Responses to weaning depending on diet in two pig lines divergently selected on residual feed intake

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Feed efficiency and stressors

- **Improving feed efficiency** (rate of conversion of the feed into body weight) is necessary to reduce feed costs and the environmental impact of pig production.

- Improving the **animal robustness** is necessary to reinforce the animal ability to maintain high production levels when facing stressors.

- But selecting for improved feed efficiency might impair the animal’s ability to respond to stressors.

- **Weaning** is the main natural stress in pig production, responsible for about 50% of the use of antibiotics.

→ Hypothesis: more efficient pigs might be more sensitive to weaning.
Divergent pig lines for residual feed intake (RFI)

Low RFI (LRFI) → better feed efficiency

-163 g/d RFI

-317 kg feed / kg BW FCR

→ eat less than predicted from growth and body composition
Objectives

1. Compare weaning in the RFI lines (Montagne et al)

2. Test a protective dietary regime after weaning on growth and health in the RFI lines
Design - Animals

n=264 pigs in two successive batches

Post-weaning test
- 66 females and 66 castrated males tested per line from weaning (4 weeks of age) to 10 weeks of age
- Conventional post-weaning units
- 22 pigs per pen, penned by line and diet

Growing-finishing test
- 44 females and 44 castrated males tested per line (2/3) from 10 weeks of age to 23 weeks of age
- Conventional growing-finishing units, automatic feeders
- 11 pigs per pen, penned by line and sex
Design – records

No creep feed

Birth

Maternity

Post-weaning

No antibiotics

Weaning

Growing-finishing

Slaughter

1 2 3 4 5 6 7 8 9 10 11 12 . . . 23
Design – records

No creep feed

Birth → Maternity → Post-weaning → Growing-finishing → Slaughter

BW
Feces
FI (pen)

0 1 2 6 19 40 w23
12 6 19

No antibiotics
higher diversity of ingredients:
less crude protein, more AA
high digestibility diet: extruded cereals (rice), potatoes protein concentrate

No antibiotics
No vaccination
Statistics

Linear models on gaussian traits

sex
batch
line (L)
diet (D)
line x diet (LxD)

At each time independently

Chi² on the number of animals with normal, soft and liquid feces to test separately the effects of the line and diet
Growth rate, feed intake and FCR from weaning to D40

→ Major line effect: LRFI grow slower during post-weaning
  → at weaning + 40 days, no line difference for BW

→ No diet effect on HRFI pigs; slight improvement of LRFI pigs performances

**Legend:**
- **L**: Conventional LRFI
- **D**: Conventional HRFI
- **LxD**: Protective LRFI
- **K**: Protective HRFI

**Bar Chart:**
- **ADG D0-D40**
  - **N = 66 x 4**

**Graph Notes:**
- Major line effect: LRFI grow slower during post-weaning
- At weaning + 40 days, no line difference for BW
- No diet effect on HRFI pigs; slight improvement of LRFI pigs performances
Growth rate, feed intake and FCR from weaning to D40

Major line effect: LRFI pigs eat less and grow slower during post-weaning
  ➔ improved FCR

➔ No diet effect on HRFI pigs; slight improvement of LRFI pigs performances
Early, middle and late post-weaning

→ LRFI pigs growth less, especially during week 1 after weaning
→ Diet favors better growth in weeks 2 and 3 after weaning

**ADG (kg/d)**

(N=66 x 4)

- LRFI pigs eat less, especially in weeks 1, 2 and 3
- Protective diet tends to increase feed intake in LRFI pigs during this period

- Conventional LRFI
- Conventional HRFI
- Protective LRFI
- Protective HRFI

- ADG (kg/d)
- ADFI (kg/d)
Early, middle and late post-weaning

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First week after weaning

LRFI pigs lose weight at D0
LRFI pigs tend to lose less weight with the protective diet – drinking effect?

→ LRFI pigs eat less at D0
→ LRFI with protective diet tend to eat more than LRFI pig with conventional diet
→ No diet effect on HRFI pigs

ADG (kg/d)
(N=66 x 4)

ADFI (kg/d)
(N=3 x 4)

Conventional LRFI
Conventional HRFI
Protective LRFI
Protective HRFI
First week after weaning

- LRFI pigs lose weight at D0
- LRFI pigs tend to lose less weight with the protective diet
- LRFI pigs regain numerically more weight at D1 when fed the conventional diet

→ LRFI pigs lose weight at D0
→ LRFI pigs tend to lose less weight with the protective diet
→ LRFI pigs regain numerically more weight at D1 when fed the conventional diet
First week after weaning

→ LRFI pigs lose weight at D0
→ LRFI pigs lose less weight with securing diet
→ LRFI pigs gain numerically more weight at D1 when fed the securing diet

→ LRFI pigs eat less at D0, at all times
→ LRFI with securing diet tend to eat more than LRFI pig with conventional diet
→ No diet effect on HRFI pigs
Diarrhea

- **Line effect:**
  - At D1 and D2: higher proportion of *normal* feces in LRFI pigs (P<0.0125)
  - At D6: higher proportion of *diarrhea* in LRFI pigs (P=0.0017)
  - Line differences disappear after a week post weaning

- **Diet effect:**
  - At D6 and D12: higher proportion of *normal* feces in pigs fed the protective diet (P<0.09)
  - Diet differences disappear after two weeks post weaning
Conclusions

- The RFI lines have different strategies to deal with weaning. See Montagne et al for more details.

- The protective diet after weaning has positive effects just after weaning mainly on pigs which have difficulties to maintain feed intake immediately after weaning, i.e., LRFI pigs.

- The protective diet shows no effect during the growing-finishing period.
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Conclusions

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- The protective diet after weaning has positive effects just after weaning, mainly on pigs which have difficulties to maintain feed intake immediately after weaning, i.e., LRFI pigs.

- The protective diet show no effect during the growing-finishing period.
At D1 and D2: higher proportion of normal feces in LRFI pigs
At D6: higher proportion of diarrhea in LRFI pigs
Line differences disappear after a week post weaning
Before D12: higher proportion of normal feces in pigs fed the protective diet
Diet differences disappear after two weeks post weaning
N= 44 x 4

→ Line differences as previously reported
→ No clear effect of the diet during post-weaning on growing-finishing traits