Feeding the piglet for high productivity and good health - also with focus on reduced usage of antibiotic

Group R&D Director Hans Aae, DLG Group

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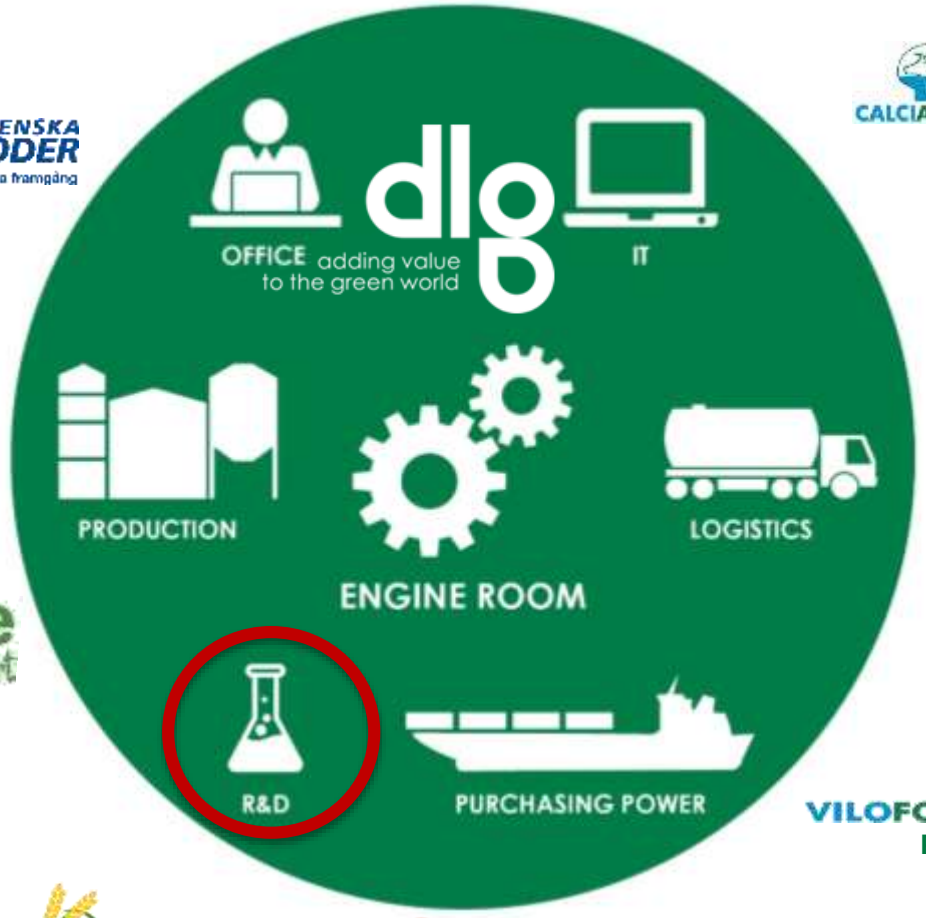
Agenda

- Introduction
- Proteinsources and – level
- Acids and ABC
- Leaky gut
- Feeding strategy
- Discussion

DLG Group join R&D forces and experiences



SVENSKA FODER
För att skörda framgång

CALCIALIMENT

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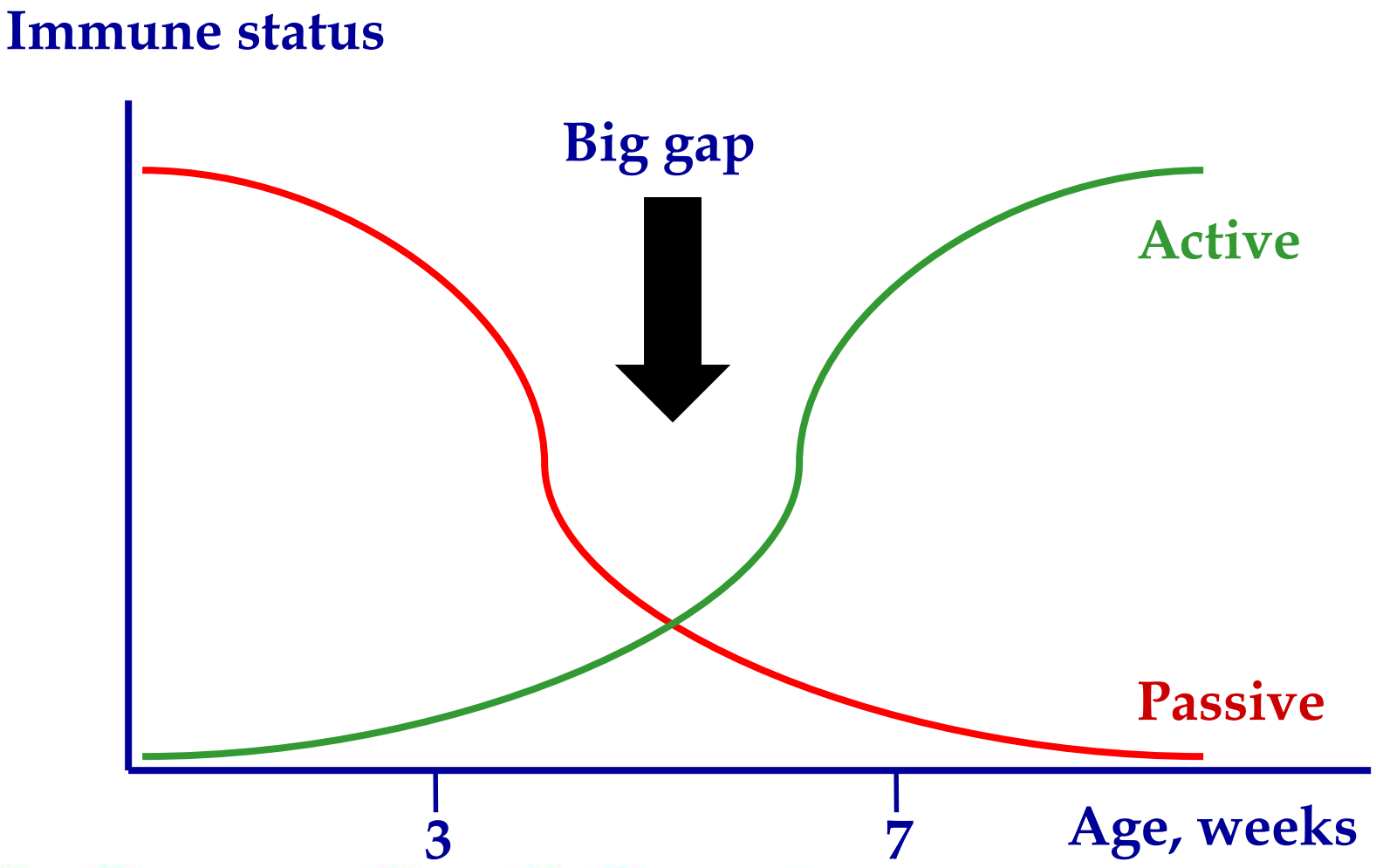
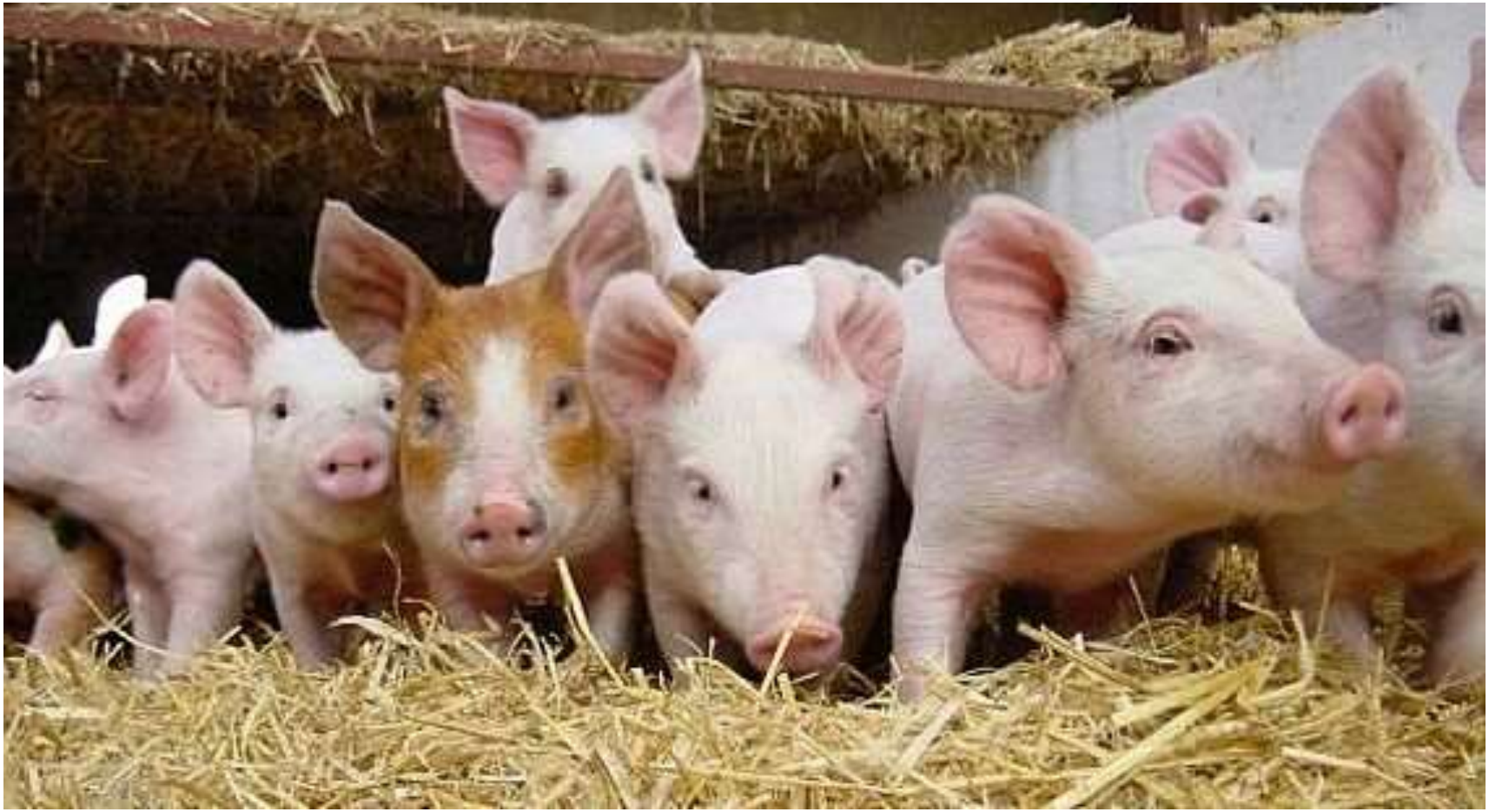
The immunological gap



