

# Sensory quality of Atlantic salmon (*Salmo salar*) fed diets with no fish meal and no fish oil

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## Introduction

An ultimate goal in the farming industry is to become independent of fish meal and fish oil in aquafeeds. In recent years, commercial diets without fish meal have become available, but complete substitution of fish oil has been difficult due to lack of alternative sources providing the long-chain n-3 fatty acids (LC n-3 FA) required by salmon during the grow-out phase (Rosenlund et al., 2016). However, with the current developments of new oil sources rich in LC n-3 FA, this can change. The aim of the present study was to test the effects of feeding diets containing no fish meal (FM) and no fish oil (FO) on performance and product quality of Atlantic salmon.

## Materials & Methods

Triplicate groups of fish of ~1kg were fed 3 different diets until they reached a harvest size of ~6 kg (Figure 1). The trial was conducted at Skretting ARC Lerang Research Station in 3 m tanks supplied with flow-through seawater at 12°C. Two levels of algal oil (Veramaris®) were added to test diets containing no FM as a source of EPA and DHA, at either 2-4 % or 8-15 % depending on fish size. The control diet contained 15 % FM and 7.5-12.5 % FO to mimic typical commercial diets (Norway) for salmon of similar sizes.

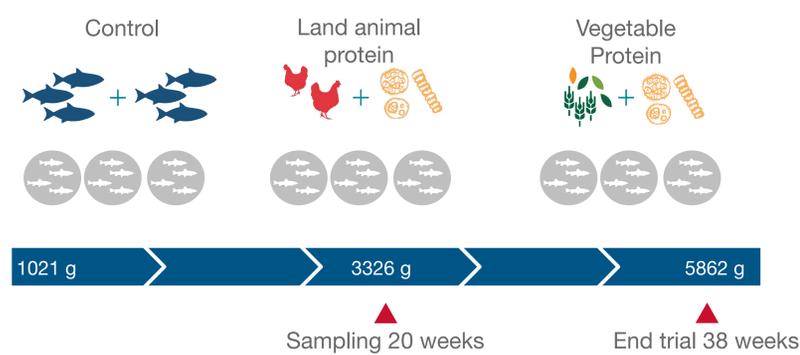


Figure 1. The diet concepts tested were based either on Land animal proteins (LAP) or Vegetable protein sources (VP).

Fish sampled at the end of the trial were sent to Nofima AS (Ås, Norway) for sensory evaluation of raw and cooked fish. The sensory tests were carried out by a trained panel consisting of 11 judges according to ISO 13299:2016. Fish were scored on a scale from 1 (low intensity) to 9 (high intensity) using the software EyeQuestion Logic8 BV, The Netherlands for attributes related to appearance, odour, flavour and texture.

## Results

Growth was good (Relative Growth Index ~100 %) and similar independent of diet (Figure 2).

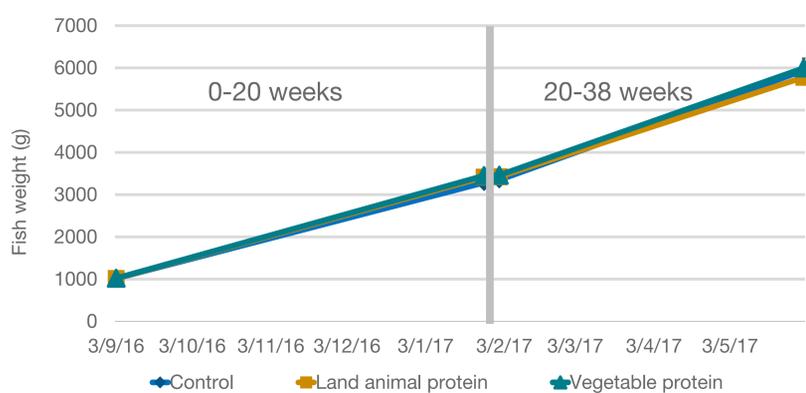


Figure 2. Development in fish body weight during the trial period

Raw fish was evaluated for odour and appearance (Figure 3).

