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# Heat stress in farrowing sows under piglet-friendly thermal environments

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# Stress in farrrowing sows kept under a piglet-friendly thermal environment

I. Why?
II. What is a piglet-friendly thermal environment? (study 1)
III. Preferences of farrowing sows (study 2)
IV. Effects of floor heating on the sow
    a. Fully heated pen (study 3)
    b. Heated pen with colder zones (study 4)
V. Conclusion

- Not a traditional ”disease model”
- Stress in farrowing sows

# I. Why ?

- Production economics, Animal welfare
- Piglet mortality 20-24 % of piglets born

- EU legislaton, 2013

# Early piglet mortality

- Hypoxia during delivery
- Hypothermia
- Insufficient intake of colostrum
- Crushing by the sow

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**Stress in the sow**

- Stress in farrowing sows kept under a piglet-friendly thermal environment

- Stress responses
  - -behaviour
  - -thermoregulation
  - -HPA-axis hormones
  - -farrowing problems

↳ piglet vitality and survial

- Stress in farrowing sows kept under a piglet-friendly thermal environment

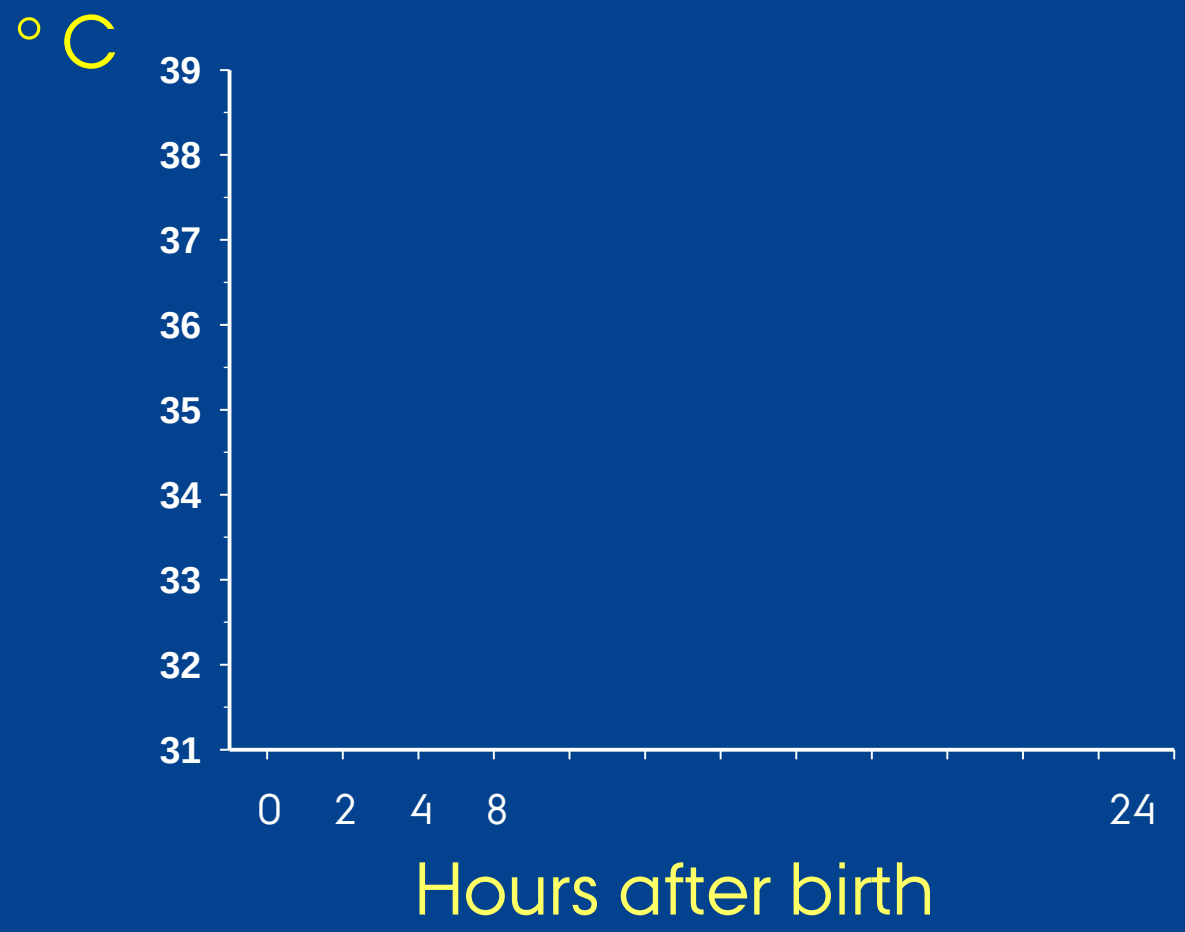
- Stress in farrowing sows kept under a piglet-friendly thermal environment

# II. What is a piglet-friendly thermal environment

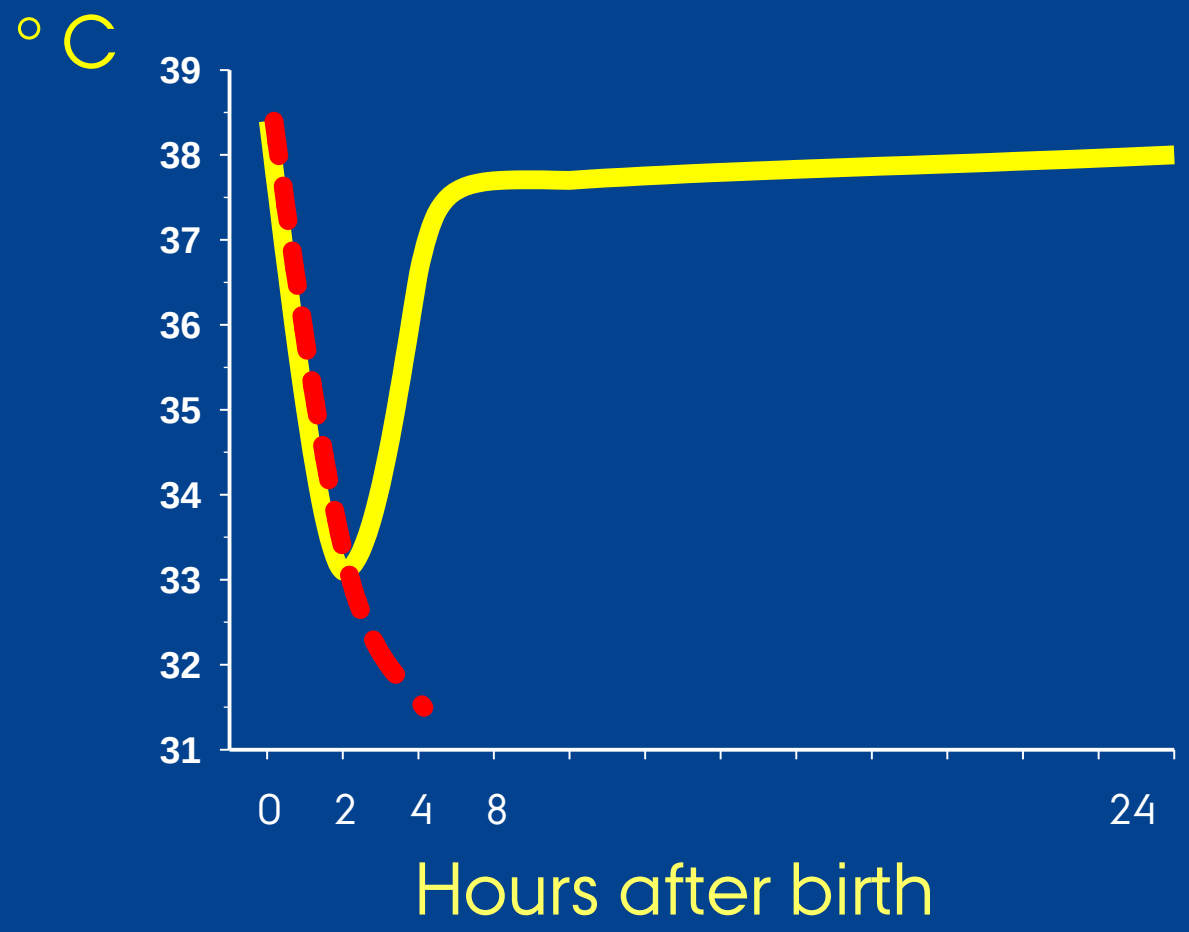
- Temperatures 18-23 °C recommended
  - -avoid thermal stress in sows
  - -optimize feed intake/lactation

- Neonate piglets' thermoneutral zone: ca. 34 °C

# Piglet rectal temperature



# Piglet rectal temperature



# Piglet-friendly thermal environment

In farrowing pens
-heated piglet area away from sow?

