

Diel variation in tissue free amino acid concentrations in salmonids

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The majority of studies into amino acid flux in fishes concentrate on changes in the plasma pool and fewer investigate tissue free amino acid (FAA) pools (1). The first aim of this study was to investigate the concentration of free amino acids in key tissues and measure changes in these following feeding. The second aim was to investigate these changes in relation to the amino acid balance of the feed, fish protein and requirements.

Atlantic salmon (*Salmo salar* L.) with an average weight of 411 ± 16 g were fed after a period of seven days without food and the free amino acid pool concentrations in the caecum, liver and white muscle measured before and at three, six, nine, 15 and 24 hours after feeding. Rainbow trout (*Oncorhynchus mykiss* Walbaum) with an average weight of 265 ± 38 g were studied in the same way and samples taken from the stomach, as well as from the other three tissues, before feeding and at four, nine, 15 and 24 hours after feeding (1).

Both species showed a very similar response. Post-prandial changes in FAA concentrations were small and there were few significant differences. Total FAA and total essential FAA concentrations increased to maximum levels after three, three to six and 15 hours in the caecum, liver and white muscle, respectively. Individual FAA concentrations tended to reflect the changes in total FAA although this was not always the case. In the caecum four essential FAA concentrations were significantly higher at three hours, after which there were few other significant differences, compared to zero hours. In the liver the time of the peak concentration was more variable and was reached between three and nine hours after feeding. In the salmon white muscle peak concentration was reached after nine or 15 hours for all essential amino acids. In contrast valine, isoleucine and leucine concentration decreased over the 24 hour period in the trout. After 24 hours the concentration of total AA, total essential AA and individual AA in all tissues studied had returned to the levels measured prior to feeding.

In order to study amino acid flux and utilisation more closely in the salmon the essential AA concentrations were compared, using Spearman rank correlation, to the AA in the feed, a whole body homogenate and the requirements. No significant correlations were observed and indicated the dynamics of AA metabolism were such that clear relationships between the balance of amino acids in the free pool and the expected utilisation for the synthesis of tissue protein could not be established. A model was developed to quantify AA flux through the tissue free pools and incorporate the role of protein synthesis in regulating FAA pool size and explain the relative constancy of the tissue FAA pools.

1. Carter CG, He Z-Y, Houlihan DF, McCarthy ID, Davidson I. Effect of feeding on the tissue free amino acid concentrations in rainbow trout (*Oncorhynchus mykiss* Walbaum). *Fish Physiol. Biochem.* 1995;14:153-164