Oxygen consumption of Eurytemora hirundoides nauplii and adults as a function of salinity

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The $O_2$ consumption of adults and nauplii of *Eurytemora hirundoides* has been measured. Both showed an increase in $O_2$ consumption in hypo- and hyperosmotic media (sea-water). The $O_2$ consumption was minimal in 6 % NaCl for adults, and in 3 % for nauplii. The osmotic concentration of the body fluids is isosmotic with 6 % NaCl.

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1. Introduction

Effects of salinity on oxygen consumption have been investigated extensively (for references to crustaceans, see e.g. Dehnel 1960). Earlier research dealt with salinity effects alone, whereas later work has concentrated upon the combined effects of temperature and salinity (see e.g. Dimock Jr. & Groves 1975).

Only a few investigations have been made on naupliar stages of crustaceans (Elissen 1952, Engel & Angelovic 1968). This short report presents some observations on the effects of salinity on $O_2$ consumption of both nauplii and adults of *Eurytemora hirundoides*.

Fig. 1. $O_2$ consumption of adult *Eurytemora hirundoides* in different salinities, and corresponding weights of the animals. A. Respiration of normally active animals, B. Respiration of anaesthetized animals (see text). Mean values and standard errors are given.
2. Methods

The polarographic equipment developed by Gyllenberg (1973) and modified by Gyllenberg & Lundqvist (1976) was used. Animals were caught in the surroundings of Helsinki and brought to the laboratory. Here they were acclimated for 1–3 days to the test salinities (dilutions of sea-water) at 4°C. A parallel set of experiments in different salinities was made with adults anaesthetized in 5 × 10⁻⁴ g/ml phystostigum salicyninum. For each experiment, we used 10–15 animals in the respiration chamber. The animals were acclimated for 1–2 h in the chamber.

3. Results

Fig. 1 shows the O₂ consumption at different salinities for adults of Eurytemora hirundoides when respiring normally (Fig. 1 A) and when anaesthetized (Fig. 1 B). The anaesthetized animals had a minimal respiration in 6 o/oo salinity, which was significantly different from the respiration in other salinities (P < 0.01). Non-anaesthetized animals also showed a minimum in 6 o/oo, but this was less pronounced and not significantly different from the other O₂ consumption values (P > 0.05). The higher O₂ consumption and larger variation in the non-anaesthetized animals were apparently due to the different levels of kinetic activity reached in different experiments. The figures for O₂ consumption suggest that the differences observed are related, at least in part, to osmoregulatory work (cf. also Rao 1958, Dehnel 1960, Bulnheim 1974), since the osmotic concentration of the body fluids is isomotic with 6 o/oo NaCl (unpublished measurements by one of us, G.L.). Lately, however, another explanation has been proposed for the increased consumption of O₂ in non-isomotic concentrations. Gilles (1973) has demonstrated an increase in the oxidative metabolism of amino acids in isolated axons of the blue crab, Callinectes sapidus, after acclimation to reduced salinity.

Our results differ from those of most other authors in showing increased O₂ consumption in both hypo- and hypersaline solutions (see also Flemister & Flemister 1951). Normally in marine organisms respiration increases only in hyposaline media (cf. Schieper 1929, Eliassen 1952, Engel & Angelovic 1968, Bulnheim 1974).

The results for nauplii agreed with those for adult Eurytemora in having O₂ consumption peaks in both hypo- and hyperosmotic media. However, the minimum value (statistically different from all other salinities except 4.5 o/oo at the level P < 0.05) was at 3 o/oo and not at 6 o/oo as in the adults (Fig. 2). Both nauplii and
adults were caught at a salinity of 3 \text{‰}, whereas the isosmotic medium is 6 \text{‰}. The reason for the lower O₂ consumption minimum for nauplii is not fully understood.

In all the figures there is a significant correlation between O₂ consumption rate and weight of the animals. It is thought that exposure of the animals to non-isosmotic media resulted in volume changes. Plotting divergence from isosmotic value against weight gave a significant regression (P ≈ 0.03) for both adults and nauplii.

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References


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