- Not used in early period
when the risk of hypothermia is high

- The piglets prefer to rest at the sow udder the first 2 days postpartum

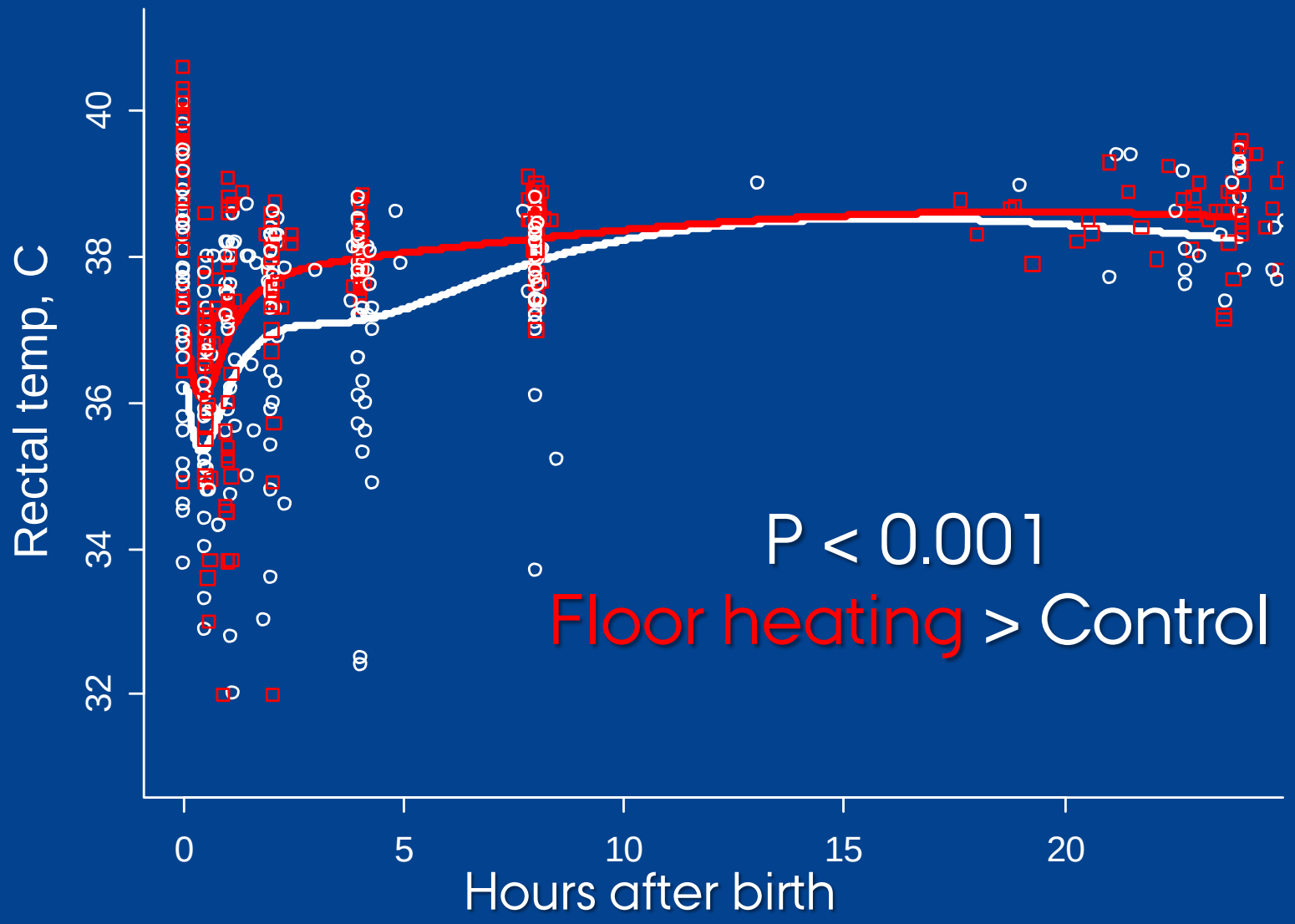
(Herpin et al., 2001; Hrupka et al., 2000; Houbak et al., 2006; Vasdal et al., 2010)

# Piglet-friendly thermal environment

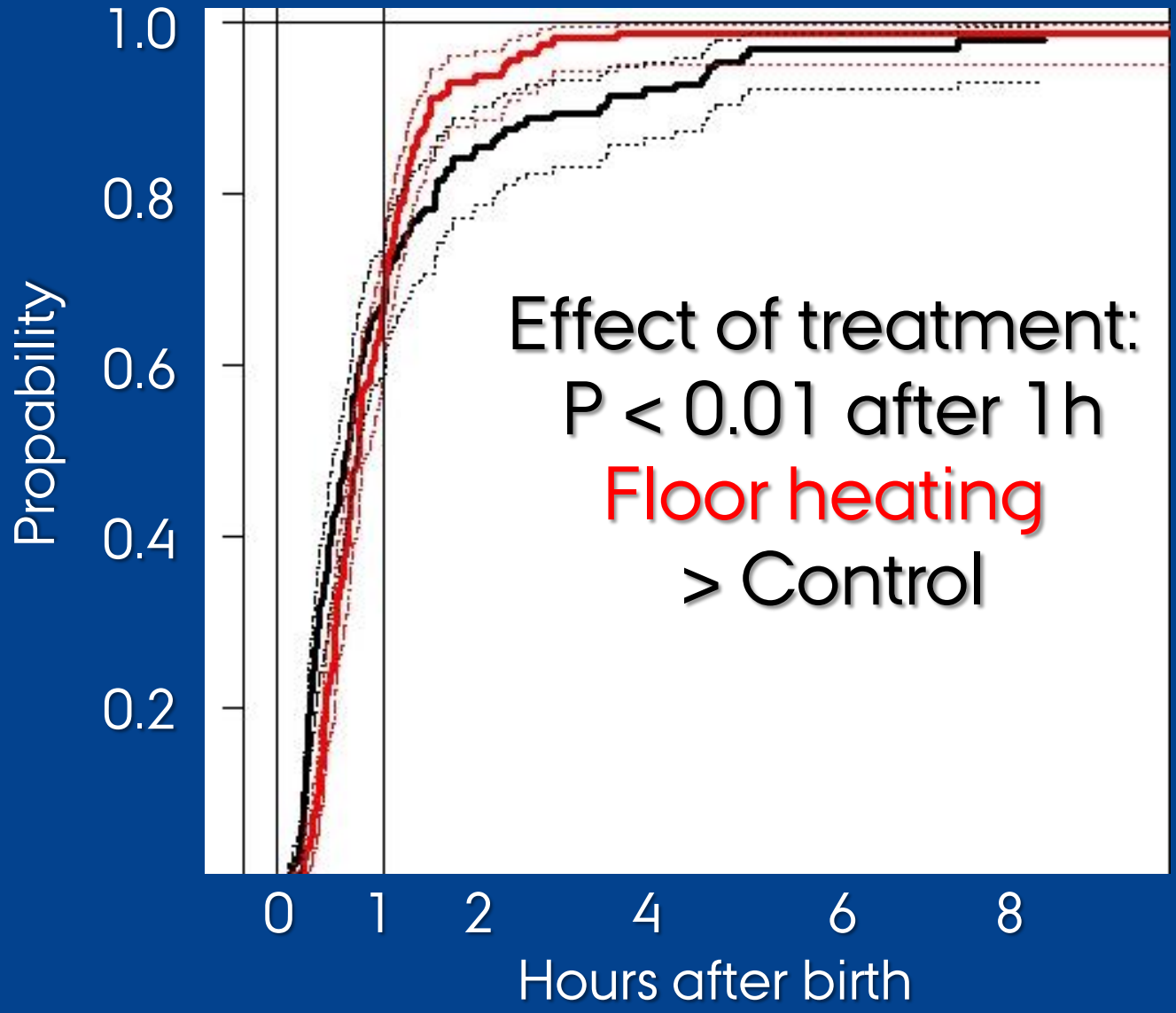
Pen floor heating?
33-34 °C at the time of birth

Study 1:
Malmkvist et al., 2006.
Appl. Anim. Behav. Sci. 99.

