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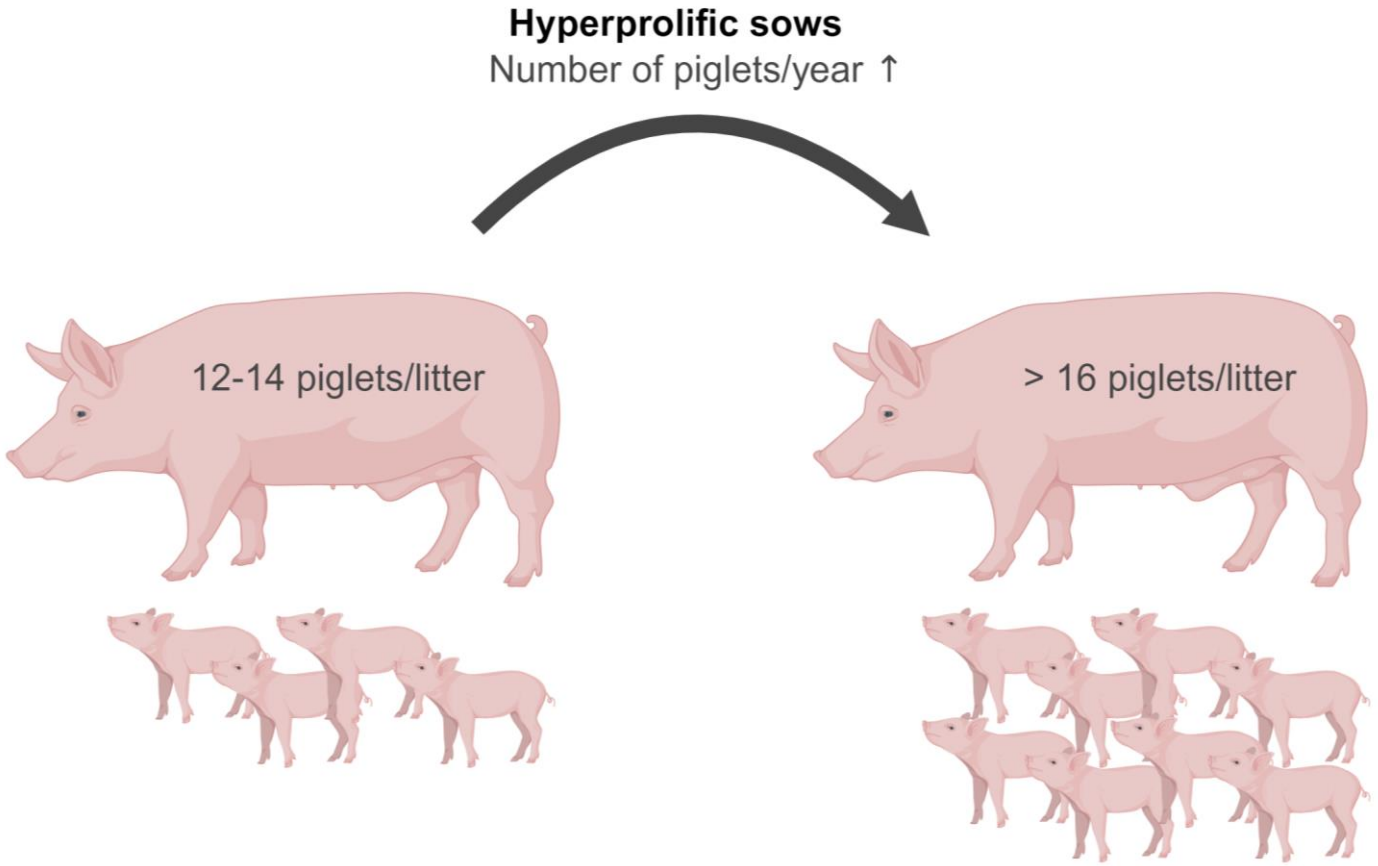
Thriving or striving: comparing IUGR, LBW and NBW piglets within the first 24 hours

