Genetic relations between the group effect for average daily gain, and post-mixing aggression and skin lesions in Swedish pigs

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Introduction

- Important genetic progress on growth achieved
- This selection can be affected by group effects: Dutch (Bergsma et al., 2008) and American (Chen et al., 2008) pop.
- Quantification of genetic parameters including group effects now possible (Bill Muir)

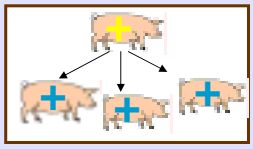
- Within-pen interactions between pigs can affect welfare and integrity
- Changes in behaviour can occur as a correlated response to selection on growth; agonistic characteristics are heritable traits (Turner et al. 2008)

Questions

Future objective of selection :

pigs with a genetic potential for high growth rate (direct effect)
and also a beneficial genetic effect
on pen mates growth (group effect)

= cooperative growth



- What consequences for aggressive behaviour, skin lesions and general activity?
- Do these genetic relations evolve during the finishing period?

At mixing (establishment of the hierarchy) → After mixing (stabilization of the hierarchy)

- Usually, group effects described in antagonism with direct effects. What would happen if competitive growth?

Methodology

Aggression traits registered in a Swedish population (1,439 pigs)

STEP 1: Estimate the breeding values (EBV)
for average daily gain (ADG), using random genetic parameters previously estimated in a Dutch population (large data set available)

STEP 2: Estimate correlations of EBV for ADG
with EBV for behaviour traits and body lesions

Performance trait: average daily gain

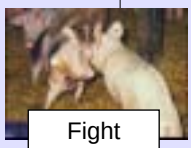
during the finishing period

Weighing at 10 wks of age and ~ 85 days later

- Group size: 15 (3 full-sibs x 5 litters)
- Feeding: *ad libitum* from a single space feeder
- Floor space allowance: 0.85 m² per pig

Mixing aggression traits ~ 10 wks of age

- Skin lesion counts (difference)
- Aggressive behaviour traits
  - recorded continuously for 24h post-mixing
  - Offensive behaviours
    - Number of fights initiated
    - Number of fights won
    - Number of bullies given
  - Behaviours associated with defeat
    - Number of fights lost
    - Number of bullies received from other pig(s)


Fight


Bully

"Stable" group traits 3 wks post-mixing

- Skin lesion counts
- Activity over 24h (1obs/h): number of times pig is active (standing)

Statistical models

GENETIC SCALE (EBV) ASReml software

- Average Daily Gain adjusted for the period: 35 to 100 kg

  competition model – Bijma et al. 2007:

  $Y = mu + sex + line + batch + mixing\ weight + pen^R + pig^R + group^R + e$

  R = random effect

  Fixed variance components from Dutch population

  Additive part : h^2 direct = 0.21 h^2 group = 0.007

  r direct-group = 0.20 cooperation

  (Bergsma et al., 2008)

- Lesion scores and behaviour Log(x+1) transformation

  $Y = mu + sex + line + batch + mixing\ weight + pen^R + pig^R + e$

Correlations between EBV ADG and EBV for aggression at mixing

« Genetic » associations

Lesions	Direct effect	Group effect
Front	0.027	-0.034
Rear	-0.103***	0.035

* : p ≤ 0.05 ; ** : p ≤ 0.01 ; *** : p ≤ 0.001

Pigs with genetic potential for OWN growth:

genetic determinism for more aggressiveness

Dominant, aggressive and successful

Behaviour	Direct effect	Group effect
Fights initiated	0.108***	0.093**
Fights won	0.081**	0.073**
Fights lost	0.003	0.134***
Bullies given	0.150***	0.216***
Bullies received	-0.216***	0.017

