

PLANT-BASED DIET IN TROUT (O. MYKISS): ARE THERE GENOTYPE-DIET INTERACTIONS FOR MAIN PRODUCTION TRAITS WHEN FISH ARE FED MARINE VS PLANT-BASED DIETS FROM THE FIRST MEAL?

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ABSTRACT

To face future decrease of marine resources, replacement of fishmeal and fish oil by plant products is nowadays worldwide priority for the aquaculture of carnivorous fish, especially salmonids. Genetic variability has been recently evidenced for growth ability on plant-based diet and pointed out potential genetic gains. In a context of fast feed evolution, this work compares heritabilities of growth parameters between rainbow trouts fed with diet containing fish oil and fish meal and fish fed on diet devoid of marine products. Assessment of genotype diet interaction informs on potential family reranking between diets and potential consequences on current breeding programmes.

MATERIALS AND METHODS

- Full factorial cross between 25 sires and 10 dams in INRA experimental farm. From the first feeding, 1400 fish on a marine diet (M) and 2598 on a plant-based diet (PB)
- Fish were reared in 12 tanks (6 per diet) individually tagged and fin clipped for DNA extraction and parentage assignment.
- First slaughtering to compare fish at same age  
Second slaughtering to compare fish at the same weight
- Recording of body weight, fork length, sex and weighing of carcass, fillet and head (Carc Y, Fil Y, Head Y in % of body weight).
- Analyzes with MIXED procedure (SAS Institute Inc., Cary, NC)  
Genetic parameters estimation with ASREML model:

$$Y_{ijklmno} = Sex_{ij} + Diet_{ik} + Tank_{il} + an_{im} + dam_{in} + e_{ijklmno}$$

Where  $Y_{ijklmno}$  is the i performance of individual o,  $Sex_{ij}$  is the fixed effect of sex j,  $Diet_{ik}$  is the fixed diet effect k,  $Tank_{il}$  is the fixed effect of the tank l,  $an_{im}$  is the random genetic effect of trait i on animal m,  $dam_{in}$  is the random effect of dam n and  $e_{ijklmno}$  is the random residual error for trait i.

