

# Heritability of udder morphology and colostrum quality traits in swine



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# Introduction

- ✓ The sow udder is very important; colostrum and milk are the source of energy and passive immune protection for piglets
- ✓ Access to an early and plentiful supply of colostrum is essential for piglet survival
- ✓ Modern hyperprolific damlines have increased udder anatomy challenges to piglet teat access.
- ✓ Genetic selection for improved litter size and carcass lean content, affects piglet birth weight and heterogeneity, impairing teat seeking behaviour.

# Research Objectives

- 1) Calculate the heritability of udder quality traits, defined as morphology and colostrum Immunoglobulin G (IgG) concentration at farrowing
- 2) Estimate the genetic and phenotypic correlations of these traits with other production and reproduction criteria

# METHODS

## ANIMALS:

- Meidam (Large White X Meishan) **MDM**

## UDDER TRAITS MEASUREMENTS:

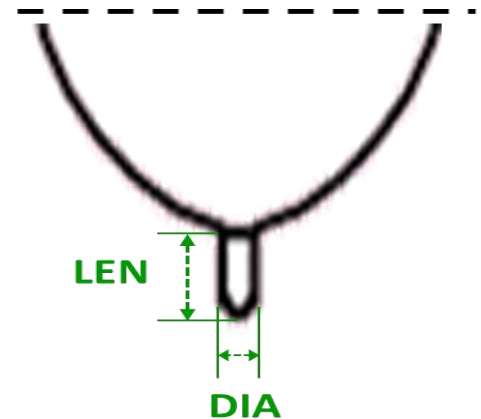
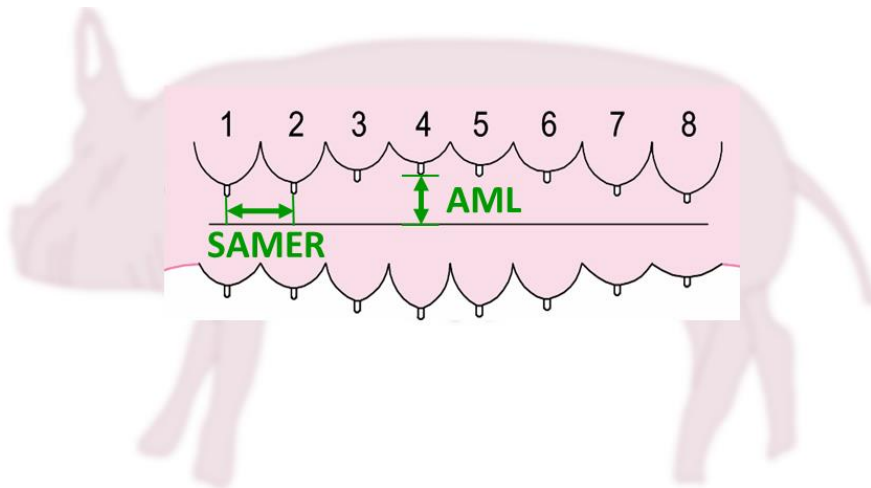
- Once shortly prior to farrowing
- Lying down posture
- Upper row of teats



# UDDER MORPHOLOGY DESCRIPTION

## MEASUREMENTS (in millimetres):

- Inter-teat distance within the same row (**SAMER**)
- Teats base to the abdominal mid-line (**AML**)
- Teat length (**LEN**)
- Teat diameter (**DIA**)



# UDDER MORPHOLOGY DESCRIPTION

## LINEAR SCORE:

- Teat Orientation (OR)
- Teats Functionality (NoFun)
- Udder Development (DEV)



Score 1



Score 2



Score 3

# COLOSTRUM SAMPLE COLLECTION & ANALYSIS

- Collected when freely available immediately before or early during parturition
- Sample obtained by using hand pressure from all teats
- Drop of well mixed whole colostrum placed on a refractometer prism to record the Brix score (%).



BRIX Refractometer

# Data analysis

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## ANIMAL

Udder conformation data on 988 Meidam sows  
Colostrum samples from 528 sows.  
Sow included as a random effect in the analyses.

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## STATISTICS

The genetic parameters were estimated using single-trait animal models.

