

Using sensor technologies to quantify rumination: development of reference standards and validation for animal welfare and health recording



1982 - 2026



Association



REFERENCE



Prediction

Celien Kemel, Christa Egger-Danner, Ilka Klaas, Luiz F. Brito, Katharina Schodl, Jeffrey M. Bewley, Victor E. Cabrera, Marie J. Haskell, Michael Iwersen, Bjorg Heringstad, Katharina F. Stock, Anna Stygar, Robert Fourdraine, Nicolas Gengler, Elsa Vasseur, Miel Hostens



Associate Prof. Dr. DVM Miel Hostens
Robert and Anne Everett Endowed Associate
Professor of Digital Dairy Management
and Data Analytics

**Insights on the use of sensors technology
to monitor transition success in high
yielding dairy cows**



Real world evidence for transition behaviour



PLOS ONE

OPEN ACCESS PEER-REVIEWED

RESEARCH ARTICLE

Sensor based time budgets in commercial Dutch dairy herds vary over lactation cycles and within 24 hours

P. R. Hut , S. E. M. Kulper, M. Nielen, J. H. J. L. Hulsen, E. N. Stassen, M. M. Hostens



Materials and methods

- 8 herds in NL
- Nedap Smarttag Neck sensors
- Nedap Smarttag Leg sensors
- 40+ undergraduate and graduate students
- 4 PhD studenten
- Intense transition monitoring
 - Ca around day of calving
 - BHB postpartum
 - Locomotion scoring pre and post partum
 - BCS scoring
 - Metritis scoring
 - ...

