tissues (leg muscle and hepatopancreas) of *Barytelphusa guerini* was determined at cold (18 ± 0.5^{0}C), warm (35 ± 0.5^{0}C) and normal temperatures. Oxygen consumption increased significantly ($p < 0.05$) under warm condition and decreased insignificantly under cold condition. Leg muscle and hepatopancreas glycogen were found to be decreased in both the conditioned temperatures (cold and warm) except for hepatopancreas in warm condition where the value was increased significantly ($p < 0.001$). Whereas the protein content in both the tissues were found to be increased on cold and warm acclimation. It was concluded that the high rate of intermediary metabolism during thermal stress was supported by utilizing oxygen and involvement of various biochemical and physiological adjustments.

Key words : *Barytelphusa guerini*, Temperature, Oxygen consumption, Glycogen, Protein

Temperature is an environmental parameter that plays a key role in determining animal distribution in any environment. Relationships between animal occurrence and survival have been clearly recognized for a long time as being related to maximum and minimum temperatures. Precht *et al*. (1973) stated that the temperature influences on the unchanging or steady systems (normal physiological conditions) which are more important than those on the changing systems (during growth, reproduction, development etc.) for better assessment of the thermal stress. Temperature is known to affect the chemical composition of aquatic organisms (Landau, 1992 and Brown *et al.*, 1994).

Rate of respiration and metabolic rate is normally assessed in terms of oxygen consumption which is a highly complex physiological process and is influenced by various extrinsic and intrinsic factors such as – temperature (Pörtner *et al*., 2004; Valeria *et al.*, 2008 and Mandic *et al*., 2009); salinity (Hagerman, 1970 and Jones, 1974); oxygen tension (McMahon *et al*., 1974); body size (Kapoor, 1974) and starvation (Kotaiah and Rajabai, 1975). With increasing concern about global warming, habitat fragmentation and introductions of exotic species, it is imperative to understand how changes in species composition scale up to affect large-scale ecosystem processes (Vitousek 1990; Lawton and Jones, 1995; Hector *et al*., 2001).

Diwan and Nagabhushanam (1976) described that the variations in chemical constitution of tissues have been associated with differences in environmental temperatures. The effects of temperature acclimation on some aspects of carbohydrate metabolism in decapod Crustacea have also been reported (Dean and Vernberg, 1965). A much higher concentration of glycogen and significantly lower lipid reserves in the tissues of fish acclimated to 5^0 C than fish acclimated to either 15 or 25^0 C have also been reported (Johnston and Maitland, 1980; Stone and Sidell, 1981 and Johnston and Dunn, 1987).

The effect of temperature on protein synthesis and degradation rate under cold condition in fresh water male crab, *Barytelphusa guerini* have been reported (Ambore, 1974 and Kadam, 1980). Berger and Emlet (2007) have also shown that acclimation of *B. glandula* to relatively higher temperatures resulted in higher levels of protein synthesis. A mechanism facilitating the release of oxygen at cell level linked with O_2 demand at the cost of increased in protein synthesis have also been reported.

A comprehensive study of the aquatic poikilotherm in relation to thermal acclimation has been proposed to investigate the effect of cold and warm temperatures on the oxygen consumption in order to observe the changes in the metabolic profiles which enable us to arrive at a clear understanding of the total oxygen consumption of fresh water male crab, *Barytelphusa guerini*.

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