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Global quality assessment in Mediterranean aquaculture

Zaragoza : CIHEAM
Cahiers Options Méditerranéennes; n. 51

2000
pages 37-39

Influence of nutrition: Bases, procedures and economic implications

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SUMMARY – The composition (fat, moisture and protein) of the fish flesh influences the physical and organoleptic properties of the final product. This text resumes the main basic principles affecting the composition of the fish body. Contrary to normal thinking, nutritional factors have a limited influence over the final composition of fish. Besides this, new alternatives on fish feed formulations are arising due to the present global situation of its raw materials, such as fish oil and fishmeal. New feed composition has to be adapted with efficiency but paying attention to its influence on the organoleptic parameters of the fish flesh.

Key words: Flesh composition, nutrition, feed, and raw materials.

RESUME – *"Influence de la nutrition : bases, procédures et enjeux économiques". La composition (gras, humidité et protéine) de la viande de poisson influence les propriétés physiques et organoleptiques du produit final. Ce texte résume les grands principes de base qui affectent la composition corporelle du poisson. Contrairement à ce que l'on pense généralement, les facteurs nutritionnels ont une influence limitée sur la composition finale du poisson. En outre, de nouvelles alternatives concernant les formulations d'aliment poisson sont en train d'apparaître, dues à la situation globale actuelle des matières premières, telles que l'huile de poisson et la farine de poisson. Une nouvelle composition des aliments doit être adaptée efficacement mais doit tenir compte de son influence sur les paramètres organoleptiques de la viande de poisson.*

Mots-clés : *Composition de la viande, nutrition, aliment poisson, matières premières.*

Introduction

The primary objective of commercial fish production is to produce a marketable product at the maximum profit. This involves a continuing effort to reduce feed cost, which is a major portion of the cost of production, while trying to maintain fish health, feed efficiency and rapid growth. In an expanding market relatively little emphasis may be placed on product quality, but as the market matures, competition between producers for market share and competition from other meat sources will put more emphasis on product quality (Shearer, 1999). There have been several previous reviews of the effects of diet on fish composition (Love, 1970; Love, 1988; Spinneli, 1979; Buckley and Groves, 1979; Mohr, 1986; Haard, 1992; Shearer, 1994).

Factors affecting fish composition

According to Shearer (1994), there are two different kinds of factors affecting the fish body composition, the external or exogenous and the internal or endogenous ones. The internal factors are sex, life cycle and size. These factors will govern the majority of principles that determines the composition of fish. The proportion of visceral content, muscles and bones are related to them. In general terms, wild fishes contain a bigger proportion of moisture whereas on farmed fishes the fat content trends to occupy some of the total water content. However, the total protein level depends on the fish size without any affection by the diet.

The relationship among total protein and body weight is specific of each fish species. The most evolutionary fishes have a major capacity of protein intake. Protein will be used mainly for growth and any protein in exceeds is deaminated and stored as fat.

The total energy intake governs the body fat storage and it is not only depending on the fat content of the feed. The deposition of the additional fat appears to differ on the fish size and also on the fish

specie (Sheridan, 1988; Navarro and Gutierrez, 1995). Normally, to increase the dietary fat affects to the final fat contents of the visceral area and the muscle. Nortvedt and Tuene (1998) affirm that fish size and fat content on the feed govern the body lipid of halibut.

Fatty acids

The nutritional value of the fat is related both to the amount of fat and to its fatty acid composition. Both parameters are affected by feeding. Fish lipids typically contain long chain fatty acids of which the polyunsaturated fatty acids of the w-3 family are of special interest. In comparison, vegetable oils principally contain shorter fatty acids typically with 18 carbons. Consumption of EPA and DHA is known to have positive effect in relation to arteriosclerosis and cardiovascular diseases (Rosenlund *et al.*, 1999).

There are strong correlations between dietary fatty acid composition in feed and fish, but of course the level of EPA and DHA on the fish fat depends on the type of fish oil used. Anyhow, actually the more expensive fish oil can be replaced partially by other oil sources as rapeseed, soybean or linseed without affects the performance of the fish. Further research is necessary to assure that organoleptic parameters of the fish flesh are not affected with the replacement of this fish based raw material.

Protein and amino acids

Nowadays, the world market of raw materials as ingredients of fish feeds is becoming more restrictive by many different causes as availability and prices among others. The feed composition plays an important role in the fish farm economy trough the feed efficiency (FCR and SGR) but also, as explained above, for its influence on the final product quality. Inside the feed composition, the protein value is the major cost of the fish feeds (72% of the total cost for sea bream or sea bass diets). As it was explained before for the fish oil, the main sources of protein for fish farming industry are the different kinds of fishmeals. Most of the nutritional research studies are now focused on the fish meal replacement on the fish diets.

The protein value is the part of the fish feed used for muscle growth. It is not the protein that gives growth, but the amino acids within the protein. The need for amino acids and the amino acid balance varies with the fish's size and age. This balance is important in order to achieve its growth potential. Previous works on energy and digestibility formulation of feed are now adapted to a new concept based on the balance of amino acids. This does not mean having the same amount of each amino acid, but balancing the various quantities in the feed so that there is exactly the amount the fish needs to exploit growth potential optimally. Compared with previous feeds, this means that the content of some amino acids is reduced, while that of others is increased. In this way, the fish's amino acid balance is stabilised and adjusted to its needs.

This new technology also has a positive environmental effect. As the protein value in the feed increases, the fish utilises more of the feed and there is therefore less discharge of undigested nutrients and nitrogen. If there is too little of one amino acid, this reduces the fish's possibility to produce fish muscle, and much of the protein is used as energy and as fat deposits instead. The fish then becomes fatter, grows less and FCR increases.

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