Pigs with higher genetic potential for OTHERS growth:

positive genetic association with aggressiveness

Challenging and winner + loser

Correlations between EBV ADG and EBV for aggression and activity 3 wks later

« Genetic » associations

Lesions	Direct effect	Group effect
Front	0.013	0.045
Rear	0.016	0.108***

Behaviour	Direct effect	Group effect
Activity	0.078**	-0.062*

* : p ≤ 0.05 ; ** : p ≤ 0.01 ; *** : p ≤ 0.001

Pigs with higher genetic potential for OTHERS growth :

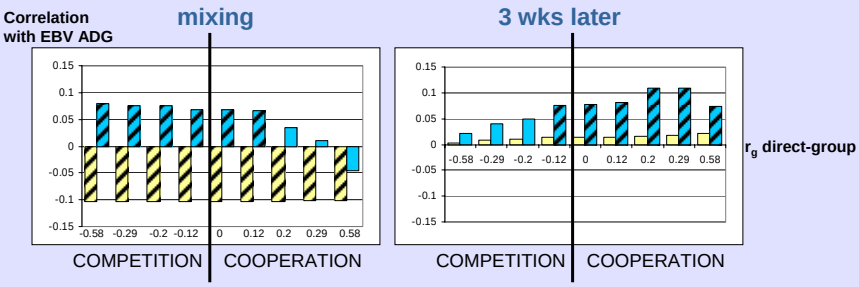
genetic association with more lesions in the rear part of the body, and with lower general activity

Reception of injuries without retaliating and calmness

Sensitivity according to r_g direct-group

EBV Lesion scores Rear part of the body

Direct Group
Not significant
Significant (p<0.05)



Pigs with higher genetic potential for OTHERS growth:

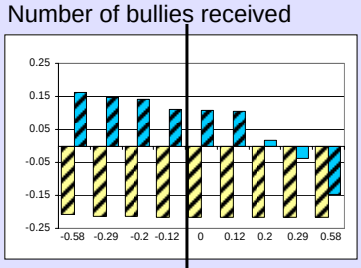
more lesions at rear (subordinate)

If genetic competition (r_g dg<0):	If genetic cooperation (r_g dg>0):
At mixing	3 wks later

Sensitivity according to r_g direct-group

- **EBV Aggressive behaviour at mixing**

Number of bullies received

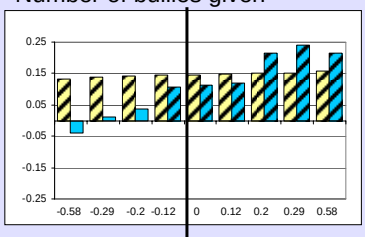


Pigs with higher potential for OTHERS growth:

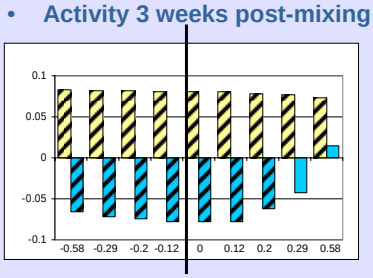
more bully received if genetic competition

more bully given if genetic cooperation

Number of bullies given



- **Activity 3 weeks post-mixing**



Direct Group
not significant
significant (p<0.05)

Genetic competition and cooperation: lower activity

Discussion

- Selection realized on the direct effect for growth
  genetically correlated with a higher potential for aggression at mixing
  (Turner et al., 2006)

- First time genetic associations of aggressiveness and group effect were estimated in pigs
  - but small data set for aggression traits
  - wise to estimate genetic parameters for growth in Swedish population

- According to EBVs,
  pigs with higher growth and beneficial group effect for ADG
  - genetic potential for fighting and challenging interactions at mixing
  - 3 wks post-mixing, they don't fight back when attacked and have a lower general activity

  In case the population would show antagonism between direct and group effects for ADG: pigs with a beneficial group effect are subordinate at mixing

Conclusion

- By selecting both on direct and group effects to improve growth, we could increase their fighting ability at mixing but at 3 wks, they could become calmer and less prone to attack.

- Further studies are required before implementing this selection incorporating interactions among individuals, to analyse carefully the potential consequences on genetics of behaviour.

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Thank you for your attention !