Benchmarking – Piglets 2014

	The best Farm	The best 5%	The best 25 %	Average
Daily gain (7-30 kg), gram	569	520	474	441
Feedconversion, kg/kg	1.40	1.50	1.55	1.65
Mortality, %	1.2	1.7	2.4	2.9

A good start is essential



Quality of weaned piglets is decided by the sow

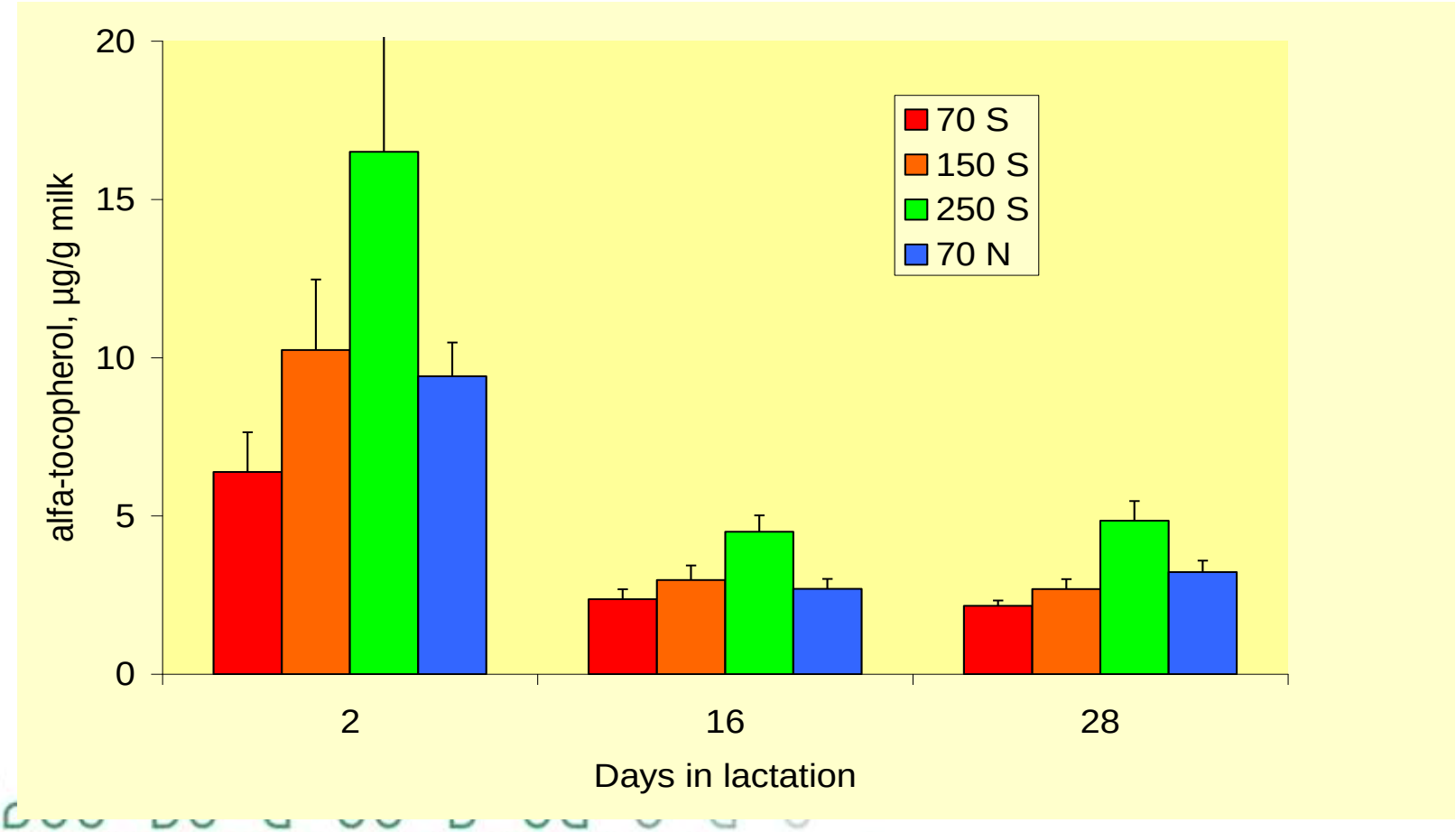
- Colostrum
  - Increased IgG gives significant increased daily gain after weaning
  - Ensure high production of colostrum
  - Ensure high intake
- Milkproduction
  - 4 liter of milk for 1 kg gain
  - HyD and organic minerals (Availa) increase milkproduction
  - Amino acids and right balance is important
- Vitamin E
  - Increase vitamin E i lactation diet reduce diarrhea after weaning

Colostrum and Immunity

- Correlation between birthweight and level of IgG had a P-value of 0,14
- Daily gain
  - Birth to wean — P = 0,63
  - Wean to 30 kg — P = 0,02 (+ 10 mg/ml ~ 6 gram)
  - 30 kg – 100 kg — P = 0,63
  - Birth – 100 kg — P = 0,15
- Threatment with antibiotic
  - Frequency — P = 0,15
  - Time — P = 0,29
- Mortality
  - Birth to wean — P = 0,06
  - Wean to 30 kg — P = 0,56
  - 30 kg – 100 kg — P = 0,33
  - Birth – 100 kg — P = 0,09

