Genetic parameters of thermoregulatory responce in lactating sows

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1/1 Introduction: the context

- **Global pig market:** Pig breeding is an international business

- **Increased pig production in warm climates:** More than 50 % of pig production occurs in warm climates, with predicted faster growth than in temperate areas (FAO, 2006)

- **Increased sensitivity to heat stress of mainstream pig breeds:** results of the genetic progress for (re)production traits (see meta-analysis of Renaudeau et *a*l. 2011)

- **Climate change:** the general average temperature is expected to increase, with the frequency and the amplitude of heat waves and thus heat stress should be accentuated (IPCC, 2007; Hoffmann, 2010)

Introduction: the context

Main effects of chronic heat stress on sows

Ambient temperature and/or relative humidity

↓ Appetite

↑ Mobilisation of Body reserves

↓ Milk production

↓ reproduction after weaning

1/3 Introduction

Most research studies deal with the genetic component of economic important traits as a function of head load
(Lewis and Bunter, 2011; Bergsma and Hermesch, 2012; Bloemhof et *al*., 2013)

The inheritance of traits directly related with thermoregulatory responses is poorly described in pigs.

The objective of this study was to establish whether the thermoragulatory responses of sows during lactation in a tropical environment was heritable.

2/1 Material and Methods: Animal and data

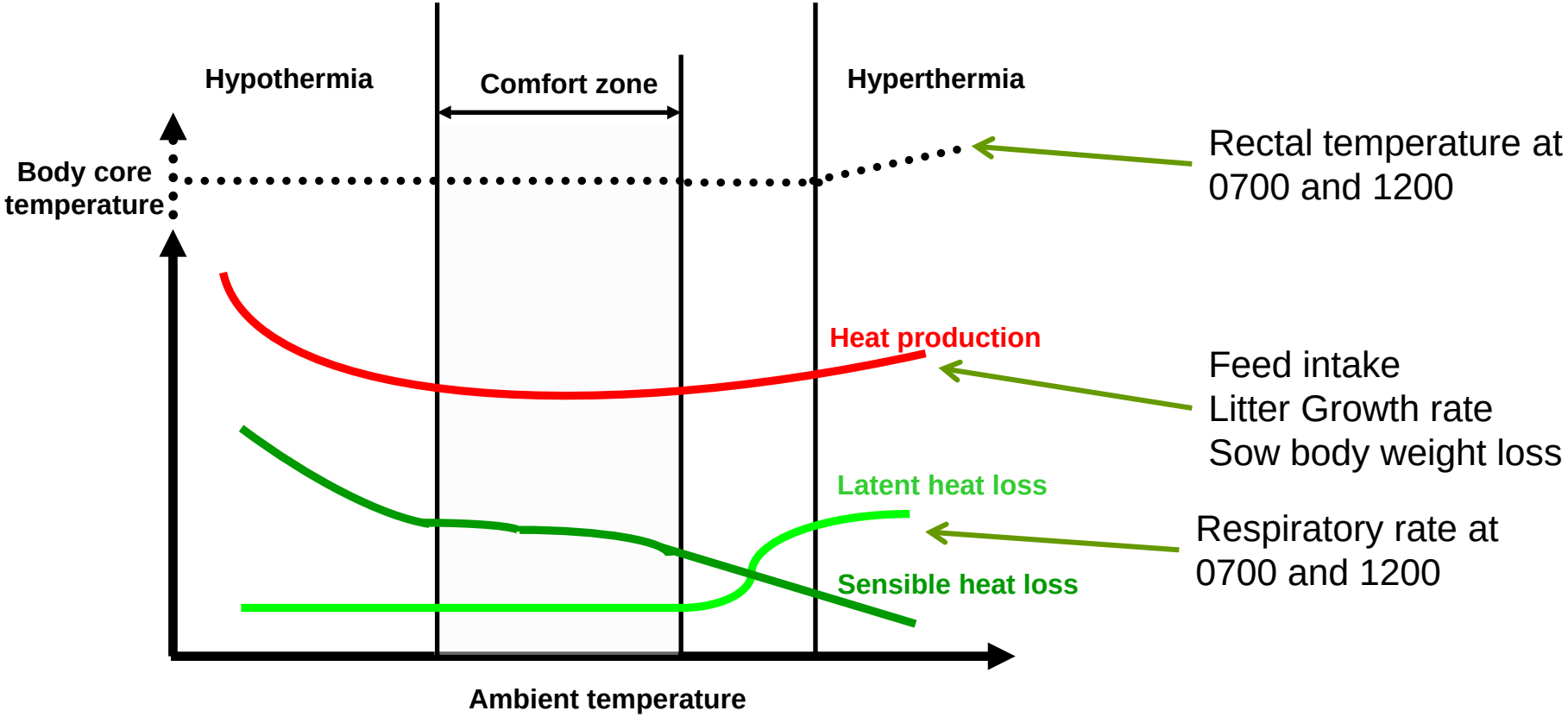
- 647 lactations
- 224 Large White sows
- Data :Jan 2002 – Dec 2012

