Can we alleviate consequences of cardiac disease by dietary intervention?

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BioMar Health Products

PRODUCTS NO	UK	TARGET & MISSION
intro FW		Maintain optimal health and growth during sea transfer phase
intro SW		
primo	Plus 3	Prepare for efficient immune response
actio Q		Facilitate and support disease handling and recovery
focus lice	Plus 4	Reinforcing barriers towards infections and infestations
focus winter		Primarily targeted towards winter ulcers

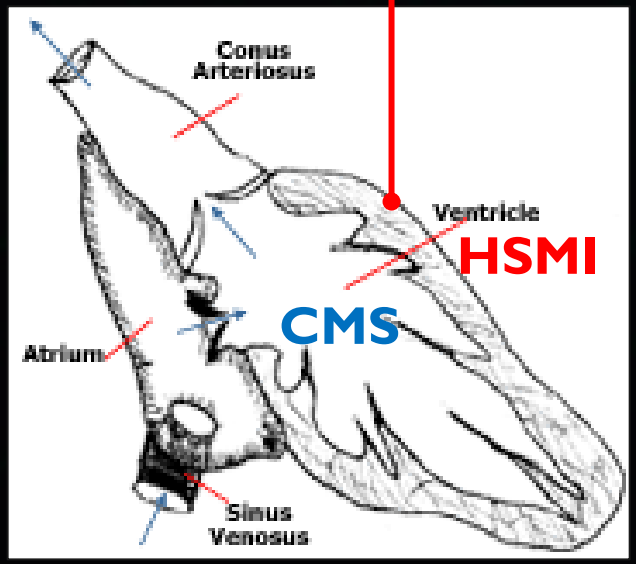
The heart and circulatory system

FISH

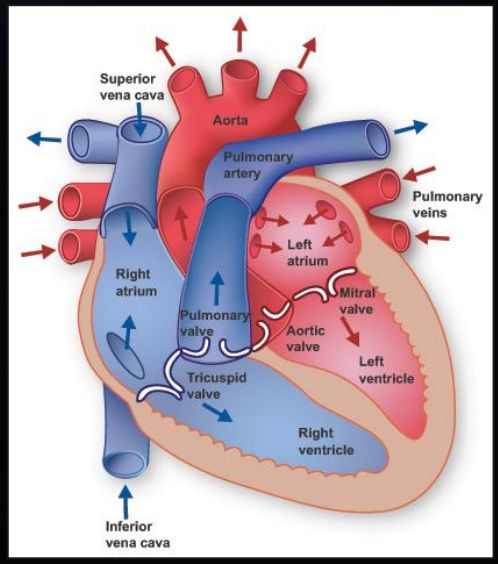
1 circuit

Low pressure

Only partial coronary supply



Only for the outer compact layer



MAMMAL

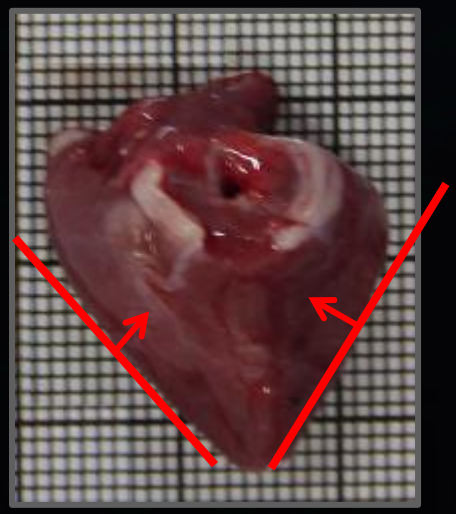
2 circuits

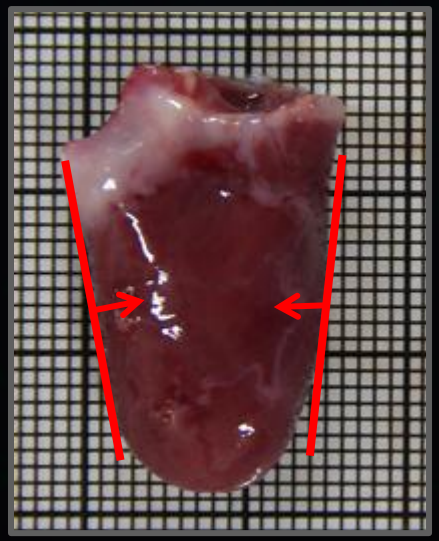
High/mod pressure

Coronary supply

The heart and circulatory system

That’s not the shape of my heart....(Sting, 1993)





