FUNCTIONAL DIETS BASED ON MICROALGAE CAN BOOST IMMUNE RESPONSES IN GILTHEAD SEABREAM (*Sparus aurata*) JUVENILES

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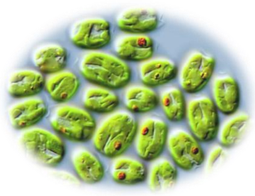
Background

Gilthead seabream is a crucial species for Mediterranean countries' aquaculture.
Rearing conditions can compromise its immune status.
Functional diets with algae can promote welfare.

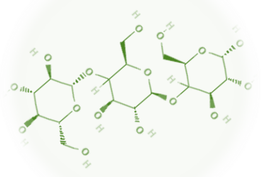
- ✓ **Improve fish health**
- ✓ **Reduce susceptibility to disease**

Tetraselmis chui



- ✓ High protein content
- ✓ Balanced amino acid profile
- ✓ Bioactive compounds
- ✓ Prebiotic

B-Glucans



- ✓ Immunomodulator role
- ✓ Improves growth rate
- ✓ Boosts stress resistance
- ✓ Antioxidant properties

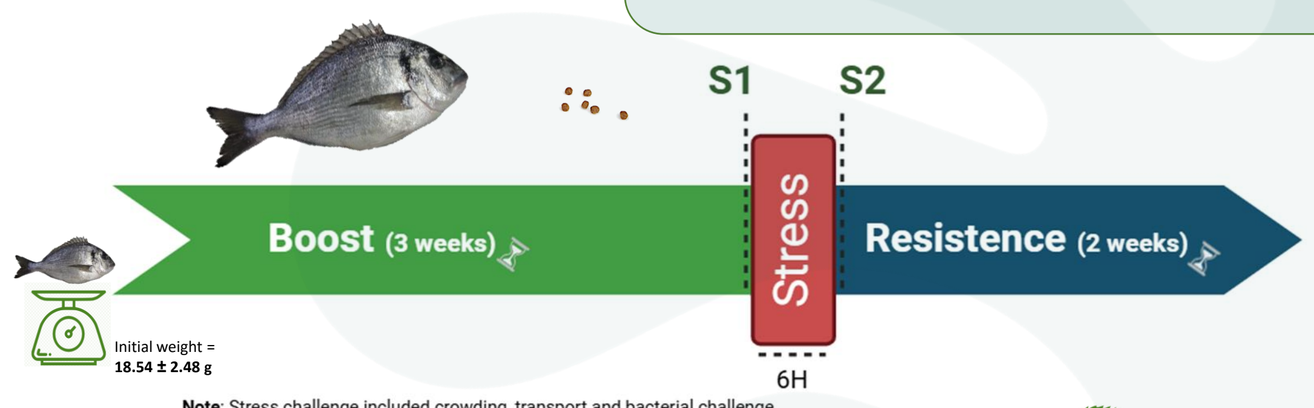
Objective

Use of microalgal extracts to modulate the immune system response, improving the performance and overall fish health.

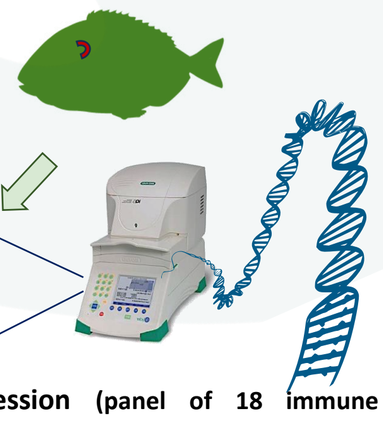
Material & Methods

4 experimental diets:

- CTRL = commercial-like diet
- High = formula with higher algae extract (*Tetraselmis chui*) inclusion
- Low = formula with lower algae extract (*Tetraselmis chui*) inclusion
- BG =formula with inclusion of β-glucans from algae



Photobacterium damselae subsp. *piscicida*



Plasma immune biomarkers:

- **Total Protein**
- **IgM**
- **Peroxidase**

Caudal fin for stress parameters:

- **Cortisol**

Head Kidney gene expression (panel of 18 immune biomarkers):
Interleukins (*il1β*, *il10*, *il8*, *tnfα*), antimicrobial peptide (*hep*), T-cell markers (*cd3x*, *cd8β*), chemokine receptors (*ccr3*, *cxcr4*), pattern recognition receptors (*tlr2*, *tlr5*, *tlr9*), and other relevant immune-related proteins (*tgfβ*, *mchII*, *mmp9, mcsfr1*, *cas3* and *c3*).

