

# The influence of genetics and environment on indicators of piglet pre-weaning survival

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# Background

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- Most pre-weaning deaths occur during the neonatal period (0-7days)
- Welfare and economic concern
- Farrowing crates used to improve survival
  - Decrease crushing
  - Restrictive physically and behaviourally
  - Mortality figures similar indoors and outdoors (~11% live-born)



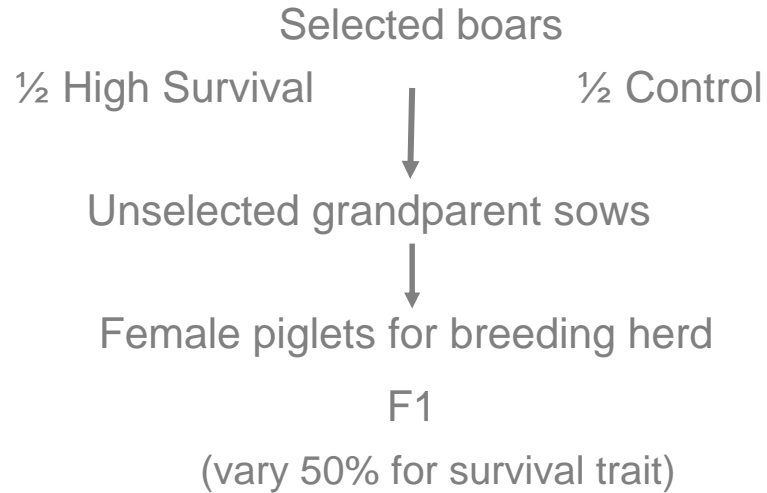
# Objectives

- Identify behavioural and physiological indicators of piglet survival
  - Which factors best predict piglet survival?
  - What makes a good/viable piglet?

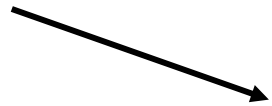
# Objectives

- Identify behavioural and physiological indicators of piglet survival
  - Which factors best predict piglet survival?
  - What makes a good/viable piglet?
- Are these indicators influenced by genotype or environment?
  - Can we breed for high survival in alternative farrowing systems?

# Methodology: Breeding for high survival



Selected boars



65 Parent Gilts

**34 High Survival and 31 Control**

(1/2 outdoor, 1/2 indoor)

Piglets followed to weaning

**F2**

(vary 75% for survival trait)



# Methodology

- Gilts and piglets video recorded until 2 days post farrowing
- All farrowings attended
- Measures taken:
  - **Piglet physiology and behaviour** (e.g. birth weight and behavioural development)
  - **Gilt physiology and behaviour** (e.g. placental characteristics and body condition, nesting and farrowing)
- Post-mortem analysis of any piglets dying pre-weaning



# Statistical analysis

- Generalised Linear Mixed Models (GLMM)
  - Allowing a binomial structure
  - Response variable = Mortality
  - Adjusted for litter and sex effects
- Generalised linear models (GLMs) investigated gilt differences
- Models
  - **Stillborn** mortality
    - Surviving vs. Born dead
  - **Live-born** mortality
    - Surviving vs. Die pre-weaning

# Results

What makes a good/viable  
piglet?  
GLMM results





## Stillborn

### Body conformation

- Lower BW (1330g)
- Longer CRL (28cm)
- Lower PI (58)
- Lower BMI (16)
- Smaller AC (24cm)

### Prenatal environment

- Lower PE (6.00)

### Farrowing kinetics

- Later in BO (9)

## Survives

### Body conformation

- Higher BW (1520g) \*
- Shorter CRL (27cm) \*
- Higher PI (76) \*\*\*
- Higher BMI (20) \*\*\*
- Larger AC (27cm) \*\*\*

### Prenatal environment

- Higher PE (6.48) \*

### Farrowing kinetics

- Earlier in BO (7) \*\*\*

## Dies pre-weaning

### Body conformation

- Lower BW (1350g)
- Lower W24h (1490g)
- Shorter CRL (26cm)
- Lower BMI (19)
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### Thermoregulation

- Lower Temps (37.89 °C)

### Behaviours

- Slower to udder (36mins)
- Slower to a teat (46mins)
- Slower to suckle (57mins)
- Less time suckling (26%)
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- Higher 24hT (38.67°C) \*\*

