THE EFFECT OF CODIUM SP. AND OSMUNDEA SP. INCLUSION ON GROWTH PARAMETERS OF JUVENILE TURBOT (SCOPHTHALMUS MAXIMA)

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INTRODUCTION

In recent years, with the growth of aquaculture and the interest in improving the health of fish during the breeding process (Asimi and Sahu, 2013), the search for natural product with a source of bioactive compounds has increased. Macroalgae offer a novel and value-added dietary ingredient in diets formulated for fish. Like land plants, the nutritional content of macroalgae can vary greatly between species, genera, divisions, seasons, and locations. Beside from its basic nutritional value, algae contain several pigments, immunostimulant compounds, and secondary metabolites that may have beneficial effects on farmed fish (wan et al., 2018; Cruces et al., 2012; Oliveira et al.2013) Species such as Codium and Osmundea abound in the area of Galicia and the north of Portugal, where the interest of exploitation is increasing due to the bioactive compounds that contain. Within the ALGALUP project, an experiment has been carried out to evaluate the effect of 4 diets with inclusions of macroalgae (Codium sp and Osmundea sp) and extracts of these rich in polysaccharides on growth and digestive physiology in juvenile turbot (*Scophthalmus maxima*).

MATERIALS AND METHODS

750 juvenile turbot from the Nueva Pescanova company with an average weight of 10.3±2.38 g were used. Fish have been distributed in 15 tanks of 200 liters with 50 fish per tank. During the following 60 days turbot have been kept in a recirculation system with a daily renewal of 100% and have been fed 3 times. Every 3 tanks were assigned to one of the 5 diets formulated and manufactured with the support of SPAROS®, Portugal: codium 5% (DC5%) and Osmundea 5% (DO5%) with the inclusion of 5% dried algae. codium 15 (DC15) and Osumundia 15 (DO15) with the inclusion of 1.5 g/kg of soluble fiber obtained within a hydrolyzing process, simultaneously using two enzymes, one with protease activity and the other with cellulase, hemicellulase and pectinase activity and a comercial feed as a control (DC). Water conditions were maintained at 16 ± 0.5 ºC, 35 ‰ of salinity and 7.2 ± 0.9 mg / L of dissolved oxygen. RAS parameters were stable during all experiments. Ammonia, nitrate, and nitrite were measured daily

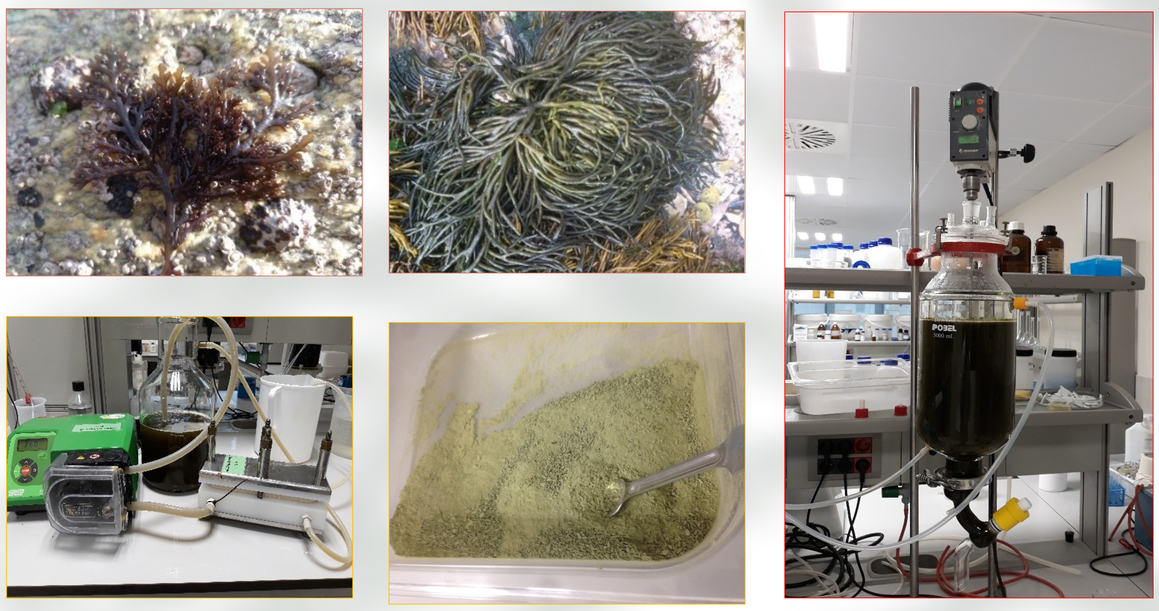

Figure 1. Hydrolyzing process of *Codium sp*. and *Osmundea sp*.

