Unraveling the impact of plant-based sustainable fishfeeds on white muscle development in gilthead seabream: a comparative study

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The problem....

Alternative protein sources of low ecological footprint and at affordable prices for fish feed formulation are key to the sustainable development of aquaculture. Nevertheless, they often impact fish physiology and metabolism due to the presence of phytoestrogens. The demonstrated negative effect of phytoestrogens on white muscle development and growth highlights the **need for tools** to screen for potential myostatic action of raw materials and fish feeds.

Objective: combine *in vivo* and *in vitro* approaches to validate white muscle gene markers in the gilthead seabream as indicators of compromised myogenesis when fed alternative protein sources.

Approach

In vivo

27 g → 116 g

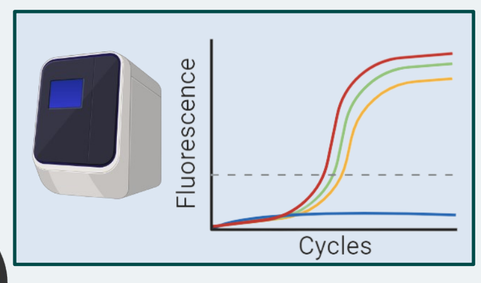
Soy-free diet

vs

20% SBM diet

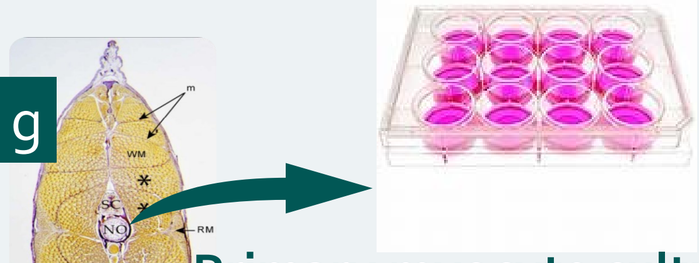
vs

20% SPC diet

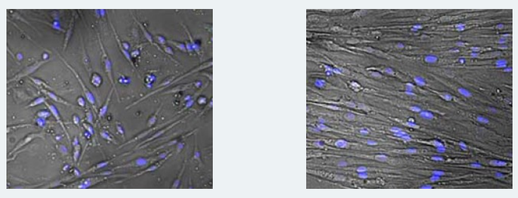


✓ Fishmeal
✓ Soybean meal
✓ Soy protein concentrate
✓ Corn gluten
✓ Wheat gluten

In vitro



Primary myocyte culture



proliferation | differentiation | fusion

48 h

200 µl extract of...

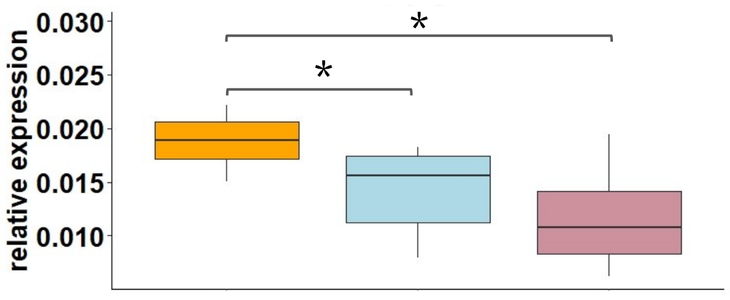
✓ Fishmeal
✓ Soybean meal
✓ Soy protein concentrate
✓ Corn gluten
✓ Wheat gluten

White muscle gene markers

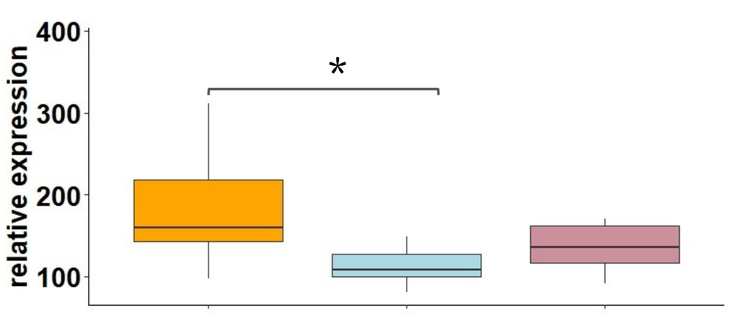
(*Georgiou et al., 2016, Cell Tissue Res 363, 541*)