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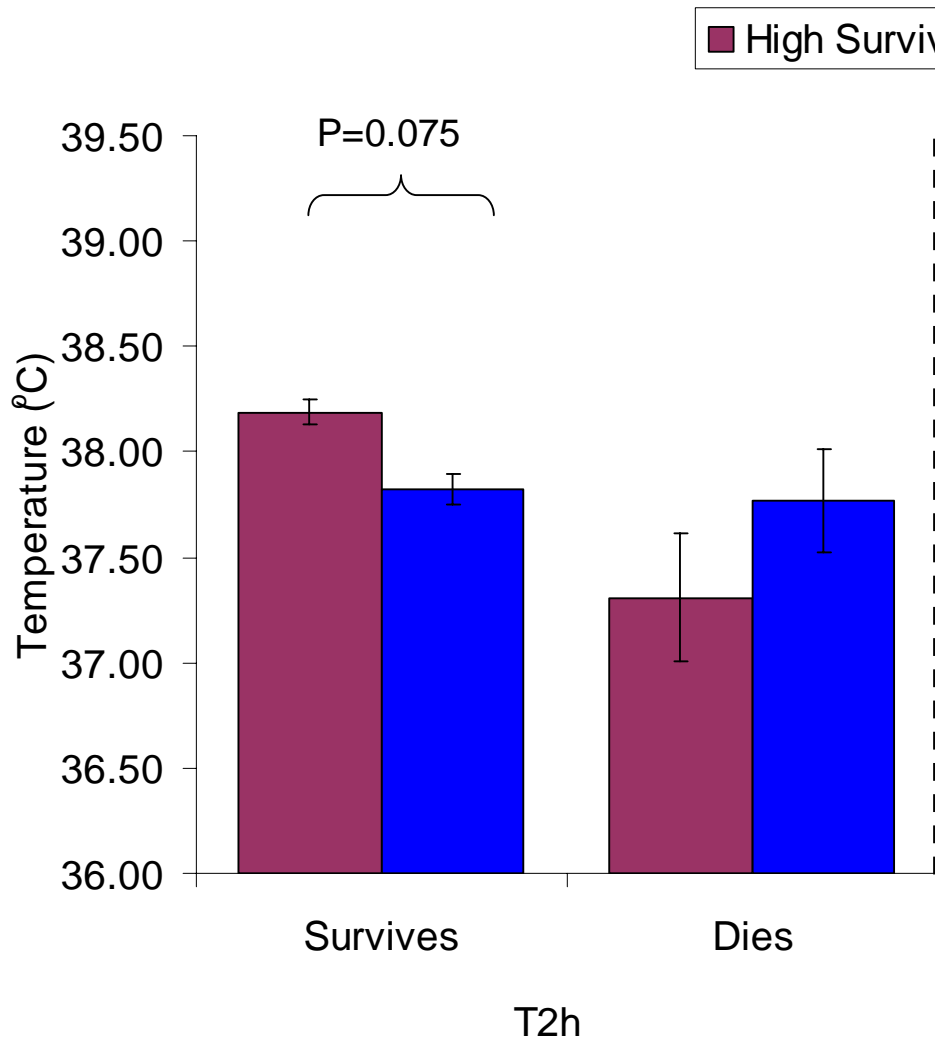
# What makes a good mother?

## Behaviour during farrowing

- Prolonged lateral lying
- Careful posture changes
  - Slow
  - **Supported\***
- **Less crushing behaviour\*\***

