Symposium 3: Nutrition and Growth

Aquaculture: nutrition for growth and product quality

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Background - Aquaculture accounted for 29% of global fisheries production in 2000 and of the 38 million tonnes from aquaculture around 5-10% was farmed intensively using nutritionally complete feeds as the sole source of nutrition. Intensive farming represents the majority of finfish aquaculture in developed countries. Considerable advances have been made in understanding the nutrient requirements of intensively farmed finfish and intensive production offers opportunity for increasing growth efficiency and controlling product quality through correct nutrient supply. This is of increasing importance due to the emphasis on reducing the use of marine ingredients in aquafeeds and reducing environmental impacts from poorly utilized aquafeeds.

Review - Determination of nutrient requirements of farmed aquatic animals is a relatively complex process. For example, there are a large number of species from different phyla, each species may have several different life-history stages, time to harvest may be as long as five years, a single species may be exposed to a wide range of environmental conditions, and production cohorts are exposed to different patterns of day to day variation in key environmental parameters. Despite these constraints, retention efficiencies for protein-nitrogen and energy in excess of 50% can be achieved by finfish such as Atlantic salmon and rainbow trout.

Marine ingredient replacement has focused on limiting the amount of fish meal and fish oil used in aquafeeds. Consequences of using plant meals as alternative protein sources relate to changes in growth performance due to protein quality and quantity and the presence of carbohydrates and anti-nutritional factors. The replacement of fish oil with plant oils changes tissue lipid composition and generally has a greater effect on product quality than on growth performance. For Atlantic salmon key changes in product quality are demonstrated by muscle n-3 and n-6 fatty acid content in relation to source of fish (wild or farmed) and the oil source:

The n-3 and n-6 fatty acid and total lipid contents of Atlantic salmon fillet samples

	Oil source	Total n-3[1] (g/kg)	Total n-6[1] (g/kg)	n-3/n-6	Lipid (%)
Scottish[1] -wild	Wild prey	8.8 (25.1%)	0.9 (2.6%)	9.8	3.5
-farmed	Fish oil	25.9 (25.6%)	4.6 (4.6%)	5.6	10.1
Experimental[2]	Fish oil	23.0 (19.7%)	6.3 (5.4%)	3.7	11.7
	Linseed oil	33.4 (34.4%)	10.9 (11.2%)	3.1	9.7
	Soybean oil	26.0 (20.5%)	34.9 (27.5%)	0.7	12.7

[1] mean g/kg, (and as % of total fatty acids)

Conclusions- Research into aquaculture nutrition has increased dramatically over recent years. Major themes are on unifying the approach for nutrient requirement determination, the replacement of marine ingredients and in controlling product quality through nutrition.

References

1. Bell, JG, McEnvoy J, Webster JL, et al. Flesh lipid and carotenoid composition of Scottish farmed Atlantic salmon. J. Agric Food Chem 1998; 46: 119-127.
2. Rosenlund, G, Obach A, Sandberg MG, et al. Effect of alternative lipid sources on long term growth performance and quality of Atlantic salmon. Aquacult Res 2001; 32 (Suppl. 1):323-328.