Crowne Plaza Northwood, Dublin

25th - 27th May 2016

UCD Research

Management and nutritional strategies to reduce the use in feed antibiotics in pig diets

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Weaning

- Loss of protective maternal milk antibodies
- Change in diet from digestible milk proteins to solid feed with complex nutrients
- Rise in cortisol due to social stress factors

- Villus atrophy, reducing nutrient absorption and allowing nutrients to pass down to the colon
- Inflammation
- Allow proliferation of *E.coli*, *Salmonella* etc. that produce toxins
- Diarrhoea, decreased feed intake and growth

Antibiotic growth promoters (AGP)

Traditional measures → ameliorate weaning associated intestinal dysfunctions

~~Antibiotic Growth Promoter (AGP)~~

Zinc oxide

- Reduce pathogenic bacteria
- Improve feed intake and growth rate

In-feed AGP → development of antibiotic resistance

EN Official Journal of the European Union

REGULATION (EC) No 1831/2003 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL
of 22 September 2003
on additives for use in animal nutrition

In-feed ZnO → accumulation of Zn in the environment

Danish research on feed additives
(Piglets 7-30 kg BW)

	No of studies	% change in daily gain
Antibiotics	**15**	**+11**
Organic acids	40	+7.1
Aromatic compounds	19	+2.6
Enzymes	9	+2.1
Microbial cultures	14	+1.0
Oligosaccharides	2	+3.1

(De Lange et al., 2010)
(Pluske et al., 2013)
(Thacker et al., 2013)

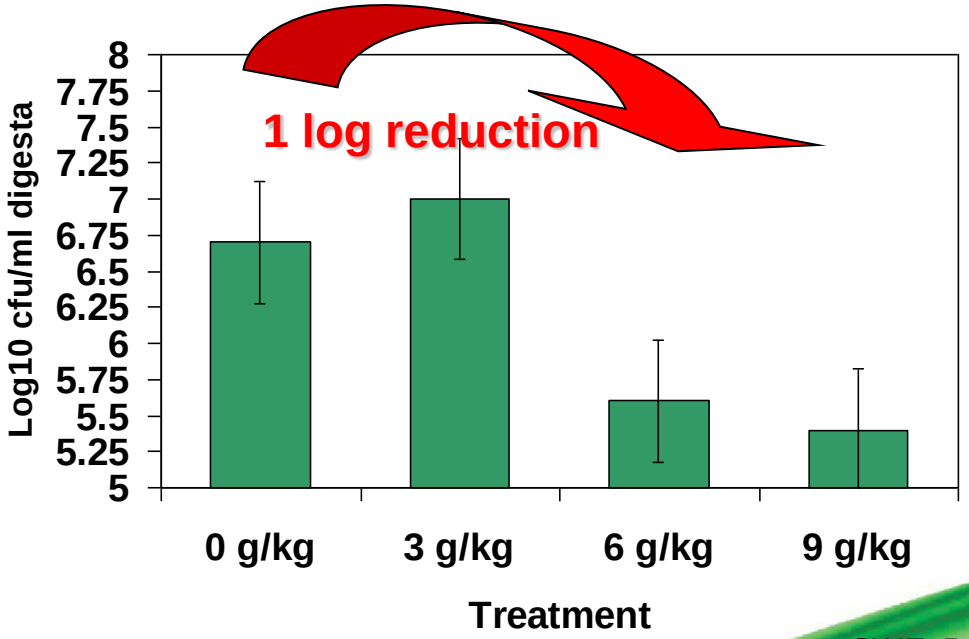
Our Overall Research Objective

To identify and characterize reliable natural alternatives to replace antimicrobial growth promoters and ZnO during weaning in the piglet

Novel sugars from seaweed

- Seaweed supplementation
  - Minerals, vitamins, fatty acids, laminarin, fucoidan, alginates, tannins, phenols, etc

Effect of crude seaweed extracts (SWE) on colonic *E.coli* populations

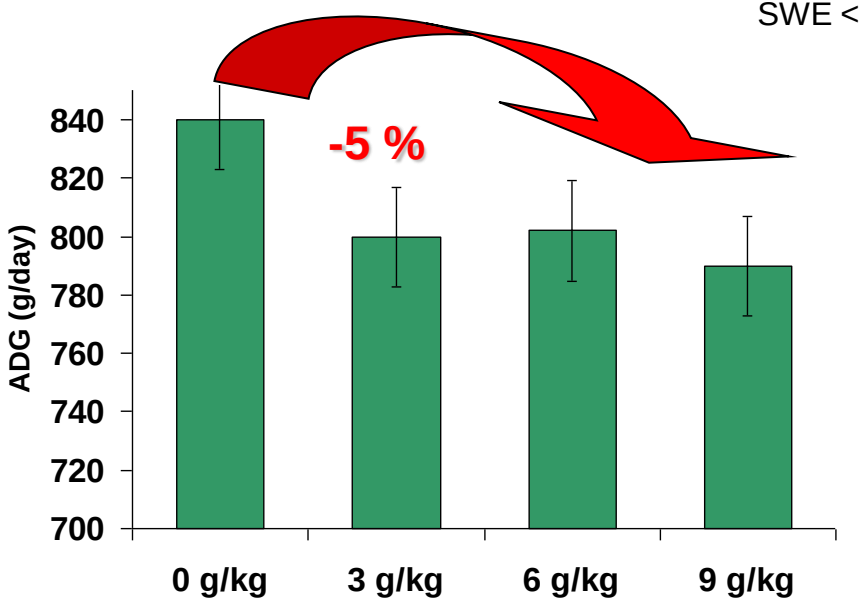


SWE P <0.05

(Gardiner et al., 2008)

