Including marine microalgae in European seabass (*D. labrax*) diets: effects on digestive-absorptive functions

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Marine microalgae deserve increasing attention as fish feed ingredients or supplements, due to their nutritional value and functional properties. They were recently shown to improve intestinal morphophysiology, which is often challenged in fish fed diets high in protein-rich plant feedstuffs. The aim of this study was to evaluate the effects of supplemental dried marine microalgae on gut histology and expression of genes encoding brush border membrane enzymes and transporters, in E. sea bass fed diets low in fish meal and supplying substantial levels of plant protein feedstuffs.
Two test diets (A1 and A2) were prepared by including a blend of *Tisochrysis lutea* and *Tetraselmis suecica* dried biomass (2:1 w:w ratio) to replace 15 and 45% fish meal protein and 10 and 30% fish lipid of a control diet (C+) containing 50:50 fish to vegetable protein and lipid ratios. A negative control (C-) preparation was also formulated with a 30:70 fish to vegetable protein ratio. One hundred **and** forty four sea bass (mean weight 204.3±0.78g) were divided among 12 tanks connected to a recirculating aquaculture system ensuring optimal rearing condition**s** (T, 23.8°C; Salinity 30 ppt). Fish groups were fed the test diets to **visual satiety over 105 days** according to a randomized design with 3 replicates per dietary treatment. At the end of the trial, 6 fish per treatment were euthanized; the digestive tract removed, divided into pyloric caeca (PC), foregut (FG) and hindgut (HG) sections, and frozen in liquid N for gene expression analysis. Subsamples of gut tissue were also collected for histological evaluation. From histological analyses fish fed diet C- had the lowest villi thickness ($P<0.05$) while those given diets including microalgae, irrespective of the inclusion level, resulted in greater villi length than that observed in either positive or negative controls. Irrespective of the dietary treatment, gene expressions of sucrase-isomaltase, PepT1, Na^+/K^+-ATPase and APN were highest in the foregut. Regardless of the gut section, gene expression of the same enzymes-transporter was higher in fish fed microalgae-containing diets ($P<0.05$) when compared to both controls.
The present results indicate that even at the lower dietary inclusion level investigated here, a mix of *T. lutea e T. suecica* resulted in potentially improved digestive-absorptive functions. Further studies are needed to understand the mechanisms underlying the observed positive effects of dietary microalgae addition.

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