

Dose-response studies on essential amino acid requirements in rainbow trout*M Rodehutscord^{1,3}, A Becker¹, M Pack², E Pfeffer¹*¹Department of Animal Nutrition, University of Bonn, Bonn, Germany²Degussa AG, Applied Technology Feed Additives, Hanau, Germany³Present address: CSIRO, Division of Animal Production, WA 6014

In a series of six growth experiments the effects of increasing the dietary concentration of one of the following amino acids on rainbow trout (*Oncorhynchus mykiss*) were studied: lysine, tryptophan, histidine, valine, leucine and isoleucine. A basal diet had been developed containing wheat gluten and a mixture of free amino acids as the only sources of amino acids (1). In each of the experiments, the respective amino acid under test was omitted from the mixture in the basal diet leading to a deficient concentration of this amino acid without any further changes in the diet. The dietary concentration was increased in 12 or 24 steps, depending on the amino acid, by replacing corresponding amounts of L-glutamic acid in the basal diet resulting in the following range of dietary concentrations in the experiments (g/kg dry matter): lysine 4.5 to 58.0, tryptophan 1.3 to 5.6, histidine 2.6 to 13.5, valine 6.2 to 34.2, leucine 10.0 to 42.0, isoleucine 5.0 to 15.3. DE concentration in the diets had been determined in previous experiments (2) and was 20.1 MJ/kg dry matter.

Each treatment group comprised 20 trout, initially weighing ~50 g/trout. One group was killed at the start of each experiment for pretreatment values. Diets were fed for a period of between 53 and 64 days. During this period trout receiving adequate amino acid supply gained about 120 g. Fish were fed twice daily to satiation in order to avoid feed losses. Each group was kept in round plastic tanks of 250 L and mean water temperature ranged from 15.5 to 17.0°C. Weight gain and feed intake were recorded per group. After termination of each experiment, trout were killed and protein concentration in the body homogenates was determined. Protein retention was calculated assuming the concentrations determined in the blank groups to be the same as in all experimental groups at the beginning of the experiments. The non-linear response of trout to increasing concentrations of the respective amino acid was described using the equation $y = a(1 - e^{-b(x - c)})$, where a is the plateau value, b the rate of change and c the x intercept at $y = 0$.

As compared to the response in body weight gain, feed intake or feed conversion ratio, protein retention was the most sensitive response parameter and therefore recommendations were derived from protein retention data. To attain 95 % of the plateau value in protein retention, the following concentrations were required (in g/kg dry matter): lysine 27.7, tryptophan 2.0, histidine 5.8, valine 15.7, leucine 13.6, isoleucine 13.7. The corresponding values for methionine, arginine and threonine, which had been determined previously with the identical method, were 8.0, 11.5 and 10.3 (2). DE concentration as well as high digestibility of amino acids used in these studies must be considered when these recommendations are applied for formulating diets.

1. Rodehutscord M, Mandel M, Pack M, Jacobs S, Pfeffer E. Free amino acids can replace protein-bound amino acids in test diets for studies in rainbow trout. *J Nutr* 1995;125:956-63.
2. Rodehutscord M, Jacobs S, Pack M, Pfeffer E. Response of rainbow trout growing from 50 to 150 g to supplements of DL-methionine in a semipurified diet containing low or high levels of cystine. *J Nutr* 1995;125:964-9.