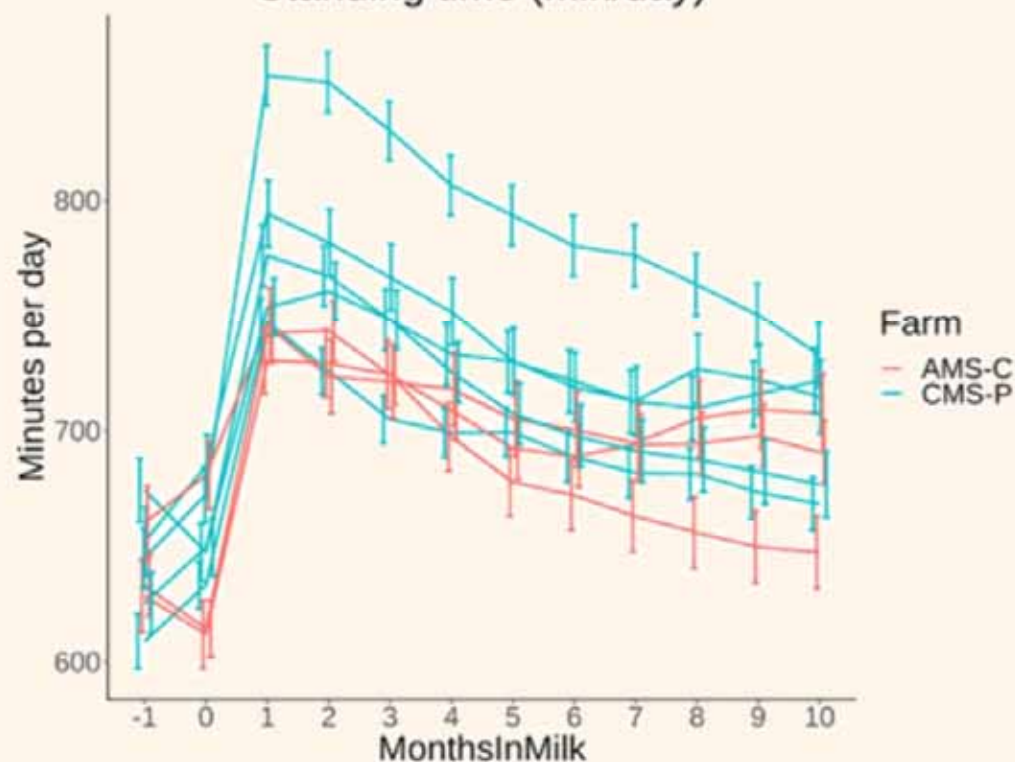


Results - time budget

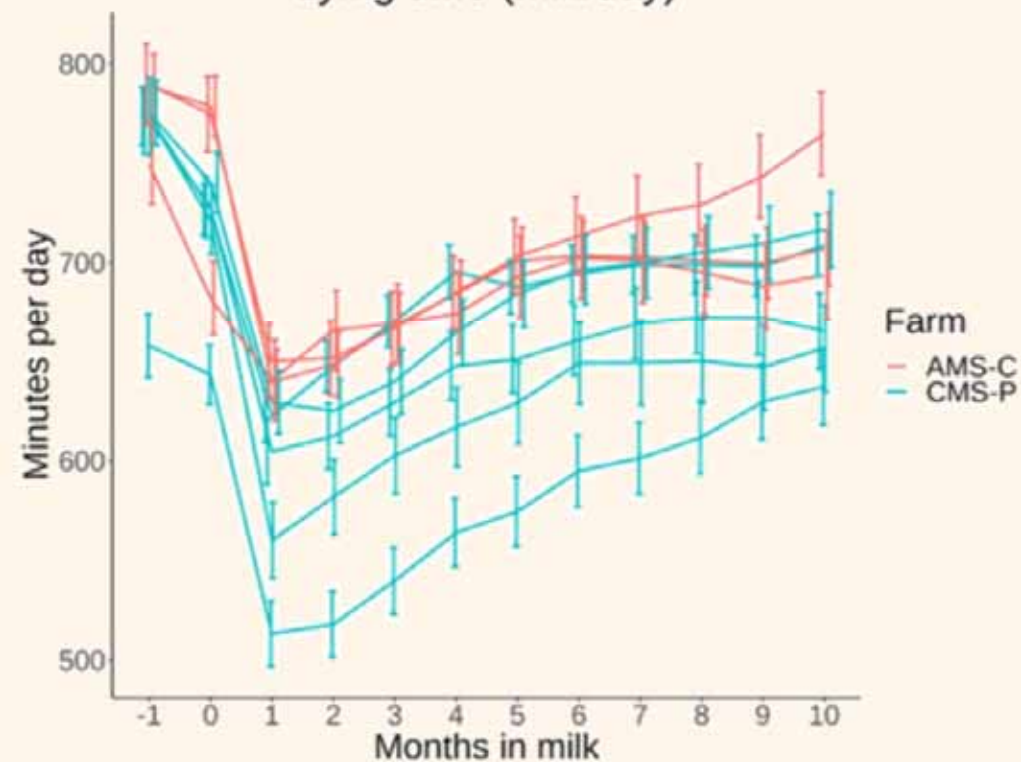


