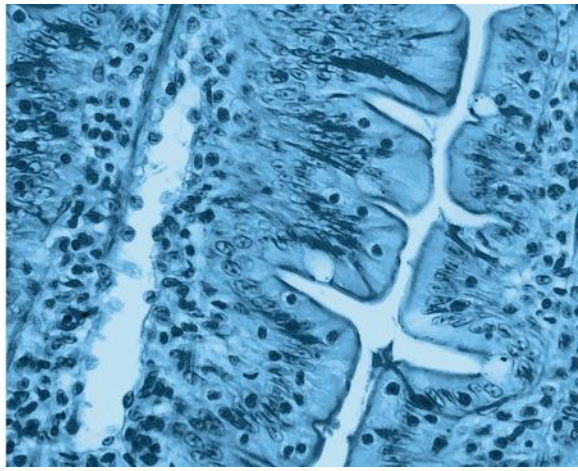
SCHOTHORST FEED RESEARCH

SEGES Grisekongres 2021

Herning, 27-10-2021





Pre- and post-weaning, are they a perfect match?

Pre-weaning strategies to get piglets eating and prepare them for weaning

Anouschka Middelkoop PhD

Knowhow to feed

Introduction

- Pre-weaning strategies from my PhD
- Let's take it broader…

PhD at Wageningen University from 2016-2020
From 2020: Researcher swine at SFR

Rooting, chewing and playing

SCHOTHORST FEED RESEARCH



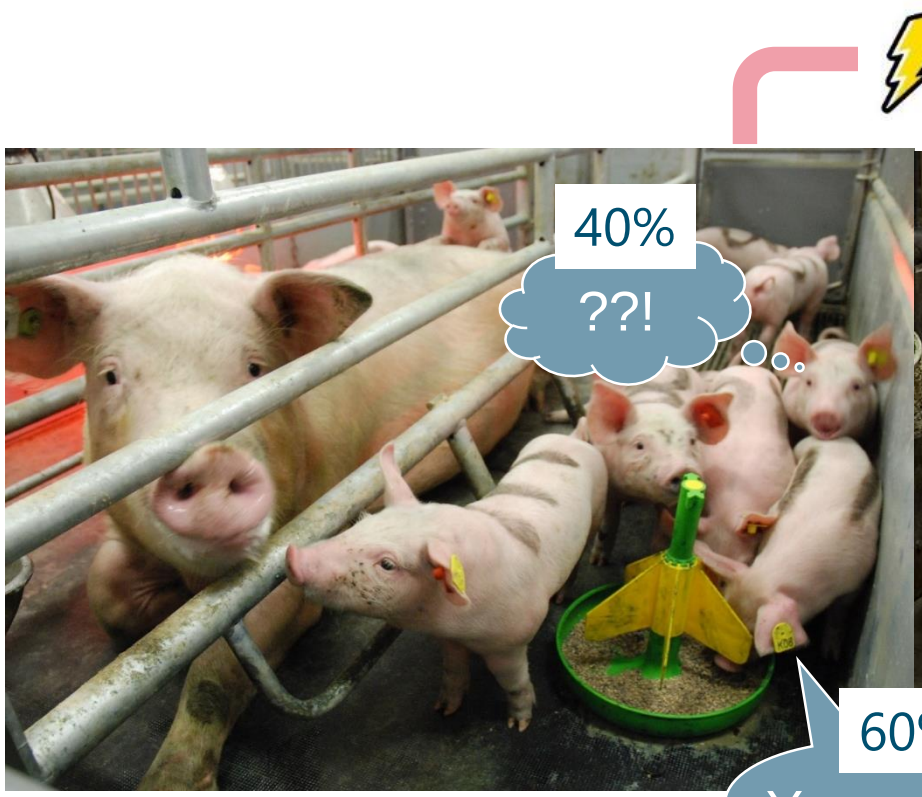






Image credits: S. Elson, O. Spata, J-L Klein and M-L Hubert

Weaning and eating creep feed



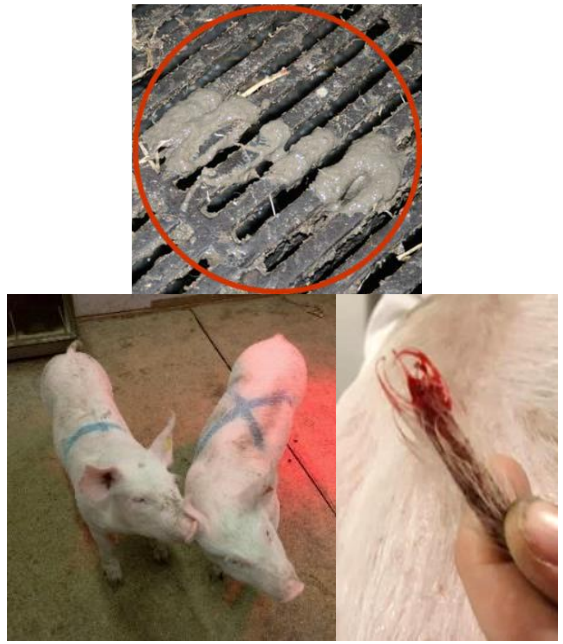
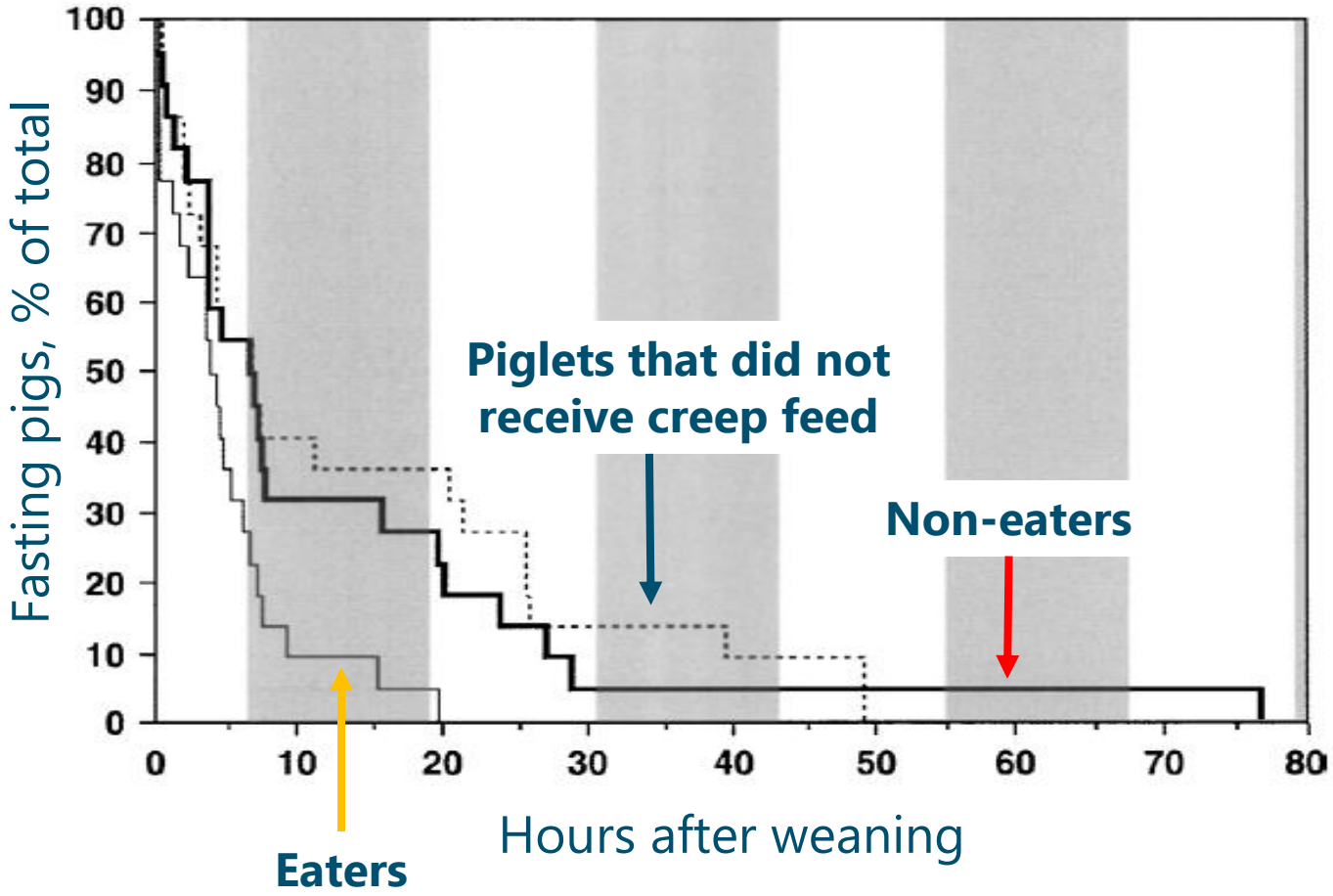
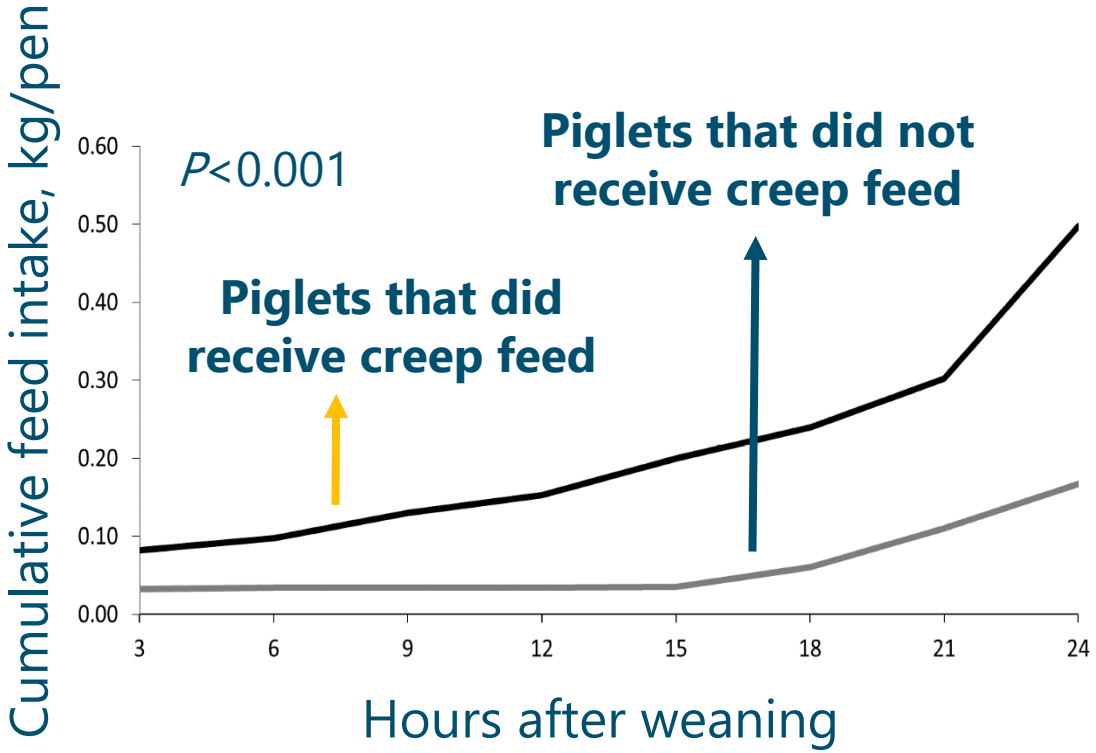