Pedigree contained 914 reproducers
Farm: INRA experimental facilities in Guadeloupe (lat. 16˚N, long. 61˚W): semiopened buildings: animals are directly exposed to variation of the outside climatic conditions (average ambient temperature 25° C)

2/2 Material and Methods: Animal and data

Phenotypes:

- Lactating performance: Litter BW gain; maternal BW loss; sow ADFI
- Thermoregulatory measurements



Source: adapted from Mount (1979) and Renaudeau et *al*. (2004)

2/3 Material and Methods: Statistical analysis

- (Co)variance components using ASReml software
  (Gilmour et al., 2006)

- Univariate animal models :

  fixed effects : batch-season-year, parity (1,2,3 and > 3)

- Multivariate animal models :

  Bivariate analyses

Results: descriptive statistics

Summary of traits analysed	N. Obs	Mean ± S.D.
Lactating traits		
Average Daily Feed Intake, kg/d	647	4.5 ± 0.9
Litter Growth Rate, kg/d	647	2.2 ± 0.4
Lactation Body Weight Loss, kg	628	18.6 ± 8.8
Thermoregulation traits		
Rectal Temperature at 0700, °C	647	38.6 ± 0.4
Rectal Temperature at 1200, °C	637	39.4 ± 0.5
Respiratory Rate at 0700, breaths/min	543	65 ± 14
Respiratory Rate at 1200, breaths/min	535	60 ± 16

Results: genetic parameters

Traits analysed	$h^2 \pm$ S.D	$r_g \pm$ S.D. with ADFI
Lactating traits		
Average Daily Feed Intake, kg/d	0.10 ± 0.06	
Litter Growth Rate, kg/d	0.28 ± 0.05	0.55 ± 0.22
Lactation Body Weight Loss, kg	0.33 ± 0.05	
Thermoregulation traits		
Rectal Temperature at 0700, °C	0.31 ± 0.09	-0.05 ± 0.32
Rectal Temperature at 1200, °C	0.39 ± 0.10	-0.12 ± 0.31
Respiratory Rate at 0700, breaths/min	0.30 ± 0.10	
Respiratory Rate at 1200, breaths/min	0.23 ± 0.07	

4/1 Conclusion

- Genetic component of thermoregulatory responses exists.
- Genetic correlations of body core temperature and feed intake are negative but all low with large standard errors : that suggests that an antagonism could be manageable in a breeding objective.
- These results suggest that selection may enhance heat adaptation capacity in lactating sows.

4/2 Conclusion

- Further studies are still needed before implementation of breeding programs for heat tolerance with thermoregulation traits:

  - Standardize thermoregulation measurements: biologically relevant traits technically easy and low cost to record

  - Evaluate economic cost of the trait:
    e.g. what is the economic cost of 0.1˚C increase of the SD of body core temperature of lactating sows?

  - Simulation of breeding programs: expected genetic responses and correlated responses.