LYSINE OPTIMIZATION OF A DIET WITH LOW FISH MEAL INCLUSION FOR GREATER AMBERJACK (*SERIOLA DUMERILI*, RISSO 1810)

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Introduction

The greater amberjack (*Seriola dumerili*, Risso 1810) is one of the new/emerging finfish species for the Mediterranean aquaculture much appreciated by consumers, achieving high prices on the market. The advantages of this species for commercial culture is the high growth rate, reaching 6 kg within 2.5 year of culture (Sicuro and Luzzana, 2016), the excellent flesh quality and the high commercial value (Mazzolla et al., 2000).
Nevertheless, little knowledge on nutrient requirements and scarce information on the formulation of commercial feeds are the main obstacles for the sustainable farming of greater amberjack (Vidal et al., 2008).
The goal of this work was to investigate the effects of different dietary levels of lysine on growth, voluntary feed intake, nutrient utilization, body proximate composition, antioxidant capacity and protein expression of heat shock proteins of juvenile *S. dumerili* fed diets with low fish meal inclusion.

Materials and Methods

A basal diet (L1) with low lysine concentration (1.93 g/100g diet) based mainly on plant ingredients such as wheat meal (28.6%), corn gluten meal (10%), wheat gluten meal (22%) and soya concentrate meal (1%), and with low fish meal inclusion (25%), was formulated to contain ca. 45% crude protein (CP), 18% crude lipid (supplemented mostly by fish oil) and 22 MJ/kg gross energy. Graded levels of crystalline L-lysine-HCl were added to the basal diet at the expense of wheat meal to produce five isonitrogenous and isoenergetic diets containing each of them a final lysine concentration of, 2.01 (L2), 2.11 (L3), 2.15 (L4), 2.20 (L5), and 2.29 (L6) g/100g diet, respectively (Table 1 & 2). The extruded feeds (2.5 mm pellets) were manufactured by Skretting ARC (Norway) and shipped to the experimental facilities of the Hellenic Centre for Marine Research (HCMR) in Ag. Kosmas, Athens, Greece.
Juvenile greater amberjack fish were obtained from a brood stock that reproduced in captivity at the Institute of Marine Biology, Biotechnology and Aquaculture, HCMR. Once acclimated, all fish with an initial average body weight (BW) of 32.8 ± 3.0 g (mean ± standard deviation; n = 450) were assigned to 18 experimental small cages (1.0 x 5 x 1.0 m; 5 m), at a density of 25 fish per cage (3 replicates/cages per diet). All cages were placed in two large rectangular concrete tanks of 36 m^3 water capacity that were continuously supplied with filtered sea water (salinity 35 ppt). Sea water was distributed in each 36 m^3 tank from 10 different pipes at 400 L/h and aerated to over 80% oxygen saturation. Water temperature followed the ambient seasonal temperature throughout the experiment with an average value of 19.8 ± 1.7 ^oC.
Fish were hand-fed twice a day (09:00 and 15:00 h) to apparent satiation, six days a week with the experimental diets for a period of 55 days (started on October 21, 2015). Uneaten feed was collected by siphoning and weighed after each meal to monitor daily feed consumption.
At the end of the feeding trial, all fish were anaesthetized and weighed individually after being deprived of feed for one day. Ten fish were randomly sampled and pooled from each tank (30 fish per diet) for carcass composition. In addition, five fish from each tank

were sampled for assessing the activity of catalase (CAT) and protein expression of heat shock proteins (HSP70 and HSP90) in the liver and mid intestine.

Results and Conclusion

The survival of fish in all treatments was ranged from 88% to 98%, while fish fed the L4 diet showed the highest mortality.

Approximately a 3-fold increase in average final body weight (FBW) was found over the course of the 8-week growth trial. No significant differences in ABW were found among the diets ($P>0.05$). Fish fed the L1, L2 and L5 diets showed lower final mean weights (88 g, 92 g and 91 g, respectively) among the experimental diets. The highest growth was exhibited by L3 and L6 diets (99 g and 96 g, respectively).

In this trial, feeds were offered to visual satiety twice daily and voluntary feed intake (TFI) was found to increase from L1 - L3 diet and then decreased in diet L5, although it was not significantly affected by the dietary lysine level. Diets L4 and L5 exhibited higher or equal TFI values, respectively, compared to L1 diet. Those differences in TFI among the diets were mirrored in FBW, weight gain (WG) and daily growth index (DGI) respectively, and can partly justify the observed variations. No significant differences in FCR were found among the diets. Diet L3 showed the lower FCR (1.18), whereas the L5 diet the higher (1.27). FCR of the rest of diets was ranged within those values.

Protein utilization (PER) was found similar among the treatments showing a slight higher value in diet L3. Similarly, L3 diet was not found to be statistically different compared to the rest of the diets, although showed the highest SGR and TGC (2.03 and 1.33, respectively), whereas L1 displayed the lowest values (1.83 and 1.16, respectively). Final body weight and weight gain of fish increased with the increase of dietary lysine levels from 1.93% to 2.11%. Both parameters were lower in fish fed the diets supplemented with 2.15% or higher lysine levels than in those fed 2.11% lysine.

The results from the present study indicated that the dietary lysine requirements, based on the Broken-line model, which can support maximum weight gain of greater amberjack juveniles fed on a diet based mainly on plant ingredients, containing 45% protein, 18% lipid and 25% fish meal inclusion, was 2.11% of diet. No significant effect of lysine levels on the expression of HSP in liver or intestine was found. Lysine supplementation found to affect the specific activity of CAT in liver and intestine of greater amberjack fed the diet containing 2.11% lysine.

The data presented in the current study will be useful in developing balanced commercial diets for greater amberjack, particularly when fishmeal is replaced by plant protein blends.

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