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Incorporation of defatted microalgal biomass (*Tetraselmis* sp. CTP4) at the expense of soybean meal as a feed ingredient for juvenile gilthead seabream (*Sparus aurata*)

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ABSTRACT

The forecasted growth of the aquaculture sector requires the use of novel and sustainable ingredients in aquaculture feeds. A study was undertaken to evaluate the effect of a 10% incorporation of defatted microalgal biomass (DMB) of *Tetraselmis* sp. CTP4, used at the expense of dehulled solvent-extracted soybean meal (SBM), on the growth performance, nutrient digestibility and physiological response to confinement stress in gilthead seabream juveniles. The trial comprised two dietary treatments: a control diet (CTRL) with relatively high levels of marine-derived proteins and 10% SBM; and a test diet (DMB10) with the incorporation of 10% DMB at the expense of SBM, while maintaining a fair constancy of all other ingredients. Triplicate groups of 30 fish, with a mean initial body weight of 6.0 ± 0.2 g were fed the experimental diets for 61 days. At the end of the trial, fish tripled their initial body weight, but the overall growth performance criteria (final body weight, daily growth index, feed conversion ratio and protein efficiency ratio), whole-body composition and nutrient retention were not significantly affected by the dietary treatments ($p > 0.05$). The DMB10 diet showed a significantly higher apparent digestibility coefficients (ADC) of dry matter, energy and phosphorus ($p < 0.05$). When measured as an isolated feed ingredient, the DMB had an ADC of protein, fat, energy and phosphorus of 87.9, 85.3, 75.5 and 41.4%, respectively. After an acute confinement stress test, fish fed with DMB10 diet displayed a significantly lower plasma cortisol response (120 ± 23 ng/mL) than those fed with the control diet (160 ± 33 ng/mL) ($p < 0.05$). Overall results showed that DMB, issued from biorefinery processes, could potentially spare the use of soybean meal in aquaculture feeds, contributing towards a reduction of the current protein deficit in the European market.

1. Introduction

There is increasing interest in large-scale production of microalgal biomass as a sustainable lipid feedstock for different biotechnological applications, which include human and animal nutrition as well as biodiesel production [1]. However, the downstream processing entailing the extraction of lipids from the biomass will generate massive amounts of defatted microalgal biomass (DMB) as a co-product. Several reports have investigated the suitability of upgrading these DMB into different biofuels to improve the net energy ratio of the whole production pipeline such as production of biogas, bioethanol and bio-oil (e.g., hydrothermal liquefaction or pyrolysis) in a biorefinery setting [2–5]. Although there is a high demand for renewable sources for global fuel supply from the market and policymakers, biofuels need to be relatively inexpensive in order to compete with fossil fuels. Therefore, to enable the commercial use of microalgae as feedstock for the generation of bioenergy, the production and processing costs have to be offset by higher-end commodities obtained from DMB and other residues.

Whole microalgal biomass (WMB) and DMB are feed ingredients not only as a solution to meet the high demand for feedstocks required by the feed industry, but also as a way to meet future demand caused by the expected growth of the human population in the forthcoming decades [6]. Thus far, most studies have focused on the incorporation of

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