Large differences between herds

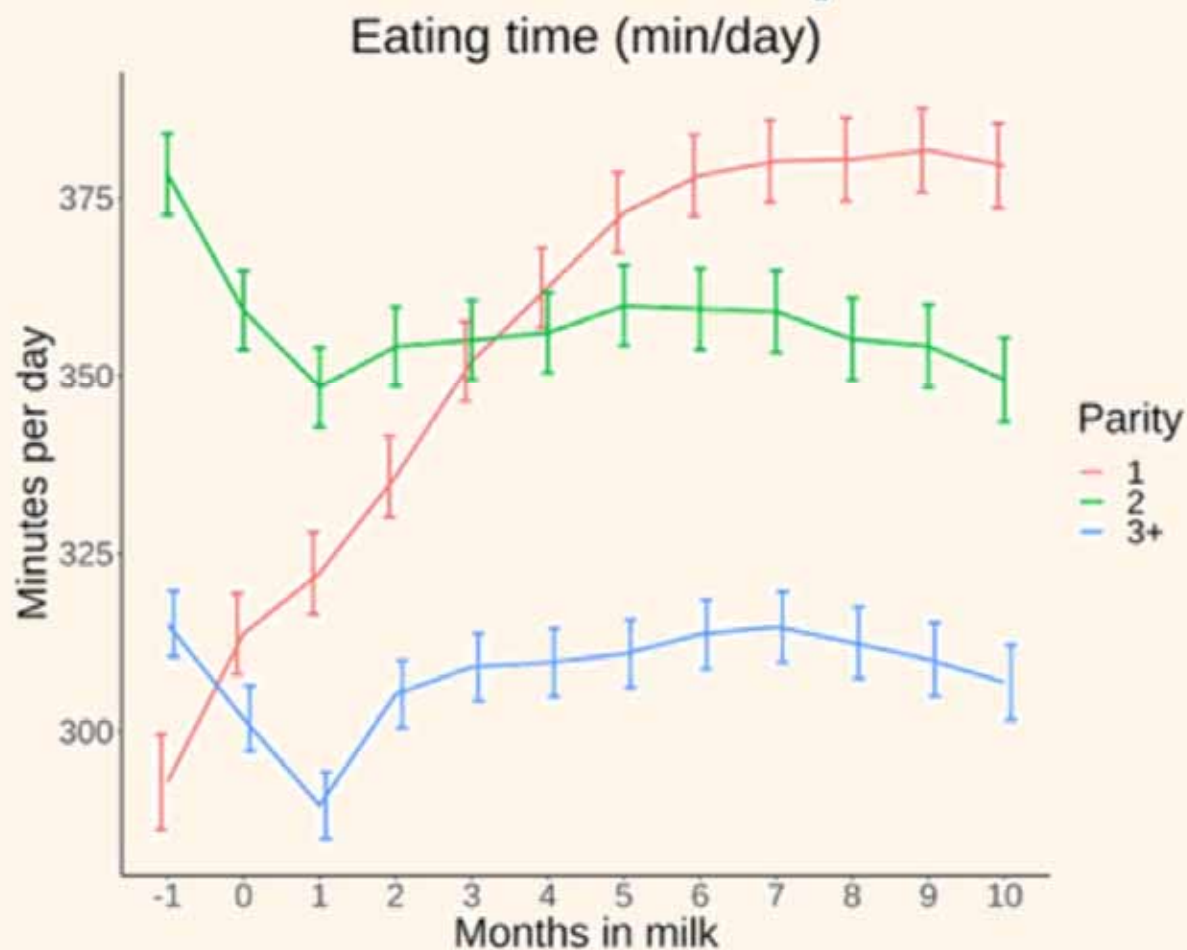
Standing time (min/day)