Image credits: A. Middelkoop, P.J.E. Roek, K.S. Pedersen and N. Toft

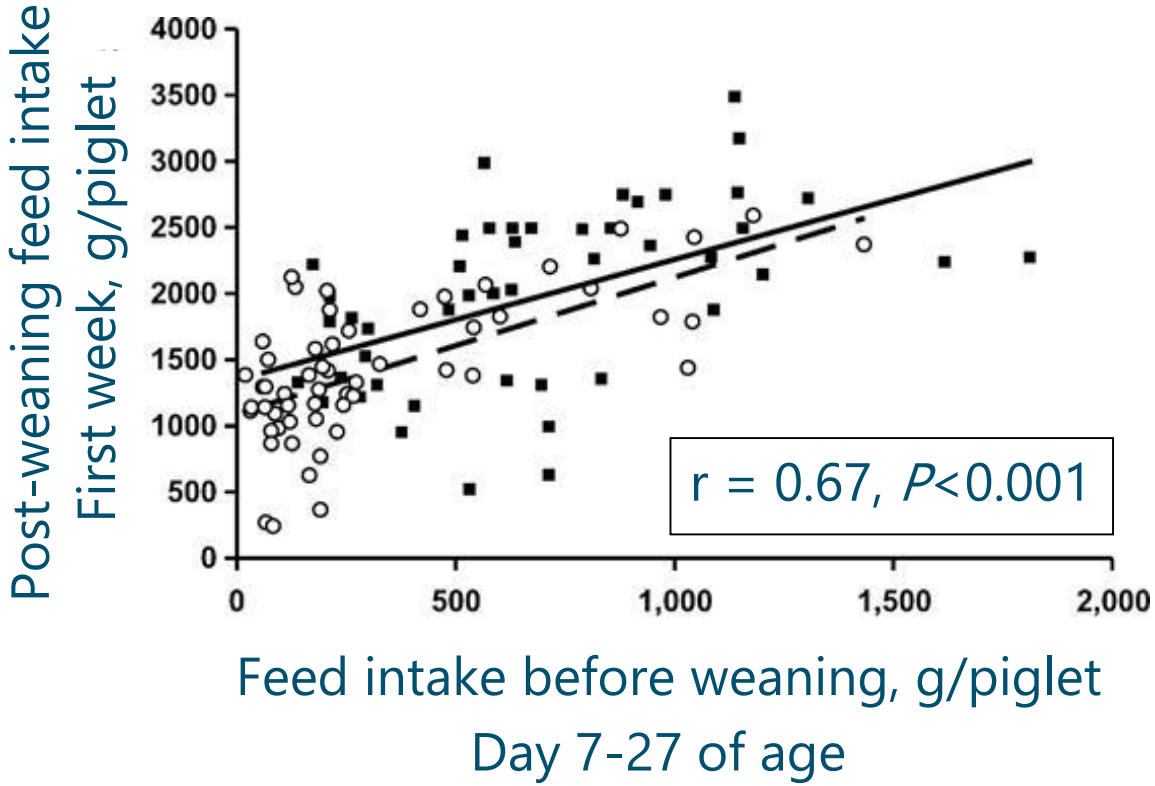
Creep feed intake, why important?

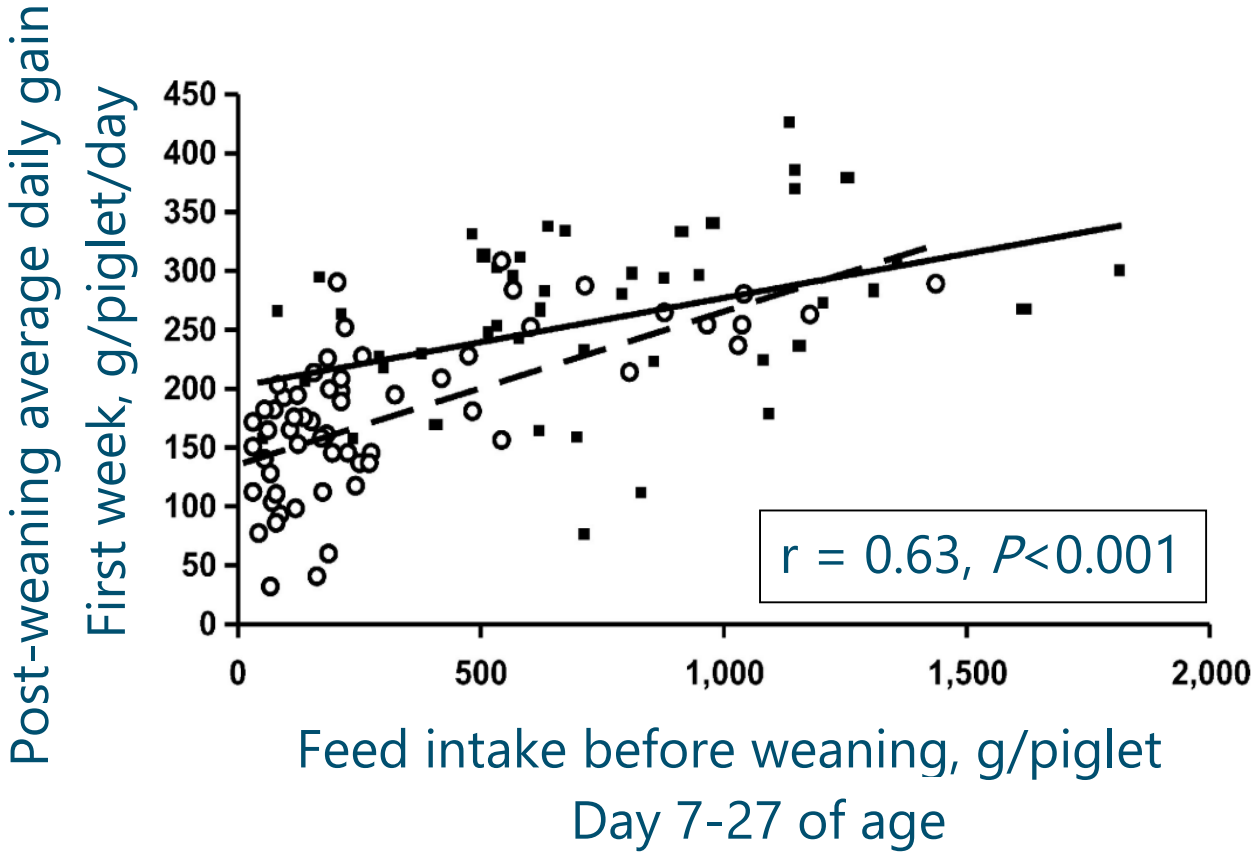




Bruininx et al., 2002; Lee et al., 2021

Creep feed intake, why important?