Every 4 weeks the fish were weighed and the length was measured. Before handling, the fish were anesthetized with 200 mg / l of 2-phenoxyethanol. At the end of the experiment, the condition factor, specific growth rate (SGR), conversion index (FCR), protein efficiency index (PER)and relative growth rate (RGR), have been calculated. Also 10 fish from each tank were dissected by separating and weighing liver and viscera and the hepatosomatic index (HSI) and the viscerosomatic index (VSI) were calculated.

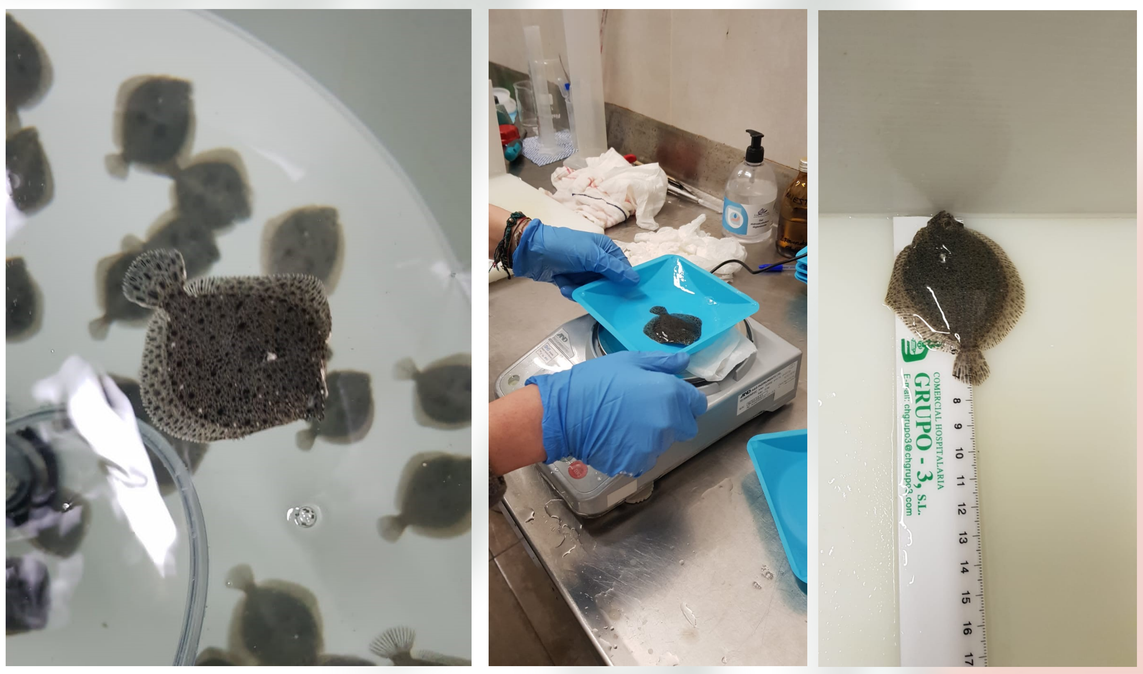

Figure 2. Sampling procedure of turbot juveniles (*Scophthalmus maxima*) during the trial

RESULTS

At the end of the experiment turbot juveniles had a mean weight of 26.29±0.65 g and a length of 11.8±0.61 cm. No significant difference was observed between diets neither in weight nor in length (P> 0.05). Although, in terms of growth, a difference has been detected in the SGR and the RGR. The DC15 diet has shown the lowest values in both rates with 1.7 and 1.35 respectively. These data are significantly different from those of the DO15 diet, which has driven the highest values in SGR (2.02) and RGR (1.76). The growth data of the diets including whole macroalgae and extracted polysaccharides did not show significant differences with the control. However, the trend has clearly shown that the DO5 and DO15 diets favor an increase in the SGR of 6 and 9.25%, respectively, compared to the control and 8 and 14%, respectively, in terms of the RGR.