Results *In vivo*

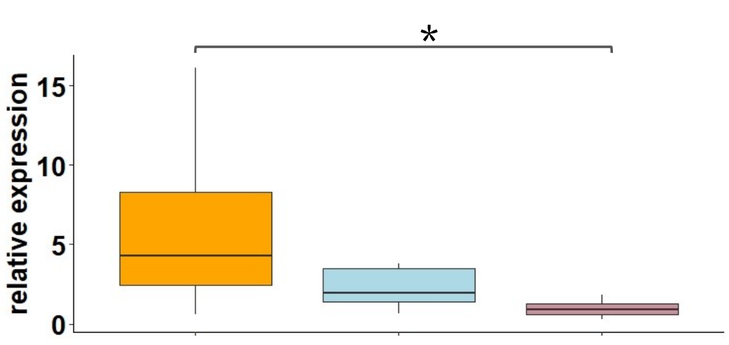
Myogenin: differentiation



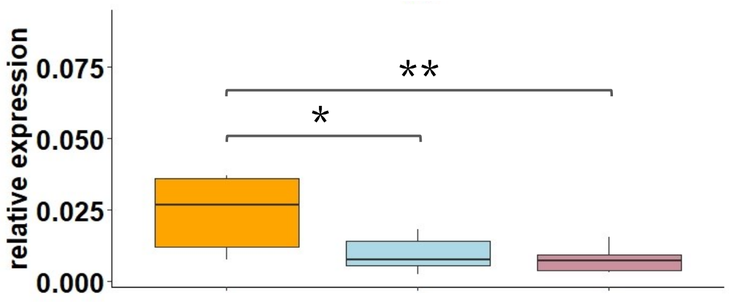
Myosin light chain 2a: hypertrophy



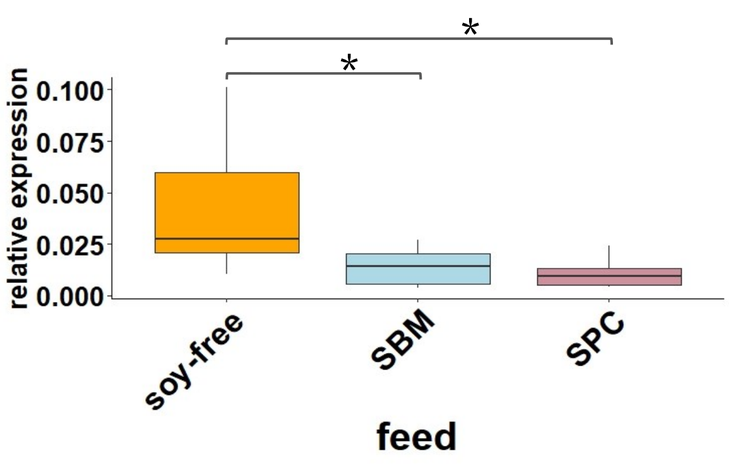
Myosin light chain 2b: hyperplasia



Hormone sensitive lipase: lipid mobilization



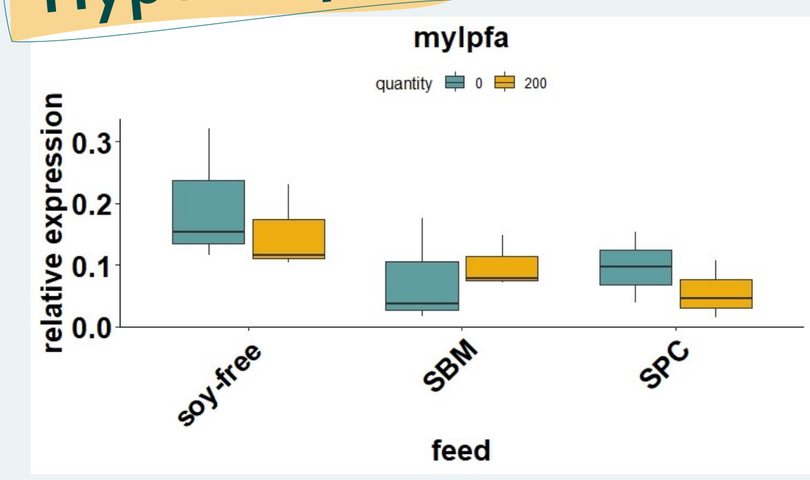
Lipoprotein lipase: lipid storage

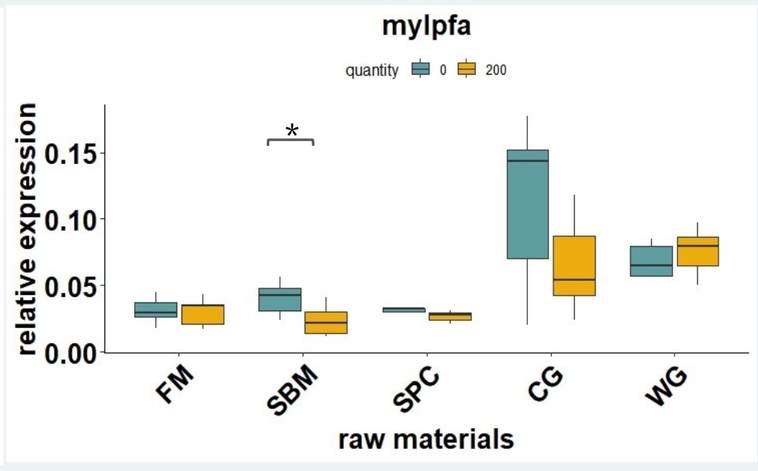


Results *In vitro*

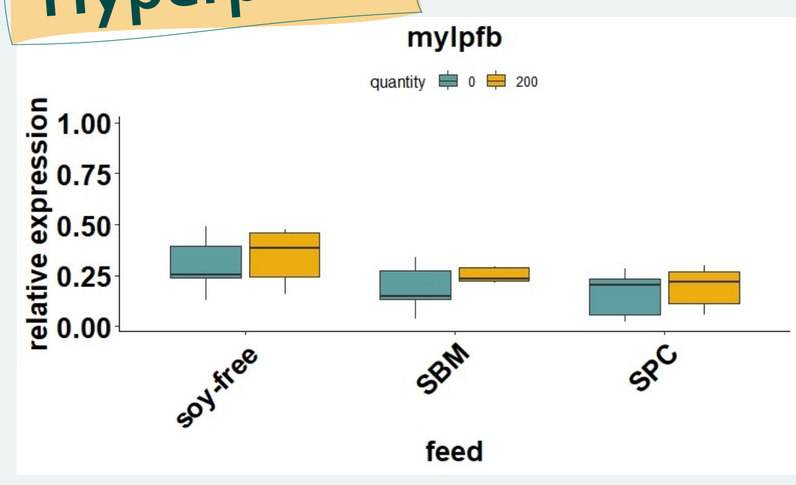