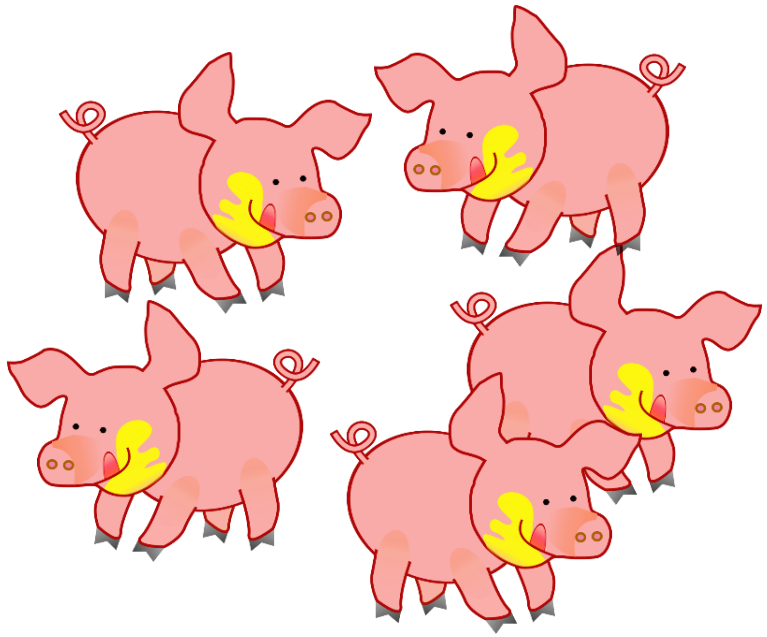


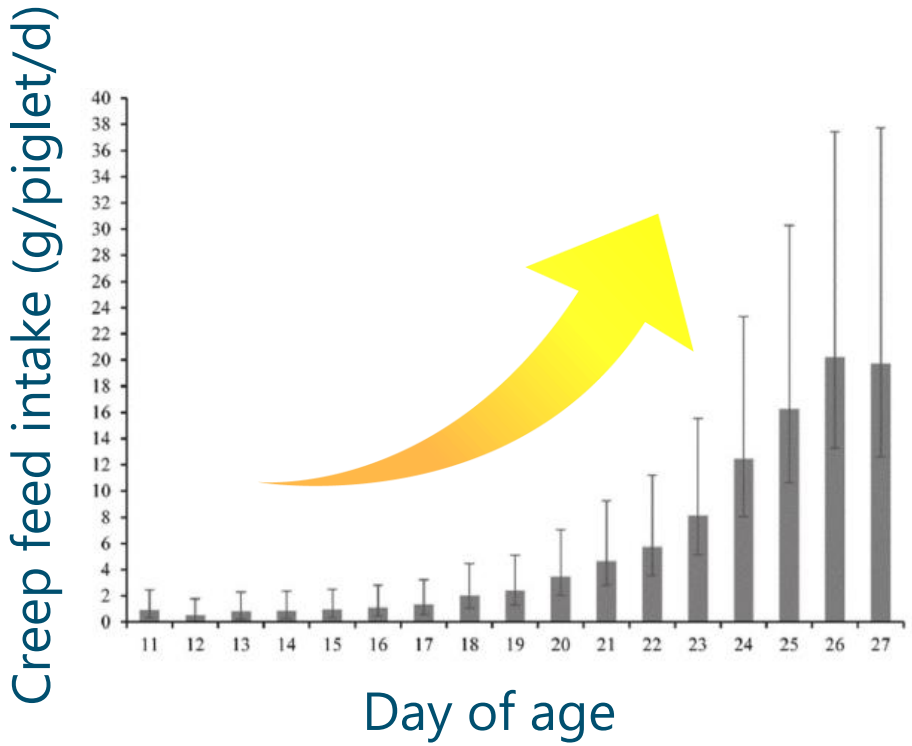
↑ ADG in first week and first 4 weeks post-weaning of good and moderate eaters vs. bad and non-eaters

Kuller et al., 2004; Pluske et al., 2007

Apply strategies that stimulate…

- The number of eaters
- The amount of creep feed consumed
- A timely onset of creep feed intake





Huting et al., 2017

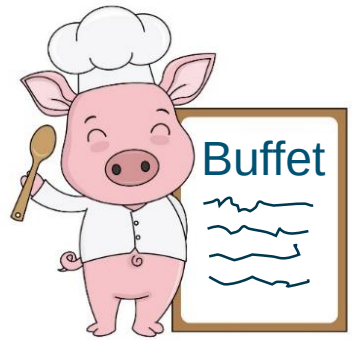
Aim and approach of my PhD thesis

How can we get more piglets to eat and improve creep feed intake, to facilitate weaning?

Strategy

1	2	3	4

m²



Environmental enrichment

- Extra space, alternating toys and substrates

Creep feed intake (g/piglet/d)	Enriched	Barren	*P*-value
d7-22	3 ± 1	2 ± 1	0.98
d22-28	34 ± 12	26 ± 10	0.35
d28-30	87 ± 15	45 ± 13	0.03
Total, d7-30	18 ± 5	12 ± 4	0.07

Luo et al., 2020

Play-feeder

- To stimulate exploratory and play behaviour, from 4 days of age

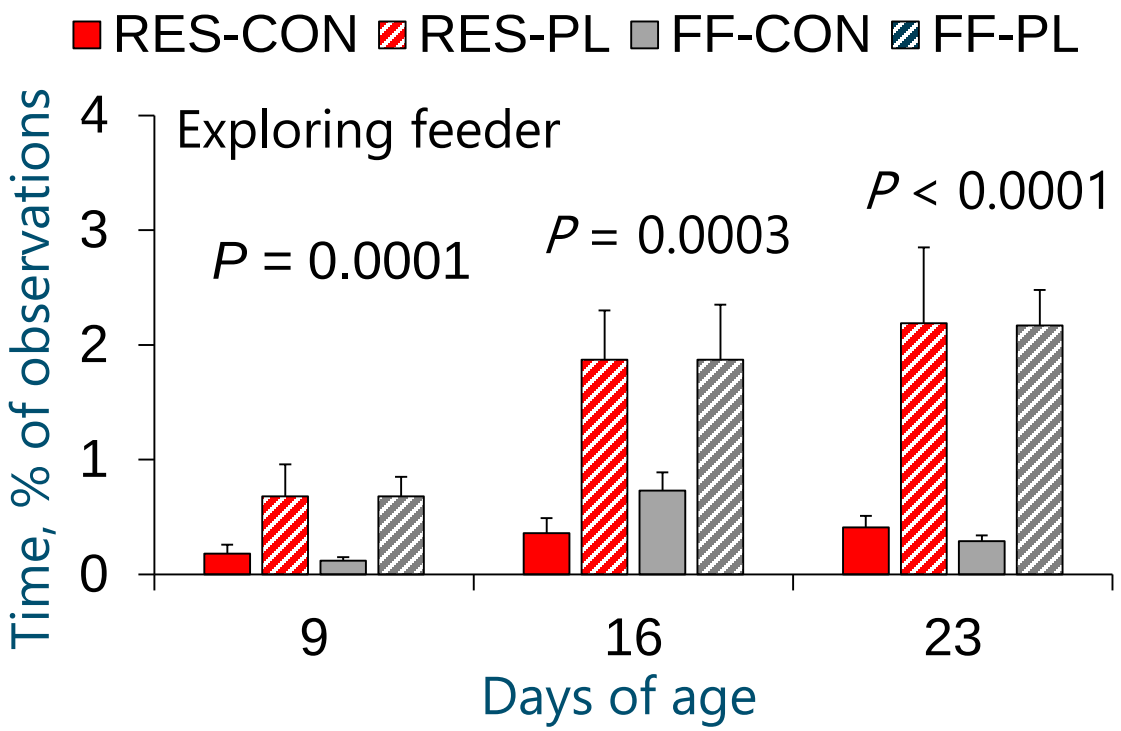
Control

Play-feeder

Middelkoop et al., 2019

Play-feeder

- Stimulates exploratory behaviour



Piglets per litter visiting the feeder

Age	Control	Play-feeder	*P*-value
d9	22%	57%	<0.01
d16	56%	81%	<0.01
d23	70%	95%	<0.01