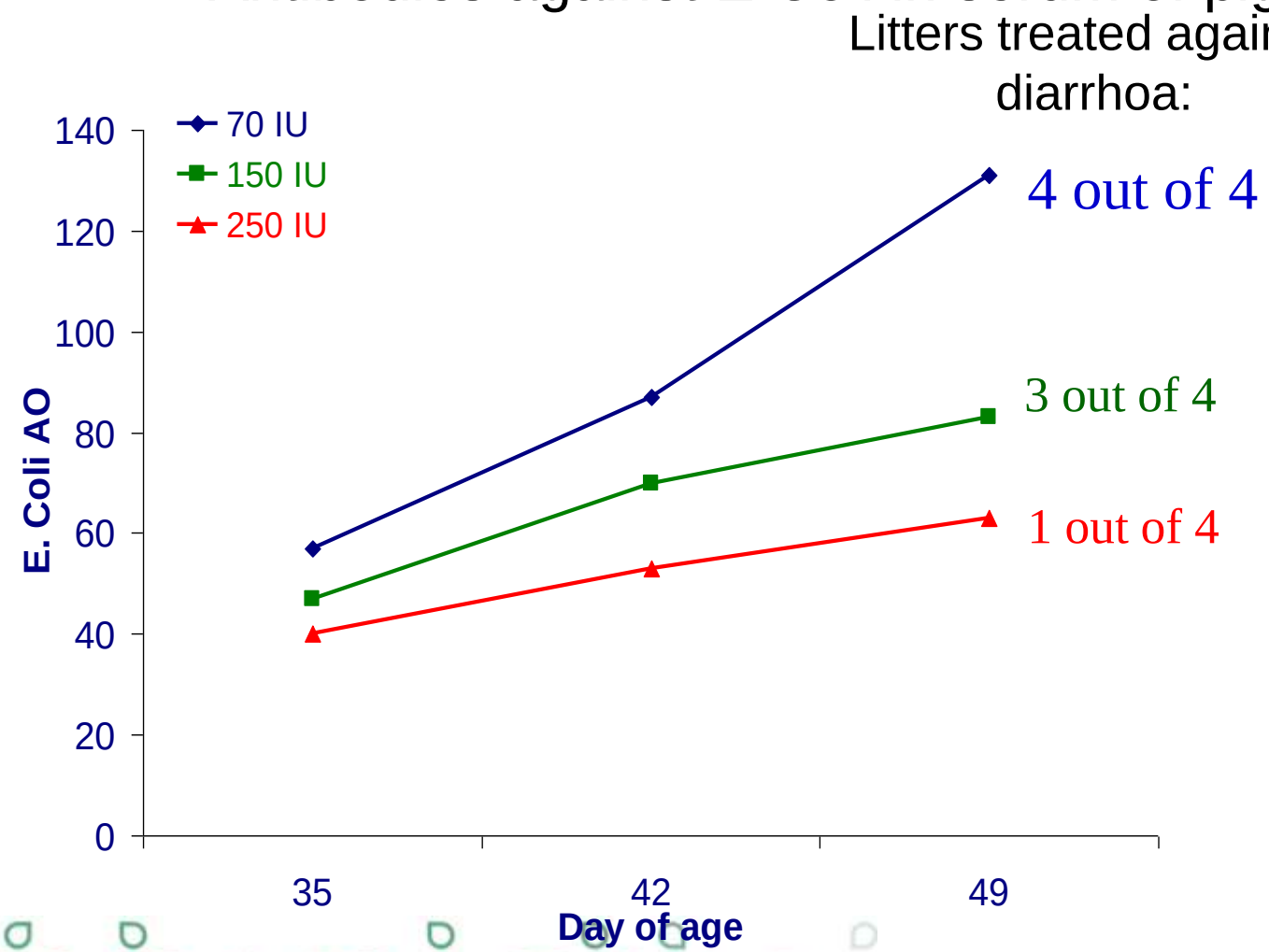
Vitamin E status

Total concentration of α- tocopherol in sow milk



Immune response

Antibodies against E.Coli in serum of piglets



Piglets

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Classification of protein sources

- According to our experience and trial results

1/ Blood plasma

2/ WPC

3/ Fish meal, Protastar, Alphasoy Pemium, SPC 60, Pea protein

4/ Standard potato protein

5/ Corn and wheat gluten

6/ Hemoglobin, Rice protein, egg powder

Trial with Plasma

Effect of plama

- Increased feed intake
- Immunity ?
- Protein quality and - digestibility

- Dosage for prestarter
  - 3,5 – 5 %

- Testing for starter diet

Effect of lowering crude protein

- Around 700 piglets castrated males and females

- 4 treatments:

- Diet with 19% of CP without antibiotic
- Diet with 17% of CP without antibiotic
- Diet with 19% of CP with antibiotic
- Diet with 17% of CP with antibiotic

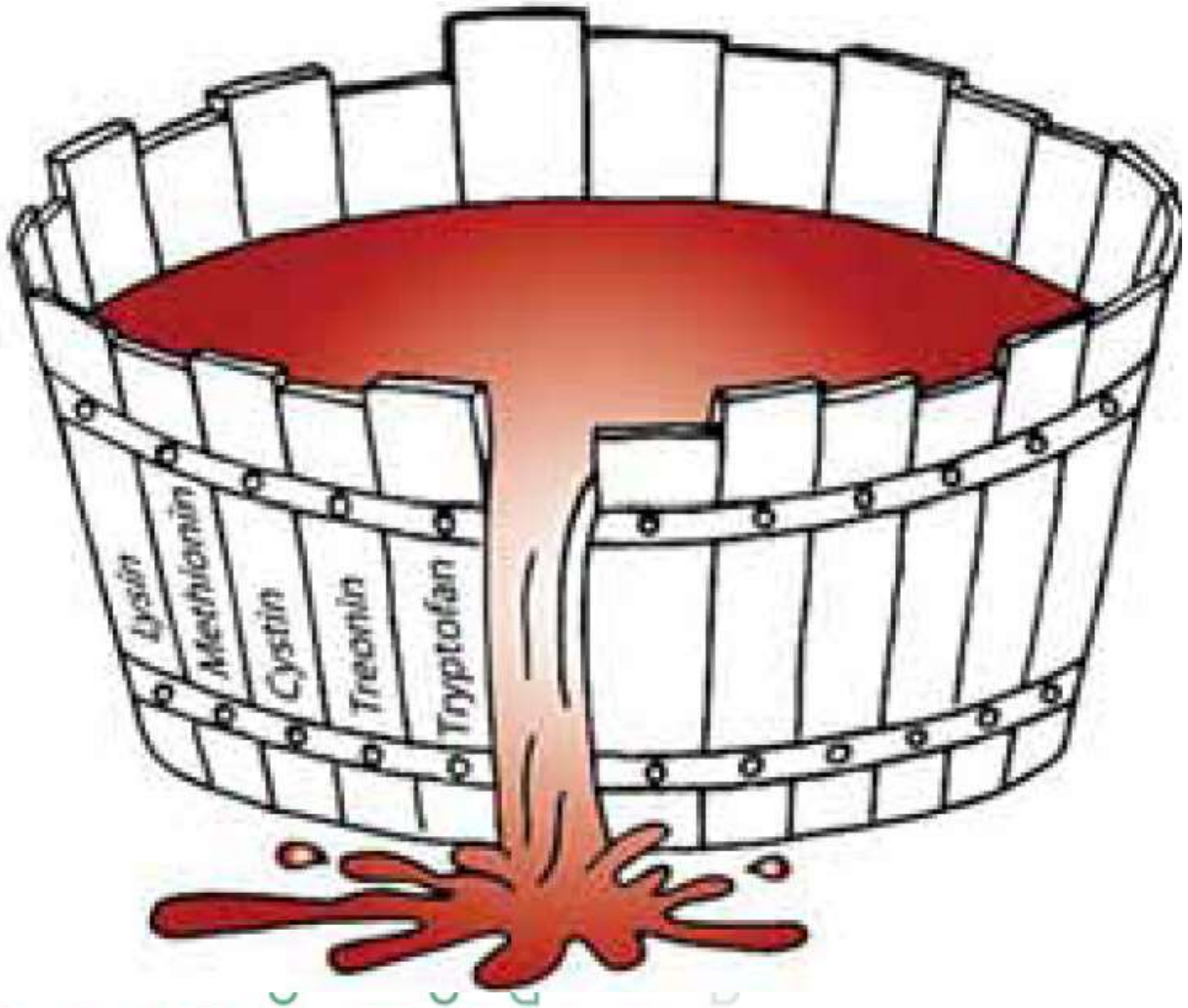
- Measures : ADFI, ADG, FCR, number of piglets and days with diarrhea

Results

Diet	**1**	**2**	**3**	**4**			
Antibiotic			**Coli/Amox**	**Coli/Amox**	**MED**	**DIET**	**M*D**
CP (%)	**19**	**17**	**19**	**17**			
Number of pens	7	7	7	7			
28 to 45 days							
Initial weight, kg	7.6	7.6	7.6	7.6			
Final weight, kg	11.0	10.6	11.6	10.9	**< 0.05**	**< 0.01**	NS
ADFI, g/d	245	240	260	263	**< 0.01**	NS	NS
ADG, g/d	202	175	219	195	**< 0.05**	**< 0.01**	NS
FCR	1.22	1.37	1.19	1.35	NS	**< 0.001**	NS
Diarrhea	0.58	0.30	0.36	0.13	**< 0.05**	**< 0.01**	NS