# Floor heating: piglet temperature



# Floor heating: Piglets' first suckling



# Piglet-friendly thermal environment

Pen floor heating
33-34 °C at the time of birth

- Favourable for piglets

-re-gaining normal rectal temperature
-quicker initiation of suckling
-increased survival of piglets (1.0 piglet/litter)

(Malmkvist et al., 2006)

# Piglet-friendly thermal environment

Pen floor heating
33-34 °C at the time of birth

- Piglets
  + production economics
  + animal welfare

- The farrowing sow?
  -recommended temp. 18-23 °C
  -floor heating as a stressor

# Floor heating: Effects on the farrowing sow

- Heat as an stressor

Cooling (17 °C) to sows in tropics:
Increase feed intake, reduce gestational weight loss, litter weight gain

(Silva et al., 2009)

Room temperatures at 25 °C or above:
Marked reduction in daily feed intake

(Quinou and Noblet, 1999)

# III. Preferences of farrowing sows

Sows chose 34-35 °C heated floor at delivery/first days postpartum

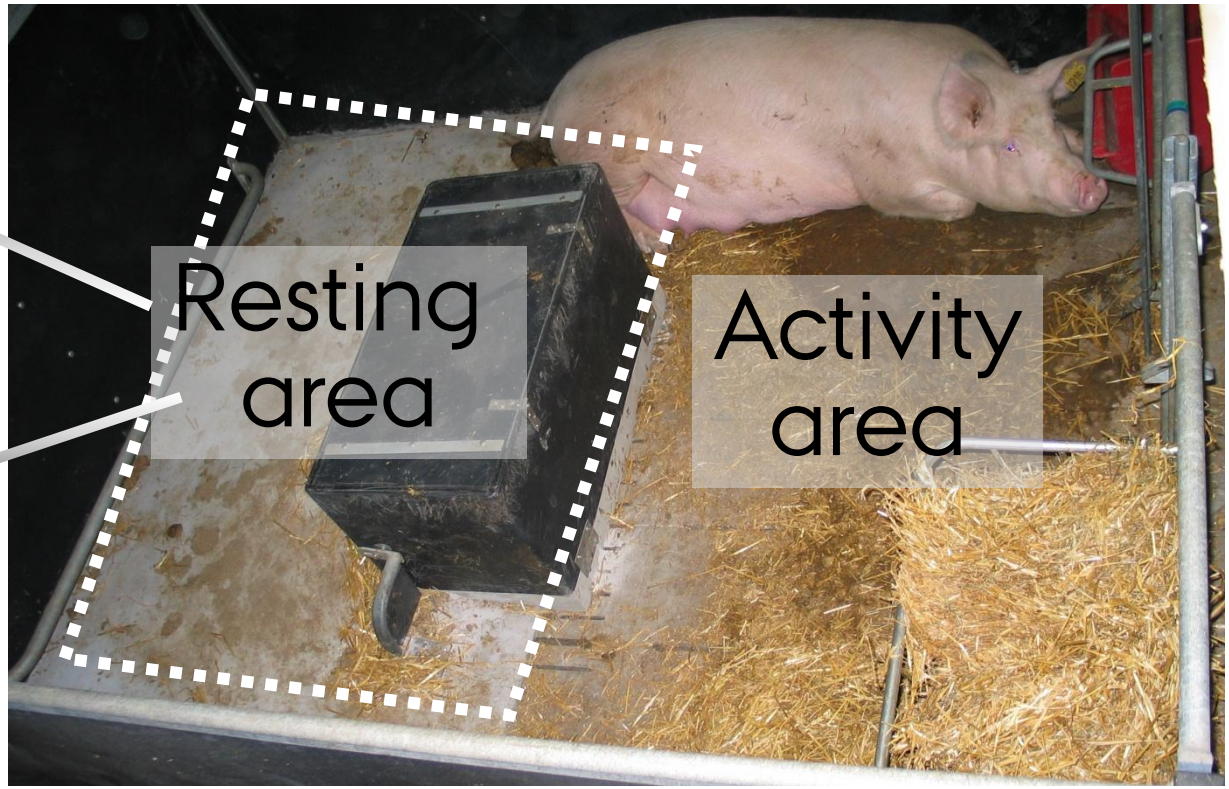
(Phillips et al., 2000)

Study 2:
Pedersen et al., 2007.
Appl. Anim. Behav. Sci. 103.

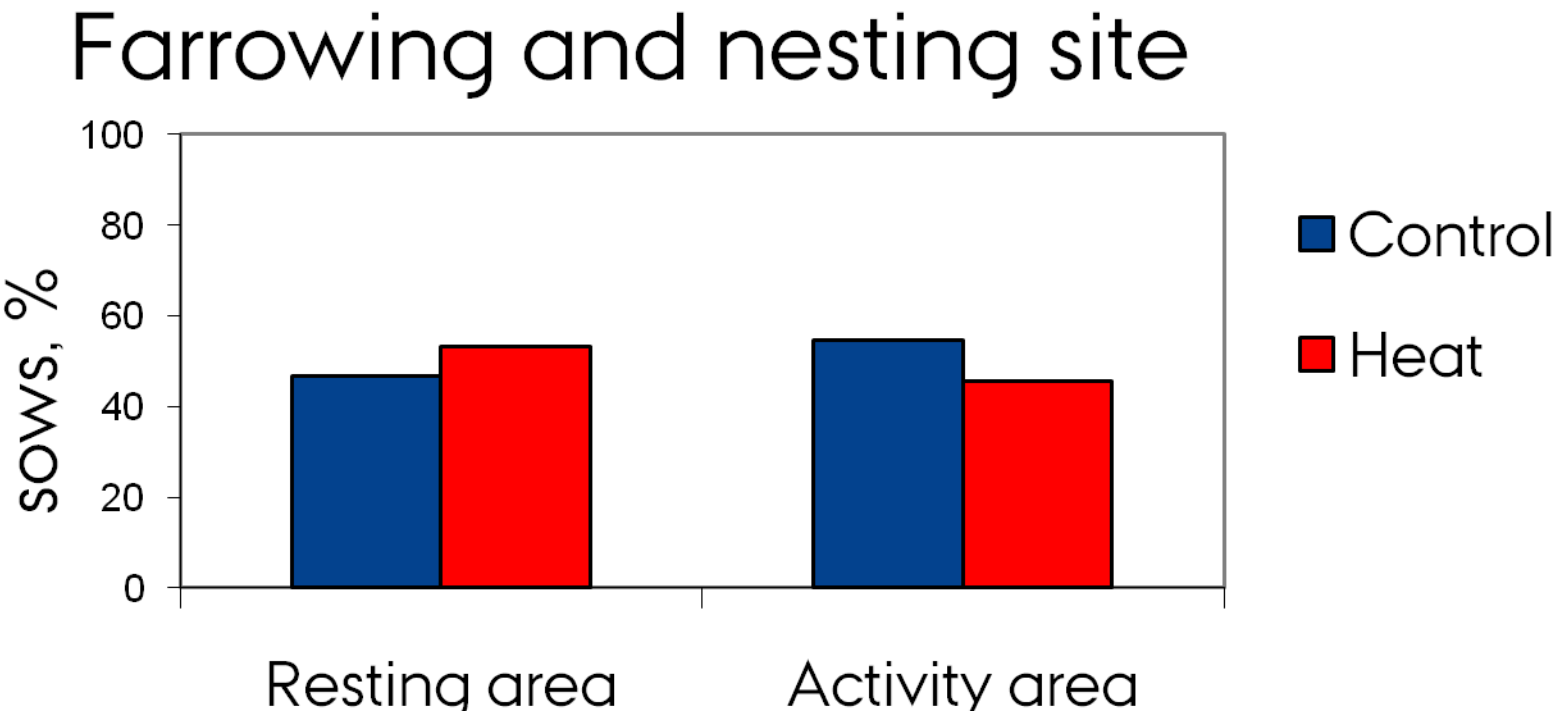
# Preferences of farrowing sows

Heat
34 °C, n = 13

Control
20 °C, n = 13



# Preferences of farrowing sows



# Preferences of farrowing sows

- No preference/avoidance around farrowing
- Piglets gradually increased the use of heated floor after 1-2 days postpartum; the sow followed

(Pedersen et al., 2007)

# IV. Floor heating:
# Effects on the farrowing sow

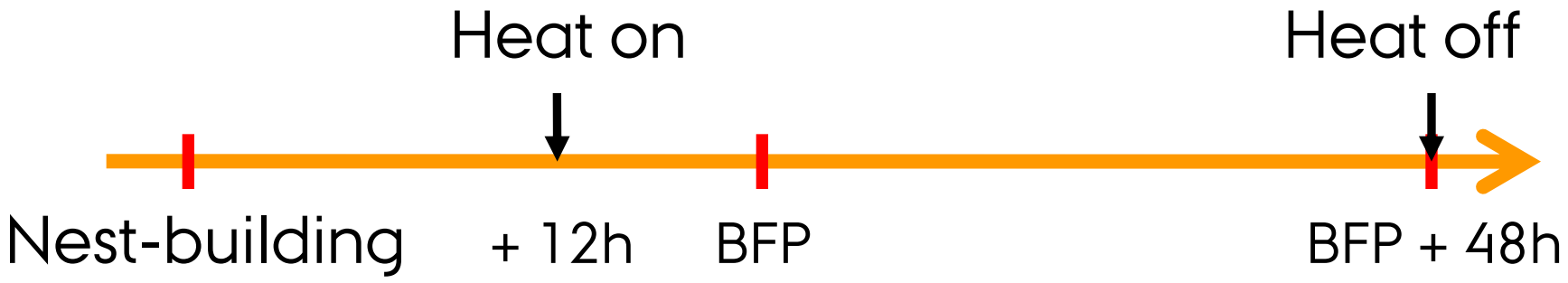
# IV. Floor heating:
# Effects on the farrowing sow

## a. Fully heated pen (study 3)

Study 3:
Malmkvist et al., 2009.
J. Anim. Sci. 87

# Floor heating:
# Effects on the farrowing sow

| | |
|---|---|
| Control (n = 14) | Unheated pen floor 21.1 ± 1.4 °C |
| Heated (n = 14) | Heated pen floor 33.5 ± 1.6 °C |