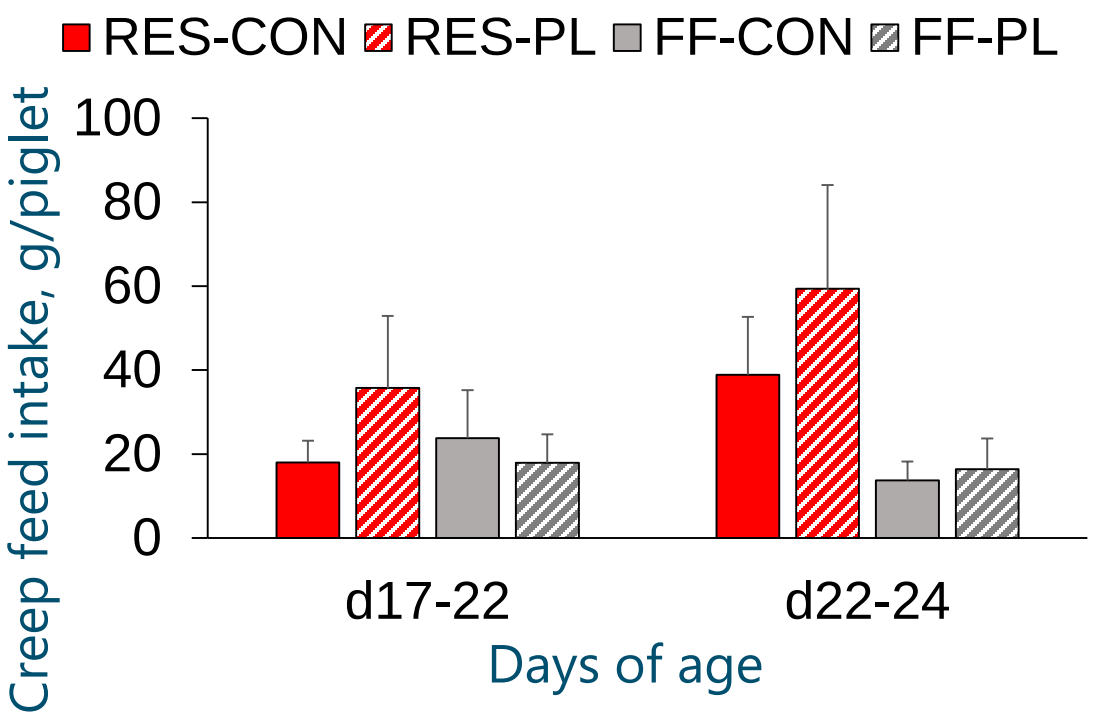
Striped bars: litters with access to the play-feeder

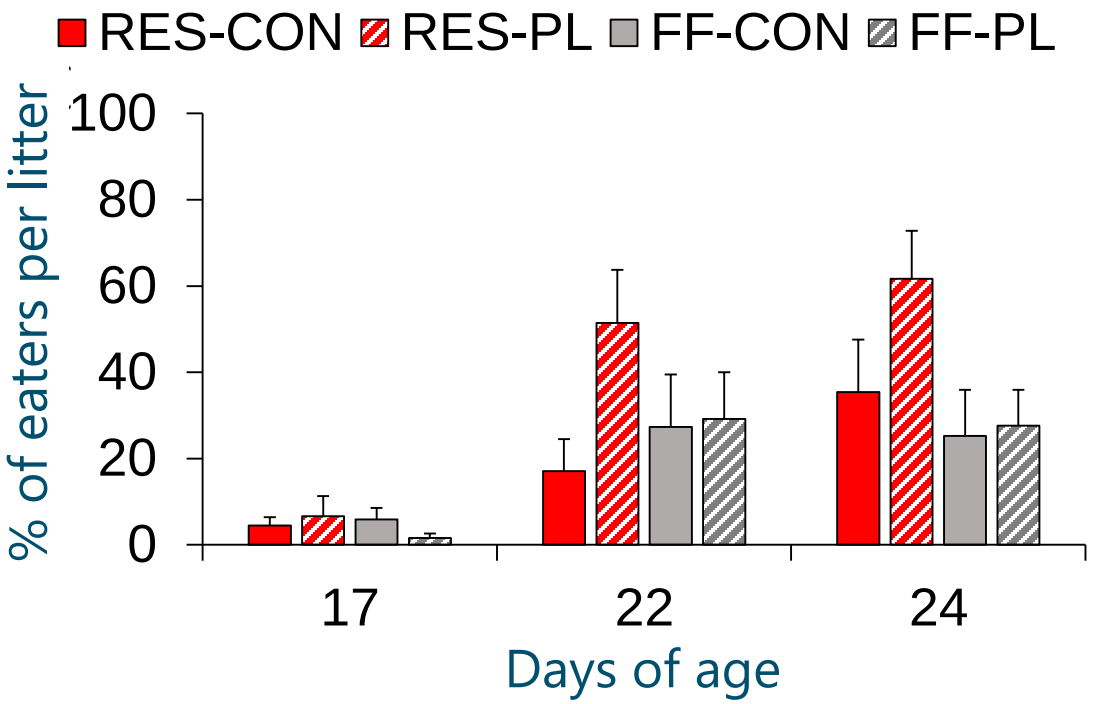
Middelkoop et al., 2019

Play-feeder

SCHOTHORST FEED RESEARCH

- Did not stimulate creep feed intake, number of eaters or weaning weight



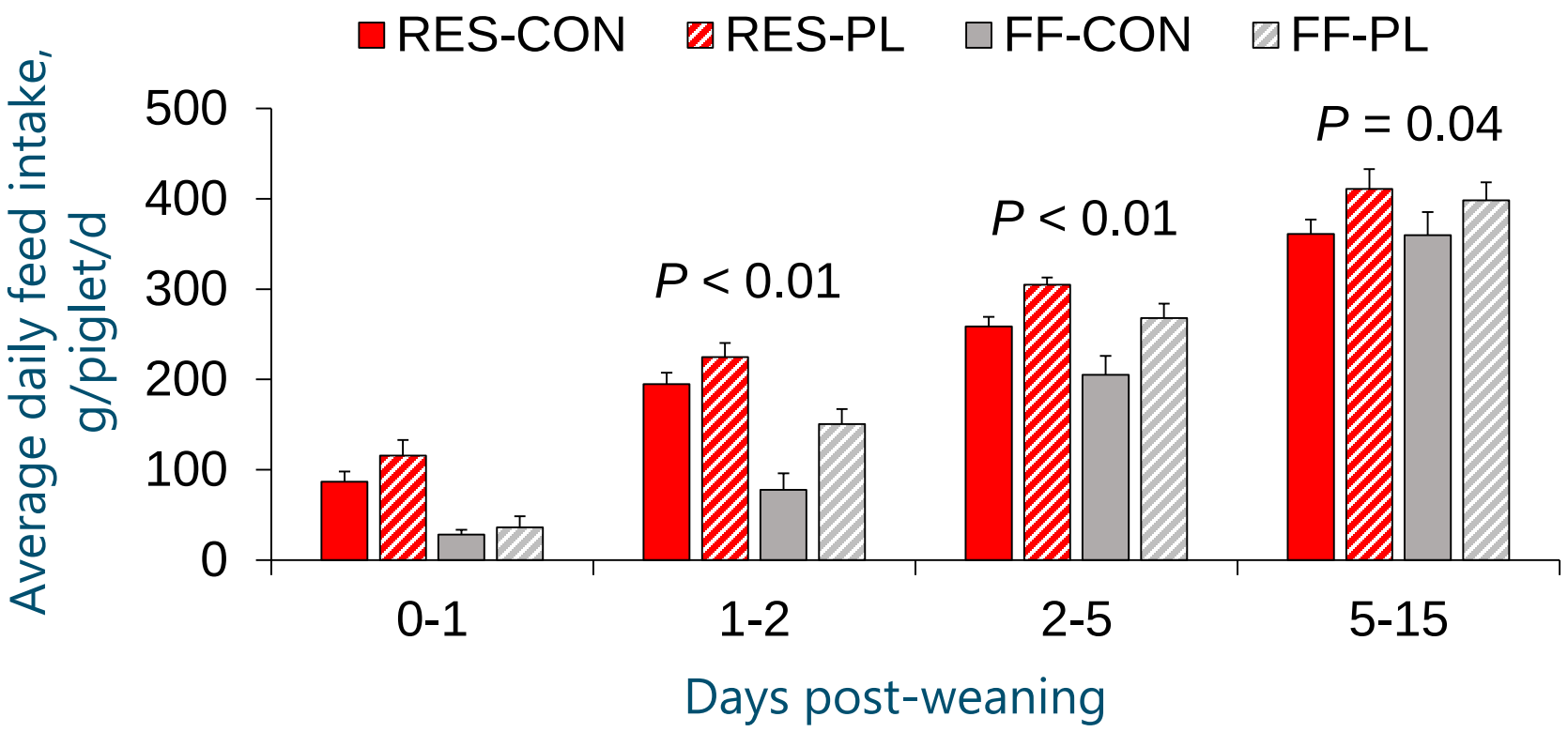


Red bars: litters of sows with low feed intake → low milk production → -800 grams weaning weight

