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The dietary effects of potassium diformate on the protein and fat digestibility of Atlantic salmon (*Salmo salar*) reared in sea water

Introduction

The preservation of fish and fishmeal with potassium diformate (KDF) is practised in Norway and is gaining popularity elsewhere. Studies using potassium diformate in piglets and in tropical fish species have shown improved growth and digestibility. Recent studies also showed the growth enhancing effects of potassium diformate treated fish meal on Atlantic salmon. However, data are still missing on the dietary nutrient digestibility of such treated fish meal. The objective of the present study was therefore to investigate the effect of potassium diformate, added during fishmeal production, on nutrient digestibility in Atlantic salmon (*Salmo salar*).

Material and methods

The trial was conducted at AKVAFORSK's research station in Sunndalsøra, Norway. 560 Atlantic salmon, at an average weight of around 350 g, were allocated to tanks of 1 m^3 volume supplied with sea water (31-35‰) and a flow rate of 30 litres per minute. 35 fish were placed in each tank at a mean temperature of 17°C. The experimental fish were fed *ad libitum,* 24 hours a day one of 4 different test diets at 15 minute intervals. Three diets contained 1% potassium diformate (KDF), added at different stages of the feed production process (KDF-1: added to the raw fish (sand eel *Ammodytes marinus*); KDF-2: added during the drying process of the fish meal; KDF-3: added during the diet mixing), while the fourth diet served as a negative control. Each experimental diet was distributed between fish in four tanks. During the trial period of 96 days, fish faeces were stripped for determination of apparent digestibility of nutrients using yttrium oxide as an inert marker.

Fig. 1 and 2 Salmon farm on the Atlantic coast

Results and conclusions

The growth was in accordance with growth tables developed for Atlantic salmon in sea water, and there was no mortality during the trial period. There were no significant differences between dietary groups in the growth of fish during the trial period (SGR of 0.97, 0.97, 0.98 and 0.99 for KDF-1, KDF-2, KDF-3 and the negative control, respectively). Furthermore, there were no significant dietary differences in the digestibility of protein, starch, dry matter or energy, while the diets containing potassium diformate had significantly higher fat digestibility compared to the control diet (see Table 1). For protein, there was, however, a tendency to slightly higher digestibility in potassium diformate diets, compared to the control diet (P=0.12 in contrast analysis).

Table 1: Digestibility of nutrients in Atlantic salmon fed diets with or without potassium diformate KDF

Diets	Protein (%)	Fat (%)	Starch (%)	Dry matter (%)	Energy (MJ/kg)
KDF-1	87.2	95.1	49.3	73.0	84.7
KDF-2	87.2	94.3	53.9	72.2	83.5
KDF-3	87.3	94.6	52.1	75.5	84.1
Negative control	86.9	93.3	57.8	72.7	83.6
P-value	0.434	0.001	0.091	0.315	0.060

The positive effects of potassium diformate on the growth of Atlantic salmon, as earlier reported were not confirmed in the present study. However, there was a clear tendency to improved protein digestibility, as is often reported after the inclusion of an organic acid salt into the diets of animals. Furthermore, lipid digestibility in salmon could be significantly improved by KDF addition. Antimicrobial effects of KDF may have indirectly influenced lipid absorption processes in salmon. As our knowledge about KDF application on dietary nutrient digestibility in aquaculture is scarce, further investigation is needed to clearly identify its role in fish metabolism.

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