BFP: Birth of first piglet

2nd parity LY sows (n = 28)
Room temperature: 21.2 ± 0.8 °C
Relative humidity: 47.6 ± 8.1 %

# Floor heating:
# Effects on the farrowing sow

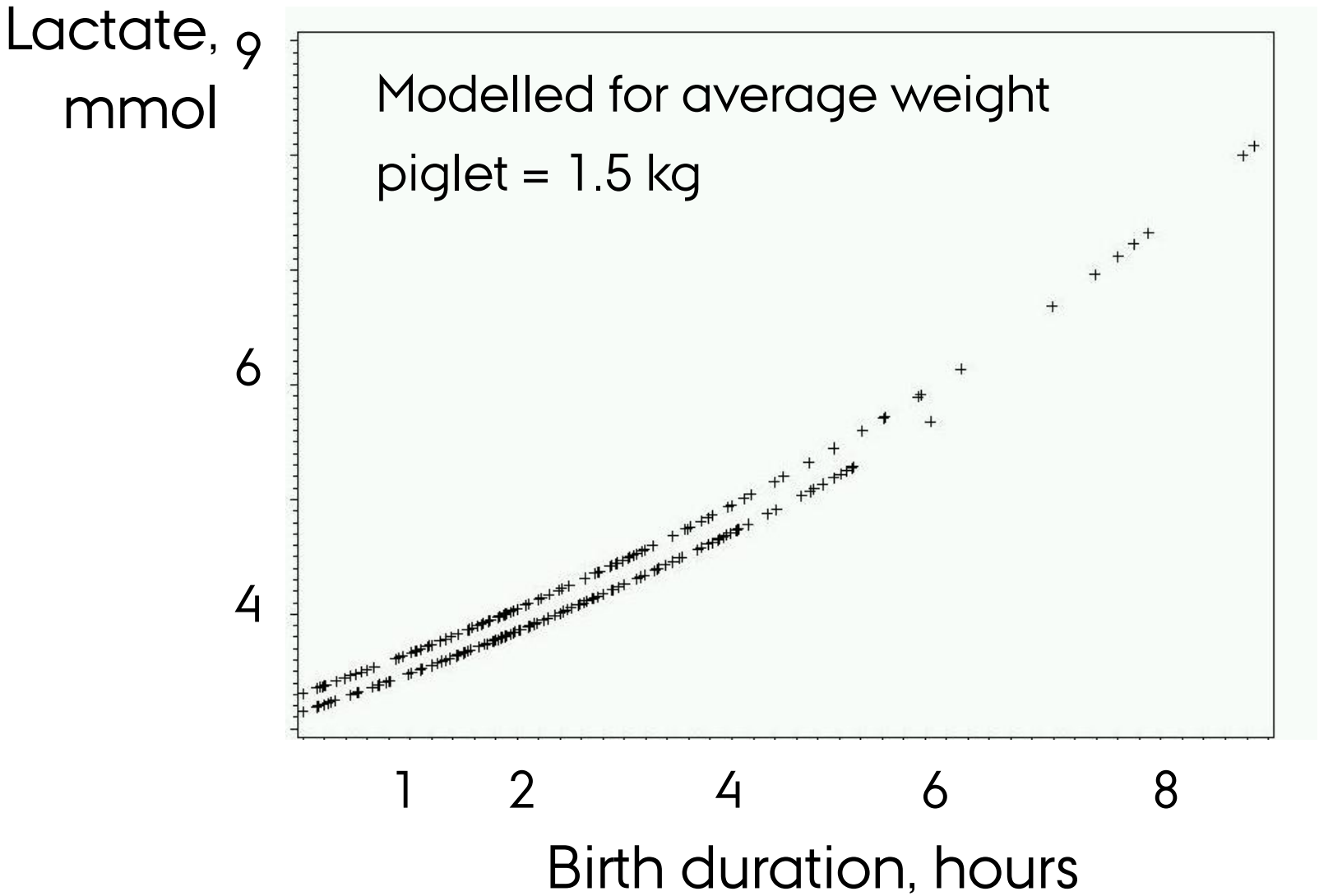
N.S. treatment effects on

- Sow behaviuor
- Duration of farrowing
- Interval between piglets
- Number of piglets at birth
  (liveborn 15-16, 10 % stillborn)
- Piglet weight gain

# Floor heating:
# Effects on the farrowing sow

- Lactate in umbilical cord: indicator of hypoxia

# Floor heating:
# Effects on the farrowing sow



# Floor heating:
# Effects on the farrowing sow

- Lactate in umbilical cord: indicator of hypoxia

  N.S. treatment effect (P = 0.57)

  Heated: 4.6 (0.23) vs. Control: 4.9 (0.23)

- No farrowing problems induced by heated floor around farrowing

(Malmkvist et al., 2006)

# Floor heating:
# Effects on the farrowing sow


- Immunological stress indicators:

Daily, gestation day 110 until 6 days after farrowing

N.S. treatment effects

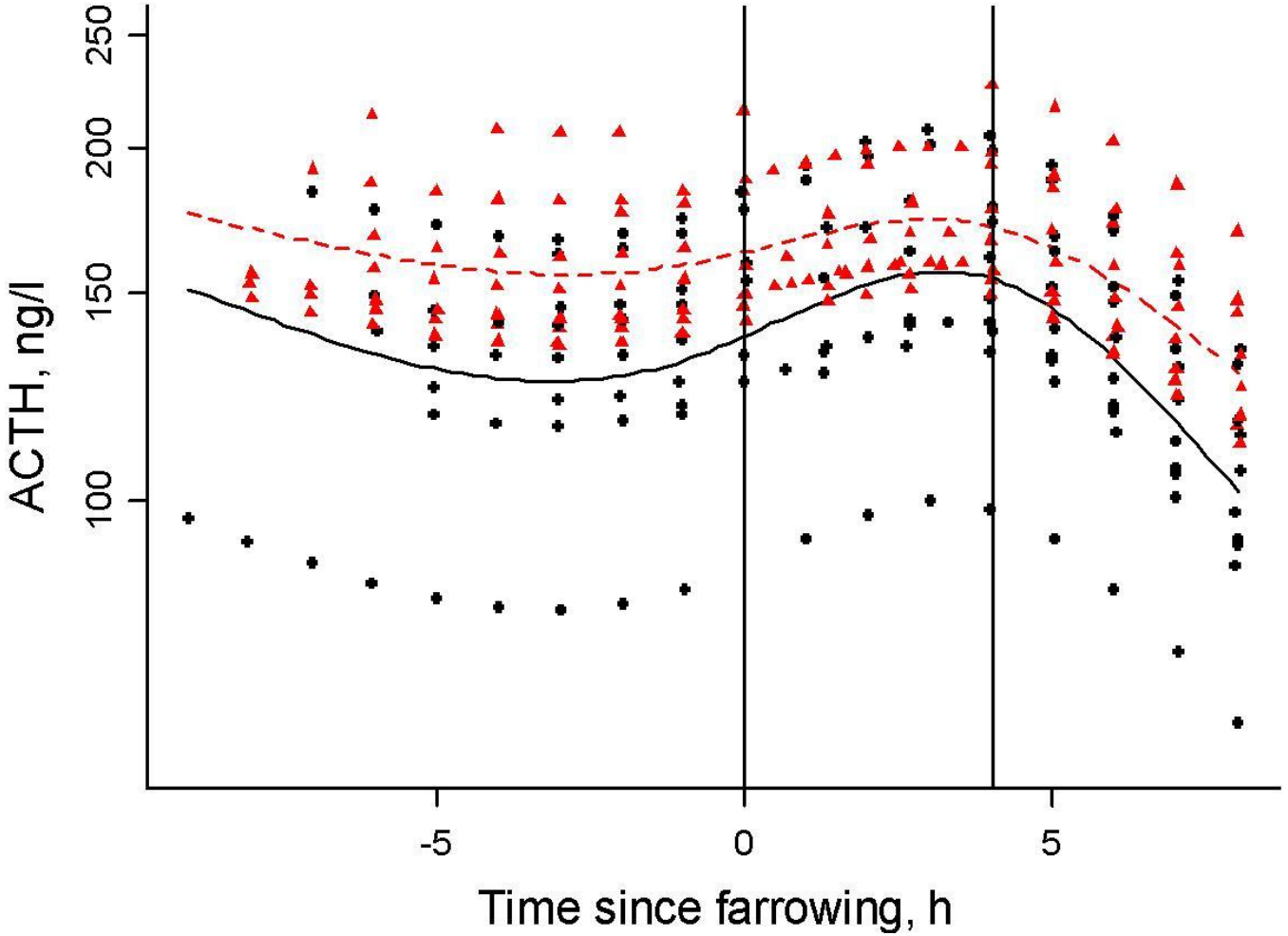
Damgaard et al., 2009. Res. Vet. Sci. 86.