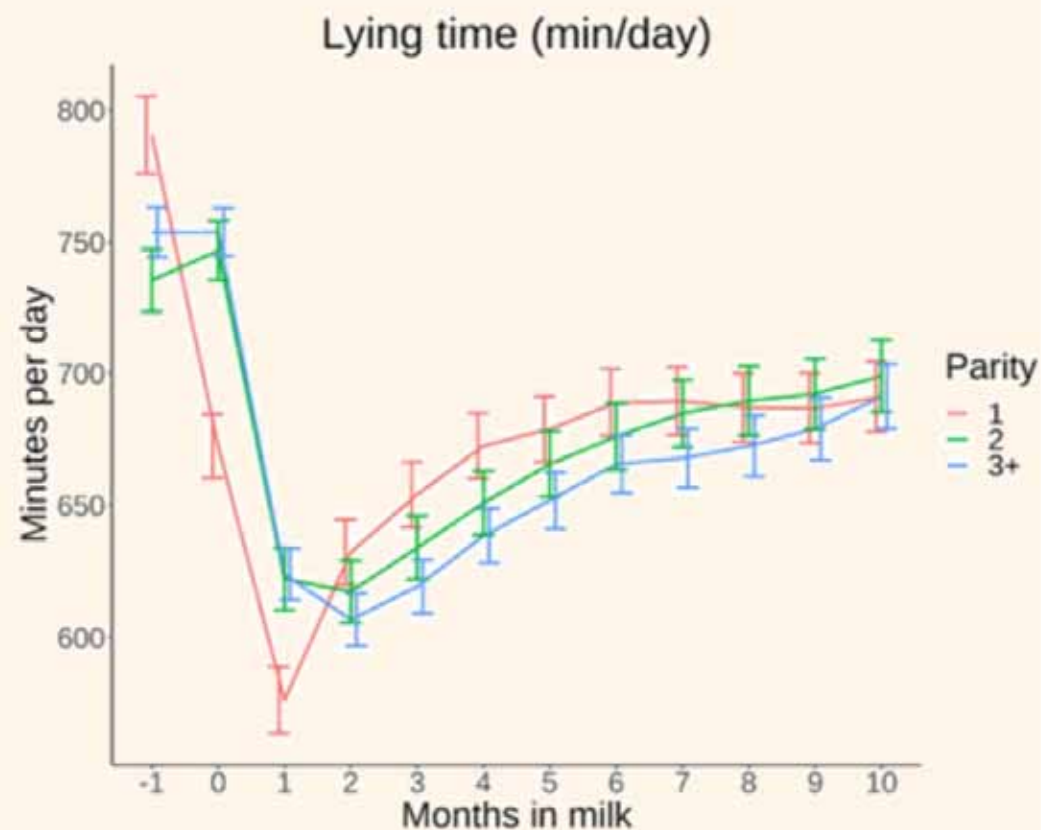
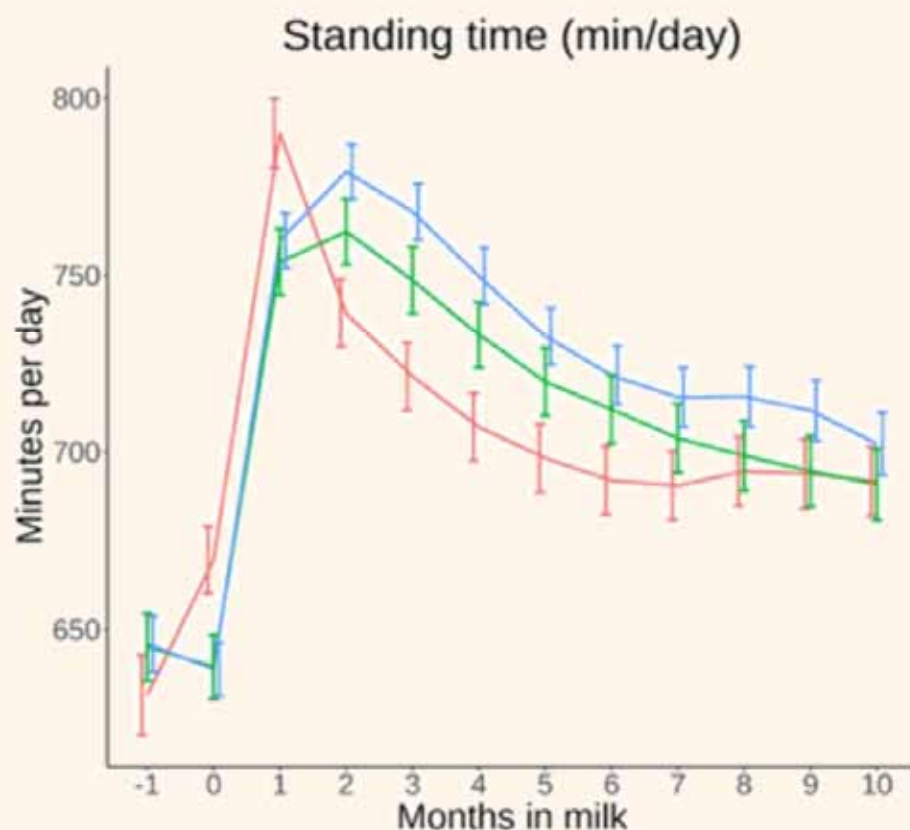
Lying time (min/day)