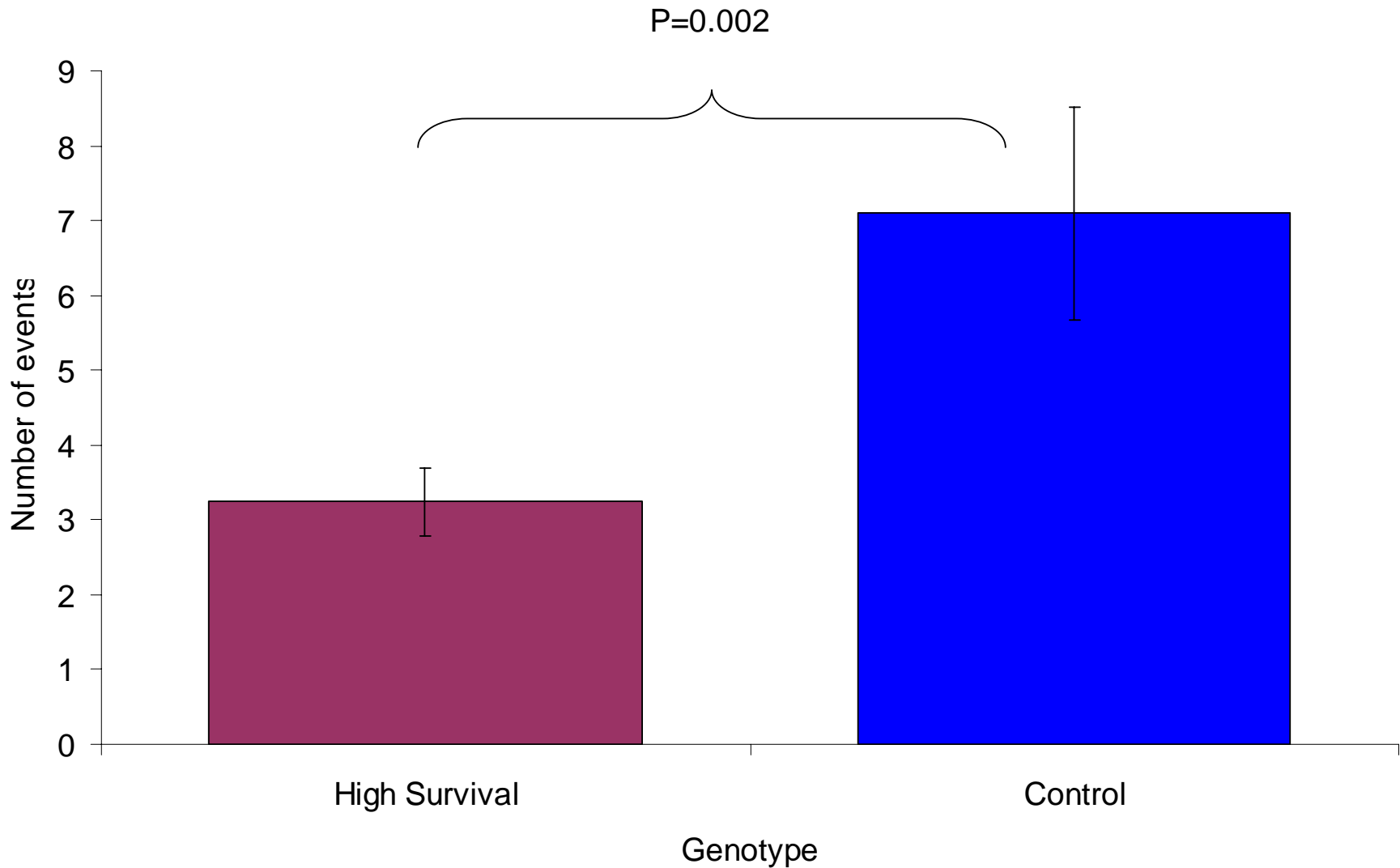


# The influence of genotype: Piglet thermoregulation



Interaction:  
 $W_1=5.49$   $P=0.019$

# The influence of genotype: Crushing behaviour\*\*



# Can we breed for high survival in alternative farrowing systems?

- OUTDOORS:

Total mortality:

- High Survival = 12.21%
- Control = 17.90%

( $W_1=3.60$   $P=0.058$ )



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- INDOORS:

Total mortality:

- High Survival = 14.86%

- Control = 12.29%

( $W_1=0.07$   $P=0.797$ )



# G x E interaction

- Maternal aggression
  - Savaging only displayed by High Survival gilts  
( $F_{1,63} = 21.83$   $P < 0.001$ )
  - 40% of **INDOOR** High Survival gilts bit/mouthed their piglets  
( $F_{1,63} = 28.64$   $P = 0.006$ )

# Conclusions and Implications

- Stillborn mortality
  - Ponderal index and Body mass index more important than birth weight - Size and shape matter
  - Placental efficiency and farrowing birth order also affect prenatal survival
- Body conformation as well as weight should be considered when selecting for survival

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- Body conformation as well as weight should be considered when selecting for survival
- Live-born mortality
  - Birth weight, landmark behaviours and good maternal behaviour are important postnatal survival indicators

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## Can we select for high survival?

- There is potential:
  - Relatively low mortality indoors
  - Total mortality ~18% in Control lines and ~12% in High Survival lines outdoors
  - Significant decrease in crushing from High Survival lines

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GxE interactions: behaviour as well as physiology is important when developing breeding strategies

# Acknowledgements

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## SUPERVISORS

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## FARM and TECHNICAL STAFF