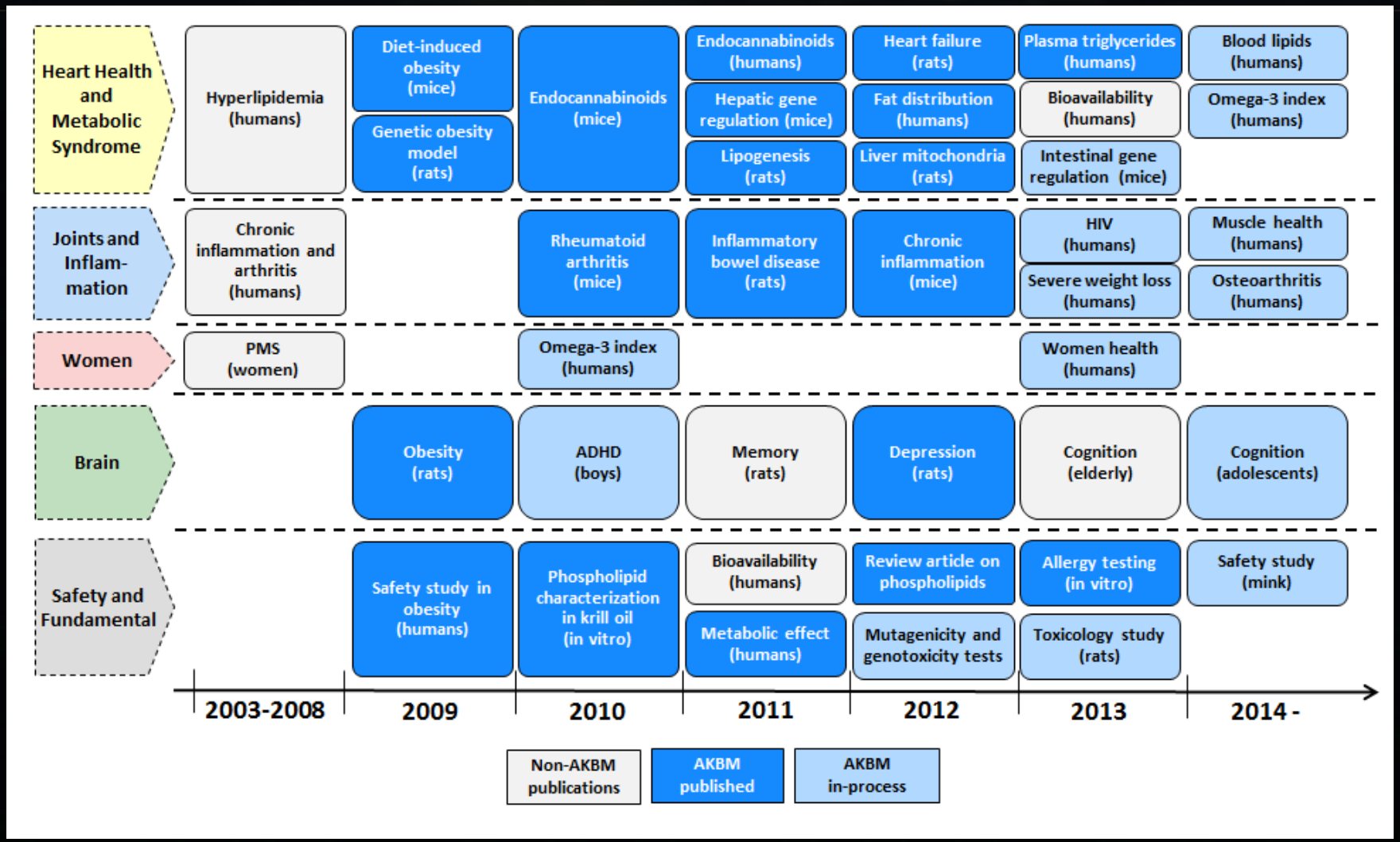
Effects of reduced circulatory output

- Reduced (aerobic) metabolic capacity
  - **GROWTH**
  - **IMMUNE RESPONSE**
- Risk of ischemia in «underprioritized» tissues
  - **SKIN**
  - **WINTER ULCERS ?**
- Reduced ability to absorb and transport O_2
  - **GILL DAMAGE**
  - **AGD ?**

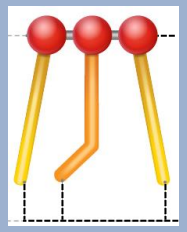
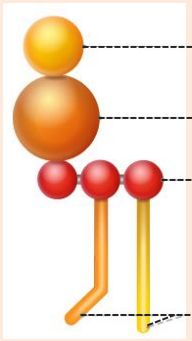
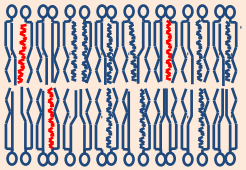
How can we influence this by nutrition?

- Affecting the pathogens possibility to cause damage
  - via the host's immune system
- Enhancing the host's ability to maintain important physiological processes despite damage