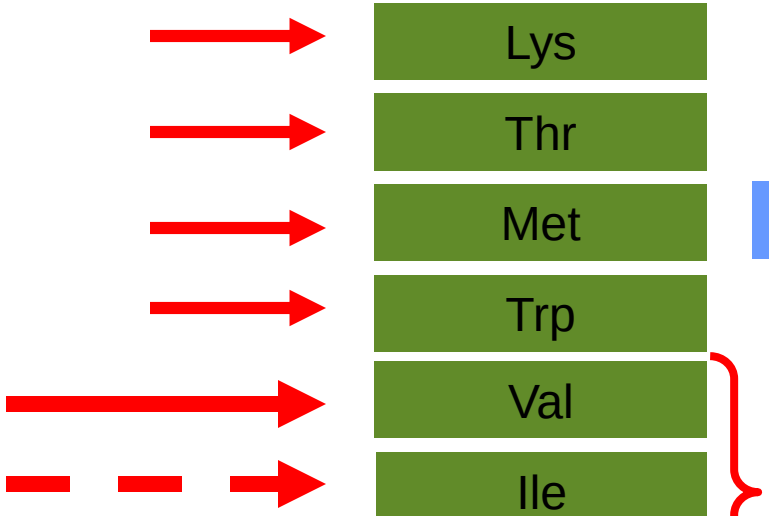
- Antibiotic and protein effect on performance
- Less diarrhea with antibiotic and at 17% of protein

Importance of Ideal protein



All amino acid are important

20 AA are the building blocks of proteins



Indispensable	Conditionally dispensable	Dispensable AA
Lys		Glu
Thr		Gln
Met	Cys	Gly
Trp		Ser
Val		Pro
Ile		Asp
Leu		Asn
His		Ala
Phe	Tyr	
	Arg	

Ideal aminoacids for piglets

Tabel 2. Anbefalinger for aminosyreindhold* ved diarréproblemer, g ford. pr. foderenhed

Interval, kg	6-9 kg	9-20 kg	9-30 kg	20-30 kg	% af lysin
Lysin	10,0	10,0	9,8	9,5	100
Methionin	3,2	3,2	3,1	3,0	32
Methionin +Cystin	5,4	5,4	5,3	5,1	54
Treonin	6,1	6,1	6,0	5,8	61
Tryptofan	1,95	1,95	1,9	1,85	19,5
Isoleucin	5,8	5,8	5,7	5,5	58
Leucin	10,2	10,2	10,0	9,7	102
Histidin	3,4	3,4	3,3	3,2	34
Fenylalanin	5,7	5,7	5,6	5,4	57
Fenylalanin+tyrosin	11,1	11,1	10,9	10,5	111
Valin	7,0	7,0	6,9	6,7	70
Råprotein, minimum	145	145	142	138	
Råprotein, maksimum	157	157	154	150	

Acid Binding Capacity (ABC)

- Definition: ABC is defined as the ability of a feedstuff to resist to a pH change when acid or base is added
- ABC-4 corresponds to the amount of acid or base needed to change the acidity of a ingredient until pH4
- If pH value of an ingredient is below 4, a base will be used and the ABC value will be negative
- ABC can be also evaluated at pH3

ABC - values

- Higher ABC-4 value in minerals and protein sources
- Limestone and Na bicarbonate: 9400 meq
- Soy product: around 450 meq
- Fish meal: 800 meq
- Negative ABC-4 values for acids:
- Formic acid: -14000 meq
- Cereals: 60-80 meq
- Fat and starch don’t affect ABC-4

Trial in Vilofoss Research Farm

- 3 treatments from 26 d (weaning) to 43 d:
- Diet 1: 100% Ca from formate
- Diet 2: 50% Ca from formate and 50% from carbonate
- Diet 3: 100% Ca from carbonate
- ABC value of the diets according to SFR Table
- Diet 1: 200 meq
- Diet 2: 225 meq
- Die 3: 250 meq

ABC-4: from 26 to 43 d

Diet	Control	Diet 1	Diet 2		
Ca from carbonate	0	50% (0.48-0.36%)	100% (0.95-0.72%)	RSD	P value
Ca from formate	100% (1.2-0.9%)	50% (0.6-0.45%)	0		
Number of pens	9	9	9		
Initial weight at 26 d, kg	7.3	7.3	7.3		
Final weight at 43 d, kg	**11.9**	**12.0**	11.7	0.4	0.19
ADFI, g/d	344	348	347	31	NS
ADG, g/d	274	281	260	25	0.20
Feed/gain	1.27	1.25	1.34	0.16	NS
Number of diarrhea/piglet	**0.24**	1.19	1.08	0.24	< 0.001

- Better performance (numerically) with the 2 levels of formate
- Less diarrhea with 100% of Ca from formate

HiPhos on superdosing from 26 to 43 d

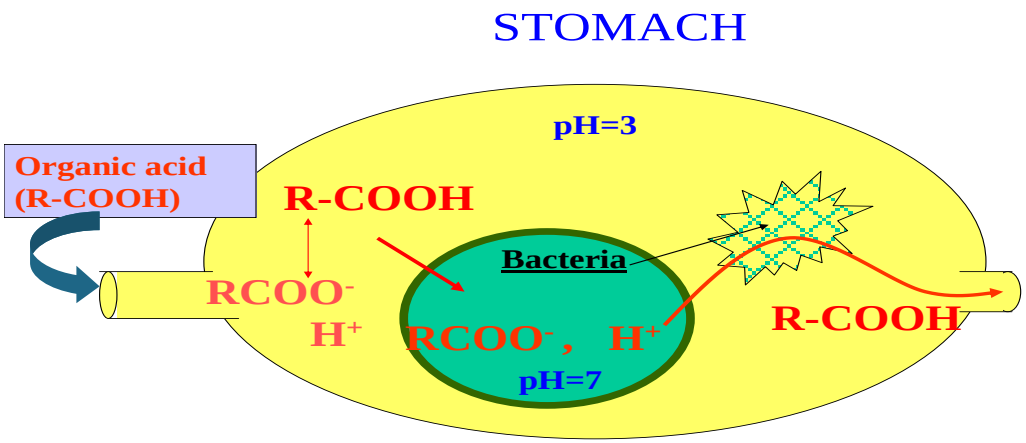
Diet	Control	Diet 1	Diet 2		
Phytase HiPhos (g/t)	**100**	**200**	**400**	**RSD**	**P value**
Number of pens	10	10	10		
Number of piglets at 26 d	156	156	156		
Number of piglets at 43 d	155	156	155		
Initial weight at 26 d, kg	7.0	7.0	7.0		
Final weight at 43 d, kg	11.1a	11.0a	**11.6b**	0.4	**<0.01**
Average daily feed intake, g/d	301	299	313	22	NS
Average daily gain, g/d	243a	240a	**274b**	22	**<0.01**
Feed/gain	1.25a	1.25a	**1.16b**	0.07	**<0.05**
Number of days/diarrhea	0.66	0.49	0.68	0.35	NS

- Improvement of BW, ADG and FCR at higher level
- No effect on ADFI and diarrhea

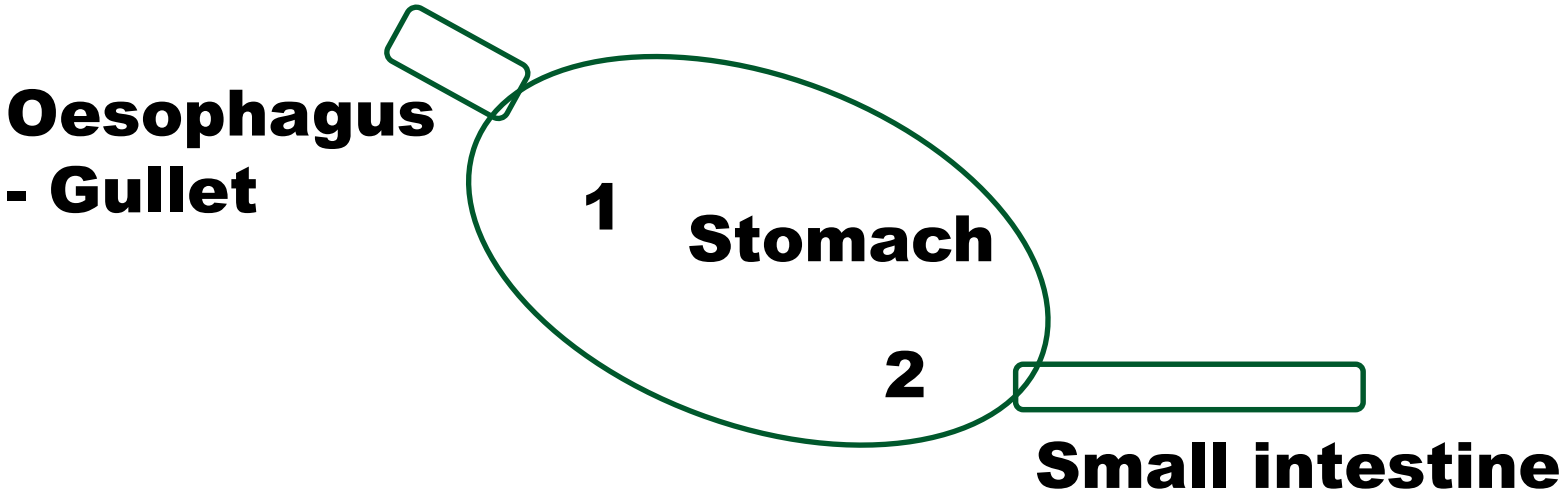
Focus on pH in stomach

Low pH in the stomach

- Anti-bacterial barrier
- Supporting the effect of organic acids
- Increased protein digestibility



