Predicting *in vivo* oxygen consumption rate from ETS activity and bisubstrate enzyme kinetics in cultured marine zooplankton

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Oxygen consumption rates (R_{O_2}) in the rotifer *Brachionus plicatilis* and the mysid *Leptomysis lingvura* during both well-fed conditions and starvation have been modeled using the electron transport system (ETS) activity, bisubstrate kinetics and intracellular concentration of NADH and NADPH. Furthermore, the influence of the food quality on the respiratory metabolism and metabolites levels has been explored. The highest values of all variables both in rotifers and mysids were mainly found on organisms grown on the lipid-rich diet, although no differences were determined between treatments in the response to starvation. Time courses of the R_{O_2} and the concentration of pyridine (NAD and NADP) and adenine (ADP and ATP) nucleotides evidenced a sharp decrease during food shortage and a fast recovery with food restoration, whereas the potential respiration (Φ) remained fairly constant. In general, the modeled R_{O_2} (V_{O_2}) predicted with a high degree of success the *in vivo* R_{O_2}, even though it yielded relatively lower values. Nonetheless, the correlation of the measured R_{O_2} with V_{O_2} during starvation was much better than with the R_{O_2} estimated from ETS measurements and a fixed R_{O_2} /Φ ratio. Finally, the observed relationship between the measured R_{O_2} and ADP suggests that the contribution of this nucleotide should be included in future applications of this model.

Keywords: Respiration; Enzyme kinetic model; Nicotinamide adenine dinucleotide (NAD); Nicotinamide adenine dinucleotide phosphate (NADP); *Brachionus plicatilis*, *Leptomysis lingvura*.

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