Effect of crude seaweed extracts on daily gain

SWE < P 0.05



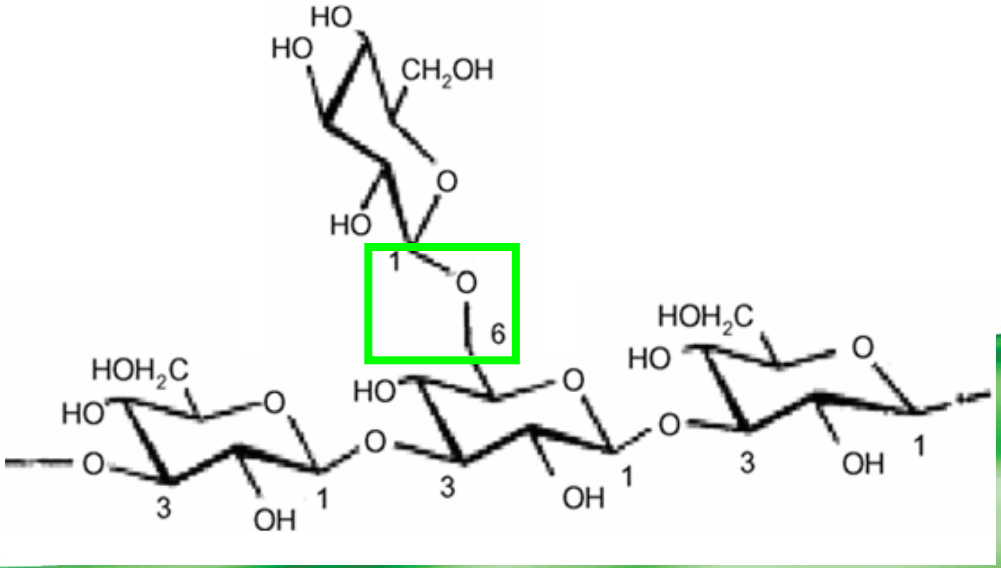
Due to high content of alginates and tannins

Lead to the search for bioactive compounds!

(Gardiner et al., 2008)

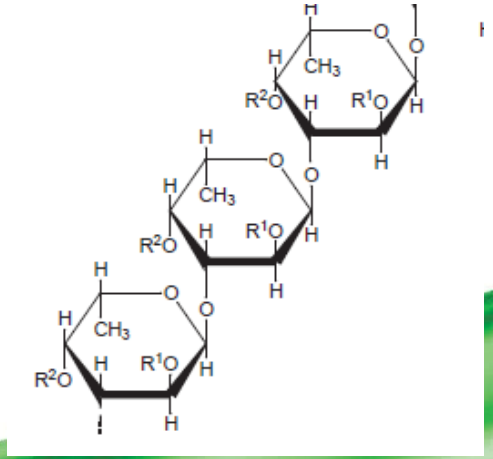
Laminarin

- water soluble polysaccharides
- low molecular weight (5kDa)
- composed of β-(1-3) linked glucans with β-(1-6) linked side chains of various distribution and length



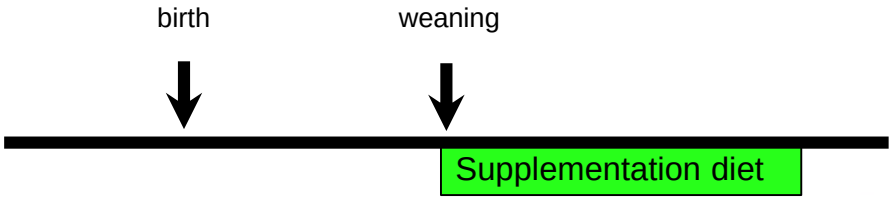
Fucoidan

- Water soluble polysaccharides
- Molecular weight 40-1400 kDa
- α(1 – 3) linkages, fucose sulphated at position 4



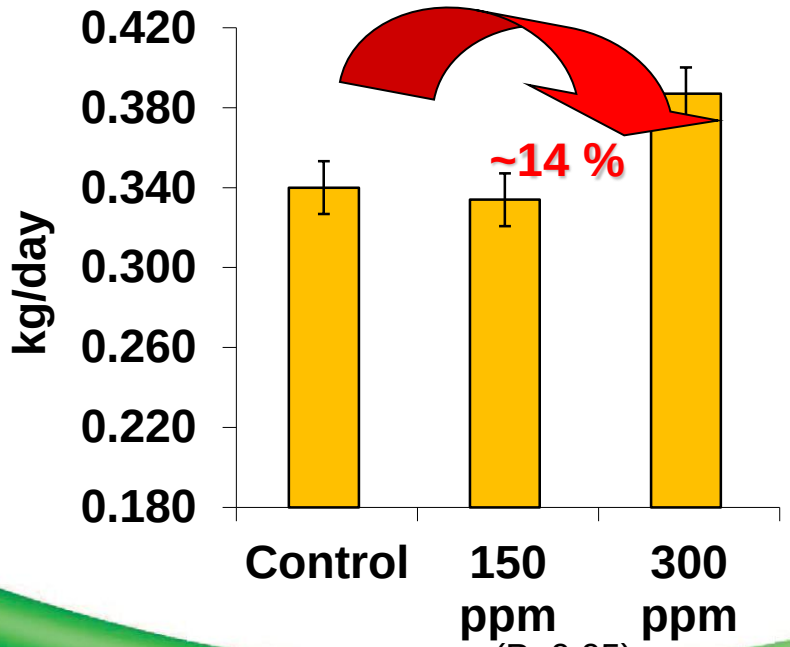
Objective 1

Can <u>supplementation of the piglet diet</u> with laminarin or fucoidan <u>at weaning</u> influence subsequent performance and health of the piglet ?



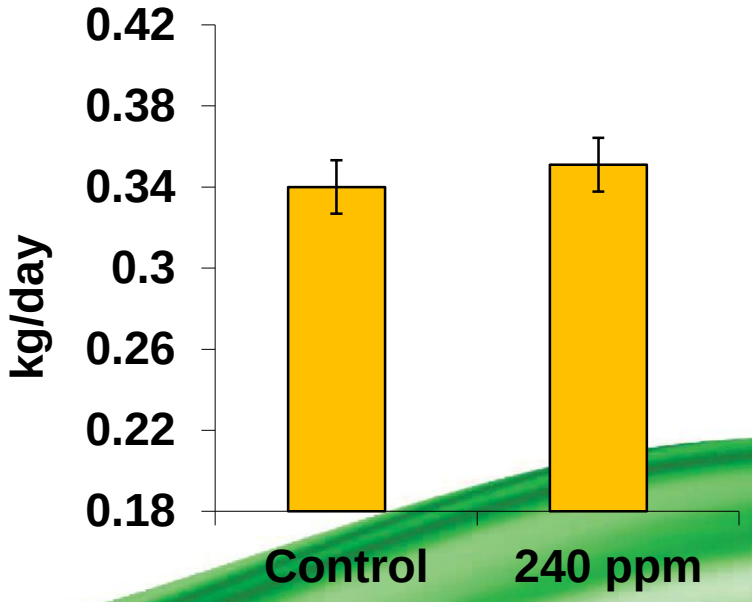
Effect of laminarin and fucoidan on average daily gain (d 0-35 pw)