Effect of physical form and acids on pH in the gastro-intestinaltract



	Pellets		Meal feed		P-values	
Acid	-	+	-	+	Form	Acid
Stomach 1	3,84	3,56	4,22	3,94	0,01	0,04
Stomach 2	3,71	3,43	2,09	1,81	<0,001	0,07

Vit-Acid

	Acidbinding		Coli-effect	
Acid	pKa	“Effect”	pH=4	pH=6
Formic	3,75	++++	+++	+
Acetic	4,76	+	++	+
Lactic	3,83	++	+++	+++
Citric	3,14	++	++	++
Phosphoric	2,10	+++++		

Contains 23 % calcium and the source do not increase acidbindingcapacity

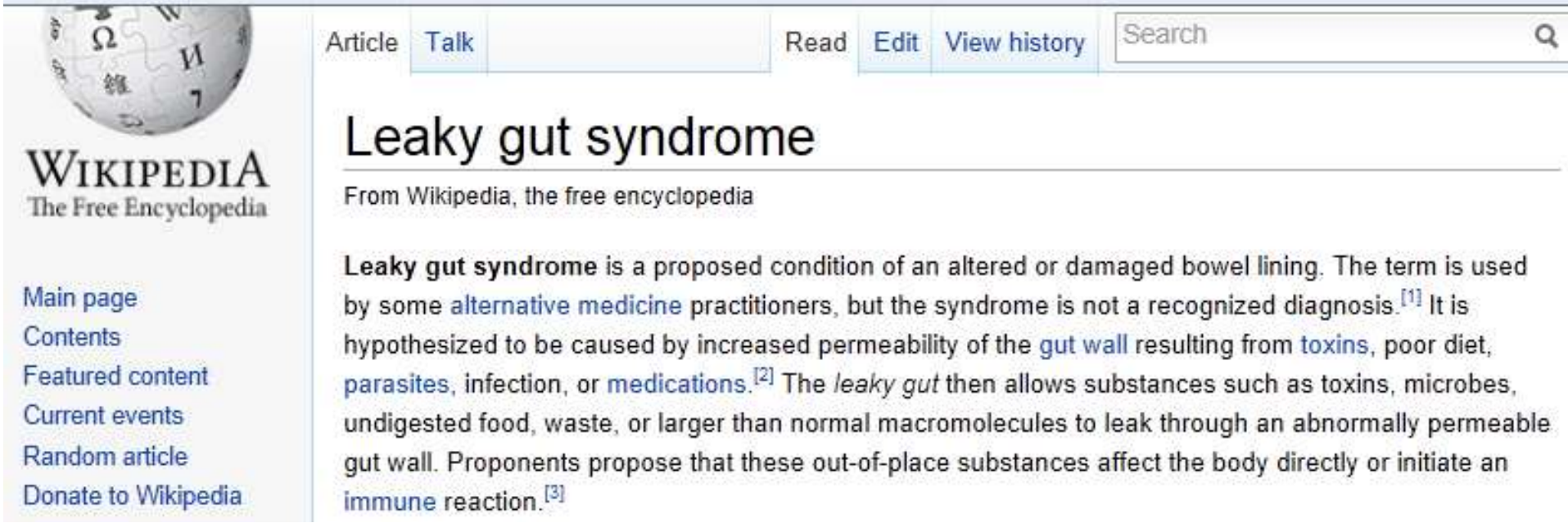
Pig-Omic for piglets

To improve pigs natural defence against diarrhoe

Zinkoxide for weaners

- Dosage is 3 kg pr tonnes or 2500 ppm Zn
- Significant reduction of diarrhoe and increase of performance
- Allowance and sustainability in future ?

Leaky gut



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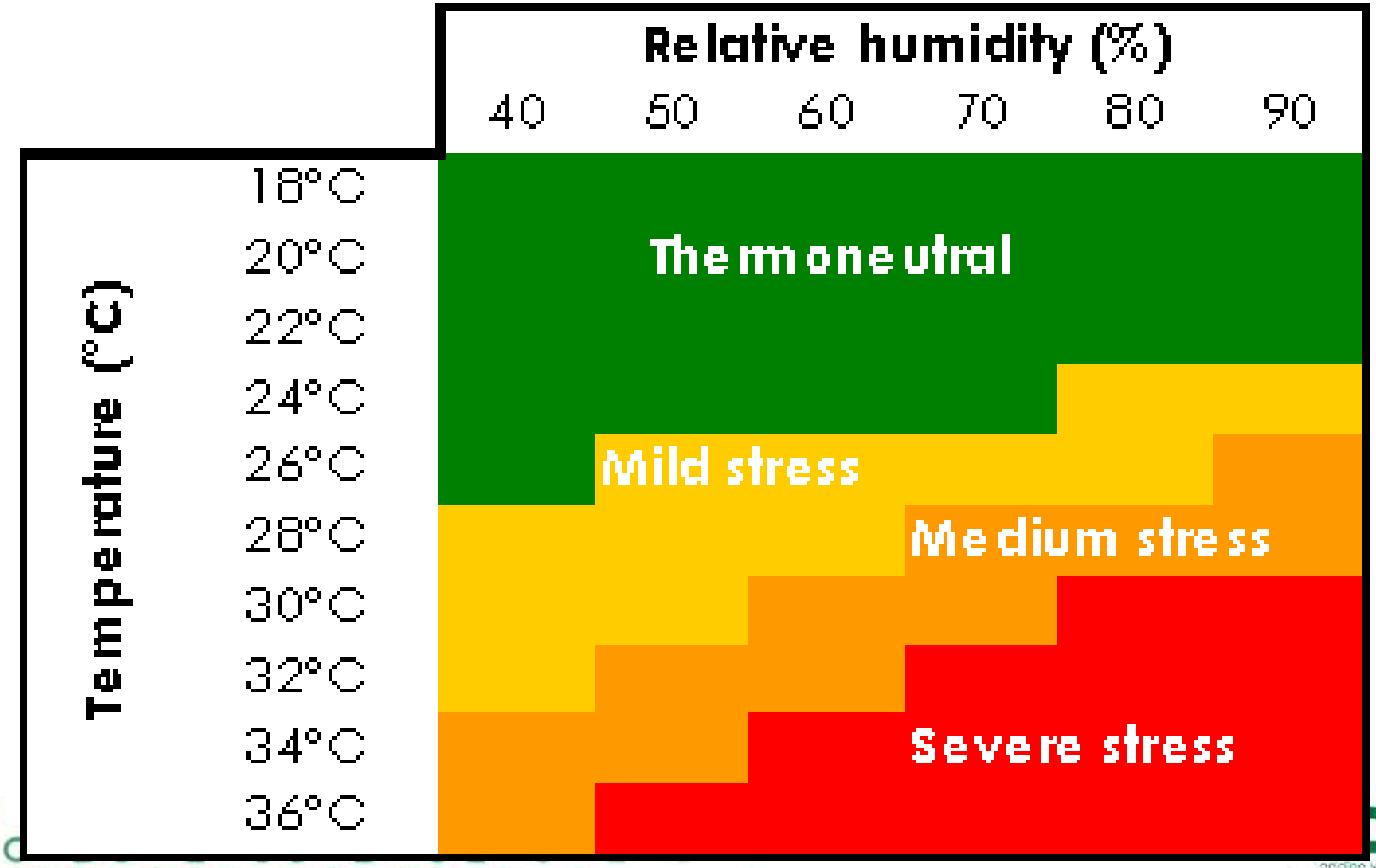
Leaky gut syndrome