Middelkoop et al., 2019

Play-feeder: post-weaning effects

- Playfeeder stimulated post-weaning feed intake

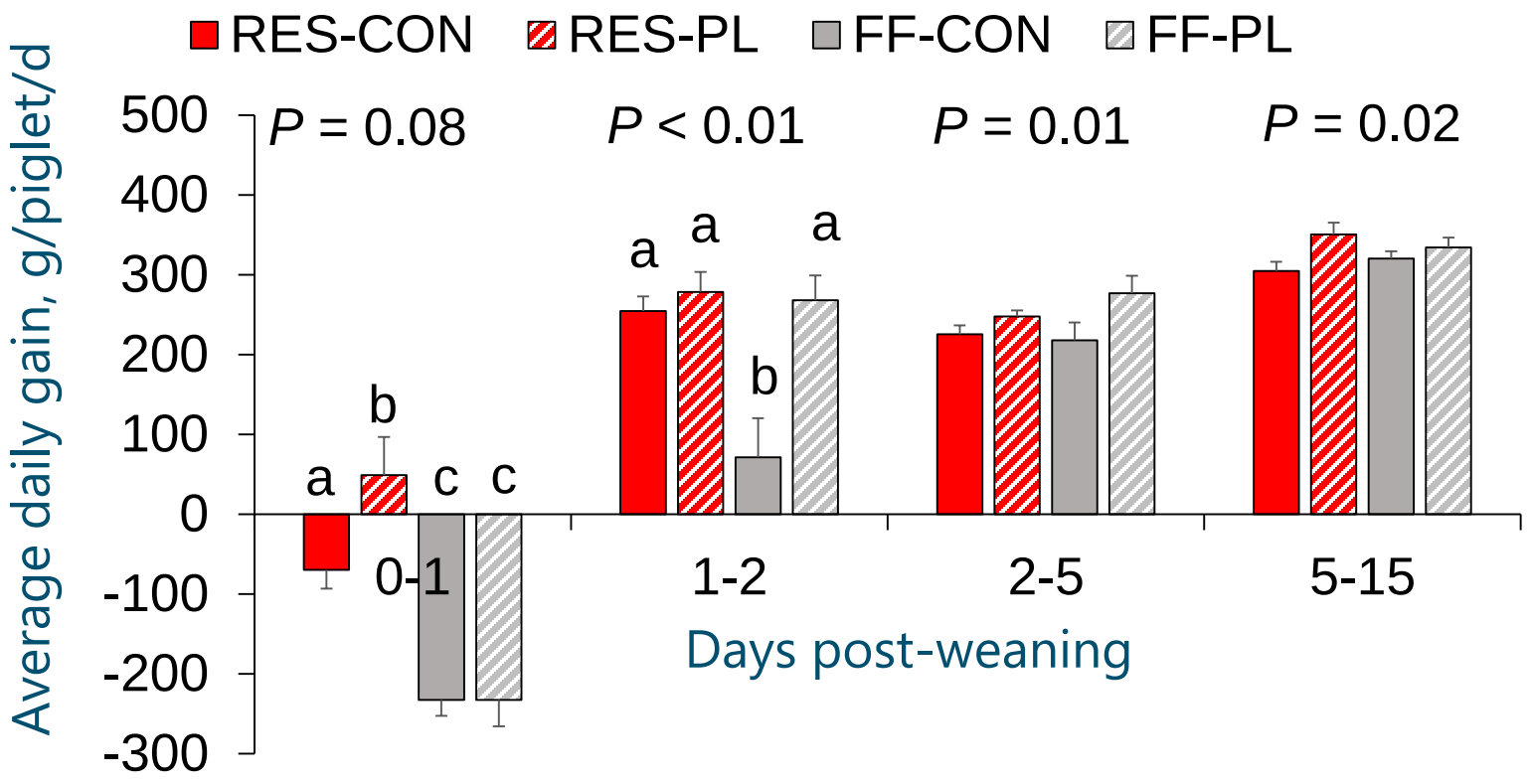


- Conventional feeder
- Commercial weaner diet
- No zinc oxide

Middelkoop et al., 2019

Play-feeder: post-weaning effects

- Playfeeder stimulated post-weaning weight gain and body weight



Body weight at d15 post-weaning:

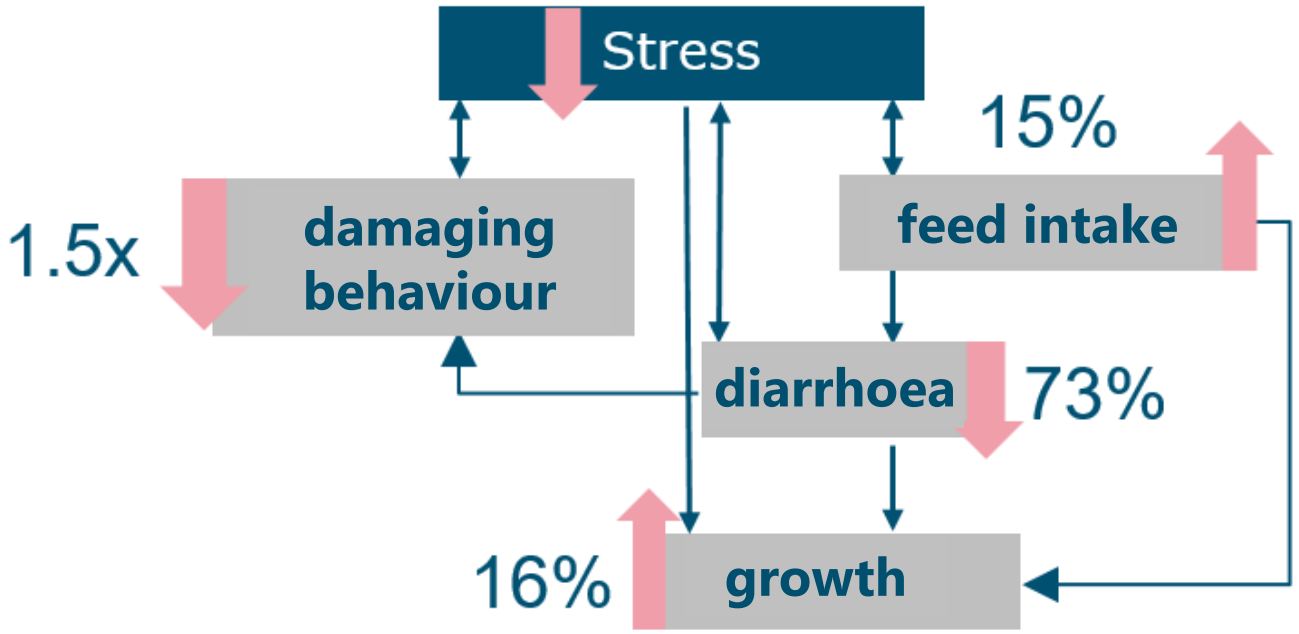
PL vs. CON: +0.6 kg, *P*=0.02

RES vs. FF: -0.2 kg, *P*=0.27

Middelkoop et al., 2019

Play-feeder: post-weaning effects

- In the post-weaning period, the pre-weaning play-feeder:



↑ eating and drinking behaviour
↓ nr. of body lesions
↓ piglets with ear and tail damage
↓ diarrhoea
↑ body weight
no effect on feed efficiency

Lower stress levels at weaning?

Middelkoop et al., 2019

SCHOTHORST FEED RESEARCH

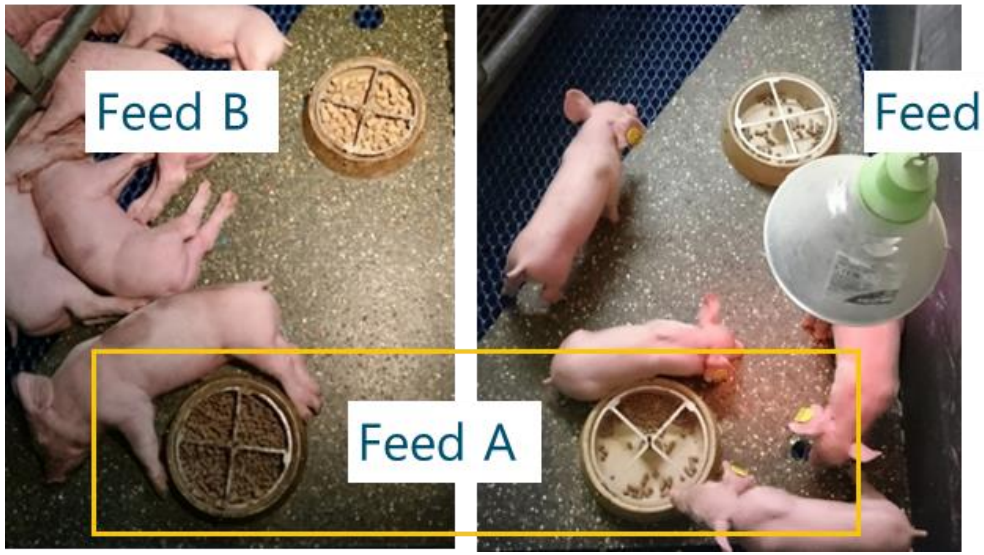
Dietary diversity

Feed A Feed B

Feed A Feed A

vs.