Results - difference between parities



Results - difference between parities



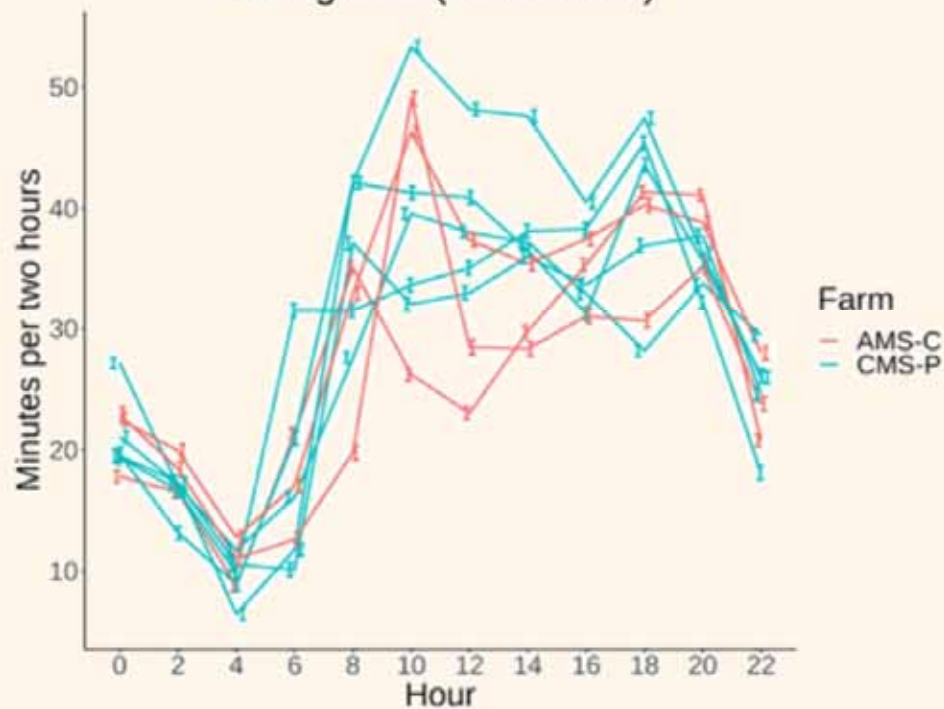
Diurnal differences

Primiparous and multiparous cows were almost synchronized completely throughout the day