Laminarin



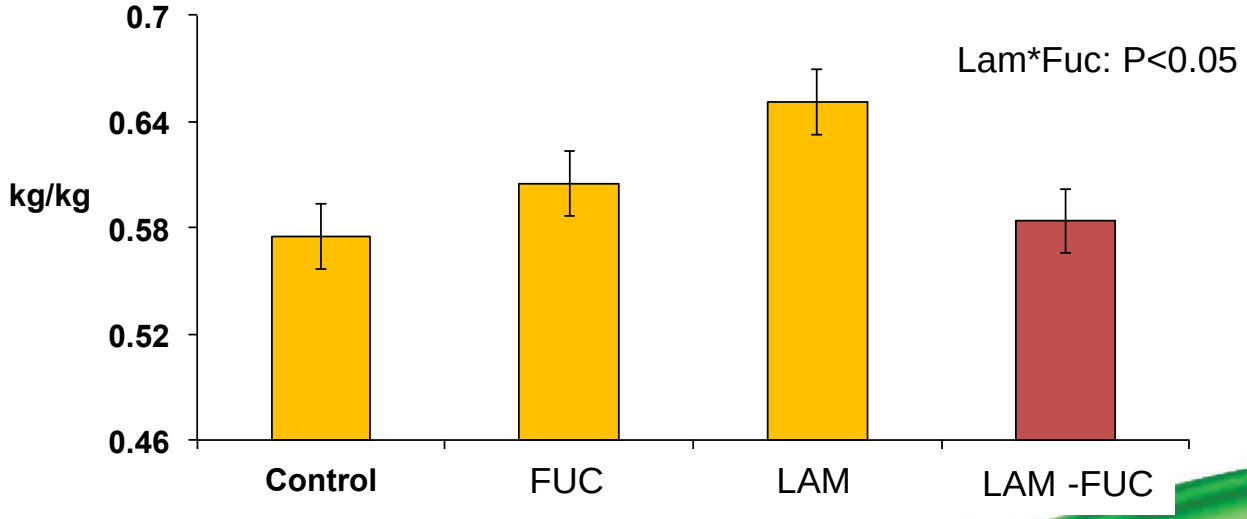
(P<0.05)

Fucoidan



(Walsh et al., 2013)

The effect was lost when laminarin and fucoidan were combined (gain to feed ratio)

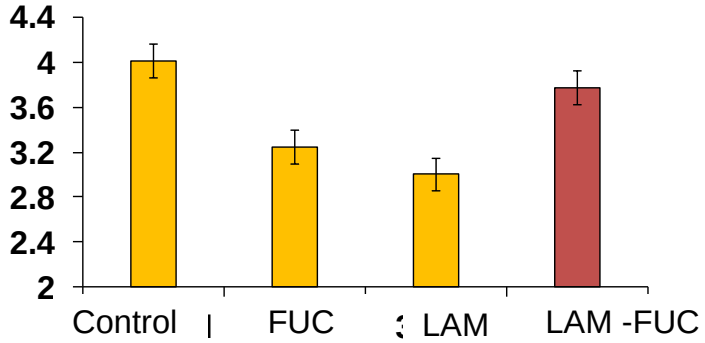


(Walsh et al., 2013)

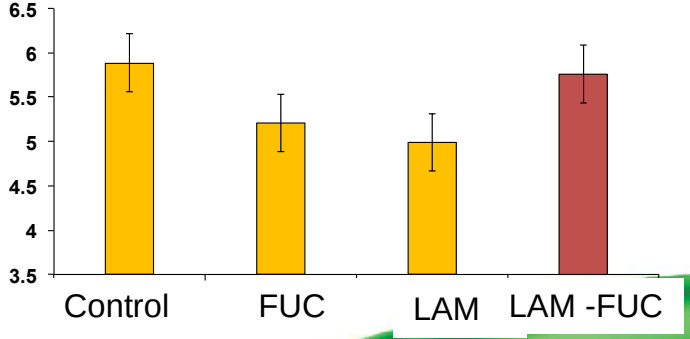
The effect was lost when laminarin and fucoidan were combined

Lam*Fuc P<0.01

faecal score d0-8

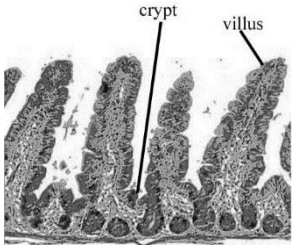


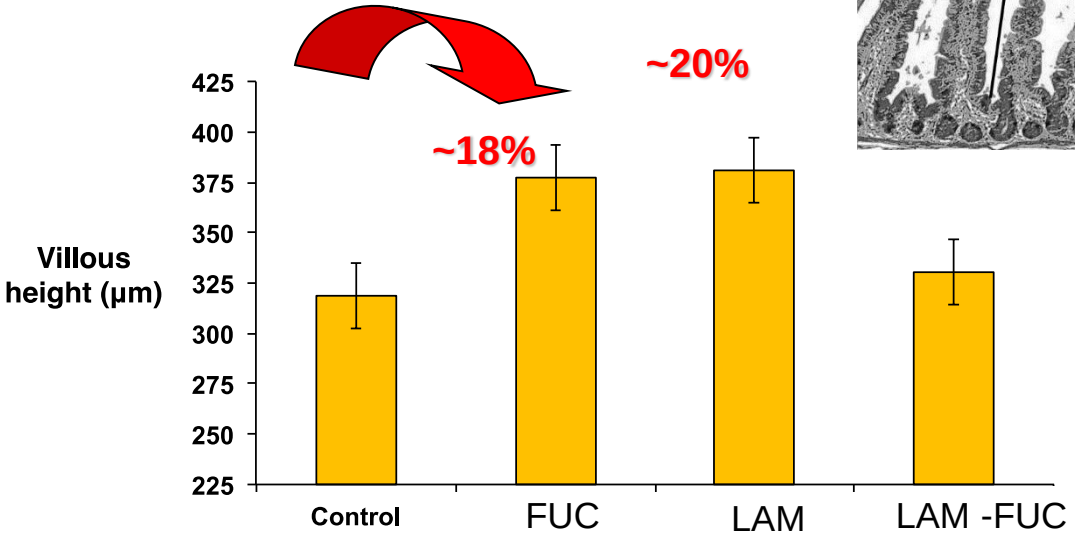
Log of AEEC gene copy number/g of digesta