From Wikipedia, the free encyclopedia

Leaky gut syndrome is a proposed condition of an altered or damaged bowel lining. The term is used by some alternative medicine practitioners, but the syndrome is not a recognized diagnosis.[1] It is hypothesized to be caused by increased permeability of the gut wall resulting from toxins, poor diet, parasites, infection, or medications.[2] The *leaky gut* then allows substances such as toxins, microbes, undigested food, waste, or larger than normal macromolecules to leak through an abnormally permeable gut wall. Proponents propose that these out-of-place substances affect the body directly or initiate an immune reaction.[3]

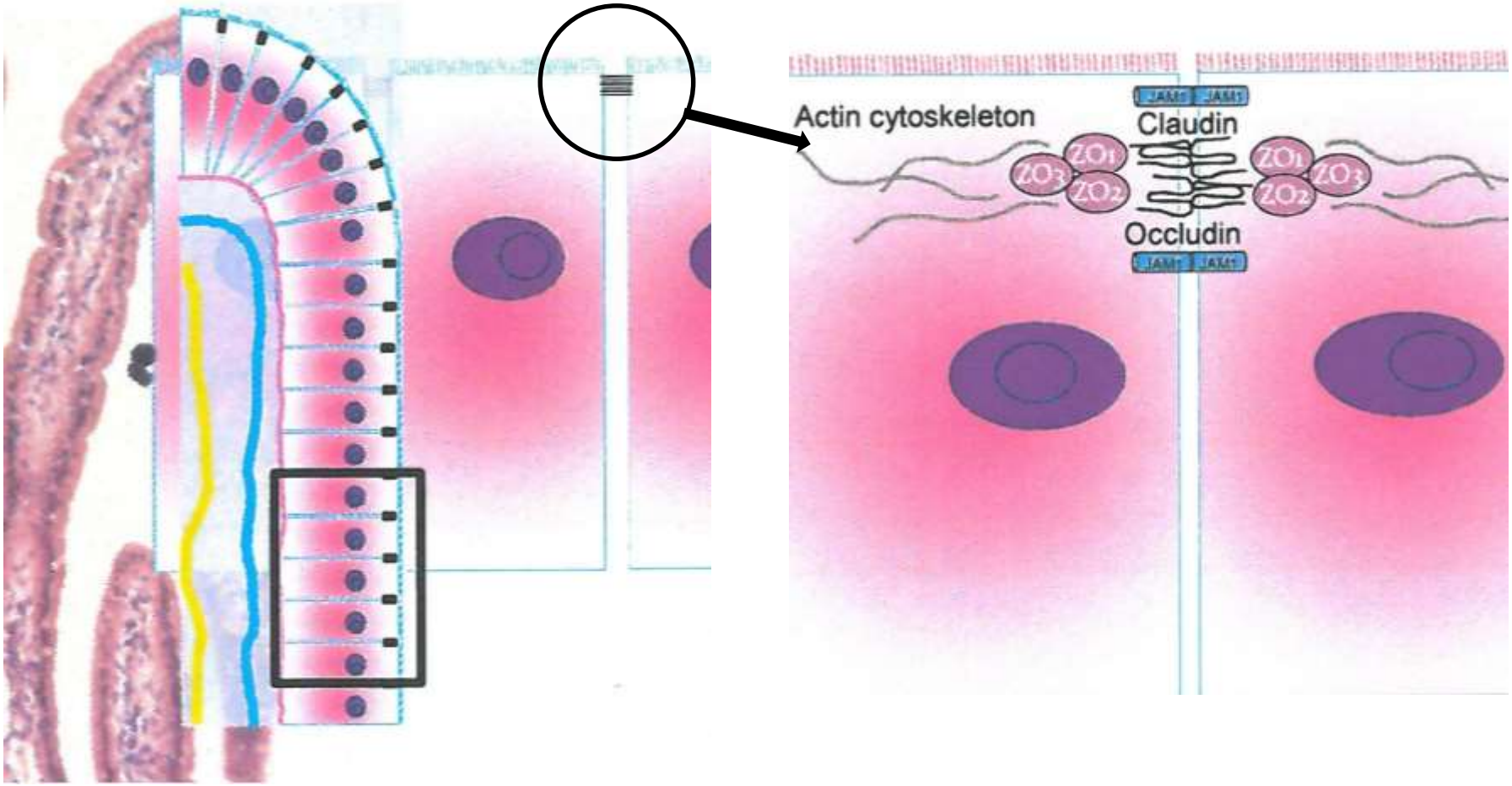
Pigs: Heat Stress Index (HSI)



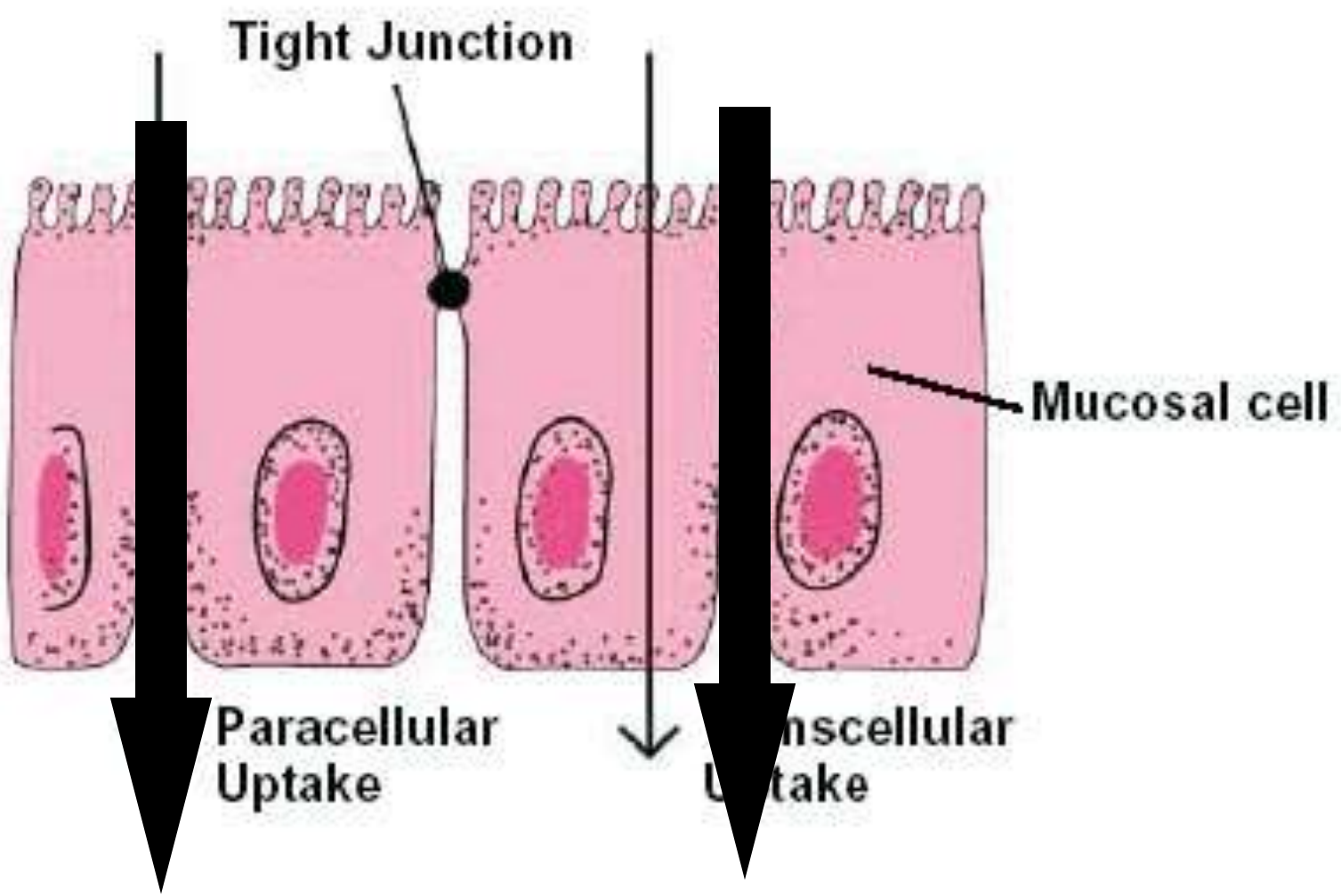
Heat Stress and Gut Health

- Massive diversion of blood flow to skin and extremities
- Coordinated vasoconstriction in intestinal tissues
  - Reduced nutrient and oxygen delivery to enterocytes
  - Hypoxia increases reactive oxygen species (ROS)
- Reduced nutrient uptake increases intestinal osmolarity in the intestinal lumen
  - Multiple reasons for increased osmotic stress