  - flexible and robust organ systems keeping spare capacity

Positive contributions from krill oil



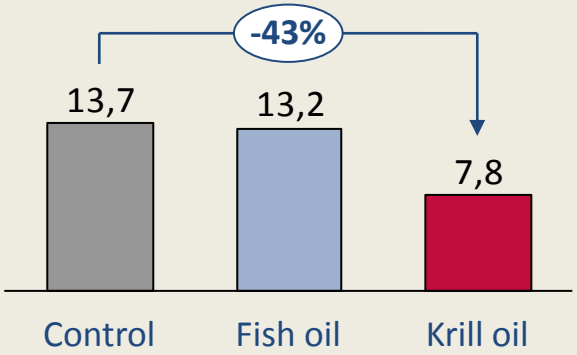
Differences in structure and function TG vs PL

	Triglyceride (fish oils)	Phospholipids (krill oil)
Structural form	  Glycerol Fatty acids	  Choline Phosphate Glycerol Fatty acids
Charac-teristics	• Non-polar • Hydrophobic	• Polar • Hydrophilic - mixes with water
Function	• Energy storage  Fat cell	• Main structural component in all cell membranes  Membrane

Effects of krill oil on heart tissue

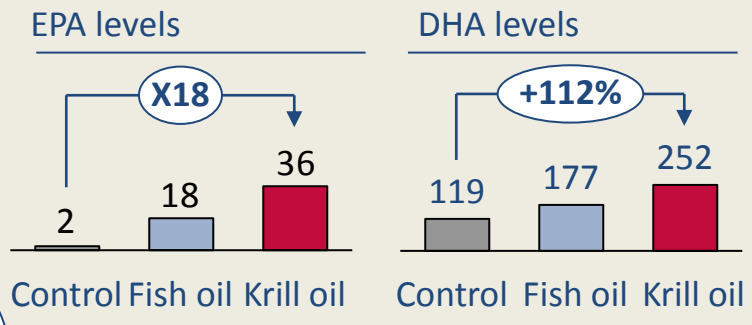
Reduced fat in heart tissue in obese rats