(Walsh et al., 2013)

Duodenal morphology



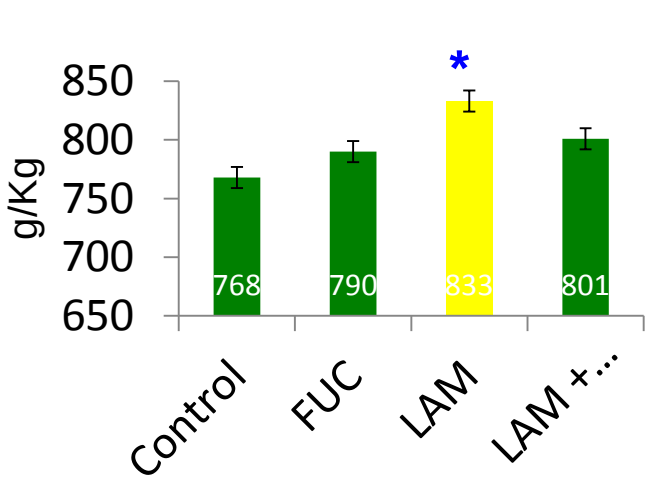


(*Walsh et al., 2013*)

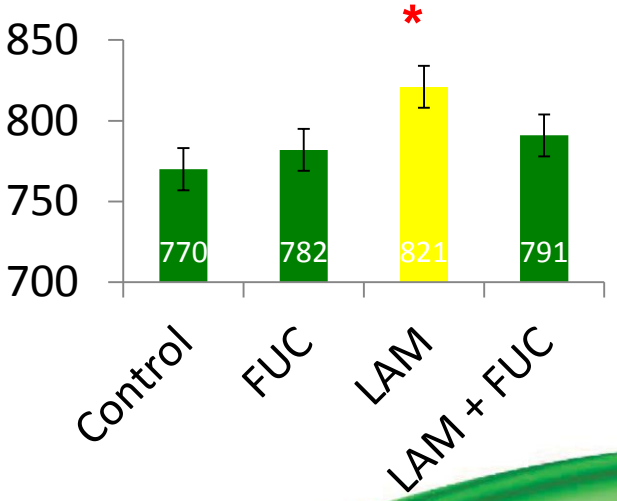
Nutrient digestibility

(* < P 0.05)

Gross energy

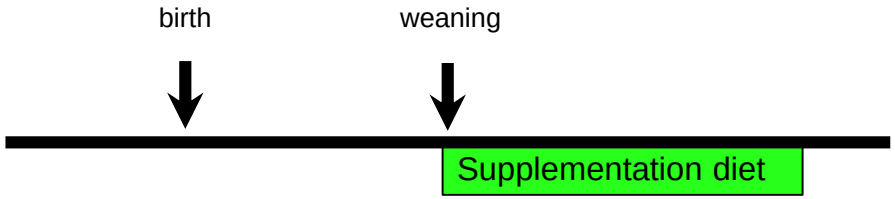


Nitrogen

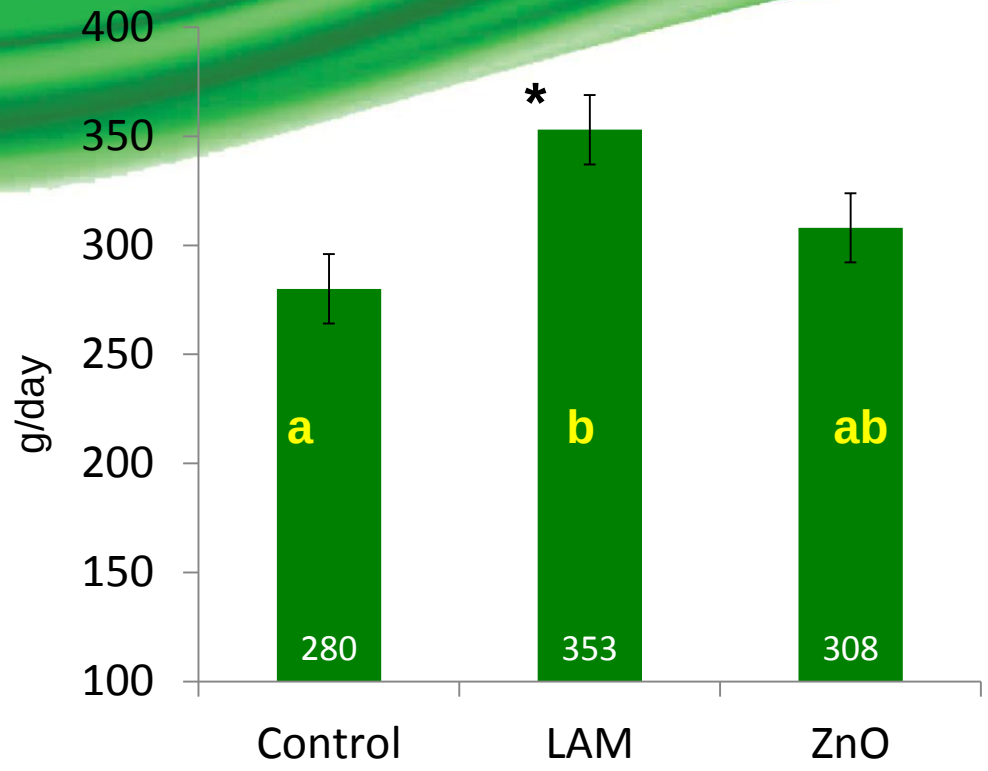


(Heim et al., 2014)