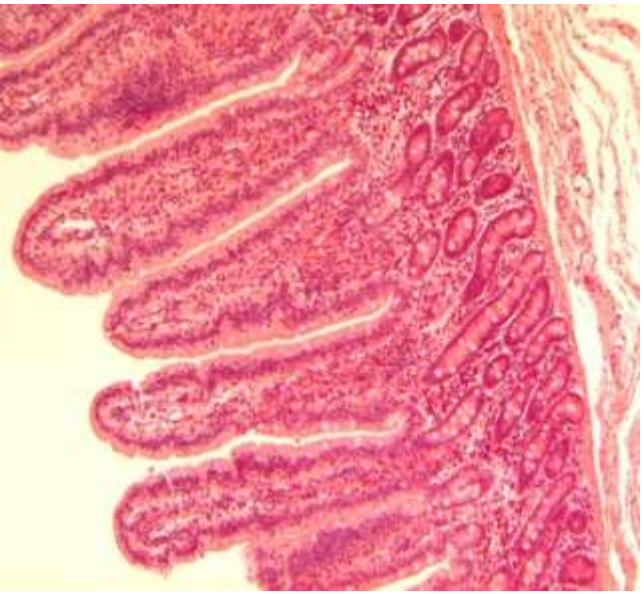
Leaky Gut


Actin cytoskeleton
JAM1
JAM1
Claudin
ZO1
ZO3
ZO2
ZO1
ZO3
ZO2
Occludin
JAM1
JAM1

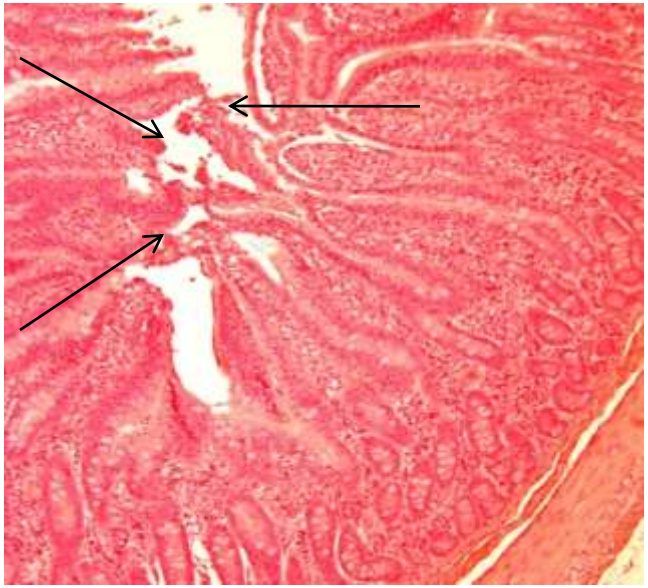
Stress



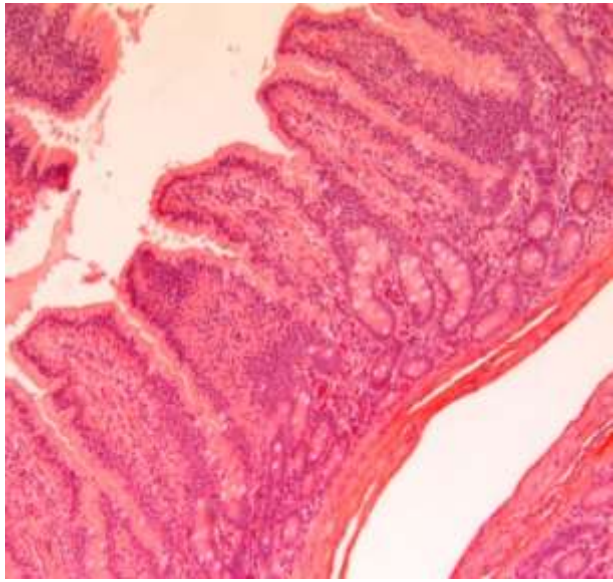
Intestinal Morphology



Thermal Neutral



Heat Stress



Pair-fed

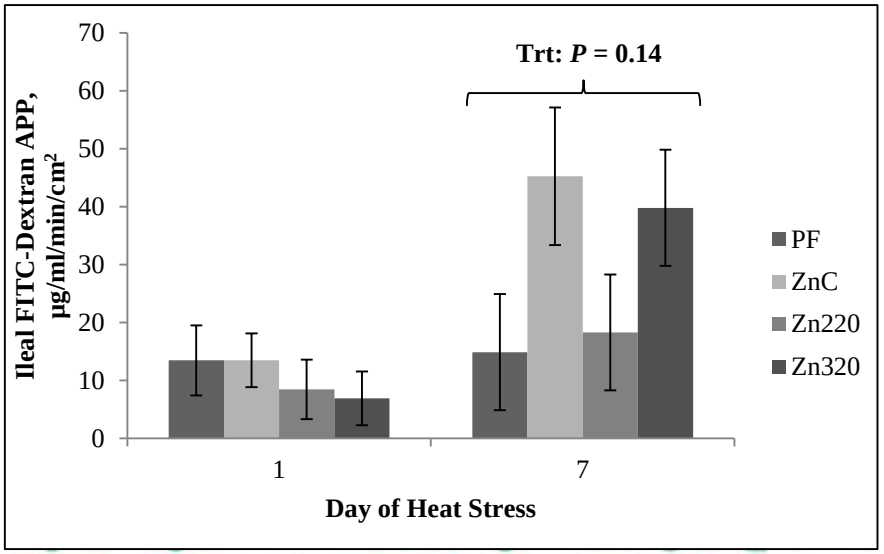
Pearce et al., 2011

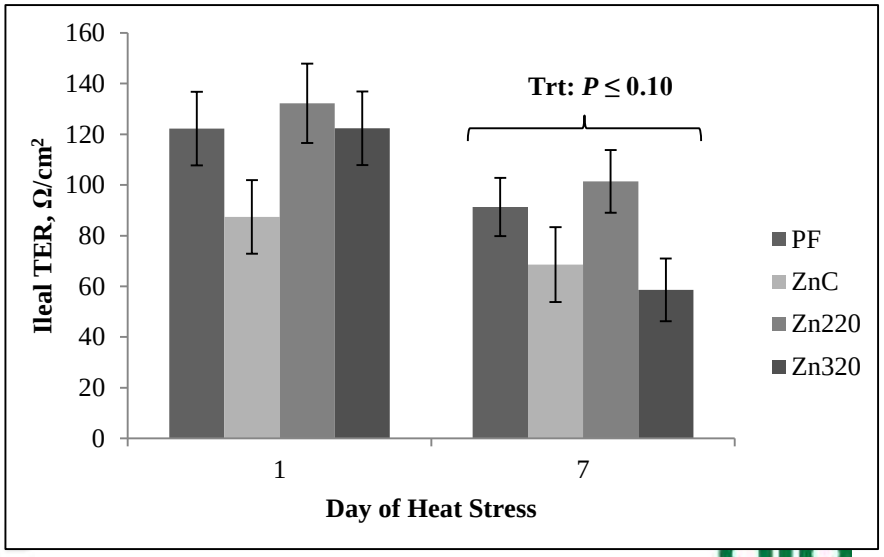
Treatment Allocation

Treatment classification	Dietary treatment	Environmental treatment	Day of sacrifice	Number of pigs (n)
Control (ZnC)	120 ppm of zinc from $ZnSO_4$ No supplemental zinc	Heat Stress (HS): 36°C; 50% humidity; THI ≈ 85.5 Ad libitum feeding	1	8
			7	5
Organic zinc (Zn220)	120 ppm of zinc from $ZnSO_4$ 100 ppm of zinc from Availa Zn		1	7
			7	7
High organic zinc (Zn320)	120 ppm of zinc from $ZnSO_4$ 200 ppm of zinc from Availa Zn		1	8
			7	8
Pair-fed control (PF)	120 ppm of zinc from $ZnSO_4$ No supplemental zinc	Thermo-neutral (TN): 19°C; 61% humidity; THI ≈ 64 Pair-feeding	1	8
			7	8