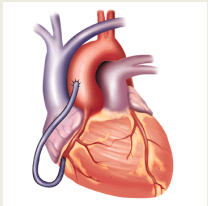
Heart triglycerides [4]



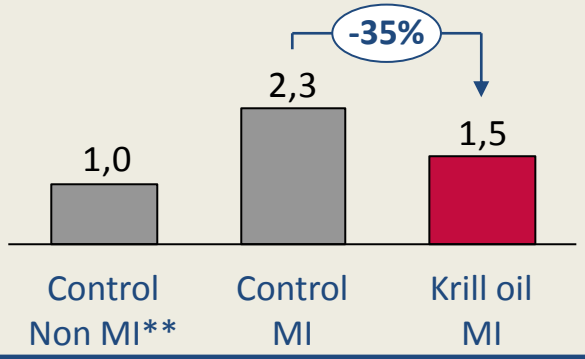
Increased levels of omega-3 in rat heart

EPA and DHA levels in heart phospholipids [4]



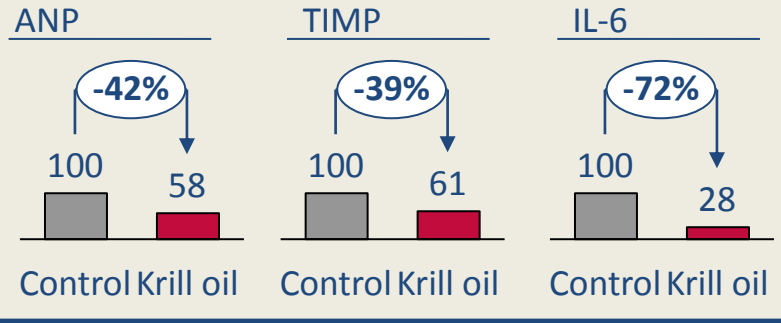


Infarction damage (ΔLVEDD*) [20]



Improves heart function in rats

Gene expression levels [20] (markers of stress and inflammation)



Beneficial regulation of heart genes in rats

[4] Batetta B., et al. 2009. J Nutr, 139(8):1495-150

[20] Fosshaug L. E., et al. 2011. BMC Lipids in Health and Disease, 10(1):245

*LVEDD: left ventricular end-diastolic diameter. ** MI: Myocardial Infarction/Heart attack

Influence on distribution of EPA/DHA

Study overview

Subjects

- Healthy male and female subjects

Treatment

- 8 weeks of daily intake
- 2 g Superba™ krill oil or fish oil

Study details

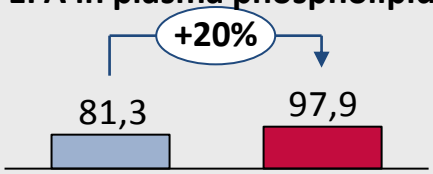
- Single centre, open-label, randomised two-way crossover study

Results

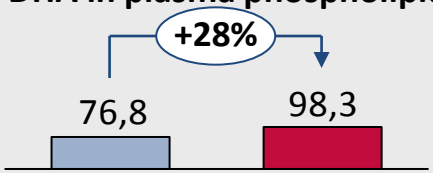
Increased presence in blood

[ng*h/(mg*ml)]

EPA in plasma phospholipids



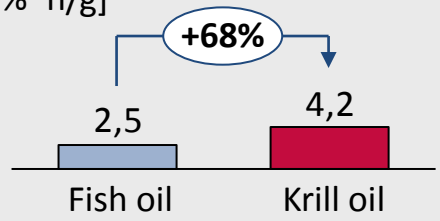
DHA in plasma phospholipids



Increased uptake in red blood cells

Omega-3 index

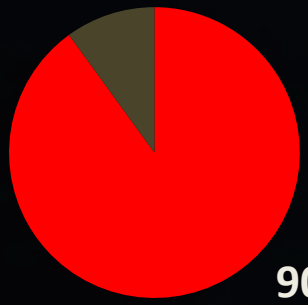
[%*h/g]



