Effects of different dosages of potassium diformate in fish meal on the performance of Atlantic salmon *Salmo salar*

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High quality fish feed

- Fish meal, plant-protein meals and grain prices are rising
- Economy and sustainability of "feeding fish" is becoming crucially important
- Fish growth and FCR are therefore key factors

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Sustainability in fish production

- Growing awareness from consumers and producers
- Use of antibiotic growth promoters (AGP) increases the risk of cross-resistance
- EU does not allow the production or import of aquaculture species which contain residues of AGP → opportunity for alternative additives, like acidifiers

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Mode of action of acidifiers

- protects raw materials and finished feed from bacterial degradation (feed hygiene)
- promotes animal (fish) performance (roles in intestinal tract and metabolism)

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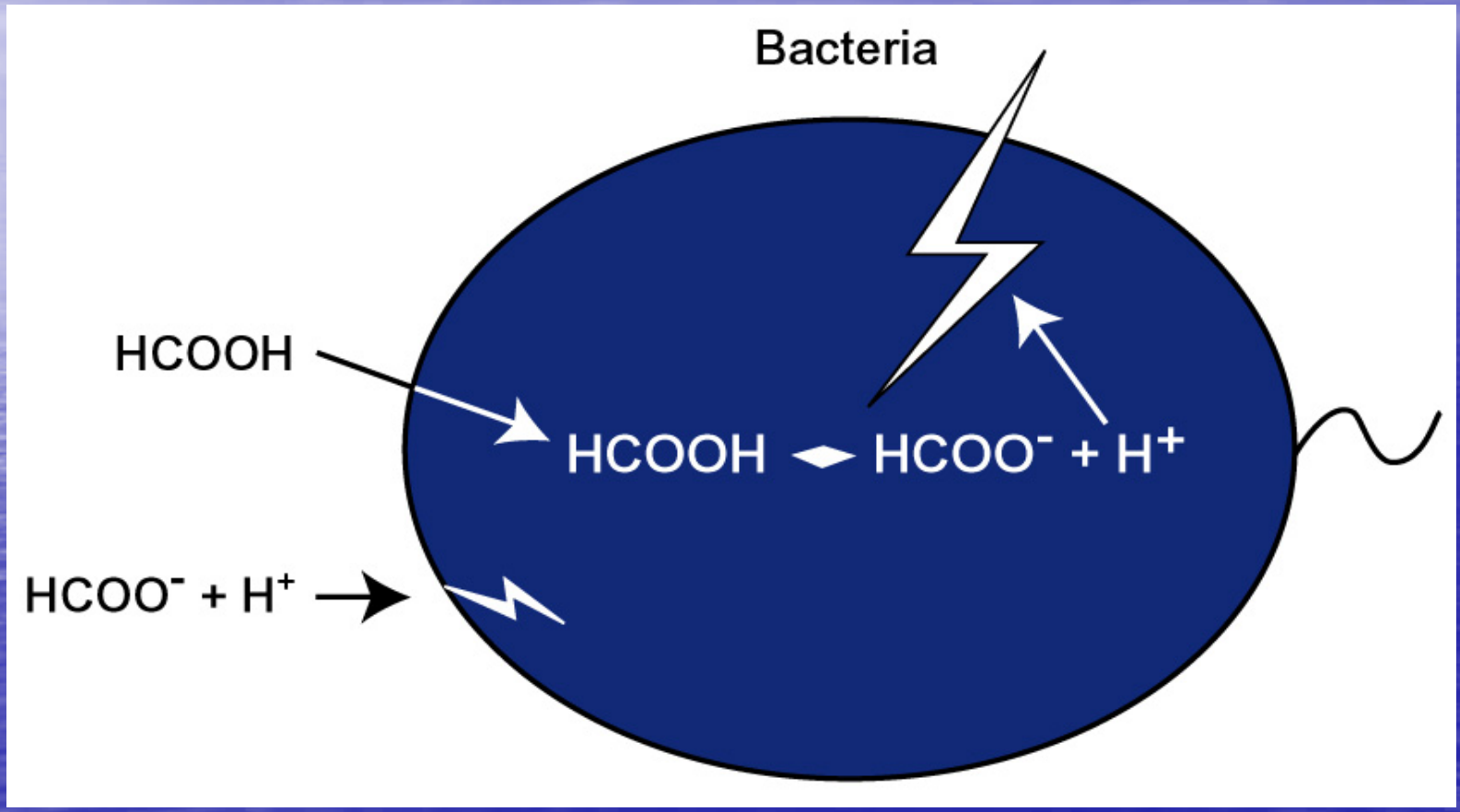
Organic acids inhibit bacterial growth – prevents feed degradation; promotes healthy intestine