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## REPRODUCTIVE TRAITS

Udder quality measurements and reproductive traits  
 $Y = \mu + \text{BSM-OD} + p + a + e$

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## PRODUCTIVE TRAITS

Udder quality measurements and productive traits  
 $Y = \mu + \text{BSMP-TEST} + a + e$

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# Results: HERITABILITY

| Trait         | MEAN± SD     | h <sup>2</sup> | SE   |
|---------------|--------------|----------------|------|
| DIA (mm)      | 10.72±1.77   | 0.56           | 0.02 |
| LEN (mm)      | 16.42±3.67   | 0.46           | 0.04 |
| TT            | 15.6±1.12    | 0.42           | 0.02 |
| SAMER (mm)    | 104.51±14.45 | 0.37           | 0.06 |
| COLOSTRUM (%) | 24.93±3.24   | 0.35           | 0.07 |
| AML (mm)      | 61.21±10.88  | 0.22           | 0.04 |
| DEV           | 2.24±0.51    | 0.25           | 0.04 |
| NoFUN         | 0.04±0.05    | 0.22           | 0.05 |
| OR            | 0.9±0.21     | 0.14           | 0.03 |

# Results:

## GENETIC - PHENOTYPIC CORRELATION

|       | LEN | DIA | AML | SAMER | NoFun | DEV | OR | TT | COL |
|-------|-----|-----|-----|-------|-------|-----|----|----|-----|
| LEN   |     | *   |     | *     |       |     | *  |    | *   |
| DIA   | *   |     | *   | *     | *     | *   | *  |    |     |
| AML   |     | *   |     | *     | *     | *   |    |    |     |
| SAMER |     | *   | *   |       | *     |     |    | *  | *   |
| NoFun | *   | *   | *   | *     |       | *   | *  |    |     |
| DEV   | *   | *   | *   | *     | *     |     | *  |    |     |
| OR    | *   |     | *   |       |       | *   |    | *  | *   |
| TT    | *   | *   |     | *     | *     | *   | *  |    |     |
| COL   |     | *   |     |       |       | *   | *  |    |     |

Black star significant positive correlation. Blue star negative correlation

# Results

|                     | GENETIC CORRELATION Morphology Traits |     |     |       |    |       |     |    |     |
|---------------------|---------------------------------------|-----|-----|-------|----|-------|-----|----|-----|
|                     | LEN                                   | DIA | AML | SAMER | OR | NoFun | DEV | TT | COL |
| Reproduction Traits |                                       |     |     |       |    |       |     |    |     |
| GLEN                |                                       |     |     |       |    |       | *   | *  | *   |
| NBA                 |                                       |     |     | *     |    |       |     | *  | *   |
| TBO                 |                                       |     |     | *     |    |       |     | *  |     |
| LW0                 |                                       |     | *   | *     |    |       |     |    | *   |
| LS10                |                                       |     | *   | *     |    |       | *   |    |     |
| LW10                | *                                     |     | *   | *     | *  | *     |     |    |     |
| LiveD               |                                       | *   |     | *     | *  |       | *   | *  | *   |
| STB                 |                                       |     |     | *     |    |       |     | *  | *   |

Black star significant positive correlation. Blue star negative correlation

# Results

|                   | GENETIC CORRELATION Morphology Traits |                             |                             |                       |                      |                      |                       |                             |                      |
|-------------------|---------------------------------------|-----------------------------|-----------------------------|-----------------------|----------------------|----------------------|-----------------------|-----------------------------|----------------------|
| Production Traits | LEN                                   | DIA                         | AML                         | SAMER                 | OR                   | NoFun                | DEV                   | TT                          | COL                  |
| ADG               | <b>0.27</b> <sub>0.11</sub>           | 0.14 <sub>0.11</sub>        | <b>0.42</b> <sub>0.14</sub> | -0.06 <sub>0.18</sub> | 0.00 <sub>0.01</sub> | 0.01 <sub>0.02</sub> | 0.03 <sub>0.11</sub>  | -0.03 <sub>0.06</sub>       | 0.26 <sub>0.16</sub> |
| BFAT              | -<br>0.02 <sub>0.07</sub>             | <b>0.28</b> <sub>0.08</sub> | 0.15 <sub>0.13</sub>        | -0.13 <sub>0.1</sub>  | 0.00 <sub>0.02</sub> | 0.01 <sub>0.07</sub> | -0.22 <sub>0.06</sub> | <b>0.36</b> <sub>0.07</sub> | 0.01 <sub>0.02</sub> |

Significant correlation between morphology traits and productive trait is highlighted in red

# CONCLUSIONS AND IMPLICATIONS

Genetic analysis shows a high to moderate heritability for all traits.

Considering their economic importance, udder morphology and colostrum quality traits should be considered in sow selection criteria.

Implementation by breeding companies could give:

- Repeatable and reliable methods for gilt selection
- Selection of sows with better nursing capacity
- Improved colostrum accessibility and quality
- Increased number and weight of weaned piglets

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- all the staff at ACMC



*Thanks for your attention*



*"The Laurentian Sow" 1<sup>st</sup> -2<sup>nd</sup> sec AC  
Carlsberg Glyptotek Copenhagen*