IPVSbb meeting 2024

Marlotte Loyens

Introduction – Hyperprolific sows



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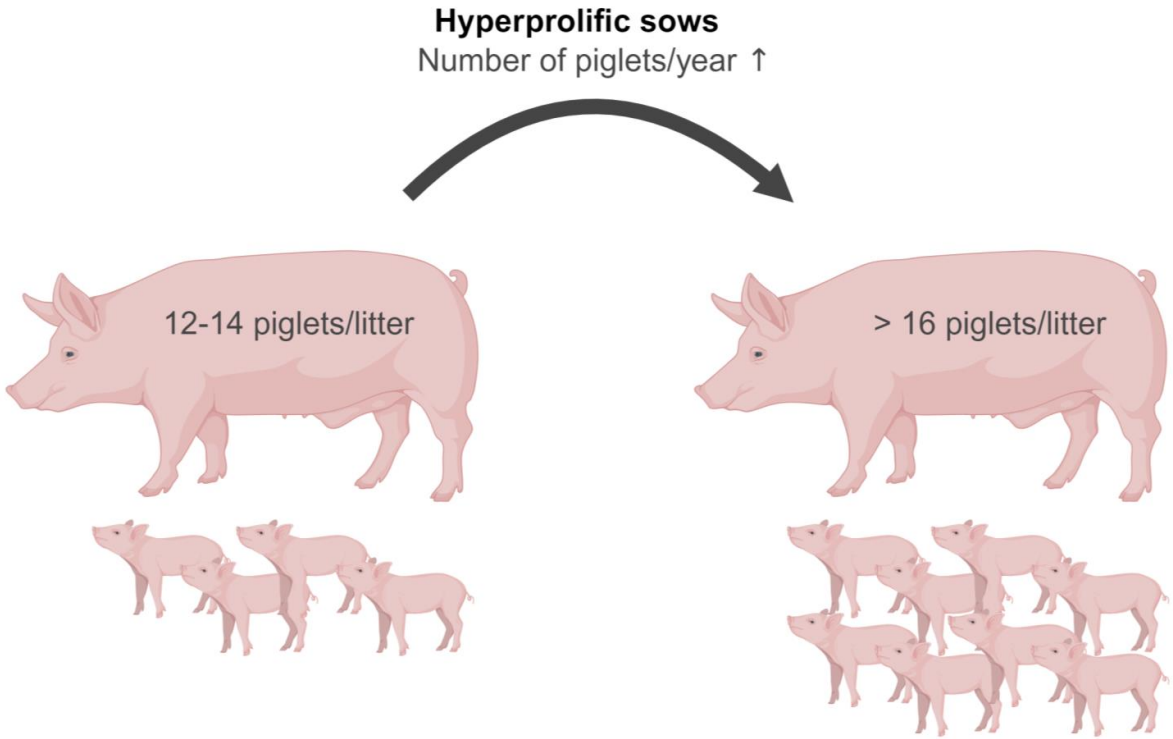
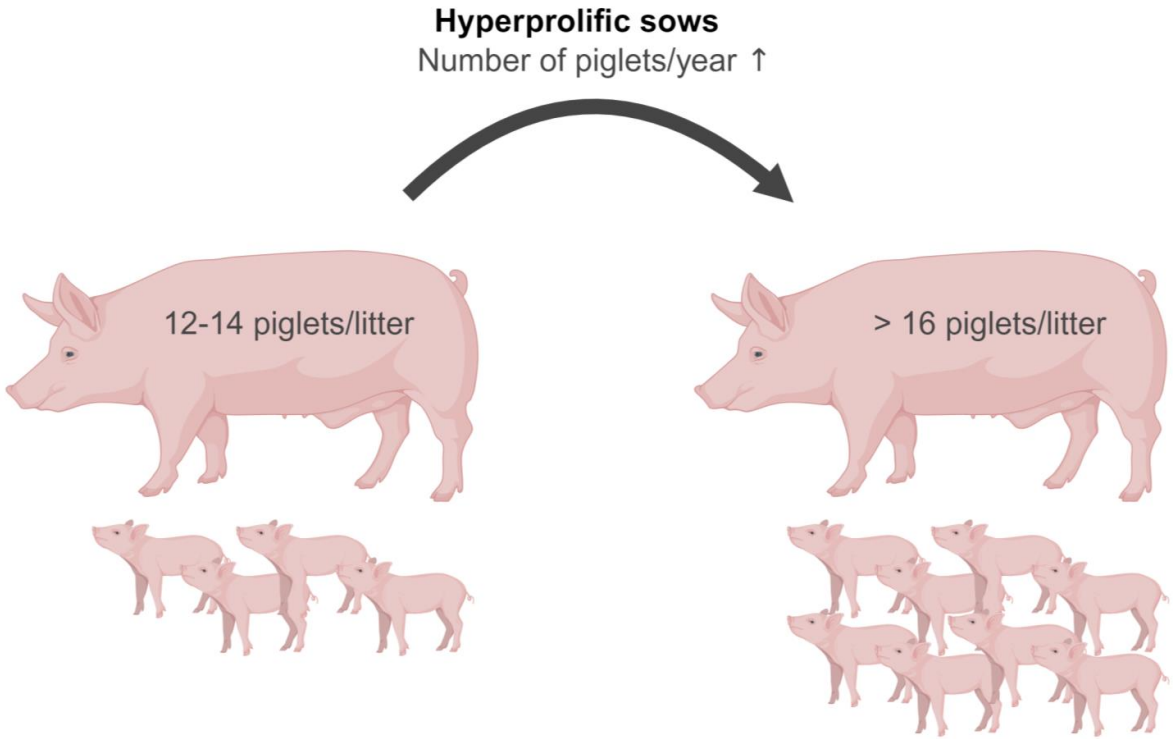


But…

- **Variability of birth weights within a litter ↑**
- **Low birth weight piglets ↑**
- **Pre-weaning mortality ↑**
- **IUGR piglets ↑**

IUGR = intra-uterine growth restriction

Introduction – Hyperprolific sows



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Introduction – Intra-uterine growth restriction (IUGR)

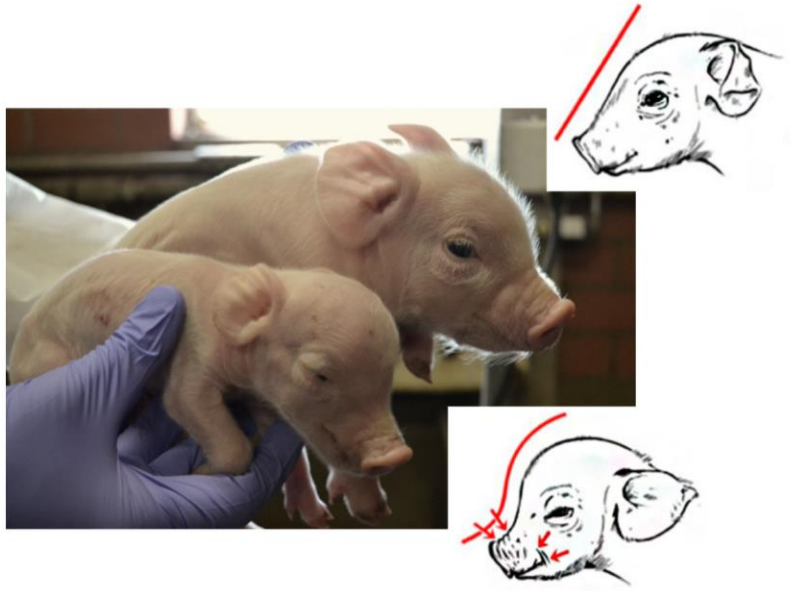


Figure adapted from *Hales et al. (J. Animal Science, 2013)* and from *Van Ginneken et al. (Mol. Reprod. Dev., 2022)*

