JOURNAL OF APPLIED ANIMAL RESEARCH
2019, VOL. 47, NO. 1, 24–33
https://doi.org/10.1080/09712119.2018.1557663

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Dietary soybean lecithin affects growth performance, fillet biochemical composition and digestive enzyme activity in *Sparidentex hasta* juvenile

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ABSTRACT

An eight-week study was conducted on silvery-black porgy (*Sparidentex hasta*) juveniles to evaluate four isoproteic, isolipidic and isoenergetic different diets (50% crude protein, 20% crude lipids, 18.5 MJ kg^{-1}) containing graded levels of soybean lecithin (SBL) (0, 30, 60 and 90 g kg^{-1} diet) at the expense of fish oil (FO). Fish fed the 60 g SBL kg^{-1} diet had significantly higher weight gain (32.4%) and feed intake (8.8 g $fish^{-1}$) than the control group (SBL 0) ($P < 0.05$). The fillet fatty acid (FA) profiles were correlated with the FA profile of the experimental diets. Fish fed with SBL-supplemented diets had higher fillet phosphatidylcholine levels than the control group ($P < 0.05$). Plasma total immunoglobulin was higher in fish fed 60 and 90 g SBL kg^{-1} diets than in the other groups ($P < 0.05$). Total protease activity was higher in fish fed the 90 g SLB kg^{-1} diet than other treatments ($P < 0.05$). Results indicated that substitution of dietary FO with SBL diet up to 67% (60 g SLB kg^{-1} diet) improved somatic growth performance and profoundly affected the fillet fatty acid profile in silvery-black porgy juveniles.

ARTICLE HISTORY
Received 15 May 2018
Accepted 1 December 2018

KEYWORDS
Digestive enzymes; feed intake; humoral immunity; lipid composition; soybean lecithin; Sobaity seabream

Introduction

Phospholipids (PLs) play a major role in maintaining the structure, integrity, fluidity and function of cellular membranes (Tocher et al. 2008). Dietary PLs have been reported to improve growth performance, survival rates, stress resistance and digestive functions in different fish species, both in larvae and early juveniles, and can decrease the incidence of skeletal deformities at larval stages (see reviews by Coutteau et al. 1997; Tocher et al. 2008; Cahu et al. 2009). In addition, PLs by stimulating lipoprotein synthesis in enterocytes can enhance lipid transport, improve the intestinal absorption of long-chain polyunsaturated fatty acids (LC-PUFA) and reduce intestinal steatosis (Fontagné et al. 2000; Gisbert et al. 2005; Tocher et al. 2008). In this regard, soybean lecithin (SBL) because of its high availability and reasonable price in comparison to marine PL sources has been commercially used as a ubiquitous source of PLs in aquafeeds (Tocher et al. 2008). From a nutritional point of view, SBL may also serve as a feed attractant, providing vitamins and EFAs that are vital for fish growth (see reviews by Coutteau et al. 1997; Tocher et al. 2008; Cahu et al. 2009). Several studies conducted in different fish species have reported positive effects of dietary SBL supplementation on growth performance (Kenari et al. 2011; Kumar et al. 2012; Taylor et al. 2015), digestive processes (Hamza et al. 2008; Kenari et al. 2011; Adel et al. 2017) and antioxidant enzyme activities (Gao et al. 2014; Kumar et al. 2014; Adel et al. 2017), as well as stress and disease resistance (Kumar et al. 2012, 2014; Adel et al. 2017).

Silvery-black porgy *S. hasta* is recognized as one of the most promising candidates for promoting mariculture activities in the south of Iran. Thus, considerable research has been focused on establishing the nutritional requirements of this species in order to optimize its diet formulation (Mozanzadeh et al. 2017). Thus, in order to continue improving the formulation of compound diets for this fish species, the current study was designed to evaluate the effects of dietary SBL inclusion on growth performance, humoral immune responses as well as digestive and antioxidant enzymes activities of *S. hasta* juveniles.

Materials and methods

Experimental design

For evaluating the effects of dietary SBL inclusion on *S. hasta* juveniles performance, an eight-week feeding trial was conducted using four isonitrogenous (*ca.* 500 g kg^{-1} crude protein), isoenergetic (*ca.* 18.5 MJ kg^{-1}) and isolipidic (*ca.* 200 g kg^{-1} crude lipids) diets containing graded levels of SBL (0, 30, 60 and 90 g kg^{-1} diet) (Tables 1–3) at the expense of fish oil (FO) as the main lipid source. Experimental diets were prepared as described in Mozanzadeh et al. (2015). Diets were prepared by mixing all dry ingredients including fish meal, wheat meal, gluten meal, beef gelatin and premixes for 30 min. Then, FO, SBL and sufficient distilled water were added to form a soft dough and mechanically extruded to

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