Objective 2
To compare the effects of laminarin to ZnO at weaning on performance and health of the piglet



(Heim et al., 2014)



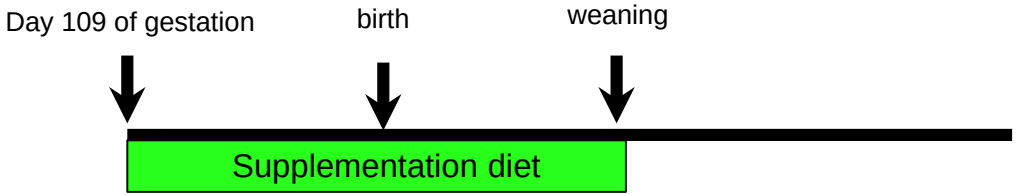
* P< 0.05

- ZnO: no effect observed until week 2
- LAM: no effect observed until week 3

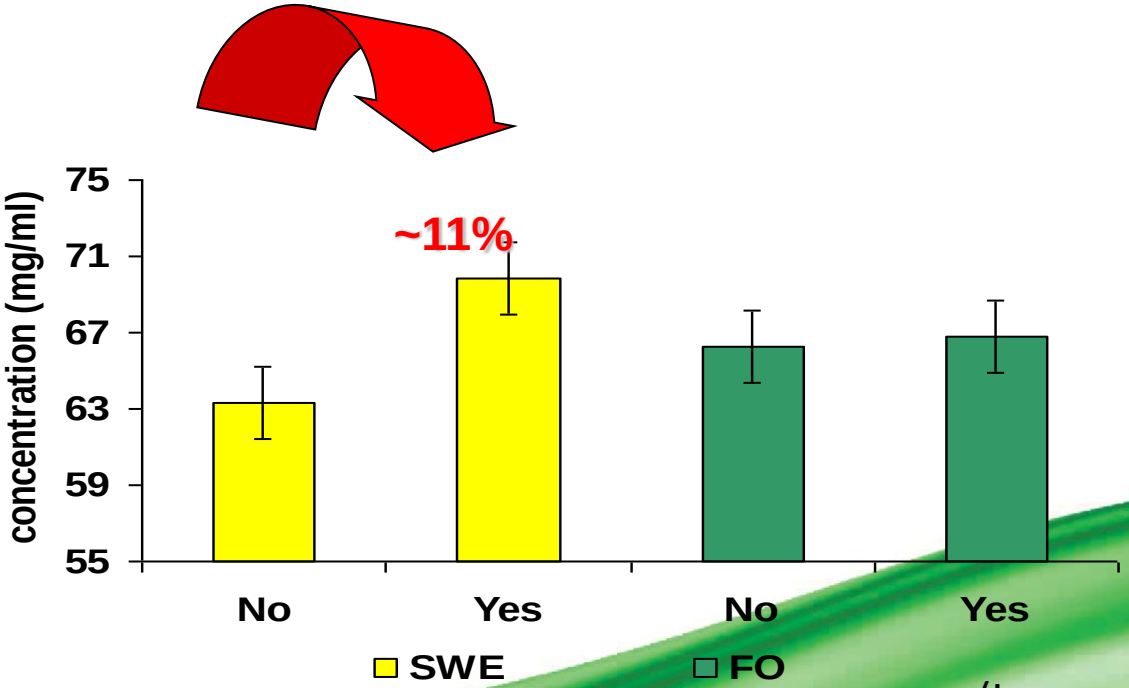
(Heim et al., 2014)

Objective 3

Can maternal supplementation with SWE or fish oil (FO) influence lifetime performance and health of the piglet ?

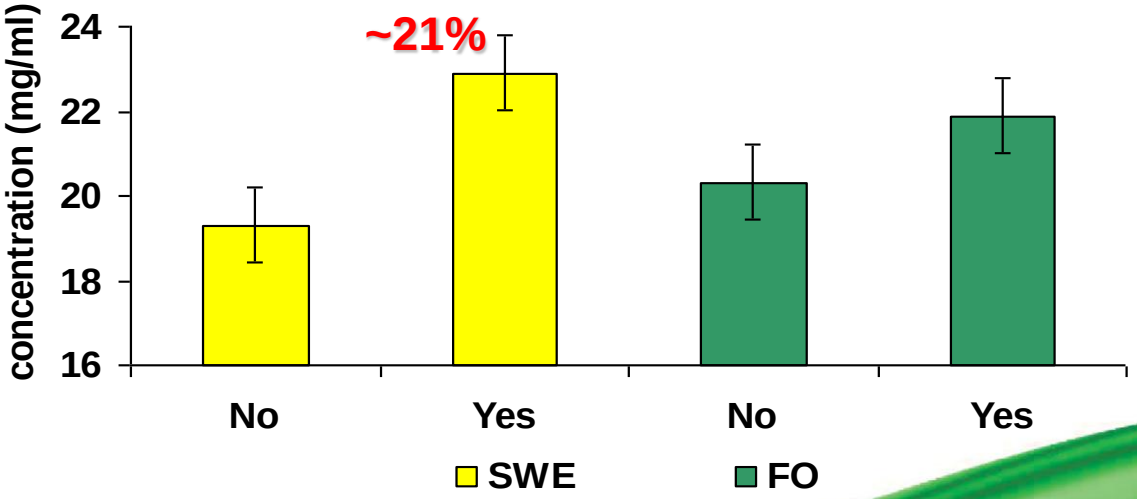


Colostral IgG concentrations
(2 hours post farrowing)