What is IUGR?
= foetus does not grow according to its genetic potential

Main causes
- Uteroplacental insufficiency
- Maternal malnutrition
- Uterine crowding

IUGR phenotype
- dolphin head
- bulging eyes
- wrinkles around mounth

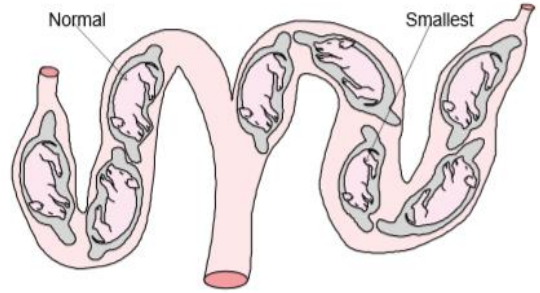
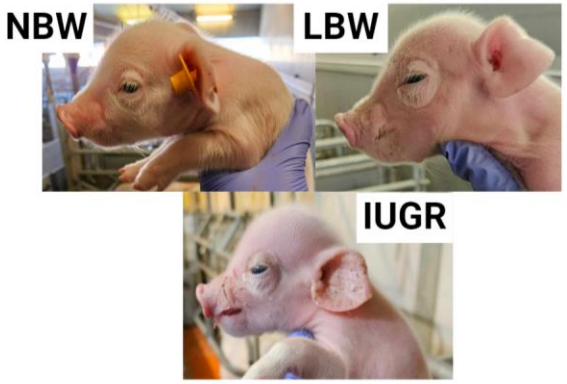


Figure adapted from *Ashworth et al. (Animal Frontiers, 2013)*

Objectives observational study

High pre-weaning mortality during first days after birth



High diversity of piglets

Which piglets will benefit the mosth from the intervention strategies?

Comparing IUGR, NBW and LBW piglets during their first 24 hours to enhance our understanding of neonatal vitality and identify at-risk piglet populations

NBW = normal birth weight; LBW = low birth weight; IUGR = intra-uterine growth restriction

Observational study

Selection:
Birth weight &
phenotype

n = 29

NBW
Mean BW - 1SD < BW < mean BW + 1SD
Normal phenotype

n = 34

LBW
BW < mean BW - 1SD
Normal phenotype

n = 32

IUGR
BW < mean BW - 1SD
IUGR phenotype

BW = birth weight; SD = standard deviation; *n* = number of piglets

Similar sex

General information
- Birth hour
- Birth order
- Sex
- Vitality score
- Umbilical cord appearance

Rectal temperature
- 0h
- 1h
- 3h
- 24h

Weight of piglet
- 0h
- 24h

Latency data
- reach udder
- find functional teat
- start suckling

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Piglet characteristics

	NBW	LBW	IUGR	*p*-Value
n	32 (16 ♂–16 ♀)	34 (18 ♂–16 ♀)	29 (16 ♂–13 ♀)	
BWB, kg	1.30 [a] (1.12–1.44)	0.75 [b] (0.70–0.78)	0.57 [c] (0.49–0.63)	<0.0001
CRL, cm	26.0 [a] (25.0–28.0)	22.0 [b] (21.0–23.5)	20.0 [c] (18.0–21.8)	<0.0001
BMI, kg/m^2	18.4 [a] (17.0–21.1)	15.3 [b] (14.0–17.5)	14.3 [c] (12.7–15.3)	<0.0001
PI, kg/m^3	68.0 [a] (63.1–80.5)	69.9 [a] (58.0–85.2)	71.3 [a] (56.3–83.2)	0.805
Mortality, %	0 [a]	0 [a]	31 [b]	<0.0001

n = number of piglets; BWB = body weight at birth; CRL = crown-rump length; BMI = body mass index (body weight/CRL^2); PI = ponderal index (body weight/CRL^3)