Table 1. Initial and final weight, growth (SGR and RGR percentages) and feed conversation (FCR and PER ratios) of turbot juveniles fed with the experimental diets. Different letters indicate significant differences (ANOVA P<0.05)

	DC5	DO5	DC15	DO15	DC
Inicial weight	10,74±2,41	9,94±2,77	10,82±2,3	9,60±2,2	10,41±2,2
Final weight	27,01±5,54	26,31±4,96	25,28±4,06	26,42±5,21	26,17±6,17
SGR	1,84±0,05^{a,b}	1,95±0,01 ^{a,b}	1,70±0,12 ^{a}	2,02±0,09 ^{b}	1,84±0,09 ^{a,b}
RGR	1,51±0,07 ^{a,b}	1,65±0,01 ^{a,b}	1,35±0,15 ^{a}	1,76±0,12 ^{a}	1,51±0,12 ^{a,b}
Feed intak	724,45±22	711,18±14	697,65±14	710,90±11	720,48±27
Gain biomass	846,39±61	851,18±41	752,20±67	874,49±47	819,75±79
FCR	0,86±0,04	0,84±0,02	0,94±0,13	0,82±0,07	0,89±0,11
PER	1,79±0^{a}	1,75±0^{a}	1,75±0^{a}	1,85±0^{b}	1,75±0^{a}

During the experiment, fish fed the DC15 diet showed the lowest feed intake and biomass gain. Although no significant difference is observed, the FCR also follows the same trend with the worst data observed in the DC15 diet. It should be noted that the DO15 diet improved FCR by 8.2% and 13% respectively compared to the DC and DC15 diet.

The analysis of the hepatosomatic index data showed that the control diet had a significantly low value compared to the rest of the diets. In the case of the viscerosomatic index, the lowest values have been observed in the DO15 diet and DC when the highest in the DC15 diet.

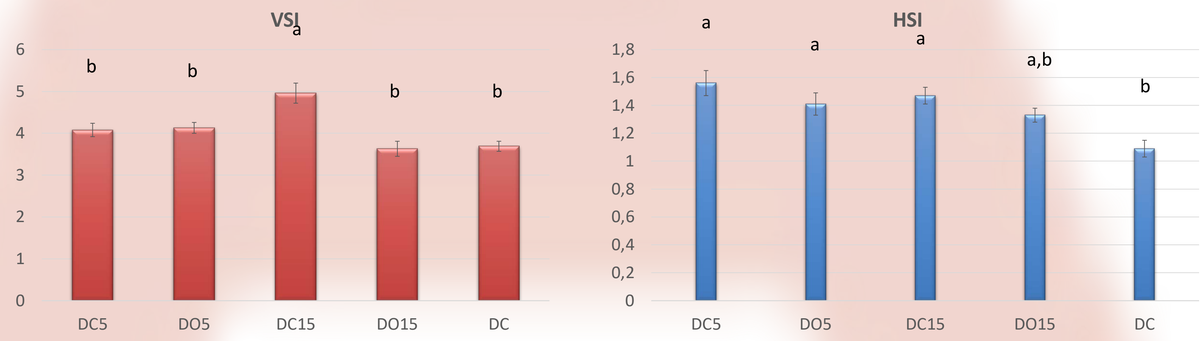

Figure 3. Data of Verosomatic (VSI) and hepatosomatic index (HSI) of turbot fed with the experimental diets at the end of experiment , Different letters indicate significant differences (ANOVA P<0.05)

CONCLUSION

Osmundea sp. could be used dry or as polysaccharide extract in the diet of juvenile turbot with a positive effect on growth parameters and with no effect on VSI and HIS. While *Codium sp*. had no effect on growth as dry product and a negative effect as a polysaccharide .

This work was realized Within the ALGALUP project founded by Interreg POCTEP Spain-portugal with FEDER co-found