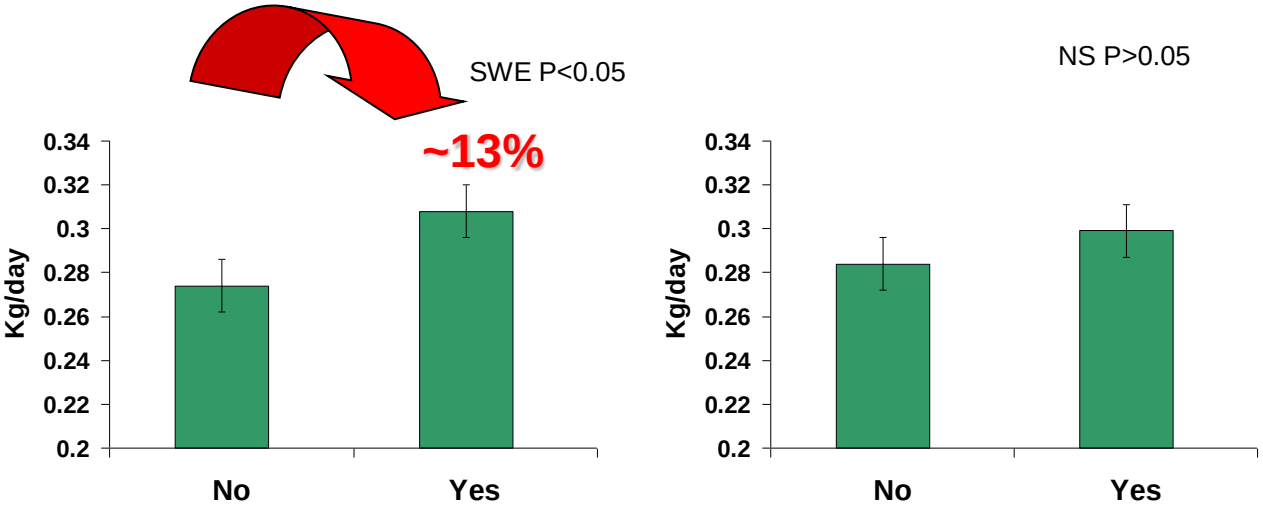
(Leonard et al., 2010a)

Piglet serum IgG conc. (d 5)



(Leonard et al., 2010a)

Overall daily gain (0 – 21 dpw)



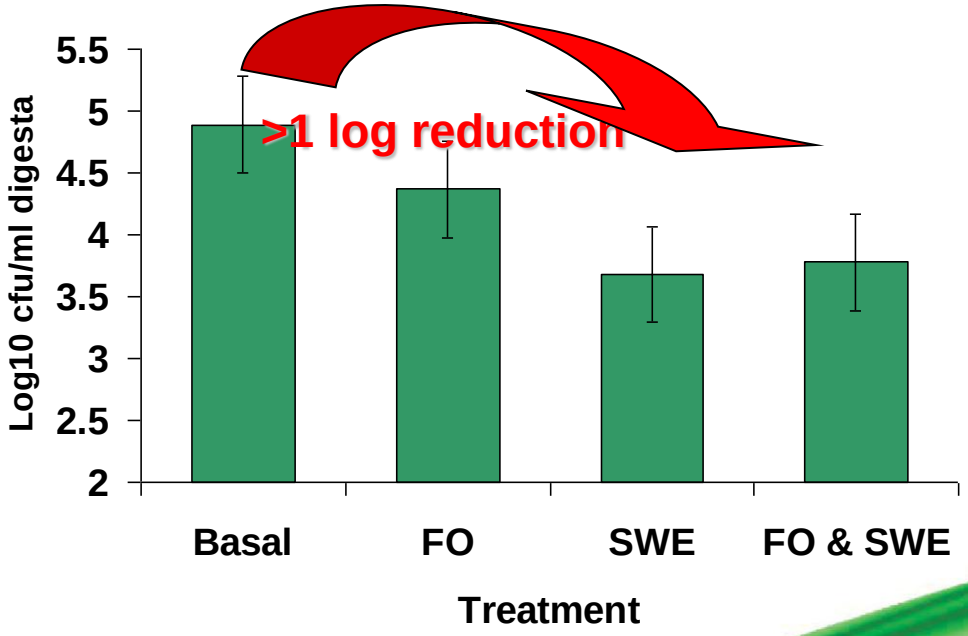
Maternal SWE supplementation

Maternal FO supplementation

(Leonard et al., 2010b)

Caecal *E. coli* (9 dpw)

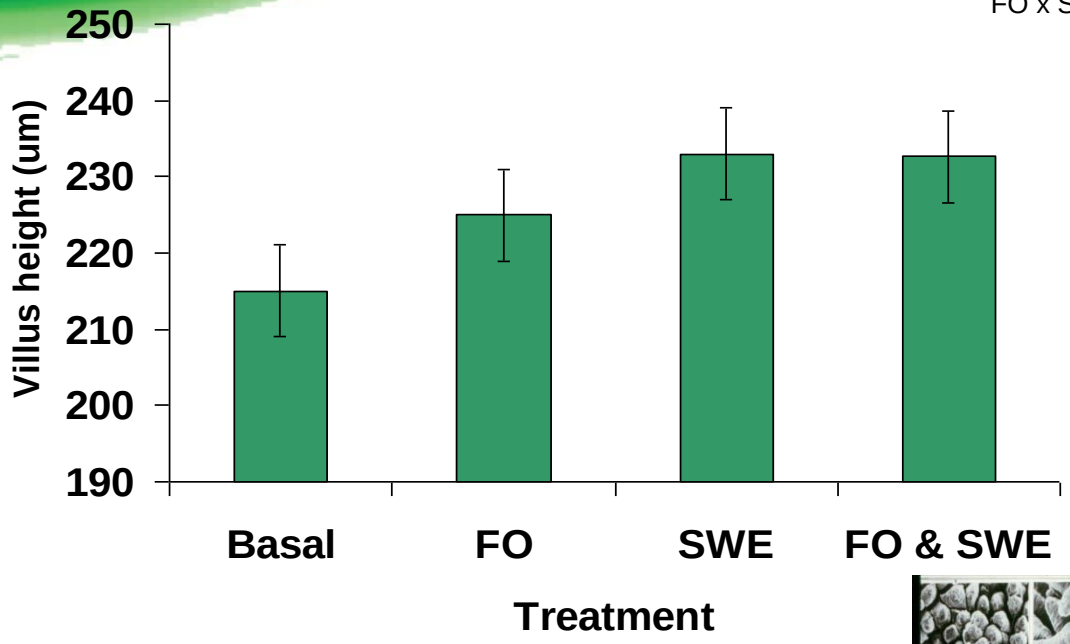
FO x SWE P<0.05

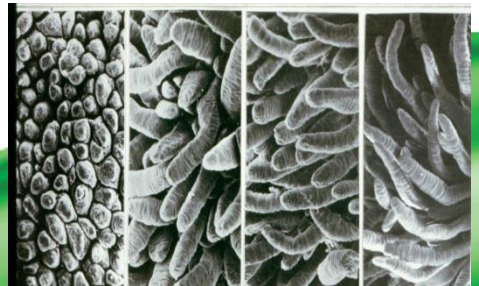


(Leonard et al., 2010b)

