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Protein synthesis in crustaceans: a review focused on feeding and nutrition

Review Article

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Abstract: This review aimed to place crustacean research on *in vivo* protein synthesis into a broader context, assess its potential for providing further insights into crustacean nutrition and physiology, and recommend future directions relevant to crustacean aquaculture. In crustaceans the flooding dose measurement of protein synthesis is the only method that has been used, it is relatively complex, time consuming and uses radioactive labels. Protein synthesis provides a subtle approach to assessing imbalances and deficiencies in dietary amino acid and energy. In addition, the calculation of protein synthesis retention efficiency (SRE) is recommended in order to understand and optimize parameters such as feeding regime and diet composition. For prawns, SRE was highest at optimum dietary protein content and quality. Similarly the most efficient feeding regimes in juvenile lobsters were demonstrated by the highest efficiency of retaining synthesized protein. Understanding how various abiotic and biotic factors influence protein synthesis has great potential for improving different aspects of crustacean aquaculture but very few studies have done this; better knowledge of how abiotic and biotic factors affect crustacean protein synthesis will contribute to optimising growth of crustaceans in culture.

Keywords: *Fisheries • Aquaculture • Crustaceans • Protein metabolism • Protein synthesis*

1. Introduction

Protein synthesis is central to growth and renewal in all organisms and has been investigated across taxa, in relation to numerous variables and using a variety of methods [1]. Understanding protein synthesis at the tissue and organism level has revealed much information about animal physiology and provided new insights into many biological questions ranging from fundamentals of growth to applied issues that relate feeds and nutrition [1-3]. Research on ectothermic aquatic animals has mainly concerned fishes, less has been done on invertebrates and the literature on crustaceans is comparatively small and reflects nodes of activity by a few researchers. In this review protein synthesis refers specifically to the *in vivo* measurement of amino acid incorporation from a labeled pre-cursor pool at the level of the whole animal and tissue following the general approach adopted previously for understanding animal physiology and nutrition [2,4,5]. The general approach considers the flux of protein into and through the whole animal and expands on the energy and nitrogen budget concept to incorporate protein synthesis in tissues and at a whole animal level of organization [6-8]. Key components are protein intake, protein digestibility, amino acid absorption, tissue free amino acid pools, protein synthesis, protein degradation, ammonia excretion, and protein retention as protein growth [8-10]. Relationships between intake, synthesis and retention describe levels of efficiency of protein use and provide important comparative indices including synthesis retention efficiency and will be discussed further [2,4,5].

Several reviews have been written about protein turnover in ectotherms [2,5,11-14], only one was written

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