GROWTH PERFORMANCE OF GILTHEAD SEABREAM (*Sparus aurata*) FED LOW FISHMEAL DIETS WITH INNOVATIVE INGREDIENTS

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Introduction

The constant demand of sea products forces the global fisheries and aquaculture to produce more. Aquaculture of carnivorous species rely on marine protein and oil, but during 2018, 18 million tons of wild fish have used for the production fishmeal and fish oil (FAO ,2020). This, nowadays, has led most of the research to focus on the replacement of fishmeal and fish oil with sustainable sources of protein and lipids. This study aims to evaluate the effect of dietary fishmeal replacement with alternative ingredients such as algae meal, insect meal and tunicate meal on growth performance of gilthead sea bream (*Sparus aurata*).

Material and methods

The experimental trial was conducted at the Department of Ichthyology and Aquatic Environment, University of Thessaly, in Volos, Greece. Briefly, 720 individuals *S. aurata* (initial mean weight 6.57±0.04g) were distributed randomly to twelve 250l tanks. Four experimental diets were formulated to be isonitrogenous and isolipid, with diet 1 (control, FM) consisted of 26.55% fishmeal, diet 2 (0%FM) consisted of total replacement of fishmeal with algae meal (*Schizochytrium limacinum Phaeodactylum tricornutum*), insect meal (*Hermetia illucens*) and tunicate meal (*Ciona intestinalis*). Diet 3 (IM) consisted of 68.09% replacement of fishmeal with insect meal (*H. illucens*) and diet 4 (TM) consisted of 45.91% replacement of replacement of fishmeal with tunicate meal (*C. intestinalis*). Each diet was assigned to triplicate groups of 60 fish per group. The trial lasted 65 days, after 15 days of acclimatization. The fish were fed three times per day *ad libidum*. Fish wereweighted individually at the beginning and end of the experimental trial under anesthesia. Feed consumption was recordeddaily in order to be able to evaluate accurately values for feed utilization.

Results

The results showed that weight gain, feed consumption, specific growth rate, feed conversion ratio and protein efficiency ratio did not have statistically significant differences between the control diet (FM) and the total replacement of fishmeal with algae meal, insect meal and tunicate meal (0%FM). Fish fed with 68% replacement of fishmeal with insect meal diet (IM) had statistically significant lower feed consumption, weight gain and SGR values compared with diets FM and 0%FM. However, FCR and PER values for diet IM were not statistically significant different compared to diets FM and 0%FM. In addition, fish fed with tunicate meal diet (TM) had statistically significantly the lowest growth, feed consumption, FCRand PER ($p<0.05$).

Discussion

Karapanagiotidis et al. 2014 found that 30% fishmeal dietary replacement by *H. illucens* meal in *S. aurata* diet did not significantly affect SGR, FCR and PER, but the weight gain and feed consumption were reduced compare to control diet. In addition, 45% replacement of fish meal by insect meal (*H. illucens*) on *Dicentrarchus labrax* diet had not adverse effect on growth and feed utilization in contrast with protein utilization which was lower compare to control diet (Magalhães et al. 2017). Fishmeal replacement with the microalgae *P. tricornutum* in started diets of *S. aurata* showed that SGR was not affected ($p>0.05$) but had an adverse effect on survival (Atalah et al. 2007). Moreover, the inclusion of 2.5% *P. tricornutum* in finishing diets of gilthead sea bream did not significantly change growth and feed utilization parameters ($p>0.05$) (Ribeiro et al. 2017). Furthermore, the 2.5% inclusion of *Schizochytrium* sp. as lipid source and especially DHA source in microdiets of *S. aurata* had no negative effect on larvae, nevertheless the total replacement of fish oil reduced the growth and survival (Ganuza et al. 2008). The results of this study showed that total replacement of fishmeal with algae meal, insect meal and tunicate meal did not affect sea bream growth performance compared with the 68% replacement of fishmeal with insect meal and 45% replacement of fishmeal with tunicate meal.

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Table 1: Growth performance parameters of gilthead seabream fed the experimental diets

	FM	0%FM	IM	TM
Final Weight (g)	28.41±0.43 [a]	28.86±0.47 [a]	26.4±0.47 [b]	19.83±0.37 [c]
Weight gain (g)	21.87±0.43 [a]	22.19±0.47 [a]	19.84±0.47 [b]	13.3±0.37 [c]
Feed consumption (g)	17.95±0.42 [a,b]	19.36±0.75 [a]	16.56±0.43 [b]	13.96±0.53 [c]
Specific growth rate (SGR, %/day)	2.25±0.02[a]	2.21±0.02 [a]	2.09±0.02 [b]	1.65±0.03 [c]
Feed conversion ratio (FCR)	0.89±0.02[a]	0.95±0.02 [a]	0.93±0.3[a]	1.51±0.23 [b]
Protein efficiency ratio (PER)	2.62±0.05[a]	2.62±0.05 [a]	2.73±0.06 [a]	2.19±0.06 [b]
Survival (%)	91.71±2.88 [a]	97.82±0.58[a]	95.86±1.44[a]	96.13±1.09[a]

Values are presented as means±standard error). Means sharing the same superscript are not significantly different from each other (P<0.05)

In terms of sustainable feed formulations, recent advances prove, among other low trophic level organisms the concept of the nutritional (Kousoulaki et al., 2017) feasibility of substituting fish oil by heterotrophically produced microalgae in salmon feeds. This study confirms that a mixture of innovative ingredients used for aquafeeds that can be grown on byproducts and waste of other agricultural industrial practices open new horizons for fishmeal replacement in fish feeds.

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