RESULTS

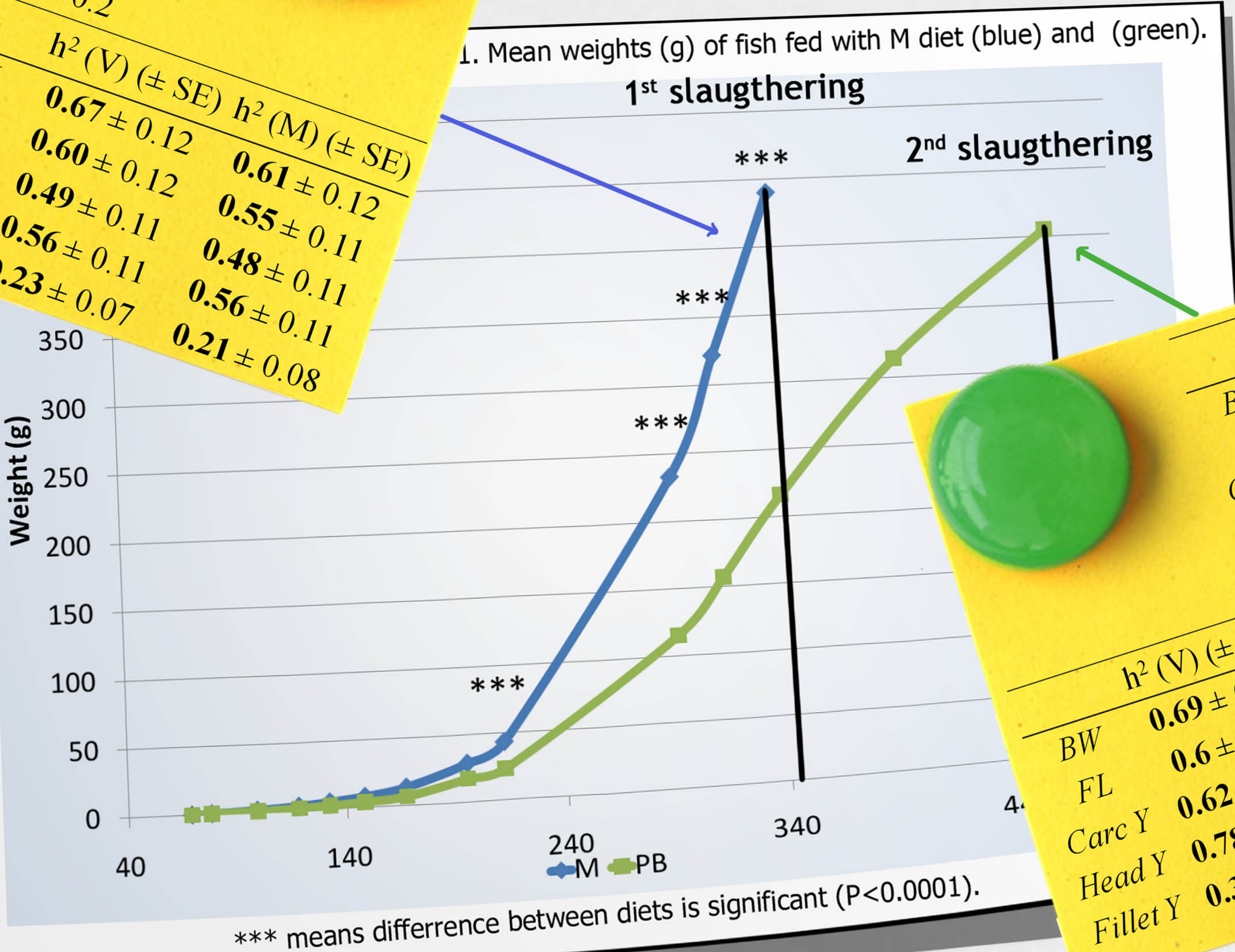
- Diet effect was important on growth (Figure) but survival rates were not significantly different (~ 96 %).
- No significant differences were observed among diets for heritabilities of the different traits.
- Genetic correlations were high for all parameters meaning a limited genotype-diet interaction, thus a low (even though significant) re-ranking of the families

Diets	M	PB
Ingredients (g/kg)		
Fishmeal	692	0
Maize gluten	0	250
Soybean meal	0	208
Wheat gluten	0	239
Extruded wheat	187	0
White lupin	0	70
Extr. dehulled pea	0	0
Fish oil	81	0
Rapeseed oil	0	62
Linseed oil	0	37
Palm oil	0	24
Soya lecithin	0	20
L-Lysine	0	15
L-Arginine	0	0
CaHPO4.2H2O (18%P)	0	35
Binder	20	20
Min. Premix	10	10
Vit. Premix	10	10
Composition(% DM)		
Crude Protein	54.6	50.5
Lipids	15.6	16.2
Energy kJ/g DM	22.5	23.2

	Gen. Corr.
BW	0.91 ± 0.05
FL	0.90 ± 0.05
Carc Y	0.9 ± 0.06
Head Y	0.87 ± 0.07
Fillet Y	0.66 ± 0.2

	h² (V) (± SE)	h² (M) (± SE)
BW	0.67 ± 0.12	0.61 ± 0.12
FL	0.60 ± 0.12	0.55 ± 0.11
Carc Y	0.49 ± 0.11	0.48 ± 0.11
Head Y	0.56 ± 0.11	0.56 ± 0.11
Fillet Y	0.23 ± 0.07	0.21 ± 0.08



	Gen. Corr.
BW	0.82 ± 0.08
FL	0.86 ± 0.07
Carc Y	0.87 ± 0.07
Head Y	0.86 ± 0.07
Fillet Y	0.67 ± 0.17

	h² (V) (± SE)
BW	0.69 ± 0.13
FL	0.6 ± 0.12
Carc Y	0.62 ± 0.07
Head Y	0.78 ± 0.01
Fillet Y	0.34 ± 0.09

GEN.COR ARE CALCULATED BETWEEN FISH AT SAME WEIGHT

CONCLUSION

- Very low family re-ranking between extremely contrasted diets
- Significant and early weight differences between diets (M fish grew almost twice faster than V fish).
- Heritability estimates were high for all traits, and in the same range under both diets.