Significantly higher omega-3 index after krill oil treatment compared to fish oil treatment

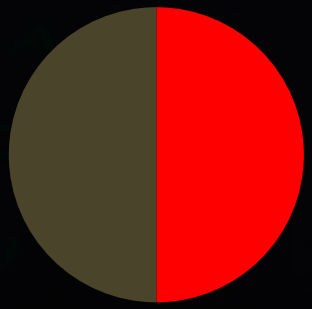
Fat deposition on salmon hearts

Shehzad/NVH

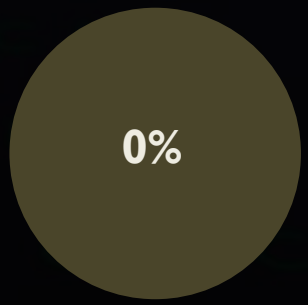


Master UMB n=2700 (291 families)

Nofima/BioMar feed A



Nofima/BioMar feed B

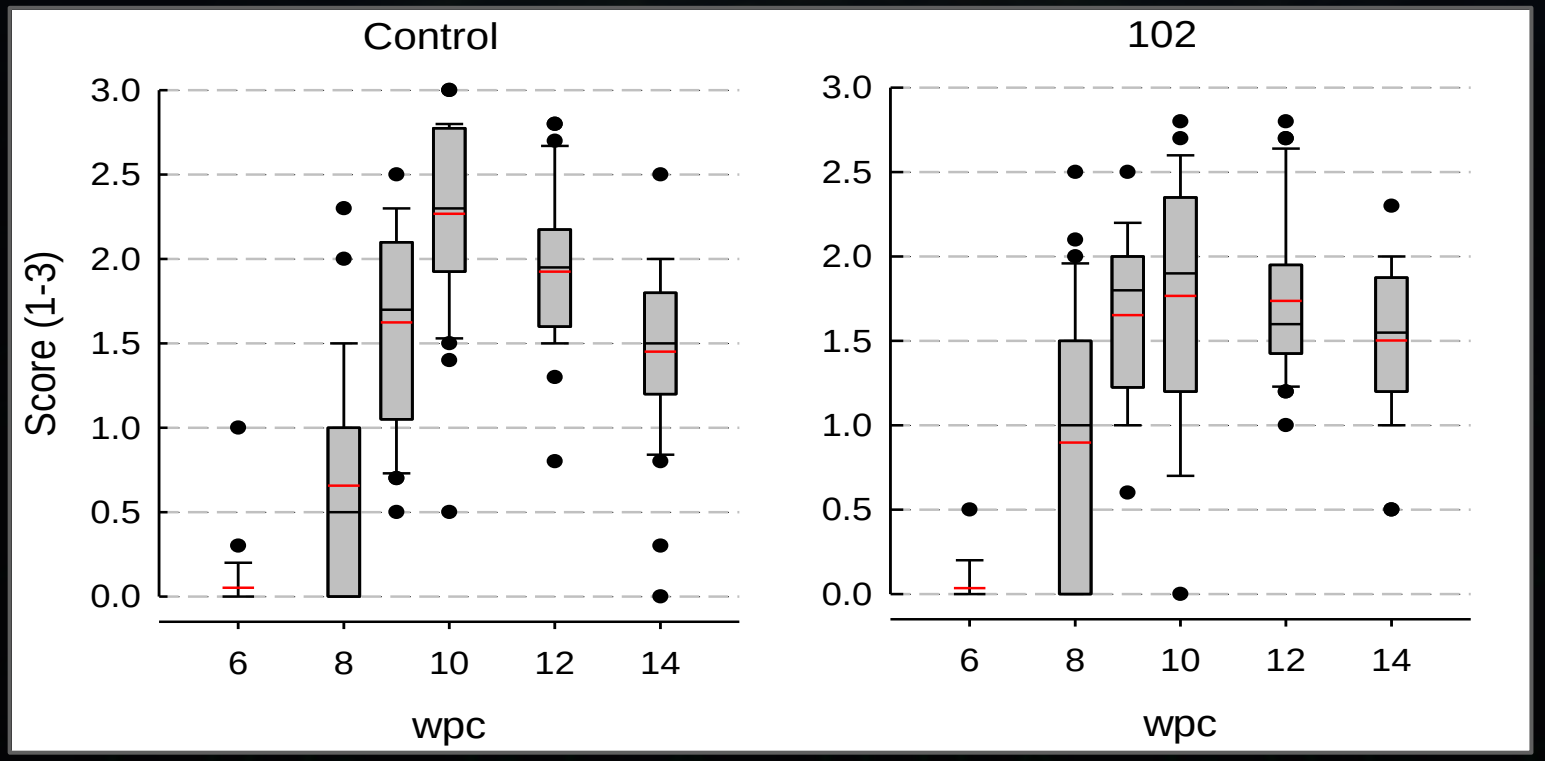


Last moth before harvesting 5,5-6,7 kg n=40

Heart pathology in HSMI transmission trial

- 1 test feed + 1 control
- 4 replicates = 12 tanks=1 test cell
- 100 fish/tank, 20 g + shredder fish
- 1 week acclimatization
- 6 week feeding before challenge
- 14 week challenge
- Cohabitant challenge, i.e. injection of virus in shedder fish that are put in all tanks