Effekt af AvailaZink on Heat Stress

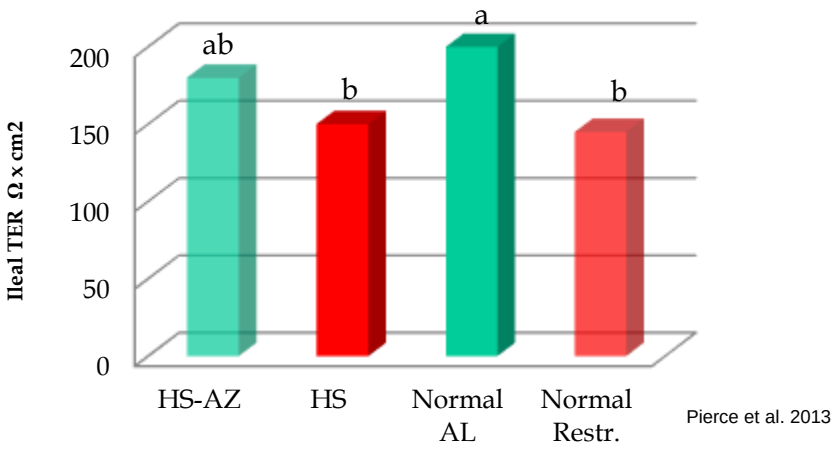
Threatment	Pair-Fed	Zn120	Zn220	Zn320	P-value	
Organic zinc	-	-	100 ppm	200 ppm	Thr	Day
Heatstress	No	Yes	Yes	Yes		
FITC Dextran APP µg/ml/min/cm2	12,78	26,64	10,41	19,95	0,30	0,01
TER, Ω/cm2	106,80^{b}	76,27^{a}	119,65^{b}	91,36^{ab}	0,04	0,01



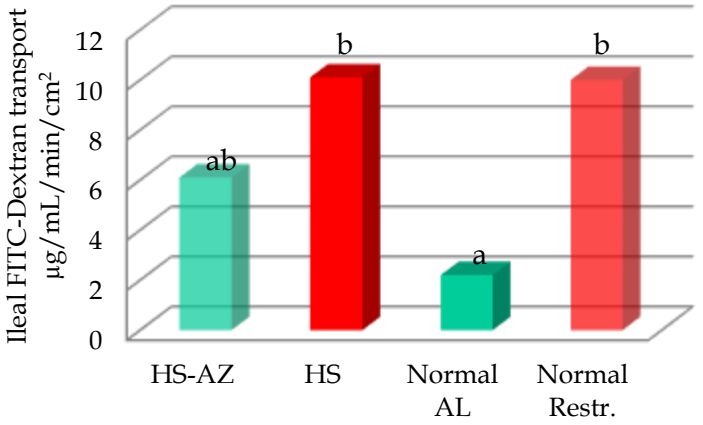


Heat stress and leaky gut in finishing pigs

Diet			Feeding		Environment		Ileal TER	Ileal FITC-Dextran transport
	Availa-Zn	ZnSO4	Ad lib	Restrik-tive	37°C 40%RH	21°C 70%RH	Ω x cm2	µg/mL/min/cm²
Heat stress, AvailaZink	60	60	X		X		180	6,1
Heat stress "Negative" control		120	X		X		150	10,1
Normal ad lib (Thermoneutral control)		120	X			X	200	2,2
Normal restr. (Thermoneutral control)		120		X		X	145	10



Pierce et al. 2013



- The use of Availa-Zn reduces the impact of heat stress in **”leaky gut”** to a level similar to no heat stress

Piglets Organic Microminerals Pig-OMic

	DK-standard	Pig-Omic
Iron	200 ppm inorganic	100 ppm (Organic + inorganic)
Zinc	125 ppm inorganic	125 ppm (Organic + inorganic)
Cupper	160 ppm inorganic	160 ppm (Organic + inorganic)

To make a cost efficient solution for the benefit of the piglets

Results with Pig-Omic

- 2 trials compared with 3 kg ZnO pr tonnes
  - No difference in daily gain
  - No difference in feedconversion
  - No difference in mortality and diarrhoe

- Pig-Omic and Oedema disease

Period	03.12.09 – 16.03.10	17.03.10 - 21.06.10
"Threatment"	Serum	Pig-Omic in feed
No of pigs	1.965	1.914
Daily gain, index	100	99
Feedconversion, index	100	92
Mortality, index	100	79

Piglets

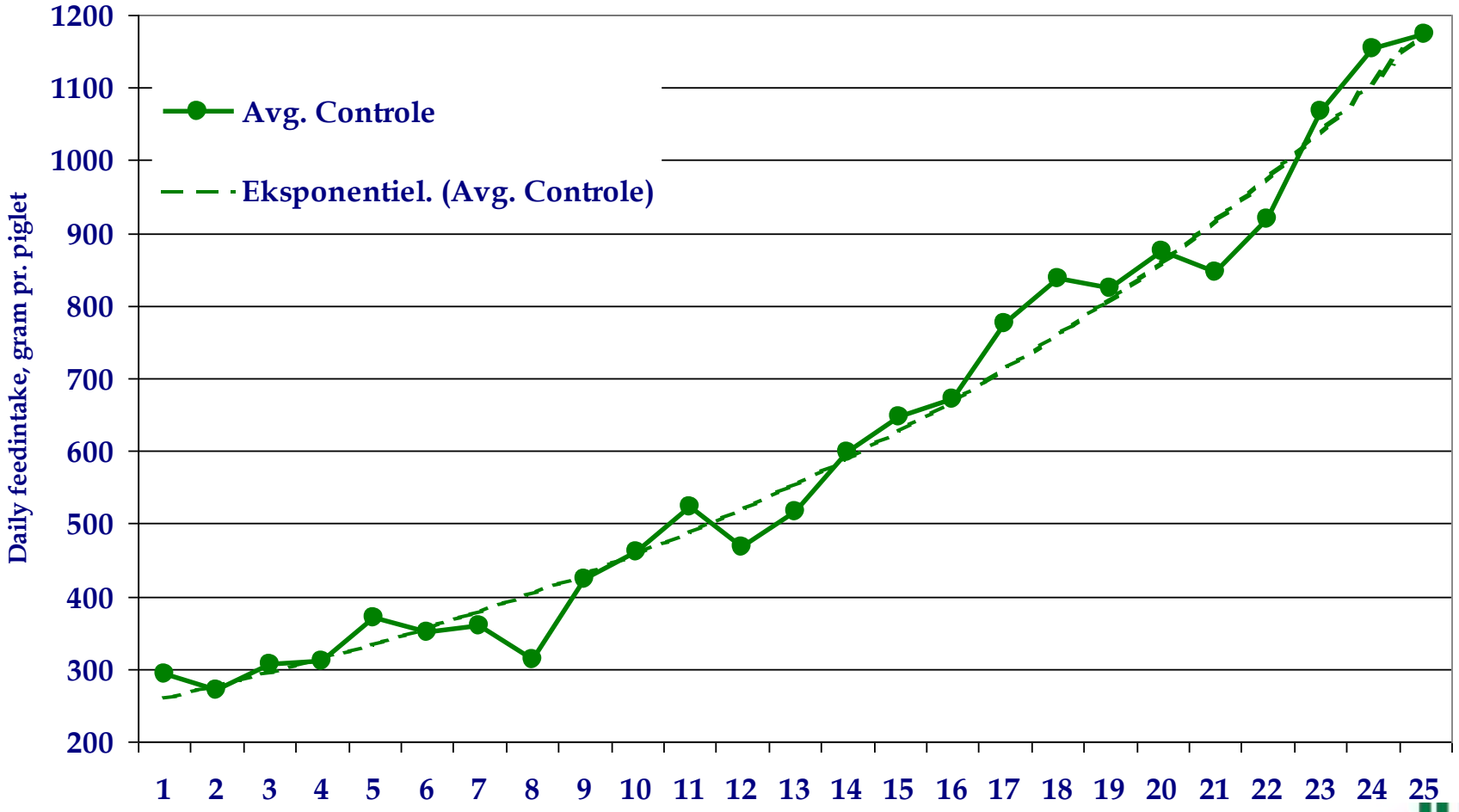
- Ensure temperature for room and floor
- Small pens
- 3 feeds from 7 – 30 kg
- Enough water

Phases for Piglet feed

- Changes according to weight and age, and not only age

- 6 kg	Prestarter	1 kg	10 %
6,5 – 9 kg	Prestarter	3 kg	
9 – 15 kg	Starter	9 kg	22,5 %
15 – 30 kg	Grower	27 kg	67,5 %

Feed intake after weaning



Conclusion

Never give up

- Start with the sow
- Focus on protein sources
  - Increase protein digestibility
- Low protein / unbalanced amino acid profile is lowering productivity
- Focus on supporting stomach function
  - Formulating with ABC
  - Using right combination of acids
- Organic minerals has a potential – also for piglets
- Feeding strategy
  - 3 phases were two first diets ensure performance and diet 3 ensure economy
  - Feedintake first 1 – 2 week

THANK YOU FOR YOUR ATTENTION

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