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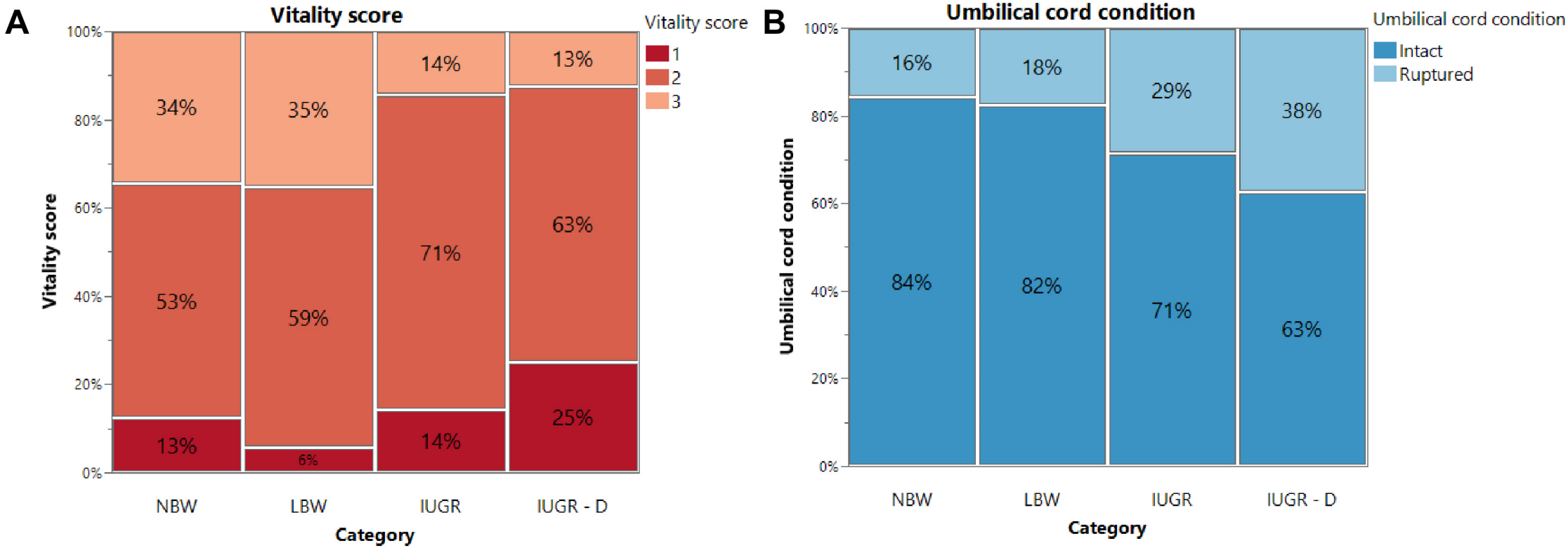
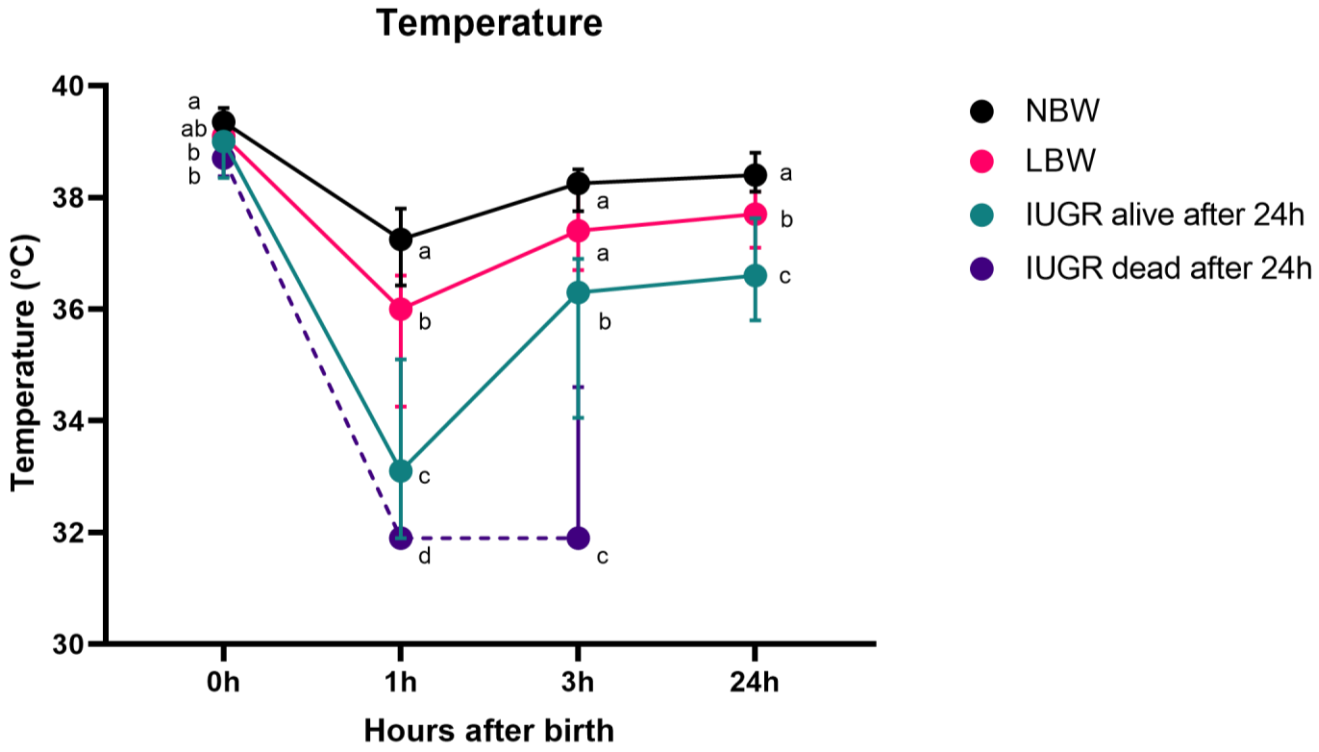
Vitality score and umbilical cord condition after birth



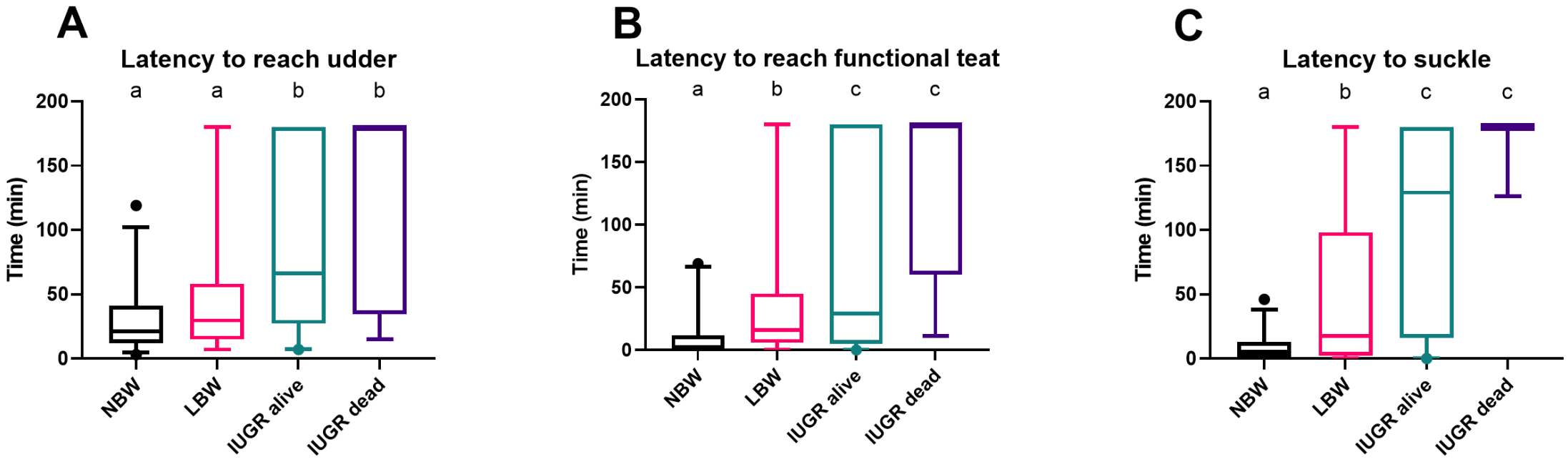
- No significant differences between NBW, LBW and IUGR piglets

