POTENTIAL INCLUSION OF MACARONESIAN SEAWEED WRACKS IN DIETS FOR GILTHEAD SEABREAM (*SPARUS AURATA*).

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Introduction

Stranding of macroalgal wracks that regularly appear on coasts from offshore seaweed beds play a key role in beach ecosystems. However, this clumping natural biomass is often interpreted as an indicator of beach poor quality by bathers, and it is usually removed and discharged under considerable economic costs. On the other hand, alternatives to fish oil and fish meal for aquafeeds must be found in order to improve aquaculture sustainability. The inclusion of algae in fish feed has been described to produce several physiological benefits such as an improvement in growth performance and lipid metabolism (Moutinho et al., 2018). Gilthead seabream (*Sparus aurata*) is a marine species with high commercial value and easy adaption to captivity whose production has increased in the last few years. Nowadays it is the most important finfish aquaculture product in the Mediterranean with a total production of 136,000 tons in 2020 (Savoca et al., 2021). The use of Macaronesian macroalgal wracks as a supplement in aquafeeds from a feasible ecological perspective is proposed in the present study.

Material and methods

For acclimatization, 228 juveniles of *S. aurata* (initial weight: 18.63 ± 1.00 g) were fed with the commercial control diet for 1 week. Then, fish were randomly divided in 12 tanks (1000 L) and daily fed three times a day with 3-5% of their total biomass, with one of four different diets in triplicate: (1) an extruded diet for gilthead seabream (Skretting) (CD, control diet); (2) CD supplemented with a 7% of a wind dried powder (1 mm) product of multispecific (MU) macroalgal wrack (30.9% *Lobophora* sp.; 21.9% *Dictyota* sp.; 19.6% *Asparagopsis* sp.; 17.5% *Cymopolia* sp.; 1.8% *Hypnea* sp.; 0.3% *Laurencia* sp.; 0.1% *Stypocaulon* sp., and 8.0% undetermined); (3) CD with a 7% of monospecific macroalgal wrack of *Lobophora* sp. (MOL) (>85%); (4) CD with a 7% of monospecific macroalgal wrack of *Dictyota* sp. (MOD) (>85%). After 93 days of feeding, 5 individuals of each treatment were slaughtered and specific growth rate (SGR), fish body indexes, hepatosomatic (HSI), viscerosomatic (VSI), and visceral-fat index (VFI) determined. Muscle samples were also collected for the analysis of proximate composition, lipid class (LC), fatty acid (FA) profiles and peroxides index (PI). TBARS and the activity of antioxidant enzymes were also measured in both muscle and liver. Finally, gut was removed in order to analyse the activity of digestive enzymes.

Results

Survival was 100% in all treatments. Fish growth was not compromised by the dietary inclusion of macroalgal wracks (SGR= ~1.40%day^{-1}). Proximate composition, HSI, VSI and VFI were similar regardless of the treatment. Muscle lipid composition was only affected in its higher content of monoacylglycerols in MU (1.43±0.30%) and MOD-fish (1.15±0.24%), and higher saturated FA (SFA) in MOD (26.36±0.55%) and MOL-fish (26.13±0.92%) compared to the other fish groups (0.84-1.35% and 24-25%, respectively). Antioxidant enzymes catalase (CAT), superoxide dismutase (SOD) and glutathione-S-transferase (GST) did not varied between treatments. Contrarily, glutathione reductase (GR) in muscle, presented the highest activity in MOD-fish (0.71 ± 0.09 *vs.* ~0.40 U mg protein^{-1}). Finally, digestive enzymes activities and oxidation status (PI and TBARS) of muscle remained unchanged regardless of dietary treatment.

Discussion and conclusions

Macroalgae are known to have anti-nutrient compounds that can reduce digestibility and nutrient absorption, giving rise to reduced fish growth. Nonetheless, low seaweed inclusion (2.5-10%) can even improve growth and health performance in several species (Moutinho et al., 2018). It was expected that the lipolytic activity described for some brown macroalgae (Bourgougnon, 2014) caused a lower fat deposition in fish among other effects. However, growth, body indexes, proximate composition and digestive activities were unaffected by the different seaweed inclusion. This suggests that the basic composition of experimental diets may have met the nutrient requirements of gilthead seabream juveniles at the same level as the CD specifically designed for *S. aurata.* FA profiles did not vary, except for SFA, which increased in MOL and MOD-fish, as it has been previously described in *S. aurata* with a 5% of seaweed inclusion (Guerreiro et al., 2019). The lipolytic activity reported in macroalgae may be removing SFA from triacylglycerides in the liver for their subsequent storage in muscle. Seaweed supplementation may mitigate stress responses. However, it also increased lipid peroxidation in *S. aurata*, which the authors attributed to lipid layer degradation (Guerreiro et al., 2019). GR catalyzes the reduction of GSSG to GSH, representing the antioxidant restoration potential. Thus, the increment of GR activity in muscle of fish receiving the MOD supplementation suggests a higher capacity to mold the glutathione metabolism state by MOD treatment (Peixoto et al., 2016).

In summary, the inclusion of the MU, MOL and MOD in aquafeeds for *S. aurata* did not show negative effects on fish growth, perivisceral or liver fat deposition, proximate composition, main lipid profile or digestive capacity. A potential capacity to better restore the antioxidant status of the organism was detected with the MOD supplementation. As a result, the inclusion of a 7% of macroalgal wracks in diets for *S. aurata* may be feasible without apparent detriment in fish performance. Besides, it will contribute to the sustainable use of ocean resources and might empower the sustainable blue economy strategy in islands.

References

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