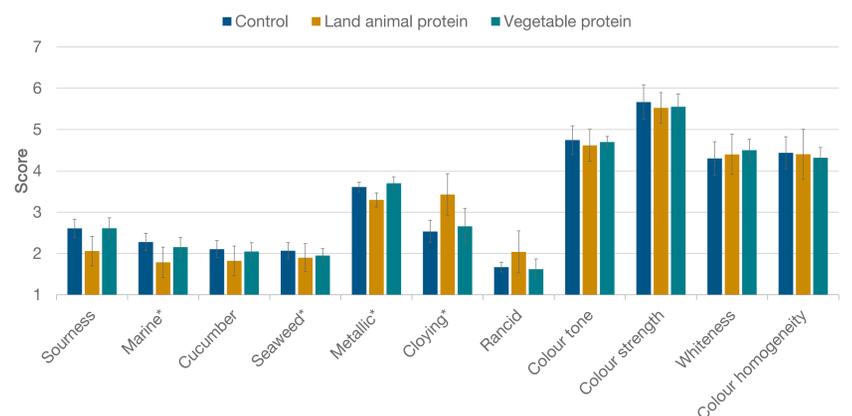


Figure 3. Attributes related to odour and appearance in raw salmon fed 2 different no FM-no FO diets and an FM-FO control diet for 38 wks. Bars show mean value and vertical lines SD (n=6). Attributes marked with \* are significantly different (p < 0.05). No differences found in appearance, but fish fed the LAP diet had slightly different marine, metallic and cloying odour. This is not related to the inclusion of algal oil which was low in the LAP diet.

No differences were found in odour and appearance of cooked salmon (Figure 4). Except for a slightly higher rancid flavour in salmon fed the VP-diet, which may be related to the higher content of LC n-3 FA in that diet, flavour and texture were also similar in all groups.

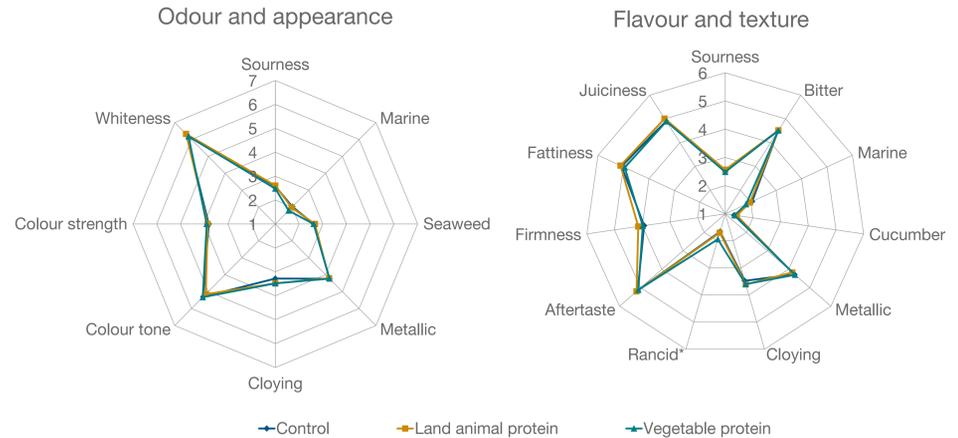


Figure 4. Sensory evaluation of cooked salmon fed 2 different no FM-no FO diet and an FM-FO control diet for 38 weeks.

The content of EPA+DHA ranged from 6.3 (LAP) to 19.1 (VP) % of total FA in the fish at the end of the trial corresponding to 1.0 to 2.9 g of EPA+DHA in one portion (150 g) of salmon containing 17 % fat.

## Conclusions

Atlantic salmon can be fed diets without fish meal and fish oil for most of their grow-out period in sea without negative impact on performance and product sensory characteristics. Sensory evaluation of raw and cooked salmon showed no, or only minor, differences between groups. Furthermore, the content of LC n-3 FA can be tailored in salmon using the concentrated algal oil.

## Acknowledgements

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