Evolution of rectal temperature



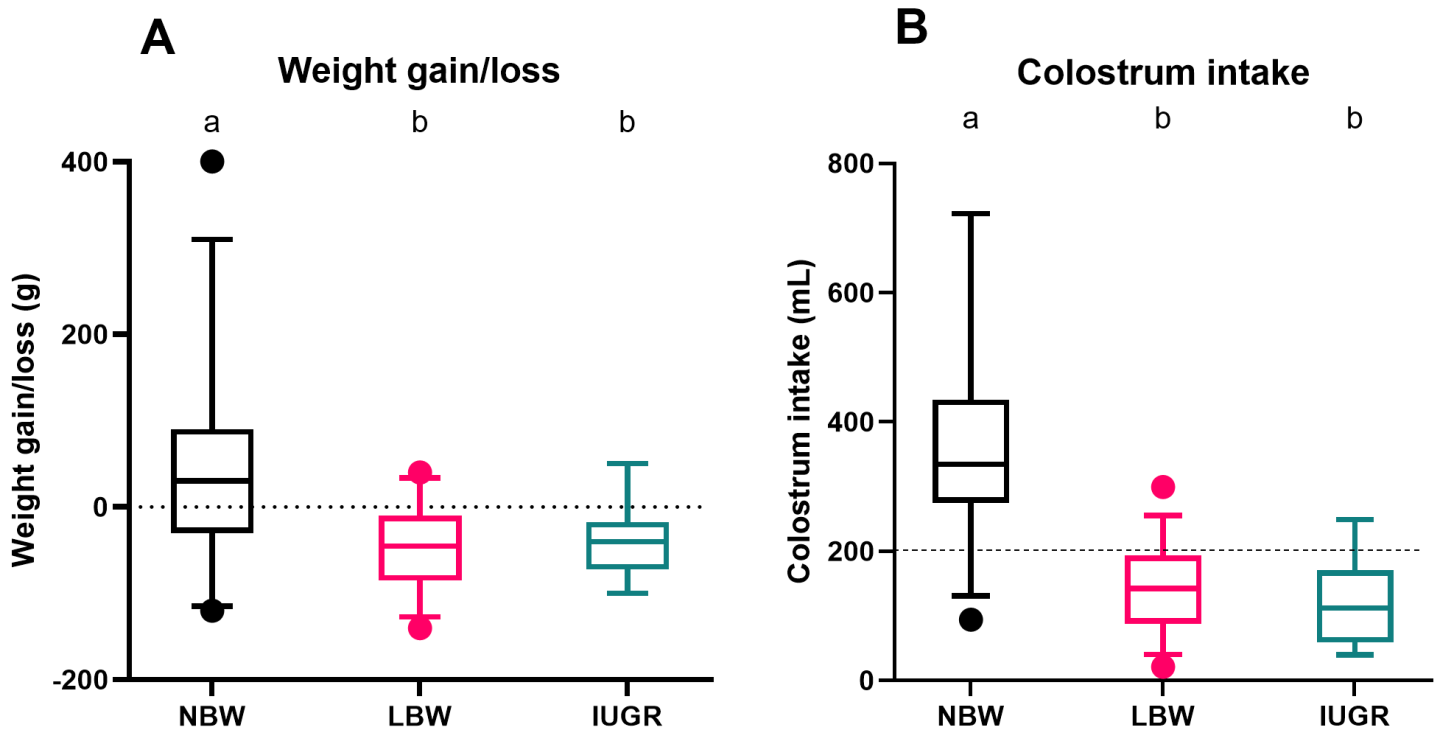
- NBW highest temperature, followed by LBW, IUGR alive and IUGR dead
- IUGR dead huge drop in temperature, cannot recover from this