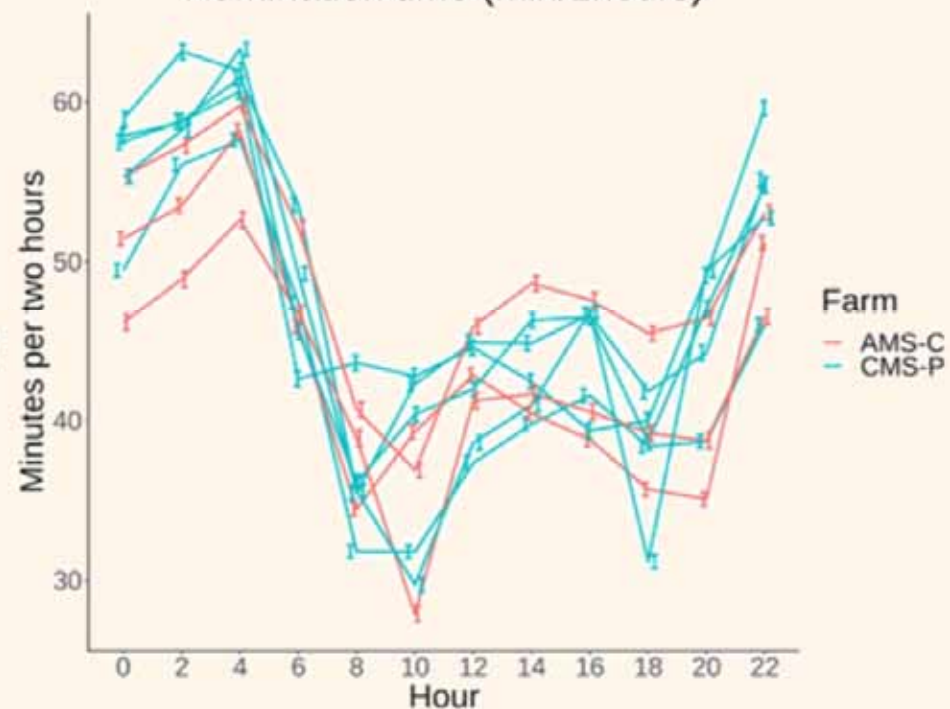


Diurnal differences

Eating time (min/2hours)



Rumination time (min/2hours)



Association between behavior and ...

- milk residuals (C. Kemel)
- heat stress (J. Scheurwater)
- lameness (P. Hut)

in high yielding dairy cows



J. Dairy Sci. 108:8859–8876

<https://doi.org/10.3168/jds.2024-26134>

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Association of artificial intelligence–predicted milk yield residuals to behavioral patterns and transition success in multiparous dairy cows

C. Kemel,^{1*} M. Salamone,^{1,2†} B. Aernouts,² I. Adriaens,² G. Opsomer,¹ P. Hut,³ and M. Hostens^{4,5}

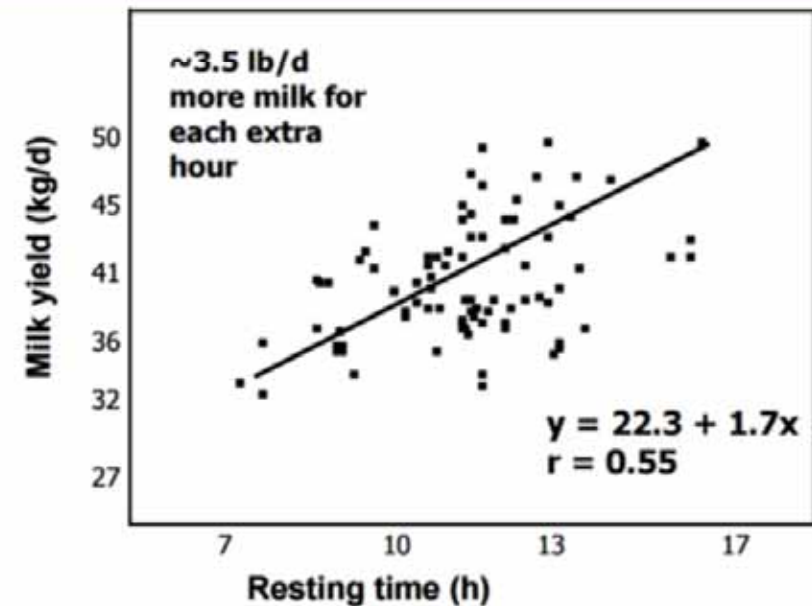
¹Department of Internal Medicine, Reproduction, and Population Medicine, Faculty of Veterinary Medicine, Ghent University, 9820 Merelbeke, Belgium

²Department of Biosystems, Division of Animal and Human Health Engineering, KU Leuven, Campus Geel, 2440 Geel, Belgium

³Department of Population Health Sciences, Division Farm Animal Health, Faculty of Veterinary Medicine, Utrecht University, 3508 TD Utrecht, the Netherlands

⁴College of Agriculture and Life Sciences, Cornell University, Ithaca, NY 14850

⁵Department of Animal Sciences and Aquatic Ecology, Faculty of Bioscience Engineering, Ghent University, 9000 Ghent, Belgium





