STRATEGIES FOR PREVENTION OF POST WEANING DIARRHEA

CHARLOTTE LAURIDSEN, PROFESSOR, HEAD OF SECTION FOR IMMUNOLOGY & MICROBIOLOGY, DEPARTMENT OF ANIMAL SCIENCE AARHUS UNIVERSITY

Organic pig production research seminar:
Pig health and welfare in eco-efficient organic systems
Dronninglund, 13. juni, 2018
KNOWLEDGE SYNTHESES


Aim: to investigate the possibilities for prevention of weaning diarrhea in pigs in organic and conventional production based on national and international literature.

PWD as response parameter – not proxy parameters.
DIARRHEA IN PIGS

- Most outbreaks occur during the first 2 wk postweaning ≈ PWD
  - Morbidity may be over 50%
  - Losses of piglets can be 17%
- Enterotoxigenic *E. coli* (ETEC) is an important etiological agent
  - ~10 million piglets die annually worldwide due to diarrhea, 50% is caused by ETEC

Adopted from Cox (2013)
Weaned piglets: Treatment of gastric-intestinal sources (pleuromutilins, tetracyklins)

Sources:
DANMAP, 2016
Udvalget for Fødevarer, Landbrug og Fiskeri, sept. 2016

Figure 4.4. Antimicrobial consumption (a) in the pig production, and the distribution on age groups, Denmark
The European Commission has confirmed the EU-wide ban on the use of zinc oxide at medicinal levels in piglet feed, giving member states up to five years (2022) to phase it out.

Increase in veterinary prescription of ZnO (0-2 weeks post weaning).

Critical because high ZnO enhance antibiotic resistance (e.g. E. coli in gut of pigs (source: PLOS one, 2018) (and organically reared pigs eat more post weaning).
PATOGENSE FOR PWD

ETEC

Stomach

Intestine

Adherence by fimbriae (F4, F18)

Production of enterotoxins

Heat-labile toxin (LT)

Stimulates adenyl cyclase activity

Increases levels of cAMP in villous and crypt

Possibly increases cellular Ca^{++}

Heat-stable toxin [ST (STa; STb)]

Stimulates guanylate cyclase

Increases levels of cGMP

• Villous cells: inhibit the non-glucose-dependent pathway for Na^+, therefore also Cl^- and water absorption
• Crypt cells: stimulate Na^+ along with Cl^- and water secretion

Diarrhea
Weaning transition

Loss of bacterial diversity

Differences in mucus availability

Nitrate respiration

Nitrite

Obligate anaerobe

NO$_2$

Weaning transition

Permeability

Infection

Inflammation

Reduced feeding

Stress

Solid-based diet

In-feed antibiotics

Antibiotic treatment

Symbiosis

Intestinal dysbiosis

Postweaning diarrhea

Gresse et al., 2017

Birth

3/4 weeks

1 to 10 days post-weaning
Natural or semi-natural conditions:

- 12–18 wk of age (organic: 7-10 weeks).
- A gradual reduction in the amount of contact between the sow and her piglets.
- A concomitant reduction in nursing frequency and milk production.
- A gradual change of diet from milk to solid or semisolid feed.

Commercial conditions:

- 3-4 weeks.
- An abrupt separation of piglets from the dam.
- A sudden change in diet.
- A move to a new environment.
- Mixing with unfamiliar animals at a much younger age than would occur in natural conditions.
Weaning

- Loss of immune protection by sows’ milk
- Delay in initiation of feed intake/very low feed intake in days post-weaning
- Dysfunction of GI-tract; Dysbiosis
- High susceptibility to enteric diseases and/or disorders

Pluske, 2016
Weaning

Loss of immune protection by sows’ milk

Strategies:

- Give the animal more time to develop its immune system (e.g., higher weaning age).
- Enhance immune maturation (e.g., probiotics);
  add immunoprotection (e.g., supply antibodies, anti-inflammatory/anti-oxidative components)

Pluske, 2016
Weaning

Delay in initiation of feed intake/
very low feed intake in days post-
weaning

Strategies:

- Stimulate feed intake:
  - Give them more time to learn eating feed pre-weaning (e.g., higher weaning age)
  - Increase feed intake pre-weaning (e.g., liquid feed, pen design)
  - Increase feed intake post-weaning (e.g., feed composition, feed additives)

Pluske, 2016
Strategies:

- Dysfunction of the GI-tract:
  - Give them more time to develop the GI-tract (e.g., higher weaning age)

- Avoid dysbiosis:
  - Reduced dietary protein.
  - Promote beneficial microorganisms (e.g., prebiotics, probiotics)
  - Reduce pathogenic microorganisms (e.g., organic acids, plant extracts, fermented liquid feed, high hygiene in environment)
  - Animals resistant to certain pathogens (genetics)
  - Vaccination

Delay in initiation of feed intake/very low feed intake in days post-weaning

Dysfunction of GI-tract; Dysbiosis

Pluske, 2016
Weaning

Loss of immune protection by sow's milk

 delay in initiation of feed intake/very low feed intake in days post-weaning

Stressors:
- Nutritional
- Environmental
- Psychological

Dysfunction of GI-tract; Dysbiosis

High susceptibility to enteric diseases and/or disorders

Pluske, 2016
Weaning

Delay in initiation of feed intake/very low feed intake in days post-weaning

Dysfunction of GI-tract; Dysbiosis

Stressors:
- Nutritional
- Environmental
- Psychological

Strategies:
- Reduced mixing of unfamiliar piglets
- Keep various litters in same area during suckling (‘multi-suckling’)
- Intermittent suckling (increase feed intake; short separation from the dam)
- ‘Weaning of the sow’

Pluske, 2016
CONCLUSION OF LITERATURE REVIEW

Suggested strategies to reduce PWD:

› **Restriction of dietary protein**
  - Valid strategy in herds with high diarrhea incidence

› **Increasing weaning age**
  - Good possibility in organic pig production

› **Optimizing the hygienic status of weaning facilities**
  - Less documented regarding organic pig production

These strategies were included in a cost-benefit analyses.
CONCLUSION OF LITERATURE REVIEW

› Besides, some dietary factors gained our interest:
› Organic acids, antibodies, fermented liquid feed,...., but these alternatives require more development and research to pinpoint their efficacy against PWD.

› Important to design studies with PWD as primary response variable, and to design the study to test PWD.