DD

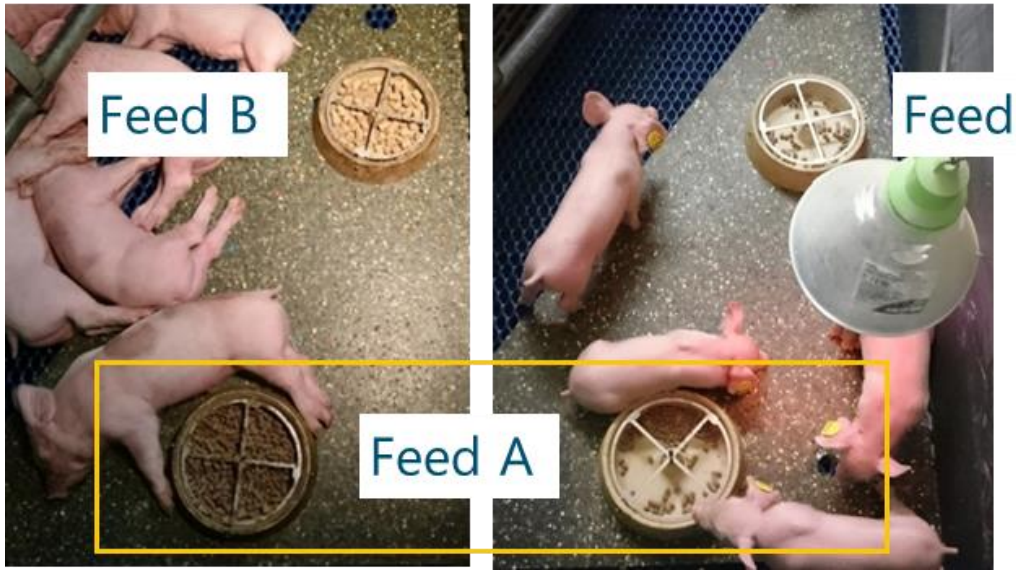


FN

Middelkoop et al., 2018

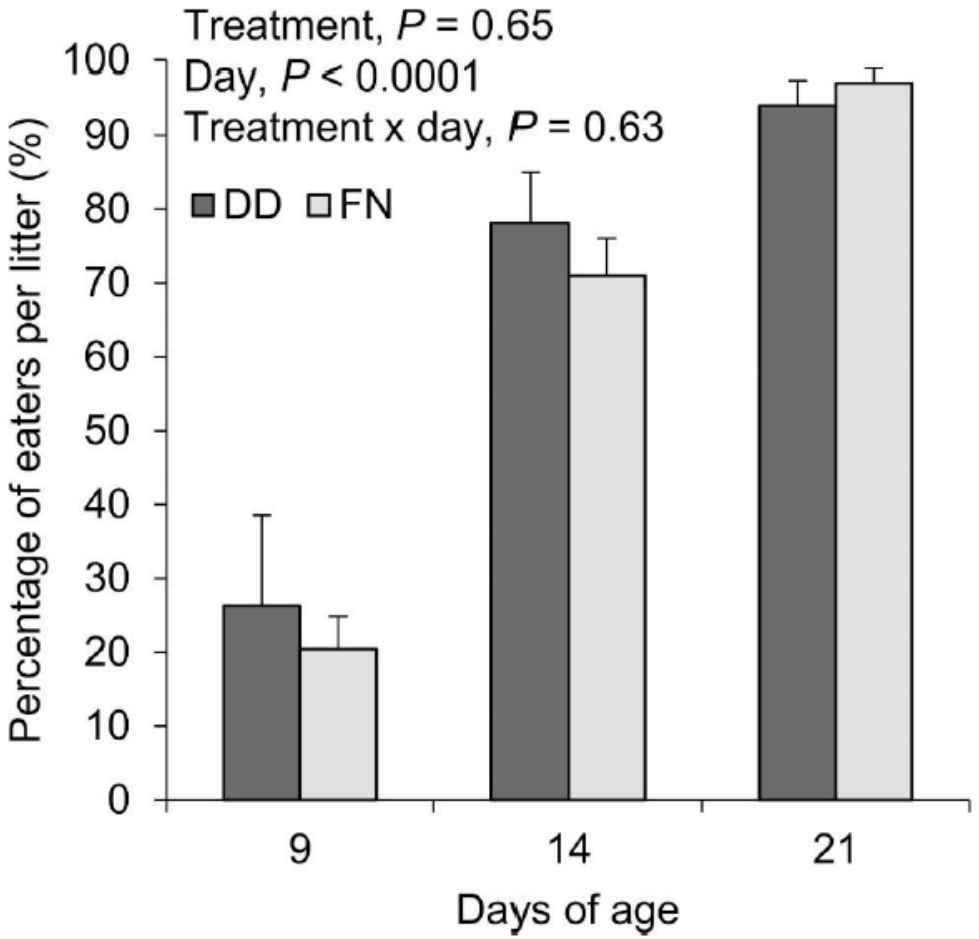
Dietary diversity

DD FN



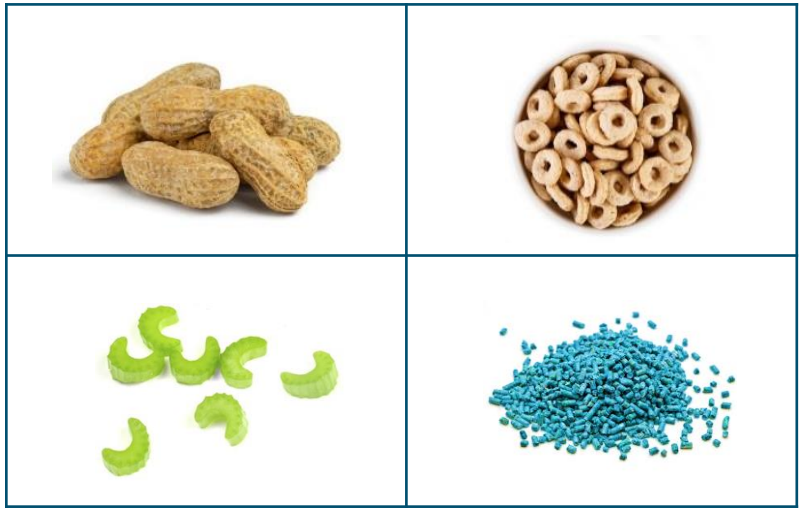
3.0 ± 0.32 kg 2.0 ± 0.12 kg

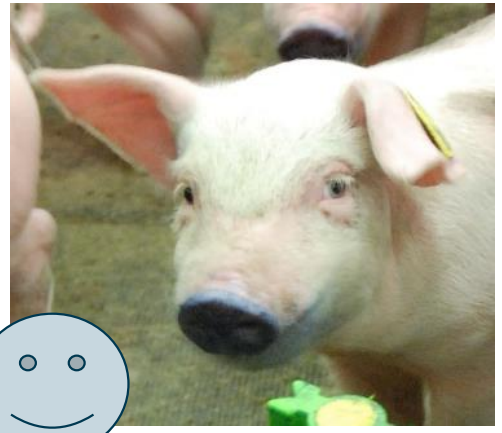
+1 kg/litter creep feed intake between d2-22 (*P* = 0.02)



Middelkoop et al., 2018

Dietary diversity



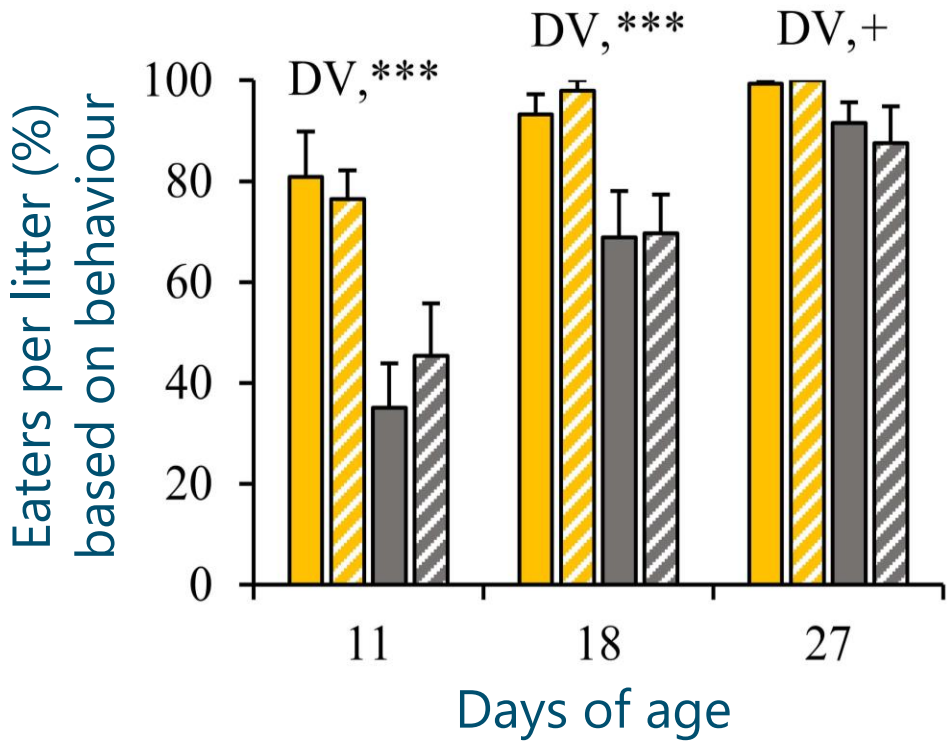


Middelkoop et al., 2019

Dietary diversity

- Diverse diet (DD) vs. monotonous diet (MO): +1 kg/piglet between d4-28

Feed intake, g/piglet	DD	MO	*P*-value
d4-12	72 ± 17	9 ± 6	<0.0001
d12-19	206 ± 38	64 ± 17	<0.001
d19-23	291 ± 53	58 ± 4	<0.001
d23-28	696 ± 96	129 ± 18	<0.001
Total, d4-28	1267 ± 169	260 ± 38	<0.0001