Villous height in the ileum (µm)

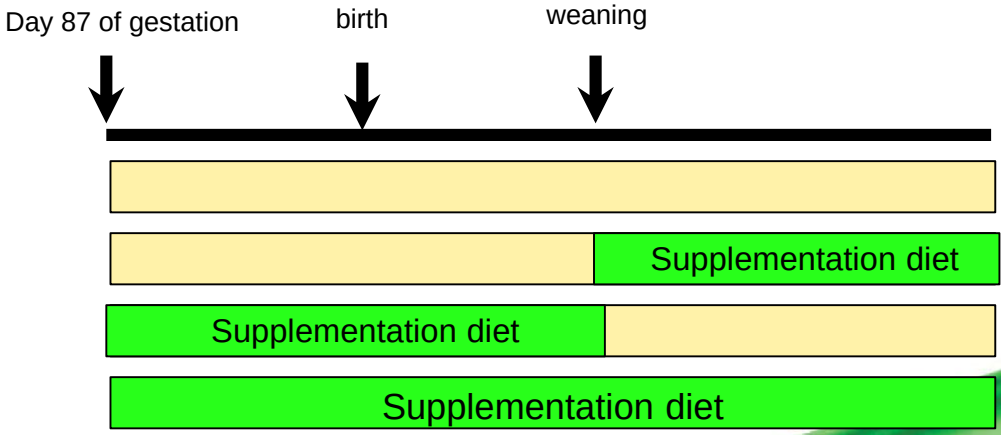
FO x SWE P<0.05





(Leonard et al., 2010b)

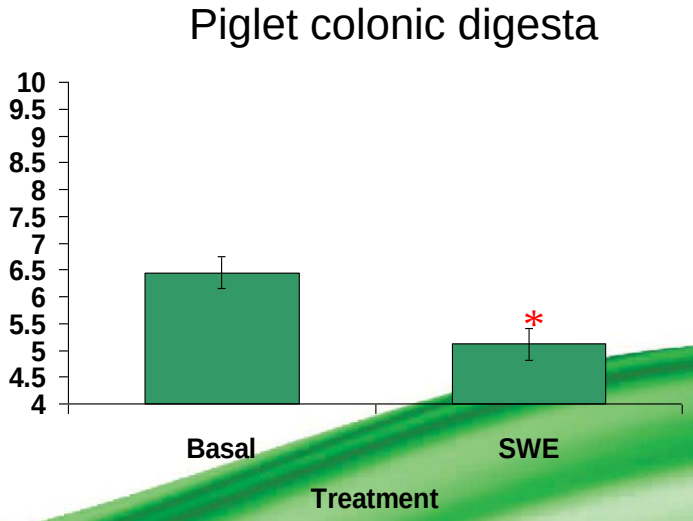
Objective 4
Is maternal supplementation or postnatal supplementation more beneficial to piglet health ?



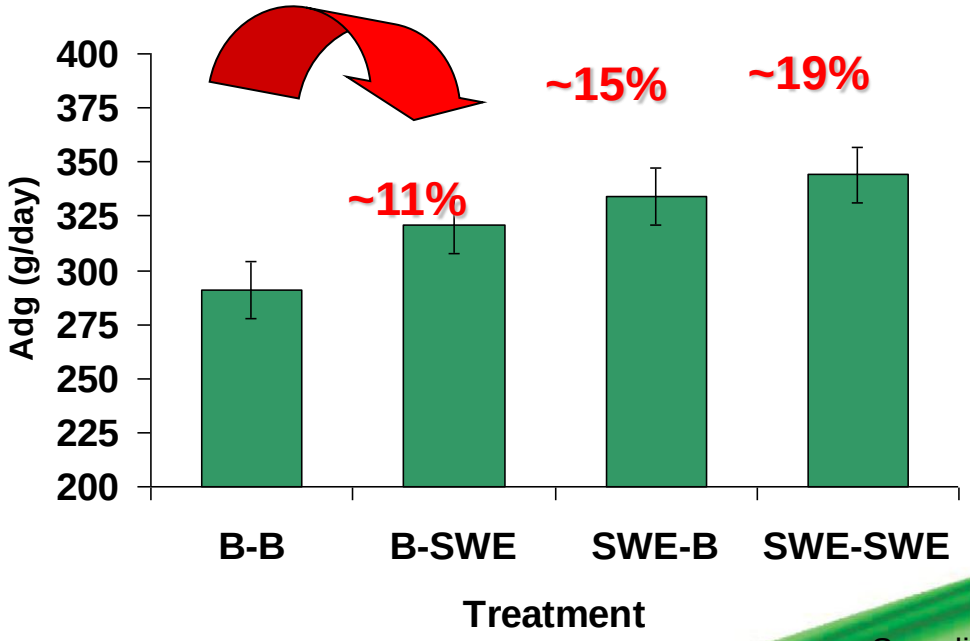
(Leonard et al., 2011)

Enterobacteria in sow faeces and piglet digesta at weaning

(* P<0.05)



