Use of by-products of the brewing industry as alternative protein and lipid sources in gilthead seabream (*Sparus aurata* L.) diets

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Introduction

- Aquaculture consumes large amounts of food to produce a kilo of fish.
- The increase of farmed fish has increased the demand for fish meal and oil as the main source of protein for food.

Aim

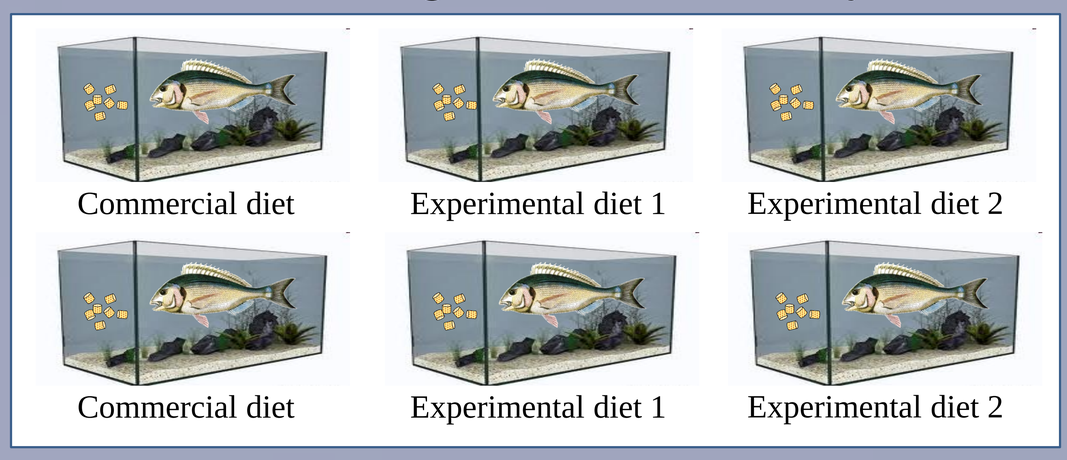
To use by-products of the brewing industry as alternative protein and lipid sources for fish diets.

By-products of the brewing industry included in the experimental diets:

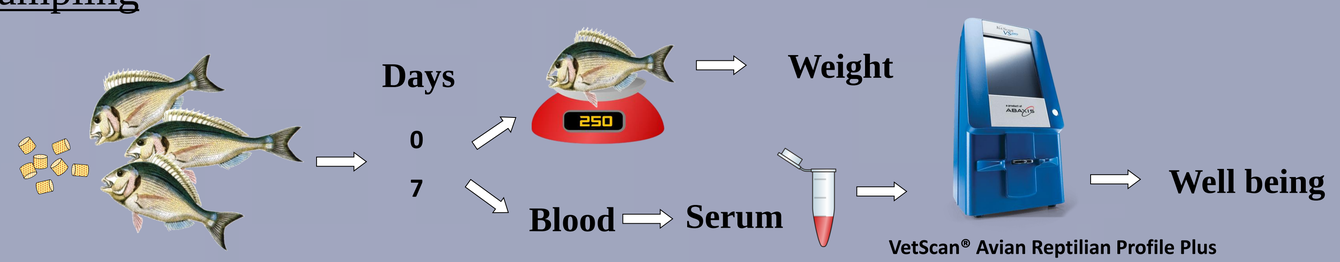
- yeast, grain and root (experimental diet 1)
- yeast and grain (experimental diet 2)

Materials and Methods

Experimental design



Sampling



Results

Blood parameters measured in serum of gilthead seabream specimens fed control or experimental diet 2.

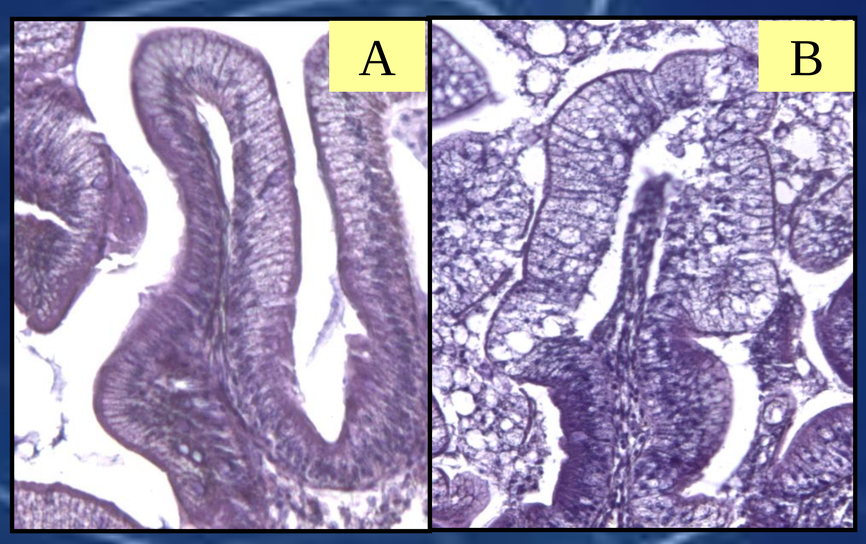
Parameter	Control diet	Experimental diet 2	Disorder associated to each parameter
Aspartato aminotransferase (U ml^{-1})	63.18 47.6	110 22	Liver disease, muscle damage
Biliar acids (µmol L^{-1})	0.00 0	0.00 0	Hepatobiliary disease
Creatine quinase (U ml^{-1})	2092.09 231	6240 354	Muscle damage
Uric acid (mg dL^{-1})	0.00 0	0.00 0	Renal health
Glucose (mg dL^{-1})	30.52 5	59 2	Severe liver disease; pancreatic disease
Calcium (mg dL^{-1})	6.15 0.37	10.65 0.25	Renal and nutritional disease; fluid balance
Phosphorum (mg dL^{-1})	4.80 0.42	8.65 1.35	Egg production; bone and renal disease
Total proteins (g dL^{-1})	1.76 0.08	2.7 0.1	Liver, gastrointestinal, and kidney disease; dehydration
Albumin (g dL^{-1})	0.93 0.03	1.5 0.2	Liver and kidney disease
Globulin (g dL^{-1})	0.83 0.05	1.2 0.1	Dehydration; antigenic stimulation
Potasium (mM)	4.32 0.23	8.3 0.2	Indicator of cell lysis,and fluid balance
Sodium (mM)	85.76 2.5	170 4	Indicator of fluid balance and dehydration

Blood analysis of fish fed experimental diets have altered levels of creatine kinase, sodium and potassium, respect to the control fish (fed commercial diet).

Enterocytes from fish fed the experimental diets had a very vacuolated cytoplasm indicating a possible enteritis.

Conclusions

- Fish fed experimental diets loss weight, respect to control fish
- Blood tests revealed a state of dehydration of the specimens
- These effects on fish seem to be due to the high inclusion of grain and root in the diets



Micrographs of anterior gut sections from gilthead seabream fed for 7 days control (A) and experimental diet 1 (B). Stain hematoxylin-eosin.

Acknowledgments

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