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Assessment of dietary inclusion of crude or hydrolysed *Arthrospira platensis* biomass in starter diets for gilthead seabream (*Sparus aurata*)

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ABSTRACT

This work evaluates the effects of the dietary inclusion of crude or hydrolysed *Arthrospira platensis* (Cyanobacteria) biomass on growth, muscle composition, digestive functionality and immune activities in gilthead seabream (*Sparus aurata*) fry (20.32 mg mean body weight). A 40-day feeding trial was conducted, aimed at assessing four experimental diets that included 5 or 10% (w/w) *A. platensis*, either crude or hydrolysed, plus a microalgae-free diet as control batch. Overall, none of the dietary treatments caused negative impacts on fish growth, body composition, muscle fatty acid profile, or innate immune response. Thus, the dietary inclusion of both crude and hydrolysed *A. platensis* reduced significantly the oxidation of muscle lipids, especially when using hydrolysed biomass, regardless of the dietary inclusion level. In relation to digestive enzymes, significantly higher levels of trypsin, chymotrypsin and leucine aminopeptidase activities were measured in fish fed on *A. platensis*-supplemented diets compared to control fish. In addition, within each inclusion level (5 or 10% w/w), those animals fed with diets that included the hydrolysed biomass yielded consistently higher digestive enzyme activities than those receiving the crude biomass. Microalgae dietary inclusion also induced favourable changes in fish gut morphology, according to the increase in microvilli length and diameter observed. This fact might well have contributed to reinforce the role of the intestinal mucosa as a protective barrier against microorganisms, as well as to enhance the absorptive capacity of the intestinal mucosa. Finally, 10% inclusion of microalgae hydrolysate enhanced lysozyme activity in liver, this fact suggesting improved protection against infectious diseases. In conclusion, the positive effects observed in fish fed with the diets including *A. platensis* up to 10% (not least the hydrolysed biomass) with regard to the different parameters assessed (digestive enzyme activities, intestinal epithelium ultrastructure, muscle lipid oxidation, and lysozyme activity) suggest the benefits of including this product in starter feeds for gilthead seabream fry.

1. Introduction

Early stages in the life cycle of marine fish are critical for the subsequent developmental changes taking place, in which fish undergo drastic morphological and physiological changes that determine further viability (Torres et al., 2020). Besides organ differentiation and morphogenesis, the larval stage is characterized by the highest growth rate throughout the productive cycle of commercial fish (Savoie et al., 2011). Consequently, considerable research effort has been made to develop inert microdiets that must fulfill certain premises for adequate larval development. Besides being tasty and economical, the most important of such requirements is to provide the necessary protein, amino acids, and fatty acids (Conceição et al., 2007; Vizcaíno et al., 2016; Khoa et al., 2019). These requirements have been traditionally met by the use of fishmeal and fish oil as the main protein and fatty acid sources, although plant protein ingredients, such as soybean meal, have also been included in feedstuffs (Ayala et al., 2020). However, in recent years, microalgae species and specific strains of cyanobacteria have emerged as a raw material of extraordinary interest in aquaculture (Shah et al., 2018; Han et al., 2019). Owing to their chemical composition, species of the genus *Arthrospira* are considered excellent candidates that have been successfully used as ingredients in feeds for several fish

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