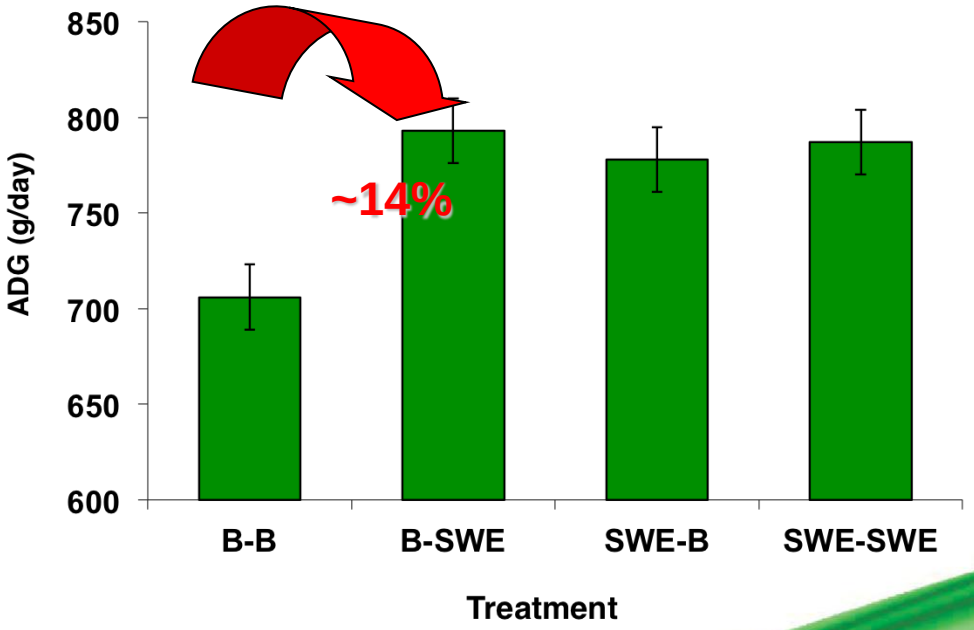
Average daily gain to 21 days pw



Sow diet P<0.05

Weaner diet < P 0.05

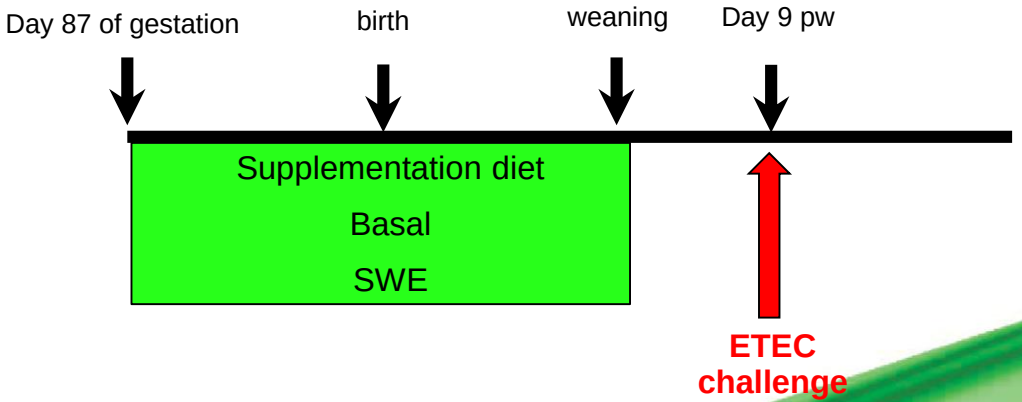
Effect of dietary treatment on daily gain from 7 weeks to slaughter at 90 kg



Sow x weaner P<0.05

Objective 4

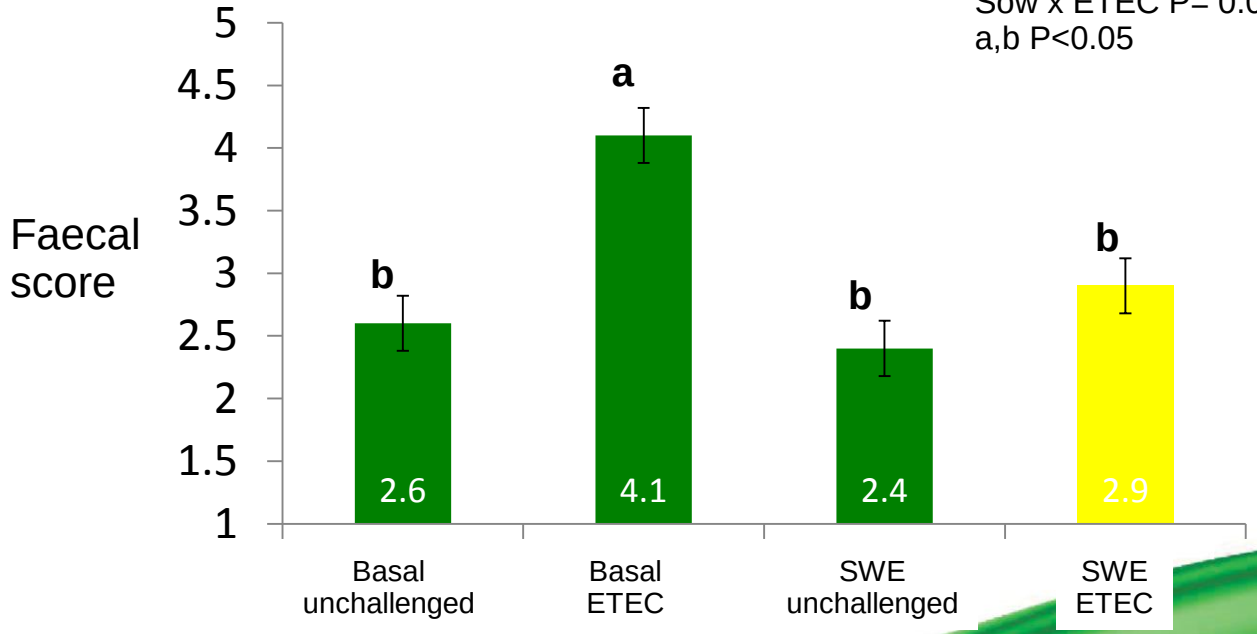
Can maternal supplementation with SWE influence the response of the piglet to an ETEC (K88 challenge) ?



(Heim et al., 2014)

Effect of maternal dietary and ETEC challenge (0-72 hr)

Sow x ETEC P= 0.03
a,b P<0.05



(Heim et al., 2014)

Conclusions

Seaweed extracts have a variety of biological properties that support gut health comparable to ZnO

The seaweed species, method of extraction and characteristics of the extract are fundamental

Supplementing the maternal diet through the latter part of gestation and lactation provides the best benefit to the offspring post-weaning