Amino Acid Metabolism in Fish Larvae and Juveniles: a Comparison

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INTRODUCTION

Dietary amino acid (AA) imbalances lead to increased AA oxidation and decreased food conversion efficiency (1). Differences between diet and fish larval AA profile may lead to AA losses over 40% of the total absorbed AA (2).

This paper intends to review recent findings in the in AA metabolism of fish larvae, compare them with observations for juveniles, and infer on the qualitative AA requirements during development.

BUDGETING OF AA METABOLISM

Recent advances have been obtained in estimating metabolic budgets of individual AA in fish larvae using an *in vivo* method for controlled tube-feeding (3,4). In both larval herring (3) and post-larval Senegal sole (4) tube-fed a mix of AA, a high proportion (>60 %) of labelled indispensable AA (IAA) profiles were retained in the body (>81%), compared to what was catabolised (<24%). In these studies it was also observed that dispensable AA (DAA) were preferred to IAA as energy substrates. In herring larvae a small proportion of tube-fed AA are converted into lipids with an apparent selectivity towards DAA (3). Therefore fish seem to have the capacity to spare IAA at the expense of DAA from the very early stages of development just as juvenile fish do (5). When AA metabolic budgets of larval fish are compared to juveniles, the major difference seems to be their considerably lower protein digestibility, in particular at the early stages.

IMPACT OF AA IMBALANCES

Although fish only store AA in the form of proteins, the different dietary AA are often handled individually by metabolism. AA which are not polymerised into proteins due to AA imbalances will be catabolised, transaminated into another AA, used in gluconeogenesis or lipogenesis. Some AA are also used in the synthesis of other nitrogen-containing molecules (e.g., purines, several hormones), what may mean additional AA requirements in certain life stages. Furthermore, protein turnover keeps a dynamic relationship between the free AA and the protein pools, and may act as a temporary buffer

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of AA imbalances. AA being an important energy source for fish, there is an obligatory AA loss, independent of the AA profile of the diet. As fish larvae grow at higher (ten fold) rates than juvenile fish, probably have smaller obligatory AA losses (% assimilated AA), making fish larvae more sensitive to AA imbalances.

QUALITATIVE AA REQUIREMENTS

The IAA profile of fish is a good index of the IAA requirements of fish (6). Although the IAA profile of juveniles is rather constant both between and within species (6), the AA profile of larvae is more variable (2). Changes in AA profile are probably associated with the allometric growth of larvae. When IAA profiles of Gilthead seabram juveniles (6) are compared to the ones of first-feeding larvae (own results), the percentage contribution of Arg, Thr, and Cys to total IAA contents increases significantly, while it decreases for Lys, Leu, Val, and Tyr. These changes are likely to be reflected in the IAA requirements.

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