Yellow = DD Grey = MO

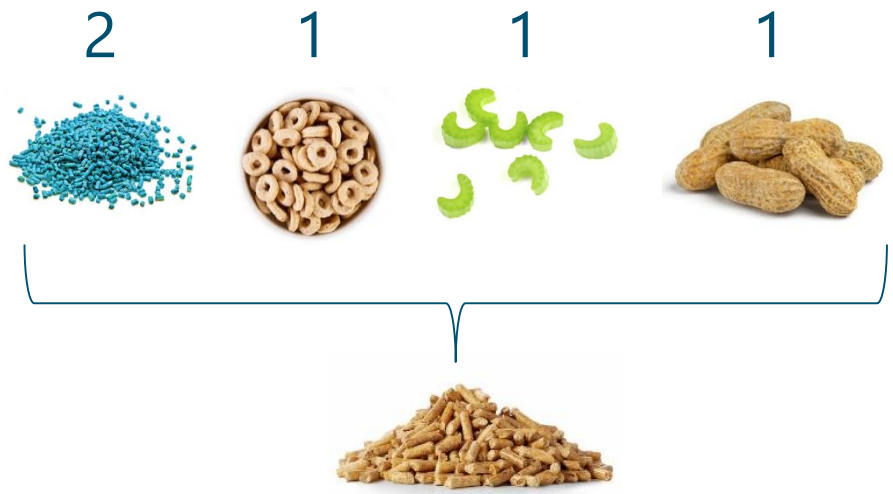
Middelkoop et al., 2019

Dietary diversity

- Diverse diet (DD) vs. monotonous diet (MO): +1 kg/piglet between d4-28

Feed intake, g/piglet	DD	MO	*P*-value
d4-12	72 ± 17	9 ± 6	<0.0001
d12-19	206 ± 38	64 ± 17	<0.001
d19-23	291 ± 53	58 ± 4	<0.001
d23-28	696 ± 96	129 ± 18	<0.001
Total, d4-28	1267 ± 169	260 ± 38	<0.0001

Creep feed intake, g/piglet	DD	MO	*P*-value
Total, d4-28	178 ± 34	260 ± 38	0.08



Minor positive post-weaning effects

Middelkoop et al., 2019

Food seeking in sand

SCHOTHORST FEED RESEARCH

- Feed hidden in substrate (SUB), which was sand, or not (CON)

vs.

- Sand did not affect feed intake or number of eaters (SUB vs. CON)
- Piglets preferred to explore and eat from the feeder with sand (within SUB)

Middelkoop et al., 2019

Food seeking in sand

- Feed hidden in substrate (SUB), which was sand, or not (CON)

Negative effects post-weaning (no sand any longer):

- Lower feed intake, growth and body weight
- More manipulation and aggression, more body lesions

Pre- and post-weaning management should match

Middelkoop et al., 2019

Feed intake or composition: what's more important?

SCHOTHORST FEED RESEARCH

	Creep feed	Weaner diet	Sow feed	SEM	*P*-value
Pre-weaning feed intake, g/litter/day					
D14-28	441[b]	393[a]	314[a]	42	<0.05
Post-weaning, D0-14, g/pig/day					
Feed intake	328[a]	369[b]	333[a]	7	0.02
Body weight gain	217[a]	261[b]	231[ab]	7	0.03
Villus height at D4	572[a]	738[b]	733[b]	36	0.07

Effect of creep feed provision on post-weaning feed intake depends on cereal source in weaner diet, e.g. barley, rice-wheat bran, corn

- Learn piglets how to eat: prepare piglets behaviourally to make dietary transition less stressful
- Learn piglets how to digest: prepare piglets physiologically to put less stress on the gut (microbiota)

Heo et al., 2018; Torrallardona et al., 2012

Overview of the strategies in this thesis

SCHOTHORST FEED RESEARCH

Pre-weaning strategy	Pre-weaning effects on feeding	Post-weaning effects when strategy stops at weaning	Post-weaning effects when strategy continues
Environmental enrichment	✓	X	✓
Play-feeder	for slow-growing litters	✓	not studied
Dietary diversity	✓	±	not studied
Food seeking in sand	±	X	not studied

What did we learn?

- Play-feeder was the best in improving post-weaning performance and behaviour
- Dietary diversity was the best in stimulating pre-weaning feeding behaviour
- The intake of creep feed is driven by a low milk intake, play and exploration
- The intake of creep feed may, just like enrichment, improve the welfare and productivity of piglets

Prerequisite: Housing & management pre- and post-weaning should match

Let's take it broader....

Pellet diameter: the bigger, the better?

SCHOTHORST FEED RESEARCH

Creep feed intake (g/litter)	2 mm	10 mm	Pooled SEM	*P*-value
D3-10	208	343	22	<0.001
D10-17	893	1409	109	0.002
D17-24	3358	3969	292	0.15
D24-weaning	2311	2364	214	0.86
Total, D3-weaning	6770	8082	534	0.09

Van den Brand et al., 2014;

Clark et al., 2016

Creep feed intake (g/pig/d)	3.2 mm	12.7 mm	*P*-value
D10-14	9.1	9.1	NS
D14-17	13.6	18.1	NS
D17-21	17.6	30.8	<0.05
Total, D10-21	13.6	18.1	<0.10

Creep feed intake (g/litter)	4 mm	9 mm	*P*-value
D3-10	95	148	<0.004
D10-20	770	1040	<0.001
D21-26	1300	1600	<0.002
Total, D3-26	2111	2770	<0.001

Craig et al., 2021

Creep feed intake (g/pig/d)	3 mm	8 mm	12 mm	*P*-value
D14-28	12.37[a]	19.35[b]	20.00[b]	<0.001

SFR report 1371

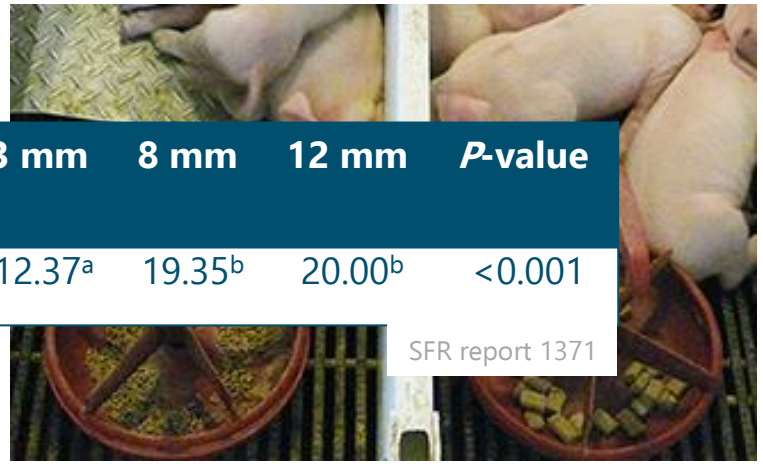
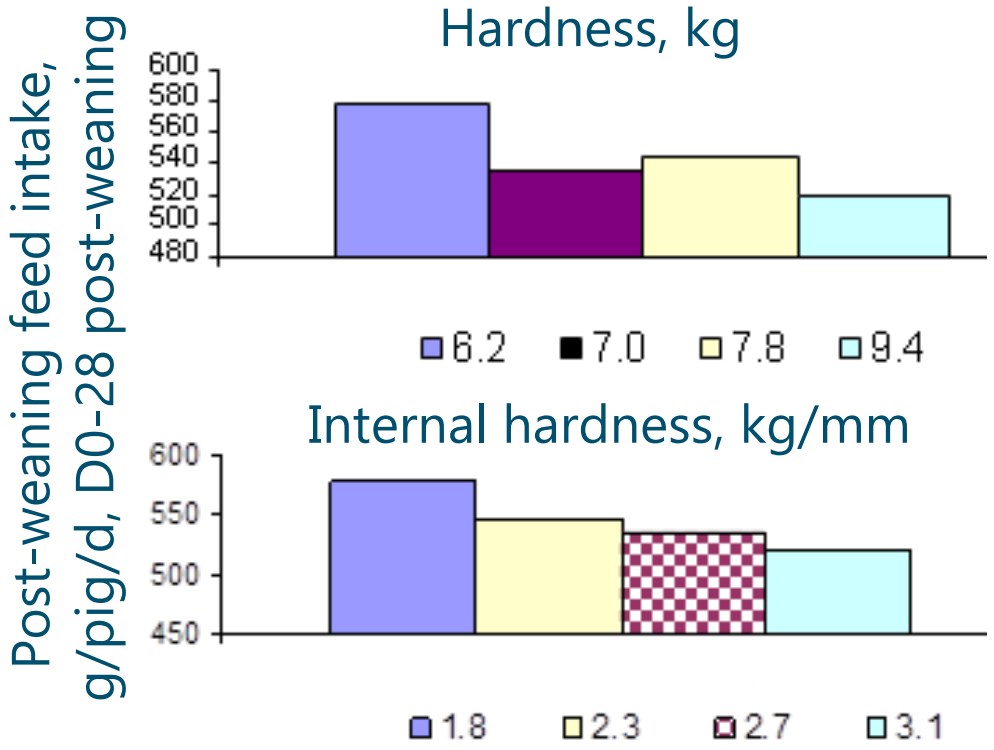