Results & Discussion

Immune parameters

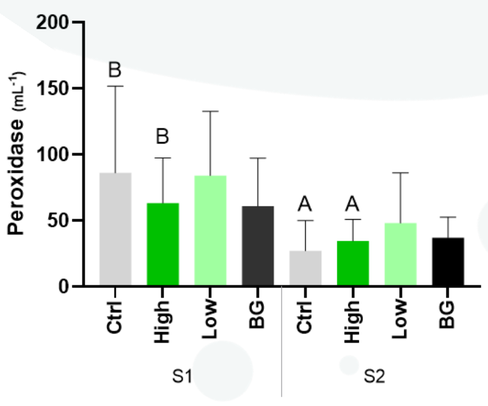


Fig.1- Quantification of peroxidase levels on the plasma of *Sparus aurata* juveniles fed dietary treatments: after boost (S1) and after stress (S2). Values are presented as means ± SD (n = 9). P-values from ANOVA one way, followed by Tukey's post-hoc test ($p \leq 0.05$). Different uppercase letters stand for significant differences in time for the same dietary treatment.

Most immune biomarkers did not change significantly between dietary treatments at each sampling time. The differences occur mainly between times with the same nutritional treatment.
Nevertheless, immune parameters are crucial to determine the immune conditions of fish, together with other stress parameters like cortisol, to evaluate their health.

Gene expression

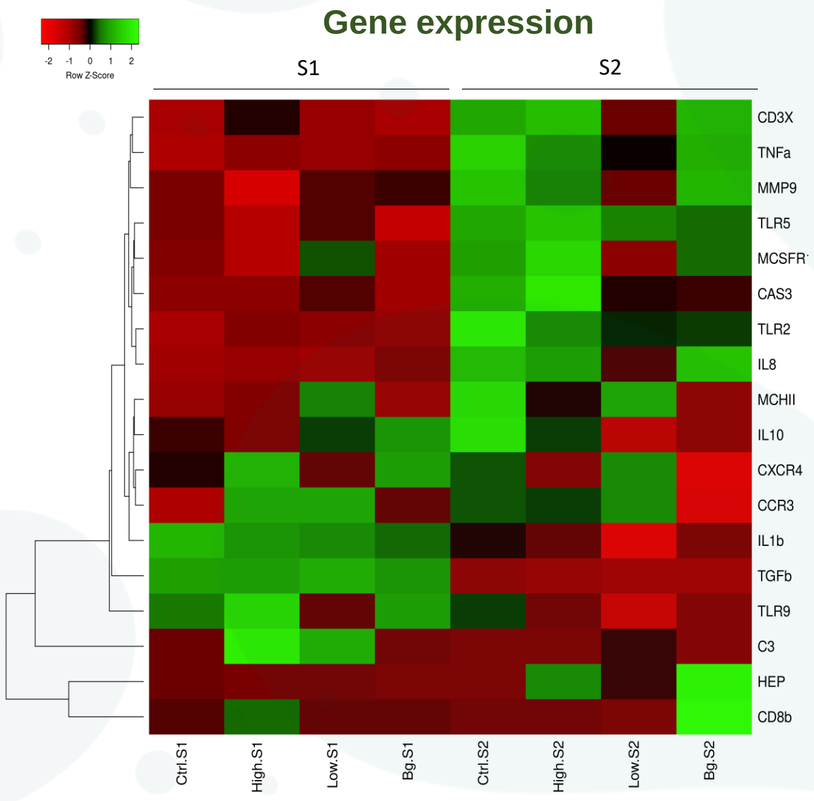


Fig.2- Relative gene expression in the head-kidney of fish fed with the different experimental diets. Heatmap depicting relative expression of differentially expressed genes in 4 dietary groups at the different sampling times (S1 and S2) on 18 immune-related genes. Green and red colors indicate a down and up regulation of the expression values according to the scale show.

- ✓ Juveniles fed High and BG diets presented normal performance and higher survival rates.
- ✓ Plasma peroxidase levels (Fig.1) suggested that including microalgae bioactive compounds have an immunomodulatory effect.
- ✓ Cortisol levels increased from S1 to S2 in all treatments as expected.
- ✓ In terms of head kidney gene expression, the stress episode caused a switch in terms of regulation of the tested genes (Fig.2).
- ✓ Seabream juveniles fed High presented up-regulation in *cxcr4*, *cd8β*, *hep*, and *c3* at the end of the feeding period, while after stress fish fed BG presented a decrease in *cxcr4*, together with a tendency of upregulation of *cd8β* and *hep* genes.

Conclusions

***Tetraselmis chui* aqueous extracts and algae β-glucans seem promising candidates for inclusion in diets for gilthead seabream juveniles, mainly during stressful rearing periods.**

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