- ACTH, Cortisol, and Oxytocin: hourly,

-8 to + 24 h relative birth of first piglet

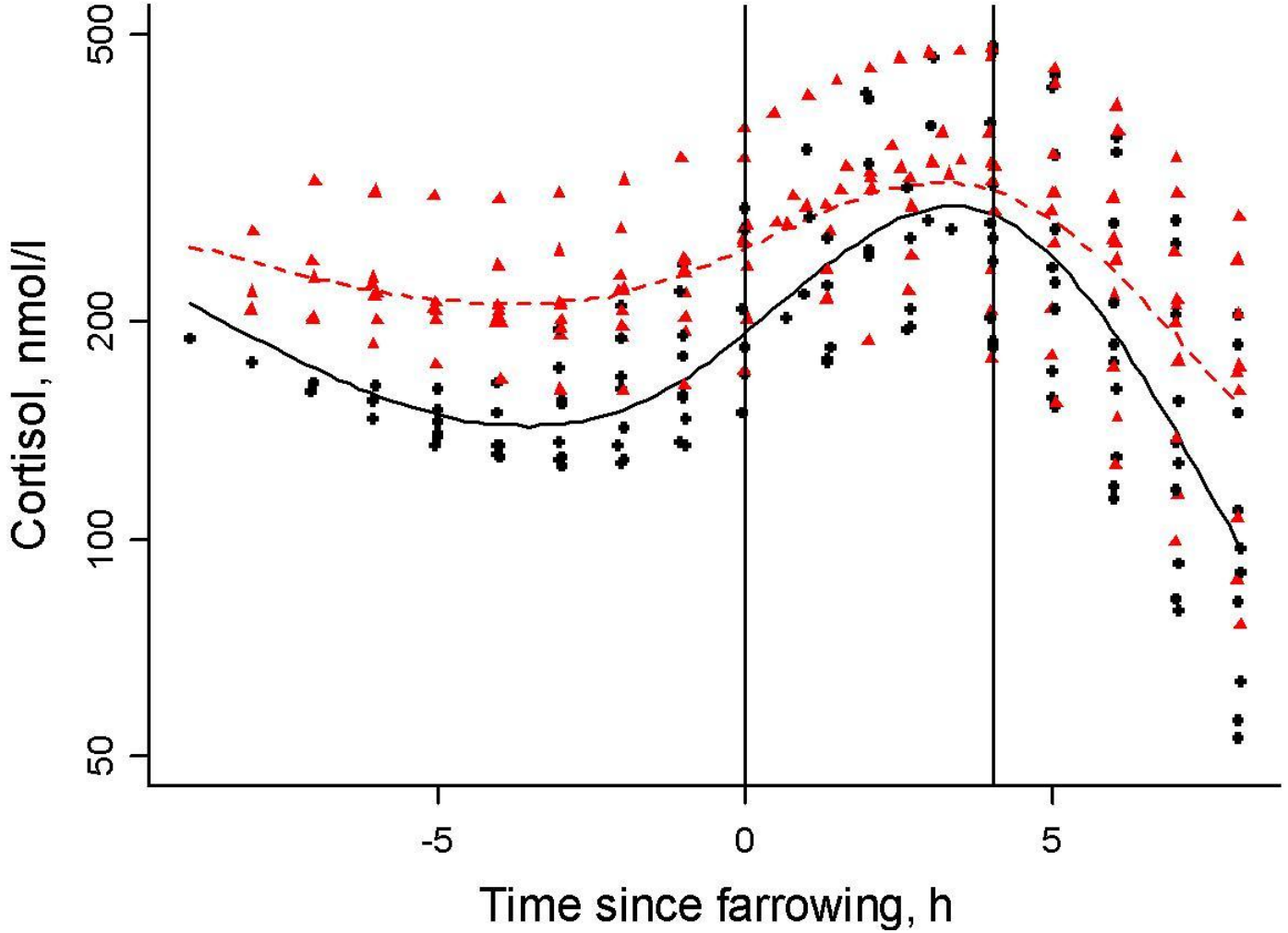
(study 3: Malmkvist et al., 2009)

# Floor heating:
# Effects on the farrowing sow



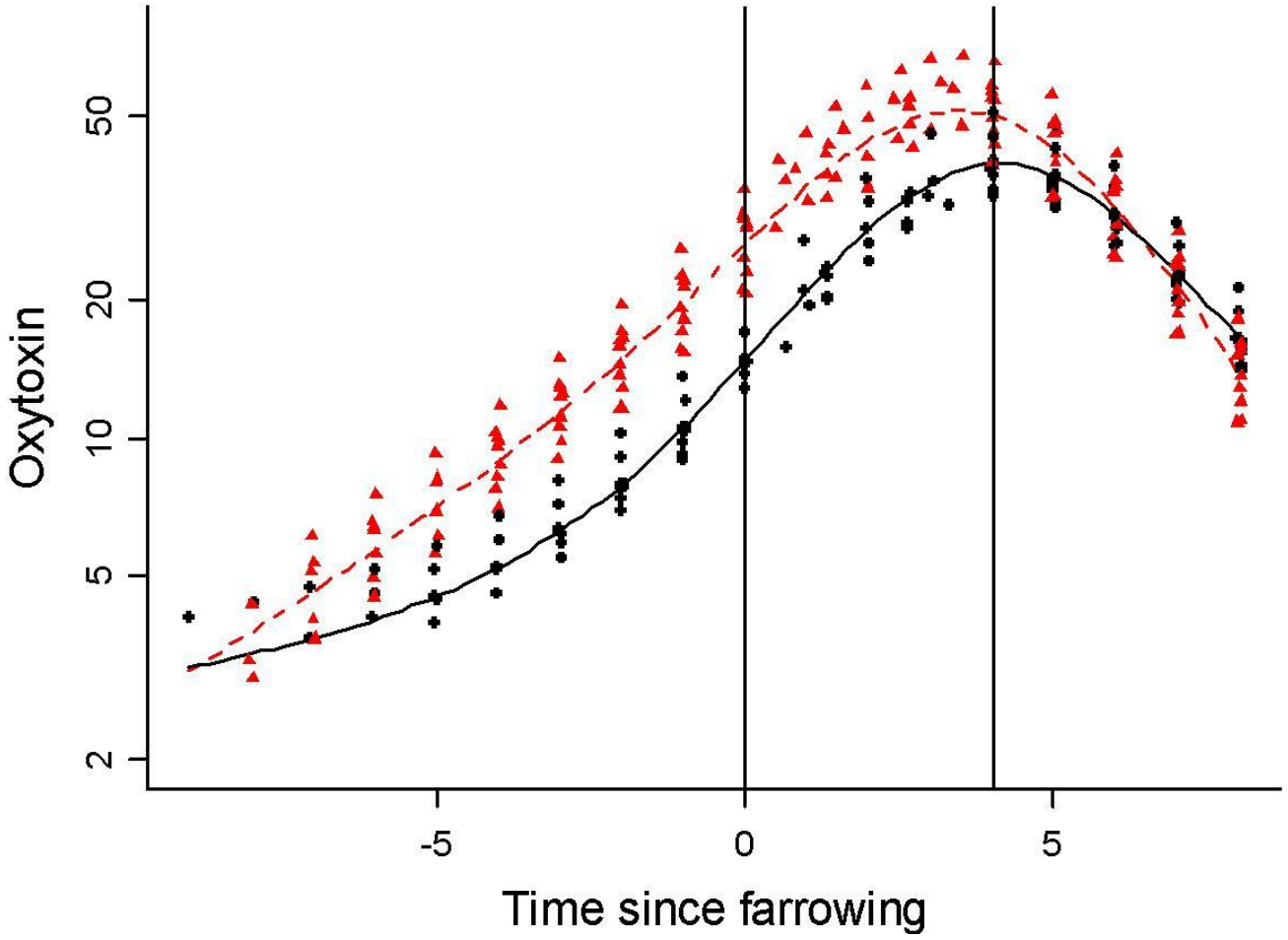

- Trend heated > control (P = 0.08)

# Floor heating:
# Effects on the farrowing sow




- Heated > control, P = 0.02

# Floor heating:
# Effects on the farrowing sow




- N.S. treatment effect (P = 0.6)

# Floor heating:
# Effects on the farrowing sow

- Floor heating (33.5 °C): acute stressor for sows around farrowing

-elevated HPA-axis hormones

-no concurrent changes in plasma oxytocin, farrowing problems or sow behaviuor

(Malmkvist et al., 2009)

# Floor heating:
# Effects on the farrowing sow

- Positive

- Stressor

Tested at room temperature 21°C
Fully heated floor = inescapable

# Floor heating:
# Effects on the farrowing sow

# IV. Floor heating:
# Effects on the farrowing sow

Heated pen with colder zones, 15-25 °C (study 4)

Study 4:

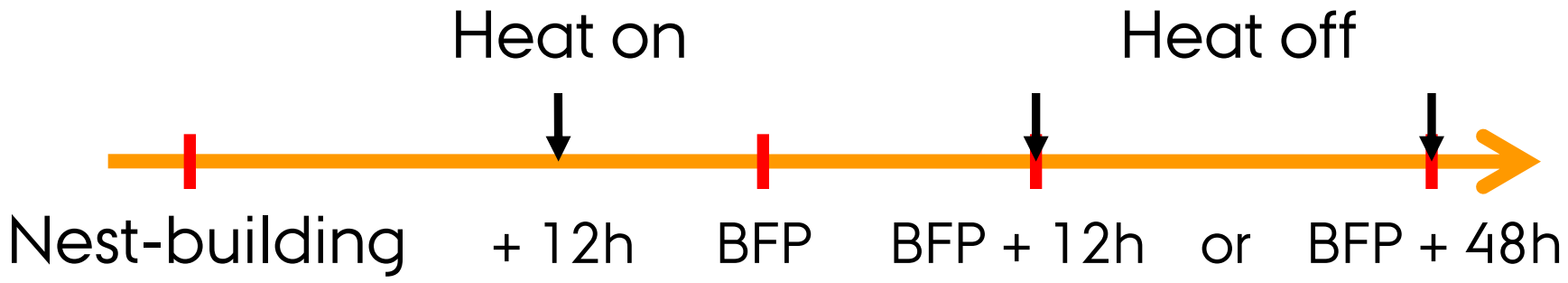
Malmkvist et al., under review

# Floor heating:
# Effects on the farrowing sow

Room temperature 15, 20, 25 °C (n = 72 sows)

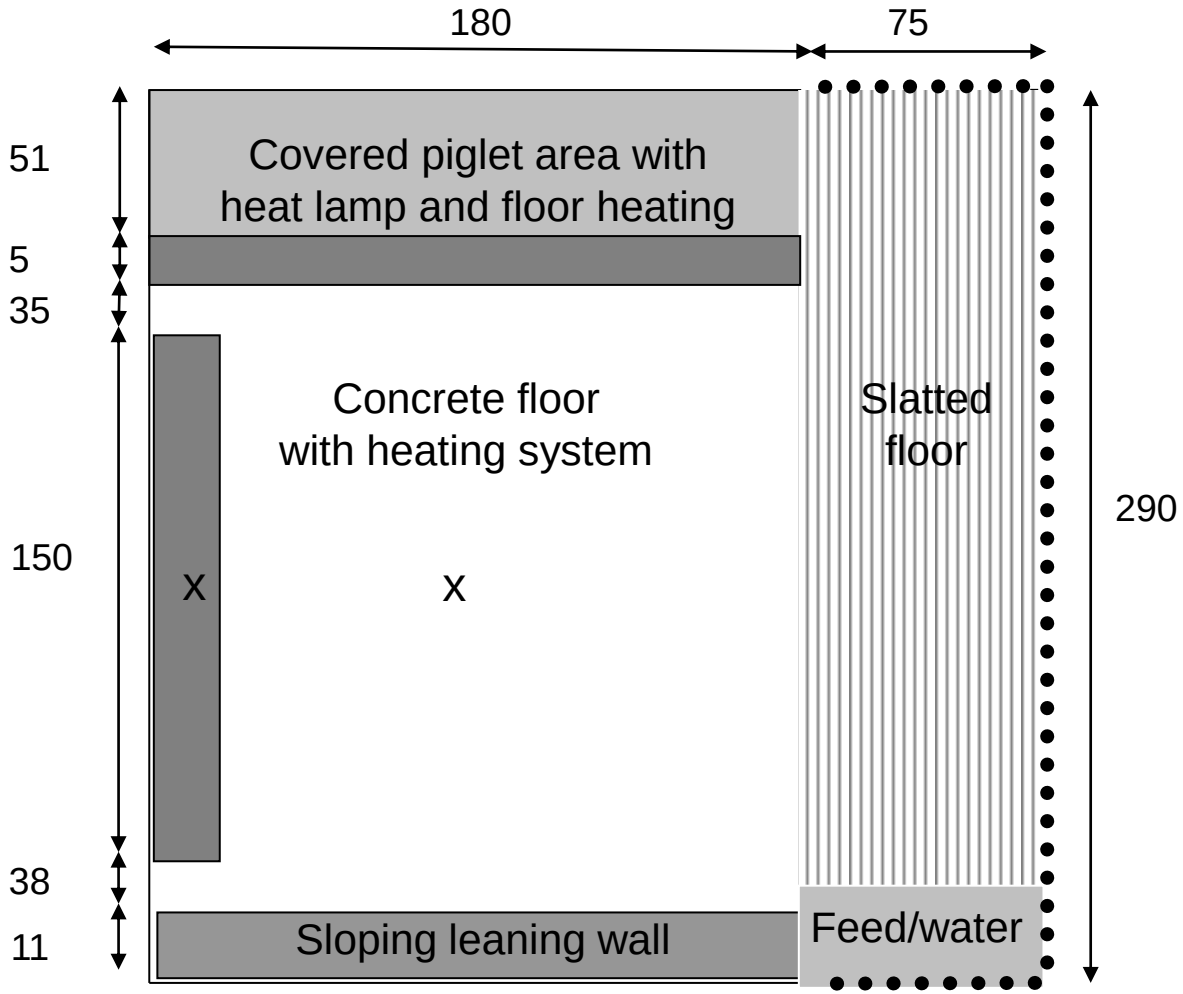
Heated floor + unheated slatted pen floor

35 °C (equilibrium with room temp.)