Image credits: Coppens Diervoeding; Craig et al., 2021; Omafra

Reduce hardness of the feed

- Hard-pellet vs. soft-pellet creep feed

	Hard	Soft	SEM	*P*-value
Hardness (g)	2690	505	0.17	<0.01
Moisture content (%)	12.8	27.0	0.90	<0.01
Starch gelatinization (%)	45.1	86.4	69	<0.01
Creep feed intake, g/litter/d				
D14-21	31	73	7.74	<0.01
D21-31	162	198	26.67	0.62
D14-31	108	146	16.61	0.29



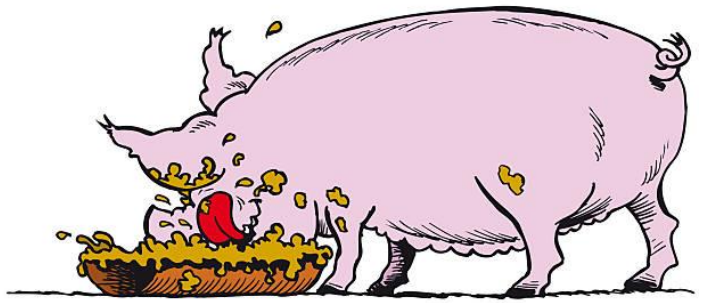
Chen et al., 2021; SFR report 471

Mix creep feed with water or supplemental milk

SCHOTHORST FEED RESEARCH

- Pellets vs. porridge (creep feed pellets-to-water ratio of 1 : 3) from D4-21
- Thereafter a pelleted transition diet was given (D21-28)

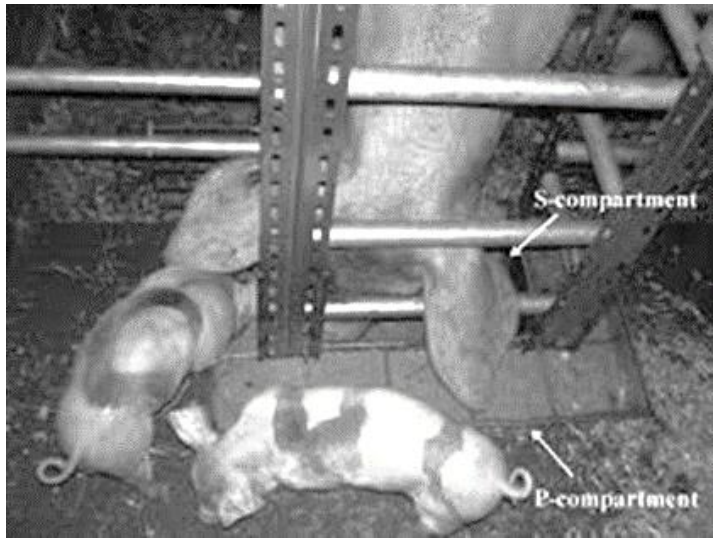
Daily creep feed intake (g/d)	Pellets	Porridge	*P*-value
D4-21	5.6	9.5	<0.001
D21-28	41.0	50.4	0.01
Total, d4-28	14.5	19.7	<0.001



Clouard et al., 2018

Allow piglets to learn from the sow

- Learning from the sow what, where and how to eat by giving piglets access to sow feed and feeder



Single-litter systems

Multi-litter system

Family feeding vs. conventional:
73 vs. 60% eaters, $P<0.001$

Oostindjer et al., 2010, 2011; Van der Peet-Schwering et al., 2021; Van Nieuwamerongen et al., 2015

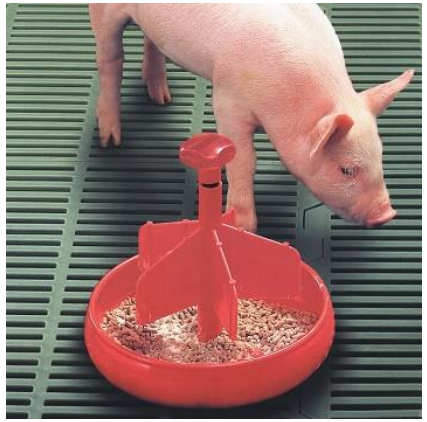
Learning from littermates

- Feeder type: number of feeding places, accessibility

73% vs. 52% eaters

163 vs. 86 g/litter/d ($P<0.05$)

d7-13



d13-26

vs.

d7-26

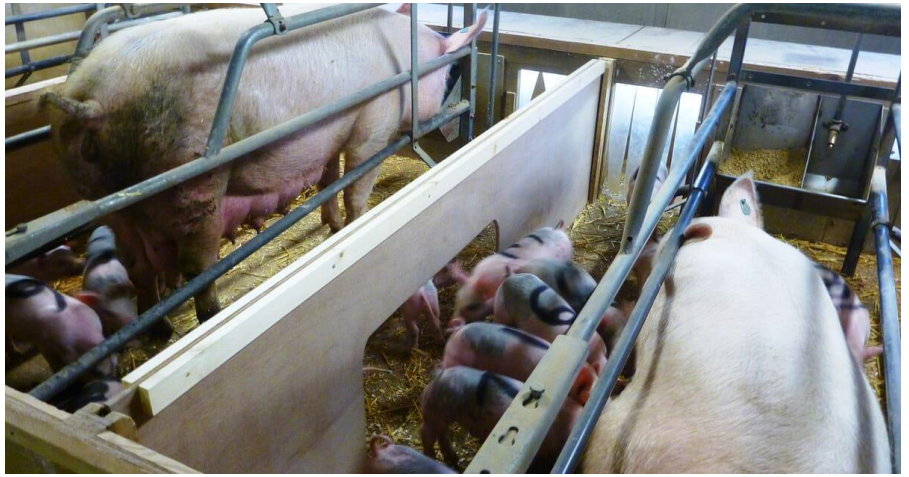
D7-26: 118 ±17 vs. 202 ± 23 g/piglet ($P<0.01$)
Difference started from d13

Seddon et al., 2015, 2016; Kuller et al., 2010

Learning from non-littermates

- Co-mingling and intermittent suckling for 8 h/d (ISCo) vs. intermittent suckling (IS) and conventional non-mingled litters (CW)

Creep feed intake	CW	IS	ISCo	*P*-value
D18-25, g/litter/d	7 ± 2.1	15 ± 2.1	22 ± 3.0	<0.01



Turpin et al., 2017; Image credits: Győri, Zs; M. Farish; F. Verliat

Why do these strategies work?

SCHOTHORST FEED RESEARCH

- Stimulate exploration towards the feed(er)

Feeding strategies, e.g. large diameter pellet, dietary diversity

- Facilitate transition to dry solid feed

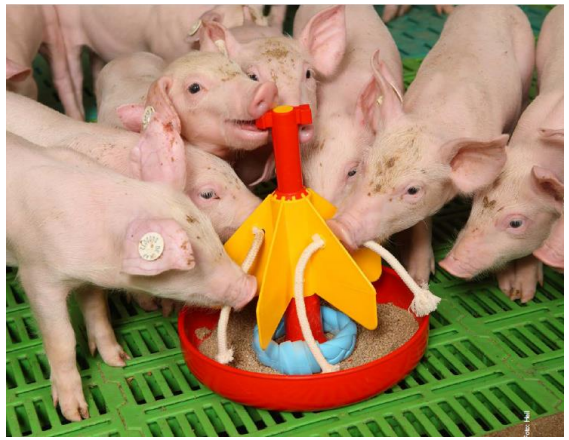
Feeding strategies, e.g. soft pellets, porridge

- Stimulate social learning from the sow and (non-)littermates

Housing and management strategies, e.g. multi-litters, feeder type

Image credits: Van der Peet-Schwering et al., 2021

Take home message



How to prepare piglets for weaning:

- Provide substrates, toys and sufficient space
- Use feed and feeder(s) that elicit play
- Feed pigs with a diverse diet
- Pay extra attention to creep feeding litters reared by sows with a low feed intake
- Increase creep feed intake and eaters by combining strategies from the 3 different categories
- Make your pre- & post-weaning housing and management a perfect match!

Young piglets should get the opportunity to forage and play, and this possibility should be retained in the growth phases that follow

Image credit: Heil

Thank you for your attention

SCHOTHORST FEED RESEARCH

Questions?

amiddelkoop@schothorst.nl