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Acids and acid salts in aquaculture

- Organic acids:

  formic acid, acetic acid, propionic acid, lactic acid and citric acid

- Organic acid salts:

  calcium formate, sodium formate, potassium diformate (KDF), calcium propionate, calcium lactate

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KDF in fish meal for salmon feed – Design I

- Trial at AKVAFORSK, Norway
- Initial weight of Atlantic salmon: 270 g
- 3 x 3 tanks (1 m^3) with 50 fish each
- 126 days in sea water (30-32‰) at 10°C
- 20 litres per minute flow-through

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KDF in fish meal for salmon feed – Design II

- Fish were continuously fed (24 h light)
- Diet contained 40% crude protein and 30% crude fat
- 3 treatments: KDF was added to fish meal to produce 0% KDF, 0.8% KDF and 1.4% KDF-diets

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KDF in fish meal for salmon feed – Results

- Non-statistical differences in final weight, but numerical improvement in KDF-fed groups
- SGR of fish fed 1.4% KDF tended ($P=0.055$) to be higher
- KDF-fed fish had a significantly ($P<0.05$) improved feed conversion ratio

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Performance of KDF treated salmon

Treatment	Final weight (g)	Body weight gain (g)	SGR (%)	FCR[1]
0.0% KDF	575±37	299±61	0.58±0.1	0.83[a]
0.8% KDF	627±15	352±22	0.65±0.0	0.77[b]
1.4% KDF	615±13	356±33	0.69±0.1	0.75[b]

[1]Means with different superscripts are significantly different (P<0.05)

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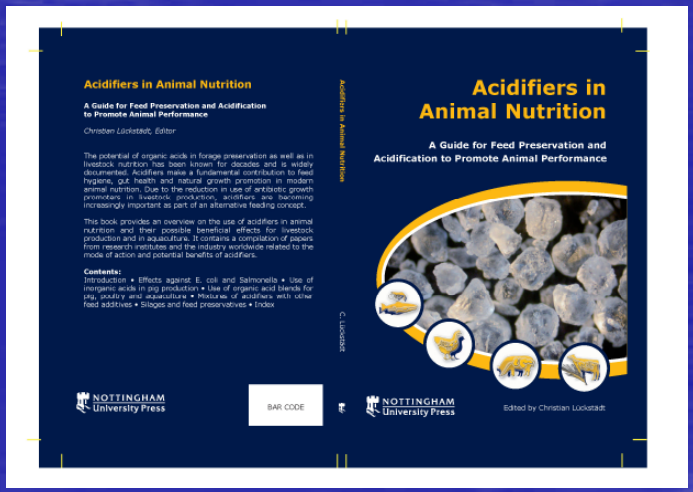
KDF in fish meal for salmon feed – Discussion I

- Positive effect of KDF on the performance of Atlantic salmon corresponds to a large extent with the results obtained for pigs; where acidifiers have been commonly used for almost 30 years.



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KDF in fish meal for salmon feed – Discussion II

- Trends for better growth performance
- Statistically proven enhancement of feed conversion
- Can be explained by:

  better protein and fat digestibility ($P<0.05$) for 1.4% KDF group

  tendency for better protein and energy retention in KDF-fed groups

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KDF in fish meal for salmon feed – Conclusions

- Beneficial impact on the performance of farmed salmon under Norwegian conditions
- Potential to decrease protein content ("saving fish meal") of salmon feed by adding KDF should be evaluated
- Possible positive effects on fish health ("anti-bacterial action of organic acids") should be explored in further research

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Potassium diformate, KDF…

…a sustainable alternative for modern aquaculture

- increasing growth
- saving feed costs
- strong antimicrobial effects
- high survival rates

Thank you for your attention!

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