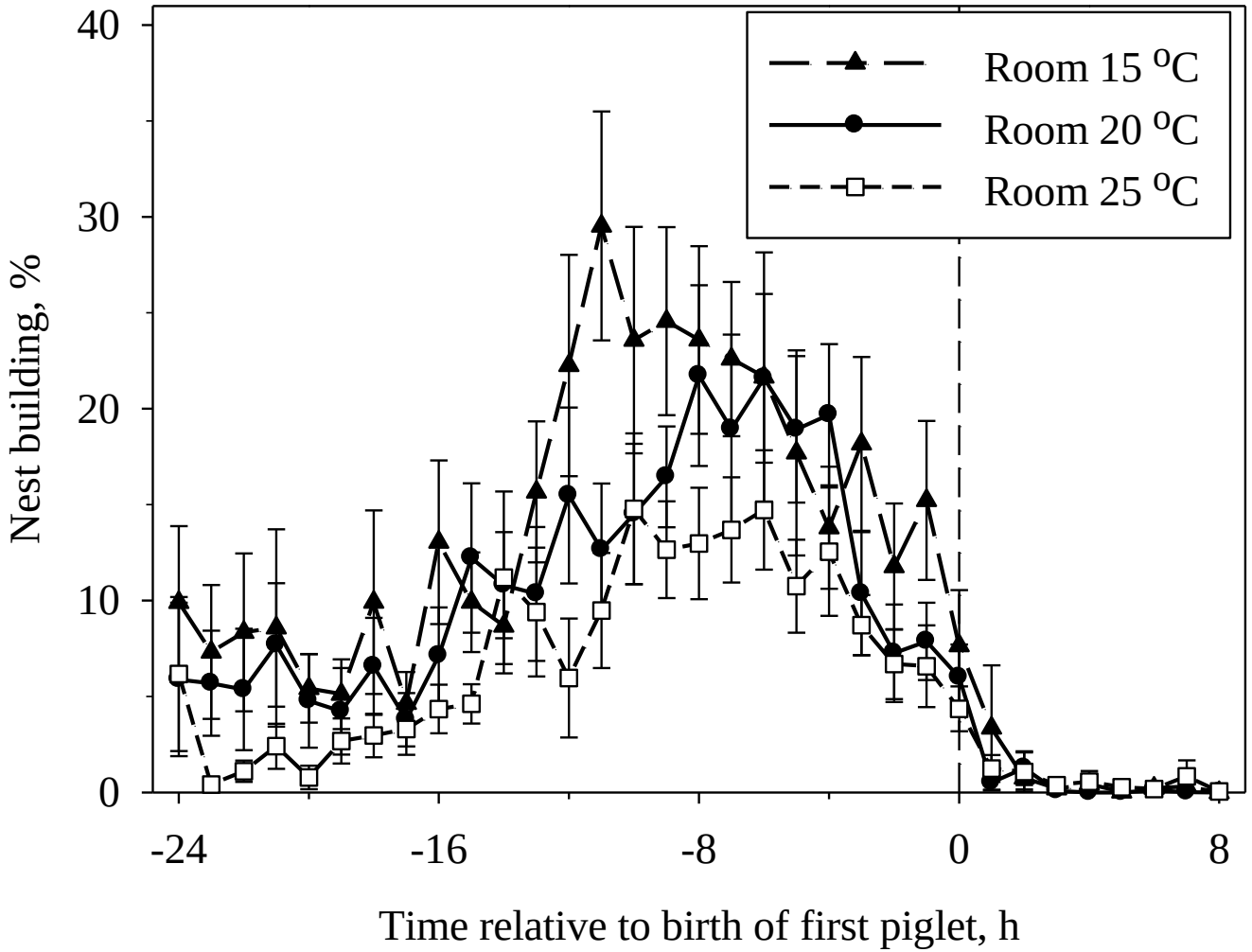

BFP: Birth of first piglet

# Floor heating:
# Effects on the farrowing sow



# Floor heating:
# Effects on the farrowing sow

Nest-building behaviour  15 > 20, 25 °C, P = 0.015



# Floor heating:
# Effects on the farrowing sow

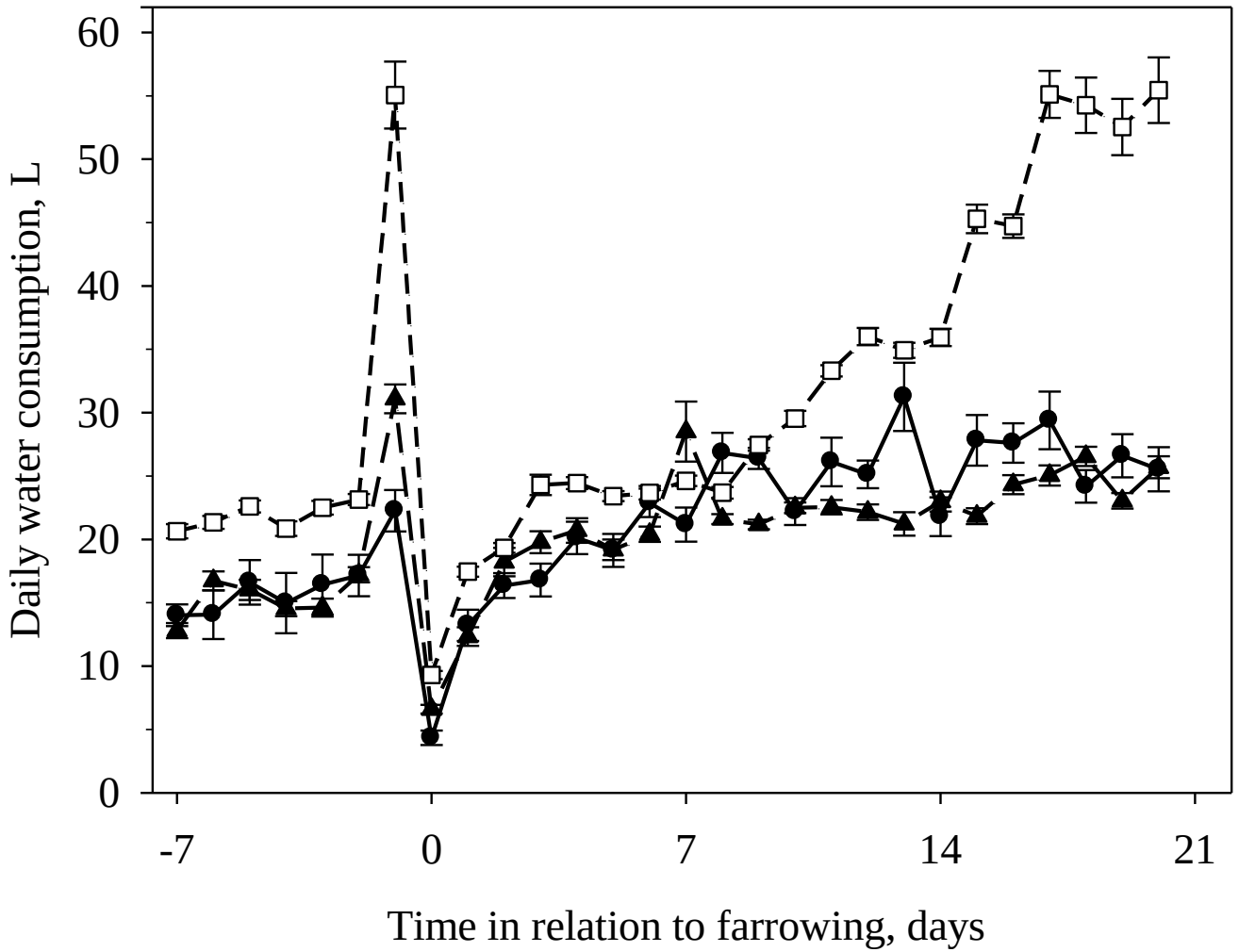
No treatment effects on

- duration of parturition
- interbirth-intervals
- umbilical cord lactate

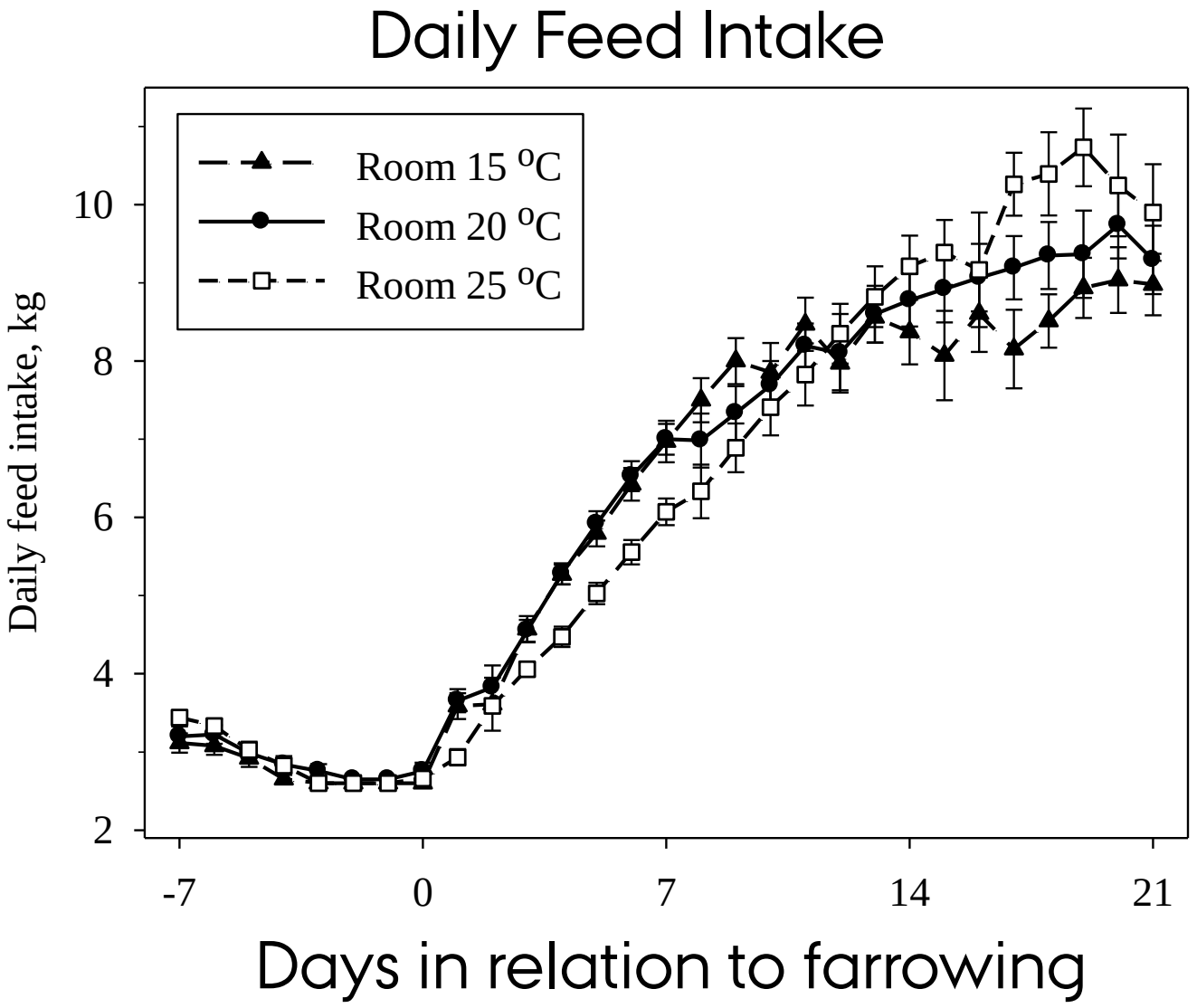
- litter size until weaning
- development in body weight in sow/litter