Latency observations



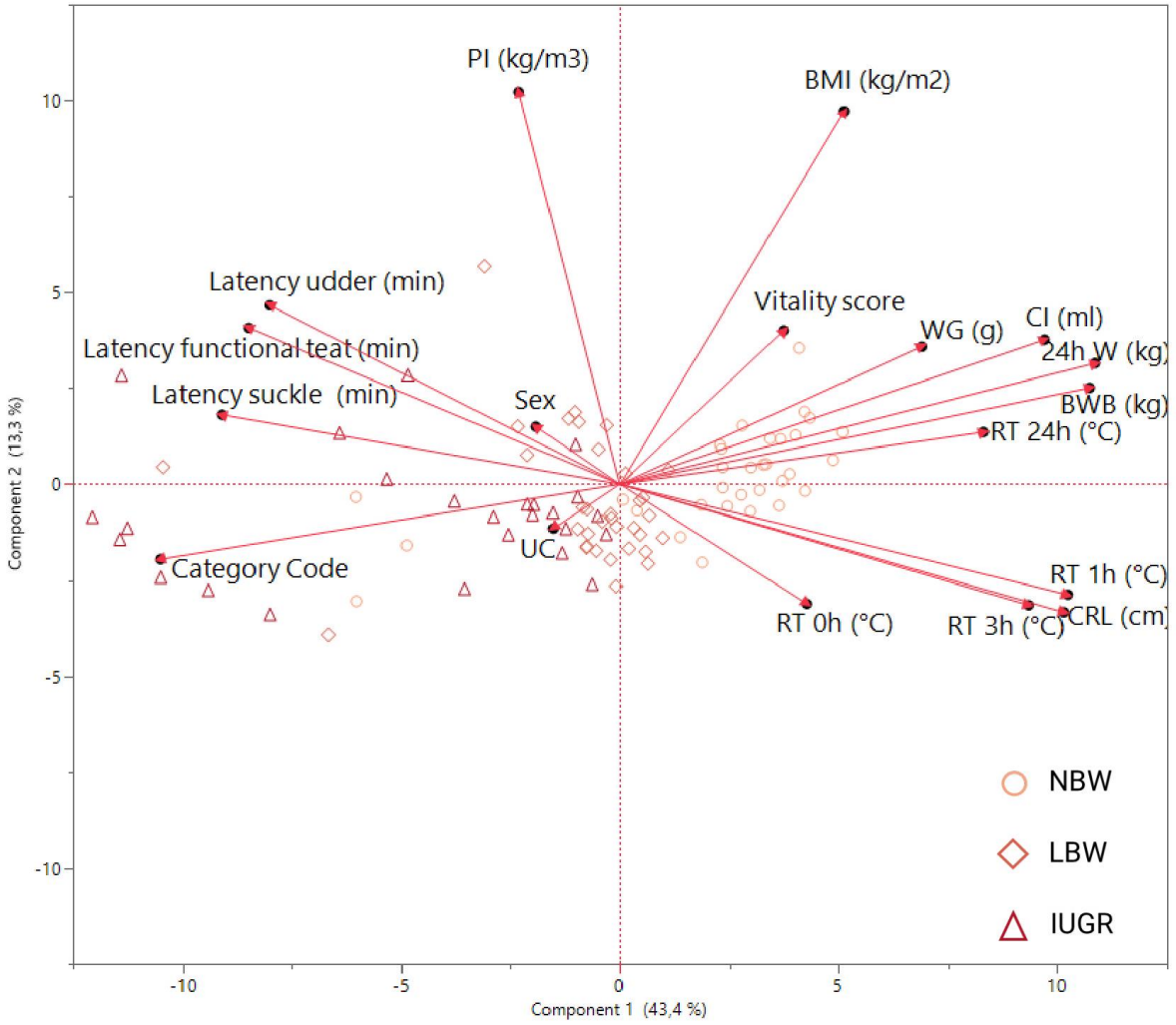
- NBW and LBW reach the udder, functional teat, and start drinking the fastest
- LBW often takes a bit longer to find a teat and start suckling (competition?)
- IUGR alive reaches the udder, functional teat, and starts drinking late (much variation)
- IUGR dead sometimes reaches the udder and functional teat, but does not drink

Weight gain & colostrum intake



- NBW shows weight gain, LBW and IUGR experience weight loss
- Only NBW has a colostrum intake above 200 mL (essential for further survival)

Putting everything together…



- **Principal component analysis (PCA)**
  - Exploration of relationships between the variables
- **Strong correlation**
  - Data grouped
  - Positive & negative correlation
- **Impact on PCA model**
  - Distance from origin

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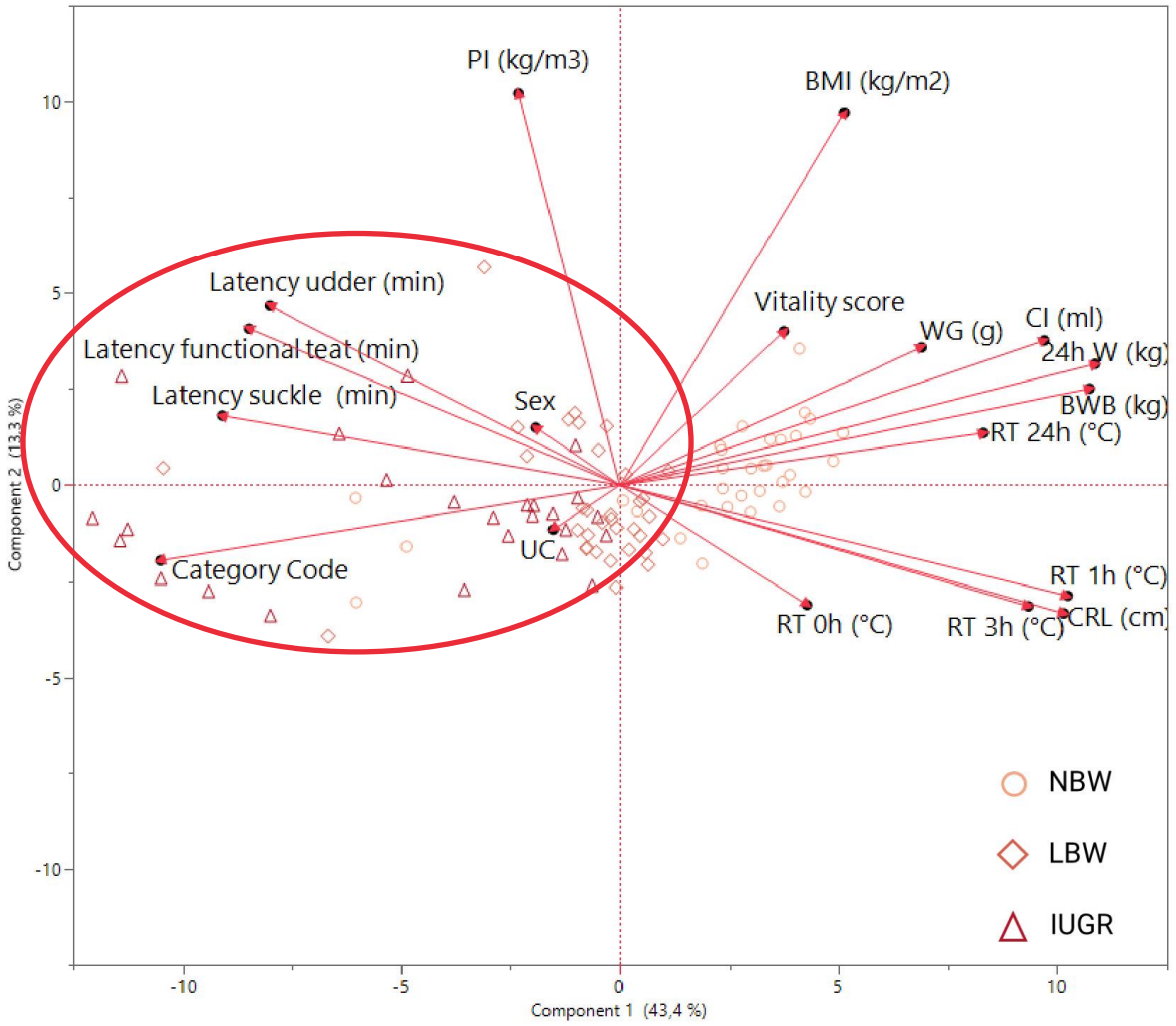
24h W = 24 h weight; BWB = body weight at birth; WG = weight gain; CI = colostrum intake; BMI = body mass index; PI = ponderal index; CRL = crown-rump length; RT = rectal temperature; UC = umbilical cord appearance