- Sampling:
    1. 0-sampling 6 weeks before start. 8 fish
    2. After 6 weeks feeding (befor challenge)
    3. 3 weeks post challenge
    4. 6, 8, 9, 10 and 12 weeks post challenge

Heart pathology in HSMI transmission trial



Box: 50% of observations
Bars: 95% of observations
Black line: Median
Red line: Mean

Scale 1-3 measures severity of tissue damage. Score 3 is max

n=32 (8 fish/tank x 4 tanks)

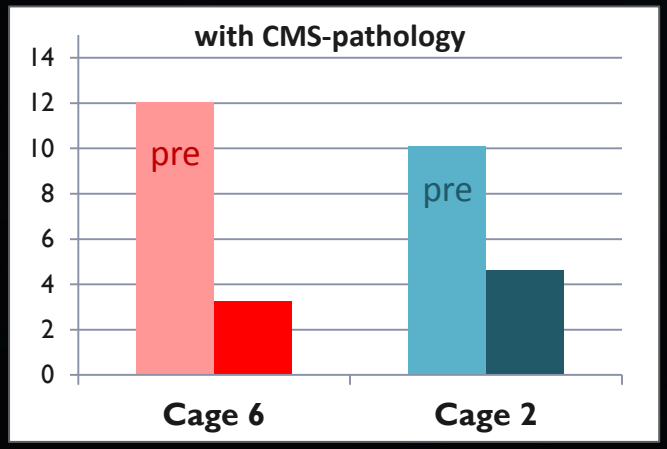
Mortality during feed trial at commercial site

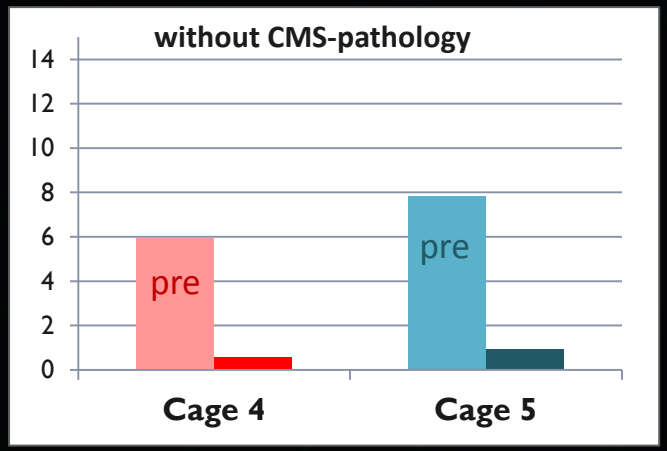
- Located in Mid-Norway, S1-2012
- History of HSMI, CMS diagnosed
- Feed trial april - september 2013 (harvest)
- 2 + 2 cages included in feed trial