SBM significantly **suppressed hypertrophy** marker during differentiation of myogenic cells

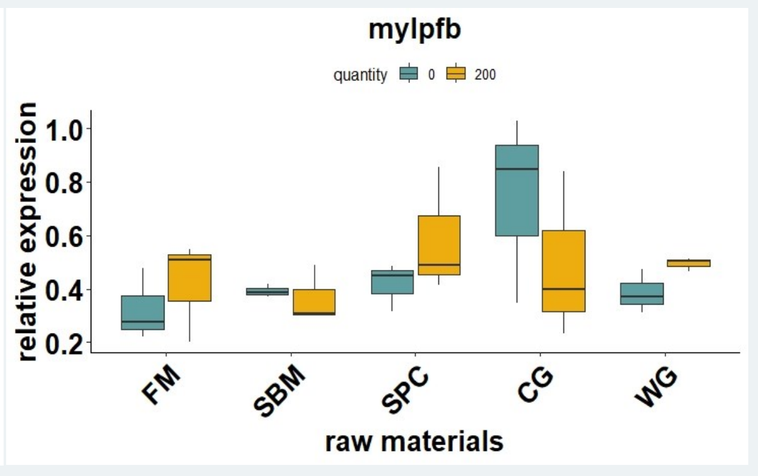
Hypertrophy





Hyperplasia





Key findings

- Inclusion of soy in the diet in the form of SBM or SPC had a significant effect on white muscle gene markers of hyperplasia and hypertrophy as well as lipid metabolism
- Primary myocyte cultures can be a useful tool in screening for myostatic activity of fish feed raw materials

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