Putting everything together – IUGR cluster



- **Cluster around:**
  - Latency measures
  - Appearance of umbilical cord
- **Distantly from:**
  - Weight metrics
  - Rectal temperature
  - BMI

➔ **Cluster around vectors related to feeding behaviour and stress indicators**

➔ **Suggest potential risk factors for IUGR piglets**

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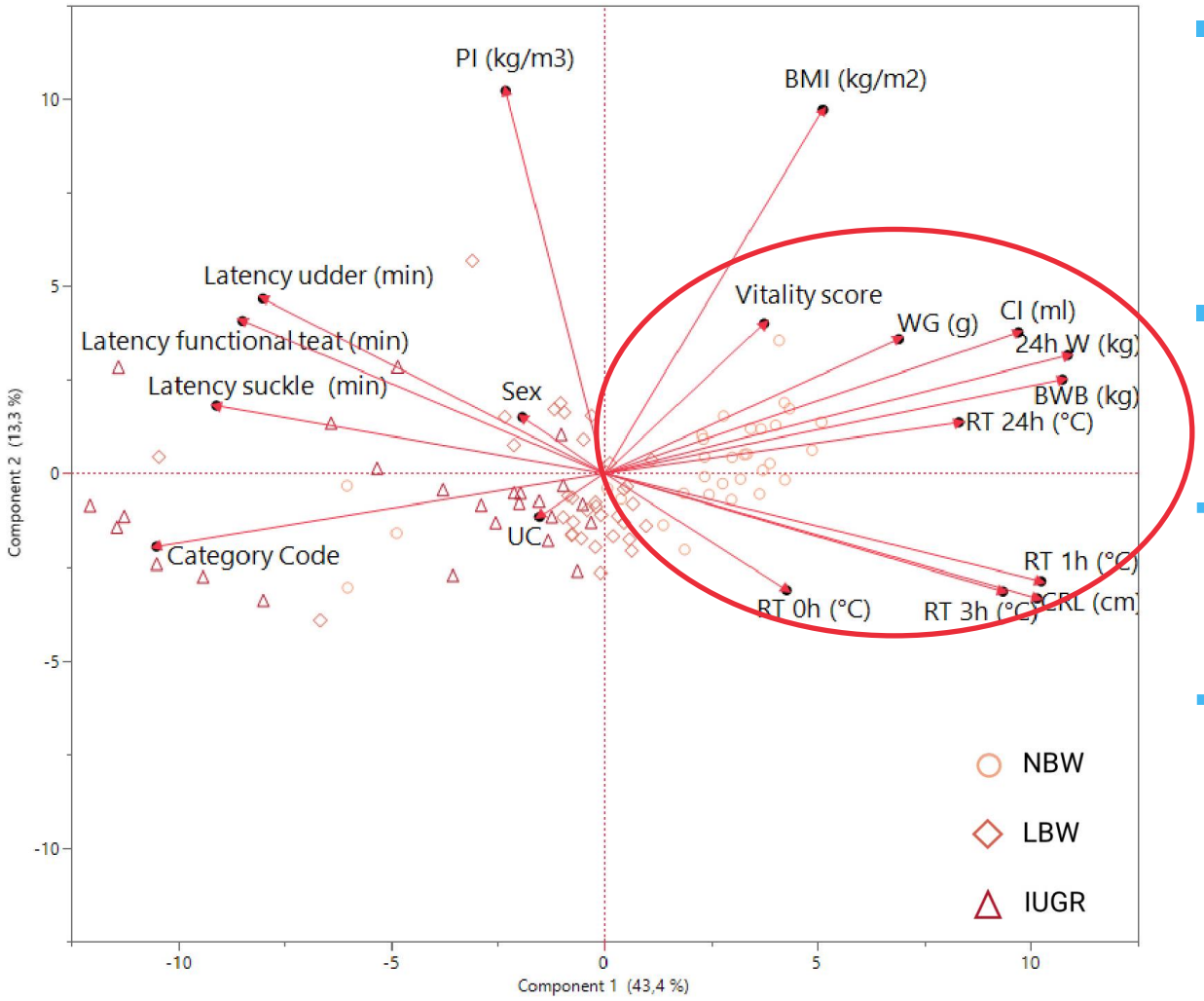
Putting everything together – NBW cluster