CMS signs

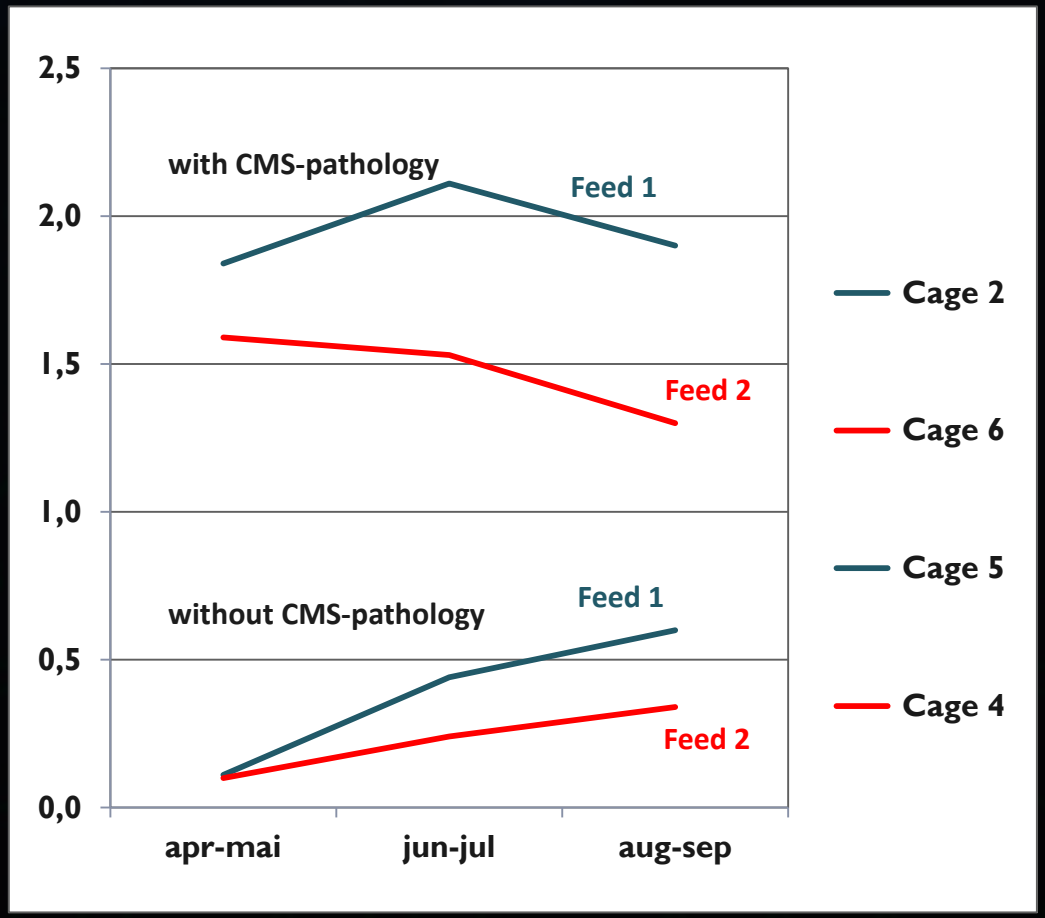
Mortality during feed trial at commercial site

Pre-trial vs during trial (%)





Relative mortality per 2 months during trial



Conclusions and further work

- We see some very promising indications
- Corresponds with documentation from mammals
- More analytical work to verify effects
- Investigate physiological enhancement as well as influence on pathology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