Effect of divergent lines selected on feed efficiency and physical activity on lameness and osteochondrosis in growing pigs

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Context

General objectives

- Understanding the multi-fac torial dimension of animal pathologies linked to the intensification of production involving numerous factors linked to animal and rearing environment
- Providing effective control strategies to reduce the impact on animal welfare, including health (housing, feeding, handling, genetic)

Production diseases: locomotion disorders in growing pigs

Depressed health and welfare

Locomotion disorders in pig production

- Second or third most important cause of culling in breeding pigs
  10-20 % of all culled sows (review Stavrakakis, 2014)
- Prevalence variable
  - in sows between 4 % and 17 % (Arango et al., 2005, Young et al., 2008, Guo et al., 2013, Stavrakakis et al., 2014)
  - in finishing pigs between 2 and 21 % (KillBride et al. 2009)
**Objective:**

Compare the susceptibility of two lines of pigs divergently selected for their Residual Feed Intake (RFI; a measure of feed efficiency) to develop osteochondrosis and leg disorders in interaction with the level of physical activity.

**What is known**

- Pigs selected for a best feed efficiency (RFI-) showed **lower physical activity** 
  
  *(Barea et al. 2010, Meunier-Salaün et al. 2014)*

- Pigs selected for a best feed efficiency (RFI-) showed **less leg lesions and lameness**

**But** these results need

- to be generalized in different environmental conditions and higher sample size
- with better understanding of the risk factors of lameness linked to the genetic lines

The study was focused on lameness which can have numerous causes.
Hypothèse que l'on retrouve dans la conclusion

Lameness

Animal

Genetic (line per se and individual variation)

• Physical activity
• Osteochondrosis susceptibility
• Infectious arthritis susceptibility
• Body conformation (overweight, body composition, …)

Environment / Management

• Physical activity
• Flooring conditions (rought, slippery, dirty, …)
• Space allowance
• Housing design
Hypothèse que l'on retrouve dans la conclusion:

**Questions**

- Environment
- Interaction environment x genetic

**Less physical activity**

- More lean meat content
- Osteochondrosis (OC) susceptibility
- RFI-/RFI+

- Growth of cartilage and bones
- Trauma opportunity

**Lameness**
Experimental study

Two groups of 80 growing finishing pigs, 10 wk of age, slaughtered at around 100kg LW (21-22wk of age)

- In each group: half females, half castrated males, half of each from divergent lines

- **Experimental room**: 2 symmetrical sides
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  - feeding area: 4 ESF, standard diet
  - weighting sorter: access to feeding area pigs with ear tags for identification at ESF / sorter
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- Resting area equiped with drinkers and chains

all areas covered by camera 📺
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    all areas covered by camera

- 2 variation factors
  - Divergent line on feed efficiency: RFI+, RFI-
  - Physical activity: spontaneous or increased between 12 and 22 Weeks of age
Application of the activity treatment

The sorter is the only access to the feeding area

The identification via the ear tag determined the side of the room in which the animal will be oriented after the sorter exit

**Pigs assigned to treatment ‘spontaneous activity’:**

- Sorter → right side of the feeding area
- Possibility to come back directly to the sorter once exited the feeding area

**Pigs assigned to treatment ‘increased activity’:**

- Sorter → left side of the feeding area
- Pigs have to cross twice the weight sorter before to have access to the feeding area
- 1st time : exit towards the resting area
- 2nd time : exit towards the feeding area
- Distance to walk : twice 30 m
Measurements

✓ Daily measurements of feeding behaviour and weight

✓ Physical Activity:
  - daily number of visits to the ESF and sorter
  - number of pigs standing from the video recordings
    * during 11 hours in diurnal period (scan 10 min)
    * 3 times during the growing period:
      beginning (before the start of the treatment “activity”), at mid and end

✓ Lameness: weekly scoring
  Scoring scale: 0 to 4
  0 = non lame, 1 = stiffness, ≥2 = lame
  
adapted from Stavrakakis, 2014

✓ Osteochondrosis: surface of the femoral et humeral bone extremities after slaughtering.
  scoring scale from 0 (no) to 5 (severe lesions) from van Grevenhof et al. 2011

Statistical analysis:
main factors tested: line, activity, sex, replicate, time period and their interactions
Sorter crossing

Average crossing number of the sorter/day

$P<0.05$ Week Line Act $W^*L$ $W^*Act$ $L^*Act$

- $\text{RFI}^+ > \text{RFI}^-$ within each level of activity
- Activity «Increased» $\rightarrow$ more crossings
- Activity «Increased»: stronger effect in $\text{RFI}^+$
- Reduced crossings over time

Weeks after the entrance in the growing pen
Feeding pattern

Meal number per day

\[ P<0.05 \text{ Week Line Act} \]

Feed intake /meal (g)

\[ P<0.05 \text{ Week Line Act} \]

Feeding strategy

- RFI+ more meal number of shorter size compared to RFI-
- Activity « increased »  lower meal number of greater size compared to activity «spontaneous»
RFI+ line more active compared to RFI- line

No effect of treatment « activity »

Standing activity decreased over time

Low physical activity during diurnal period
Lameness

Low number of pigs affected by lameness (≥2) : <10% of pigs

Total recordings during the growing period

%/total recordings

Lameness score
- non lame (score 0)
- stiffness (score 1)
- lame (score ≥2)

✓ Score «non lame» : major
✓ Line effect : no effect on score « lame » ➔ previous results not confirmed
  score «stifness» RFI- > RFI+
✓ Treatment «Activity» : no effect
## Osteochondrosis (OC)

- High prevalence of OC lesions during the growth period: 55 to 90% of pigs according to the joint

<table>
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<tr>
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<th>Replicate</th>
<th>RFI+ Spontaneous</th>
<th>RFI+ Increased</th>
<th>RFI- spontaneous</th>
<th>RFI- Increased</th>
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<td>1.44</td>
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- Line effect on proximal humerus and femur: more OC for RFI- pigs ➔ more stiffness?
- Limited effect of line on distal humerus and femur
- No specific effect of treatment « Activity » nor interaction Line X Activity
Conclusion

- **Effect of divergent line** confirmed
  RFI- pigs: lower physical activity / feeding strategy with lower number of meals of larger size

- **Effect of treatment “activity increased”**
  - no major effect on gait as expected: constraint on physical activity not so strong? threshold to generate disorders?
  - feeding strategy: more number of lower size of meal whatever the line

- **Lameness**: ow proportion of pigs affected in both lines
  housing conditions: partially slatted floor, proper space allowance and flooring

- **Osteochondrosis**: more OC in RFI- pigs on cartilage of proximal humerus and femur bones in accordance with higher lean meat content in RFI- pigs

- Link between scores of lameness and OC observed between lines but may be weak (no link when considering individual variability)

- Unfortunately, difficulty from our experiment to make a link between OC and lameness but ... coherence between higher OC scores in RFI- pigs and their susceptibility of stiffness
Thanks for the financial support by the European Project

Thanks for your attention
Feeding behaviour

Average daily feed intake (g/d)

Weeks after the entrance in the growing pen

P<0.05 Week Line W*L

RFI+ > RFI- late in growing period
RFI-: higher slaughter weight
⇒ RFI- more efficient: confirmed