- **Cluster around:**
  - Weight metrics
  - Temperature data
- **Distantly from:**
  - Latency measures

➔ **Display robust health and development signs**

➔ **Lower risk of developmental delays or complications**

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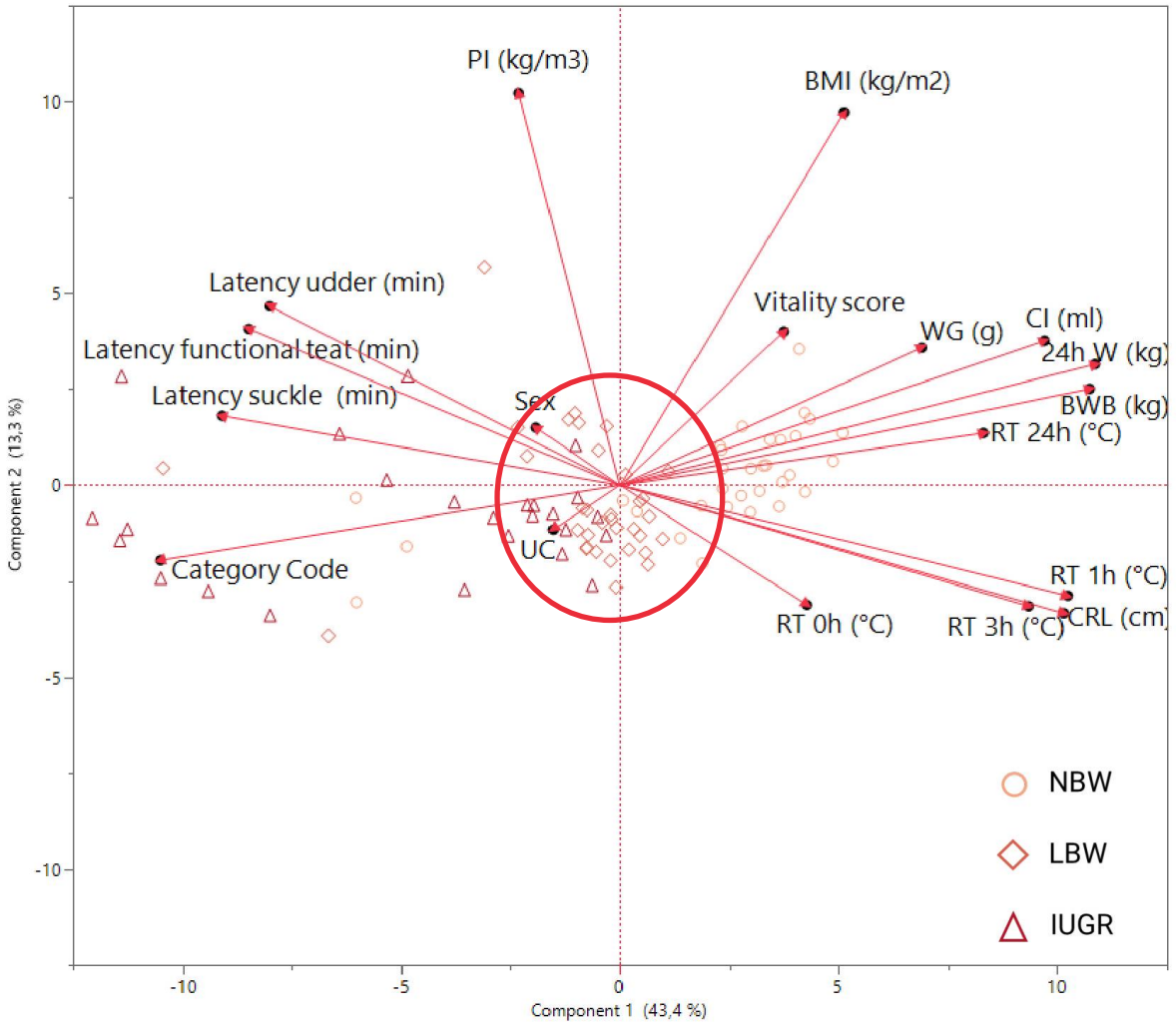
Putting everything together – LBW cluster



- **Position between IUGR and NBW clusters**
  - Sharing characteristics with both groups

➔ **May not display the extreme values seen in either group**

➔ **Suggesting growth challenges while healthier physiological metrics**

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What does the study show us?

- **Necessity for targeted management strategies for IUGR and LBW piglets**
  - Heat provision (e.g. heat lamps, heated creep areas, …)
  - Sufficient colostrum intake (e.g. split suckling,…)
  - Fostering practices when necessary (e.g. cross fostering,…)
- **A need for strategies explicitly for IUGR piglets**
  - A combination of different strategies
  - Drenching = oral administration of various substances
  - Humanely killing severely low-viable IUGR piglets
- **BUT… often costly and labour intensive**

Conclusion

- **IUGR piglets proved to be the most at-risk population during the first 24h**
  - Lower rectal temperatures
  - Delays in commencing early feeding

➔ **Urgent need for specific intervention strategies**

- **Improve survival of IUGR piglets**
  - Aligns with ethical standards of animal care
  - Boost economic outcomes

Conclusion

animals

MDPI

Article

Thriving or Striving: Comparing Intra-Uterine Growth Restricted, Low Birth Weight and Normal Birth Weight Piglets within the First 24 Hours

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Thank you for your attention!

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