# Floor heating:
# Effects on the farrowing sow

Daily water consumption 25 >15, 20 °C, P < 0.001

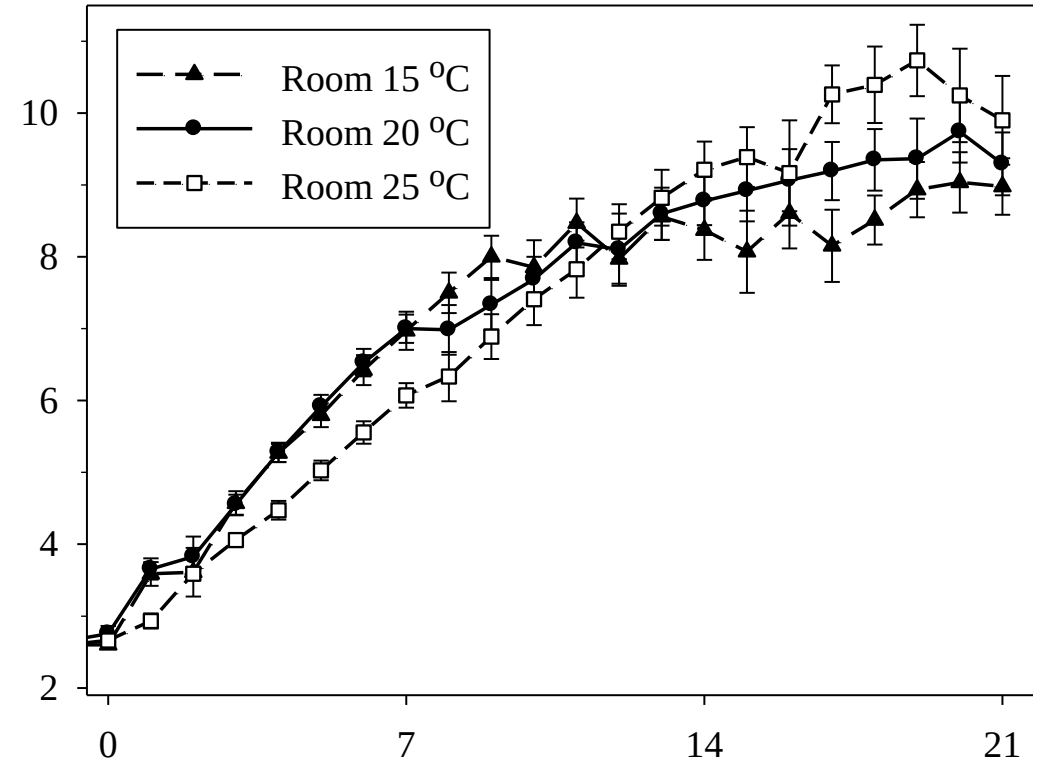


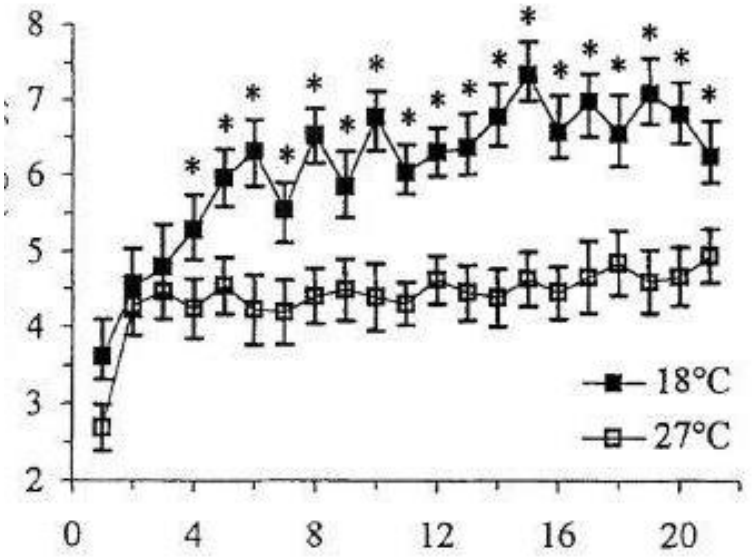
# Floor heating:
# Effects on the farrowing sow



# Effects of temperature on the farrowing sow

Daily Feed Intake, kg




Prunier et al., 1997

Livest. Prod. Sci. 52

Weaned per litter: 10 piglets

9 piglets

# Effects on temperature on the farrowing sow

## Prunier et al. ,1997

-voluntary feed intake stagnate at 4 days at 27 °C

-higher gestational weight loss at 27 °C

-suggested strategy to reduce heat production

Crated

## Present study:

-total feed intake the same at 15, 20 and 25 °C

-no gestational weight loss across temperature

-sows appear more heat tolerable

Loose housed

# Effects of housing system on feed intake and production

Danish herd study

Loose-housed (n=284) vs. crated sows (n = 288)

Loose-housed: Sow feed-intake higher

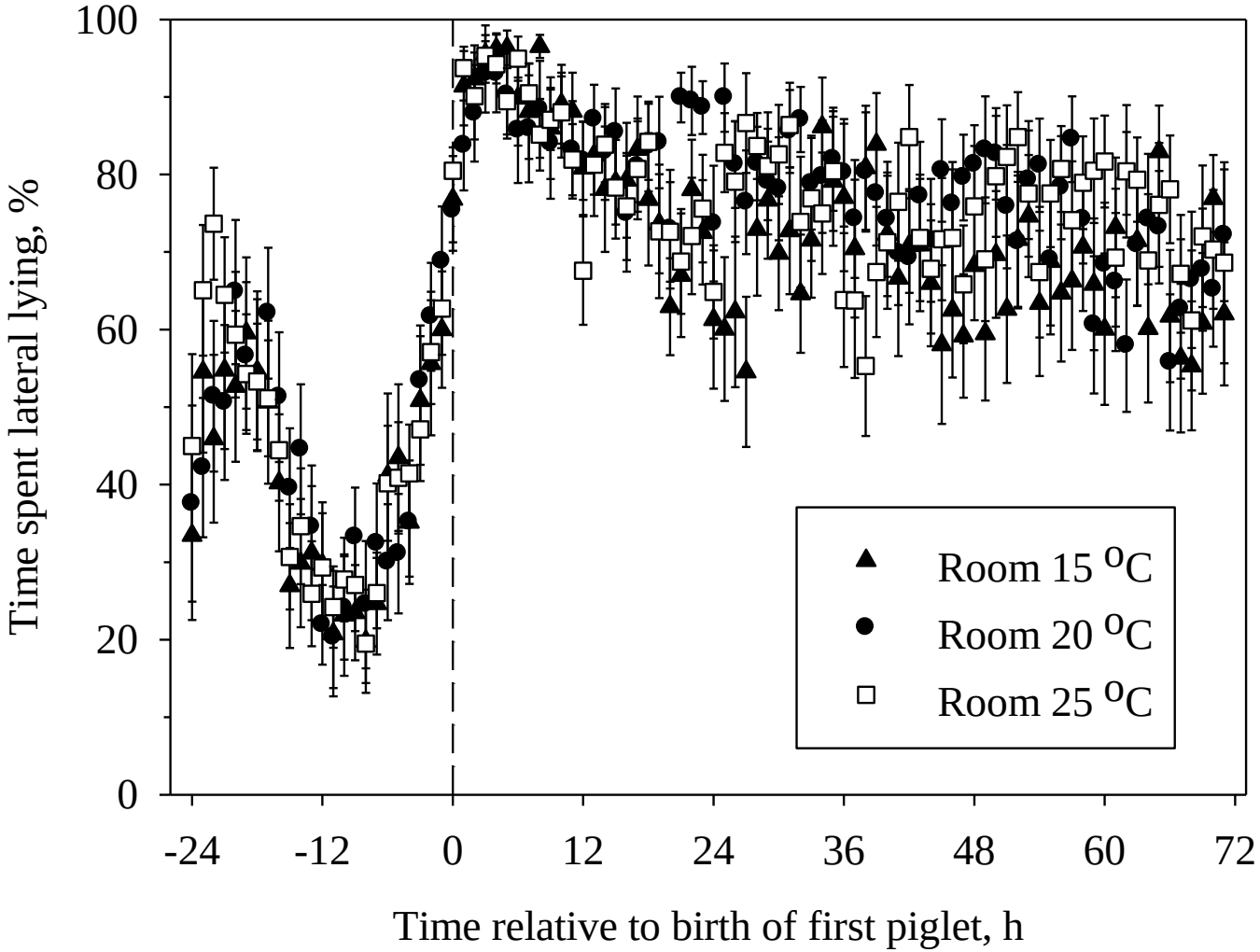
Loose housed: Piglet weaning weight increased (+4%)

No difference in weaned piglets (10.4/litter) or weaning age 24 days

(Moustsen and Poulsen, 2004)

# Floor heating:
# Effects on the farrowing sow

Time spent lying laterally NS. effect



# Floor heating:
# Effects on the farrowing sow

## Slatted floor use when lying  P < 0.005

| | 15 °C | | 20 °C | | 25 °C |
|---|---|---|---|---|---|
| -24 h to + 12h: | 13 % | < | 27 % | < | 32 % |
| +13 h to 48 h: | 6 % | < | 21 % | < | 38 % |
| +49 h to 72 h: | 6 % | = | 13 % | < | 29 % |

- Thermoregulatory behaviour

# Floor heating:
# Effects on the farrowing sow

- Unheated slatted used for lying increase with increasing temperature

- Farrowing and nesting site?

on heated solid floor

| | | |
|---|---|---|
| 15 °C: | 82 % | |
| 20 °C: | 93 % | |
| 25 °C: | 95% | N.S. difference |

# Floor heating:
# Effects on the farrowing sow

- Positive

- Succesfull thermoregulation

Tested at room temperature 15-25°C, floor heating 34 °C around farrowing. Partly heated floor = colder pen zones

# V. Conclusion

- Floor heating:

Favourable for neonate piglets born in indoor stables at 20 °C
(piglets close to sow day 0-2)

- No sow avoidance/preference at farrowing.

Day 1-2 postpartum: sow lying more on heated floor

# V. Conclusion

- Inescapble floor heating around farrowing = thermal stressor

- Behavioural thermoregulation: high thermal tolerance in sows tested at room temperatures15-25 °C

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# Thank you for your attention!

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