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Partial or total replacement of dietary fish oil with alternative lipid sources in silvery-black porgy (*Sparidentex hasta*)

Mansour Torfi Mozanzadeh [a,*], Naser Agh [b], Vahid Yavari [a], Jasem G. Marammazi [c], Takavar Mohammadian [d], Enric Gisbert [e]

[a] Fisheries Department, Faculty of Marine Natural Resources, Khoramshahr Marine Science and Technology University, Iran
[b] Artemia and Aquatic Research Institute, Urmia University, Urmia, Iran
[c] South Iranian Aquaculture Research Center, Ahwaz, Iran
[d] Department of Clinical Sciences, Faculty of Veterinary Medicine, Shahid Chamran University of Ahwaz, Ahwaz, Iran
[e] IRTA, Centre de Sant Carles de la Rápita (IRTA-SCR), Unitat de Cultius Experimentals, Crta. del Poble Nou Km 5.5, Sant Carles de la Rápita, Spain

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ABSTRACT

An eight-week feeding trial was conducted to evaluate the effects of partial (50%) or total (100%) replacement of dietary fish oil with alternative lipid sources in silvery-black porgy. Seven isonitrogenous (50%) and isolipidic (20%) experimental diets were formulated namely: FO (fish oil), CO (canola oil), SO (sunflower oil), T (tallow), FC (fish oil + canola oil, 50:50), FS (fish oil + sunflower oil, 50:50) and FT (fish oil + tallow, 50:50). Fish fed the T and FT diets statically had lower final weight, weight gain and specific growth rate than other groups ($P < 0.05$); Fish fed FT diet had the highest feed conversion ratio ($P < 0.05$). Fish fed the CO and SO diets had the highest and the lowest whole body and muscle protein content, respectively ($P < 0.05$). Fillet and liver n − 9 monounsaturated fatty acids, n − 6 and n − 3 poly unsaturated fatty acids were highest in fish fed the CO, SO and FO, respectively ($P < 0.05$). Apparent digestibility coefficient of protein and lipid, hemolytic and bactericidal activities were lowest in fish fed the T diet ($P < 0.05$). From the above results, it is suggested that the vegetal oil sources are recommended for total and partial replacement of FO in silvery-black porgy diets, whereas tallow is not advisable as an alternative lipid source in this species.

Statements of relevance: It is essential to introduce alternative lipid sources, to meet increasing global demands of aquafeeds for the sustainability of aquaculture industry. Thus, the aim of present study was to provide insight into the possibility of the use of alternative lipid sources in diet for silvery-black porgy juveniles by evaluating the growth performance, feed utilization, body composition and hemato-immunological parameters.

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1. Introduction

It is well known that the progressive growth in global finfish aquaculture exacerbated the exploitation of marine resources for fish meal (FM) and fish oil (FO), especially for carnivorous fish feed production (Tacon and Metian, 2008). Furthermore, world capture fisheries have remained static and it is not possible to further increase the annual global harvest of pelagic fish stocks and consequently, the supply of FO or FM for aquafeeds (Turchini et al., 2011). In addition, natural environmental impacts such as El Niño events and competition for using marine derivatives products in the terrestrial animal feed industries and for human nutritional use have also led to inflated FO prices and decreased FO global supplies (Tacon and Metian, 2008; Turchini et al., 2009). Thus, it is essential to introduce alternative lipid and protein sources to meet increasing global demands of aquafeeds for the sustainability of aquaculture industry. Over the past two decades, vegetable oils (VO) and terrestrial animal fats (TAF) have emerged as more sustainable alternatives to FO (Turchini et al., 2009, 2011). Vegetable oils are typically rich in C18-poly unsaturated fatty acids (C18-PUFA) and monounsaturated fatty acids (MUFA), and animal fats such as beef tallow and poultry fat are generally richer in saturated fatty acids (SFA), but vegetable oils lack, and terrestrial animal fats have very limited content of the n − 3 long chain polyunsaturated fatty acids (n − 3 LC-PUFA) that are characteristic of marine FO (Turchini et al., 2011). However, marine fish species have dietary requirements for eicosapentaenoic acid (EPA; 20:5n − 3), docosahexaenoic acid (DHA; 22:6n − 3,) and arachidonic acid (ARA; 20:4n − 6) since they have limited capacity to synthesize these compounds from α-linolenic acid (ALA; 18:3n − 3) and linoleic acid (LA; 18:2n − 6) (Glencross, 2009; Tocher, 2010). Thus, the lack of these essential fatty acids (EFA) in alternative lipid sources should be considered in feeds formulation. Different studies have shown that a 100% replacement of dietary FO with VO has a negative effect on the growth of most marine finfish species (Sales and Glencross, 2011; Nasopoulou and Zabetakis, 2012). However, a large fraction (60–75%)

* Corresponding author at: Department of Fisheries, Faculty of Marine Natural Resources, Khoramshahr Marine Science and Technology University, P.O. Box: 669, Iran.
E-mail address: mansour.torfi@gmail.com (M.T. Mozanzadeh).

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