REFINING ORGANIC AQUAFEEDS FOR RAINBOW TROUT, GILTHEAD SEA BREAM AND MEAGRE: IMPLICATION ON GROWTH, FISH HEALTH AND PRODUCT QUALITY

L. Parma1*, A. Estevez2, P. Vasilaki3, A. Marchi1, L. Morsiani1, L. Mariani1, F. Dondi1, E. Brini1, M. Candela4, D. Scicchitano4, P.P. Gatta1, A. Bonaldo1
1Department of Veterinary Medical Sciences, University of Bologna, Via Tolara di Sopra 50, 40064 Ozzano Emilia, Italy
2Aquaculture Program, Institut de Recerca i Tecnologia Agroalimentàries, Centre de Sant Carles de la Ràpita, Sant Carles de la Ràpita, Spain,
3Irida SA, Riga Fereou St. 60 GR-346 00, Nea Artaki Evia, Greece
4Unit of Microbial Ecology of Health, Department of Pharmacy and Biotechnology, University of Bologna, Via Belmeloro 6, 40126 Bologna, Italy
Contact: luca.parma@unibo.it

Introduction

The new Strategic Guidelines for the sustainable development of EU aquaculture adopted by the Commission in spring 2021 intend to further promote organic aquaculture as strategy to meet consumer demand for diversified high quality food produced in a way that respects the environment and ensures animal welfare. EU organic regulation (889/2008 and 848/2018) established that only fish meal derived from fish trimmings and from whole fish caught in fisheries certified as sustainable together with vegetable raw materials derived from organic plants can be used as the main protein sources for organic aquafeed. The difficult to reach certified ingredients, together with the high production costs, are the main problems of low production of organic EU fish. The needs for additional types of raw materials and reconsidered the sourcing of plant feed ingredients has been recognised as necessary to promote EU organic aquaculture. The aim of this study was to test the effects of certified organic novel raw materials (organic pea protein, organic yeast, organic seaweed) on growth, fish welfare and products quality of rainbow trout, gilthead sea bream and meagre.

Materials and Method

Three feeding trials (one for each species) were performed in order to replace 60, 50 and 45% fishmeal trimming (FM) in rainbow trout (RT), sea bream (SB) and meagre (M) respectively, using increasing level of organic pea protein (PP), organic seaweeds and organic yeast. Three experimental diets for rainbow trout (control, RT-C; PP 10%, RT-PP10; PP 21%, RT-PP21) and sea bream (control, SB-C; PP 8%, SB-PP8; PP 19%, SB-PP19) and four diets for meagre (control, M-C; PP 7%, M-PP7; PP 18%, M-PP18 and M-PP27) were formulated using organic raw materials according to EU organic regulation. Diets were tested in triplicated fish groups (initial weight, RT: 63g; SB:146g; M: 33g) to satiation over 60 days for RT and SB and during 85 days for M.

At the end of the trials specific growth rate (SGR), feed intake (FI), feed conversion rate (FCR), somatometric indexes (hepatosomatic index, HSI; viscerosomatic index, VSI) and nutritional indices (protein efficiency ratio, PER; gross protein efficiency, GPE) were performed for all species. In addition, fish quality parameters (fillet and liver proximate and fatty acids composition and sensory quality by trained panellists) were performed in SB and RT. In M fish health was assessed by plasma biochemistry and gut microbiome by next-generation sequencing. Differences among treatments were considered significant at $P < 0.05$.

Results

At the end of trials, no significant differences in growth (SGR, FI, FCR) were observed in M, while SB-PP8, SB-PP19 and RT-PP21 showed lower SGR in comparison to the respective control diets. FCR was lower in RT-PP10 than RT-C and RT-PP21. Concerning welfare parameters glucose was higher in animals fed M-C and lower in M-PP27. Total protein and albumin showed higher values in animal fed M-PP18 and lower values in M-C. Albumin/globulin was higher in animals fed M-PP27. In RT and SB no significant differences were observed in HSI and fillet yield while VSI was higher in RT-PP21 than the other treatments. Fillet in both SB

and RT showed a higher protein but lower lipid content in PP21. In RT, fillet showed a higher content of DHA and N3-PUFA in the fish fed RT-PP21 in comparison to the other diets. Similarly, DHA and N3-PUFA were higher in SB-PP21 than SB-C. Some similarities in sensory characteristics were observed when comparing SB and RT samples fed with organic feeds containing different proportions of PP. Effects were observed in odour, appearance, and textural sensory attributes. In particular, flesh of both species had a less intense ammonia odour, a lower quantity of exudate and was firmer but also less crumbly and juicy. In addition, the inclusion of PP significantly increased the bitter flavour perception in SB and RT, even though the effect was not significant for RT samples.

Discussion

This study highlighted the possibility to partially replace FM using novel organic vegetable raw materials (pea protein, seaweed and yeast) in rainbow trout, sea bream and meagre. The inclusion of organic pea protein at low levels in combination with organic seaweed and/or organic yeast did not produce any effect on growth and/or composition of the fish, however a high inclusion of pea protein produced a lower growth in trout, but not in sea bream and meagre. The inclusion of the organic raw materials tested induced a higher accumulation of N-3 PUFA in the fillet of trout and sea bream. Similarly, the results of the sensory characterisation of the fillet also showed a positive effect of pea protein inclusion on odour, appearance and textual sensory attribute leading to a higher product quality.

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