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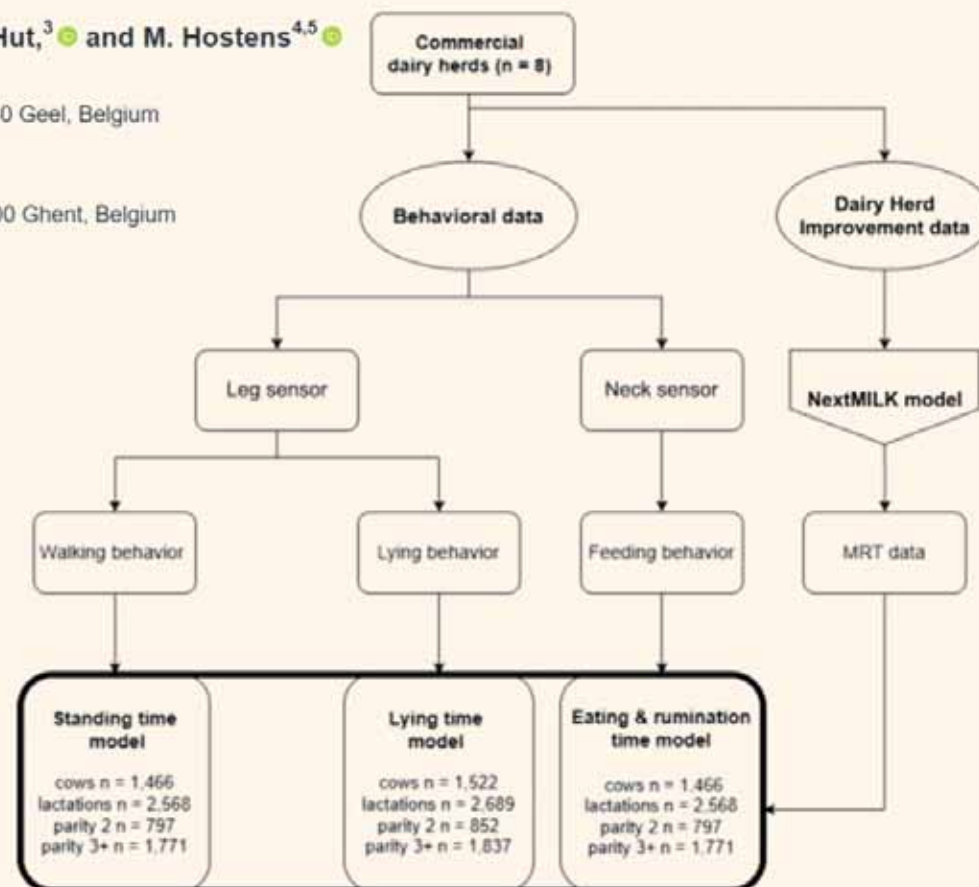
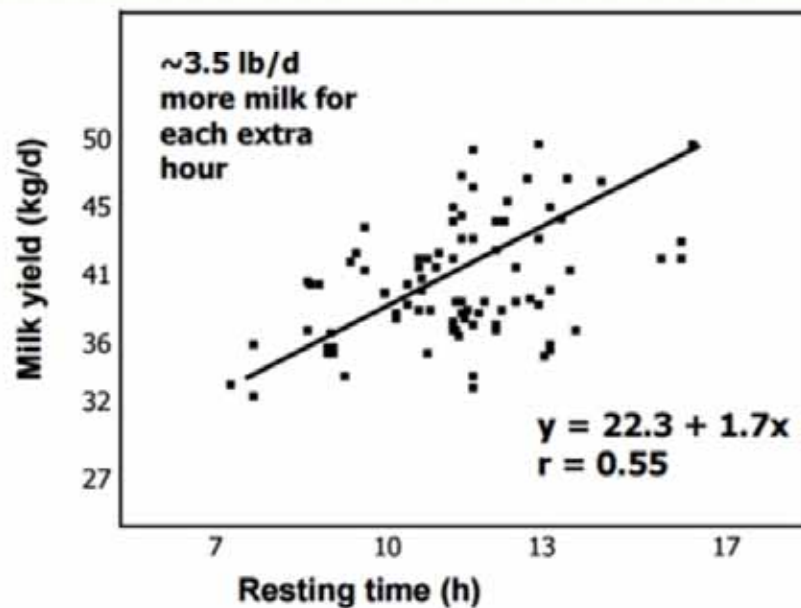
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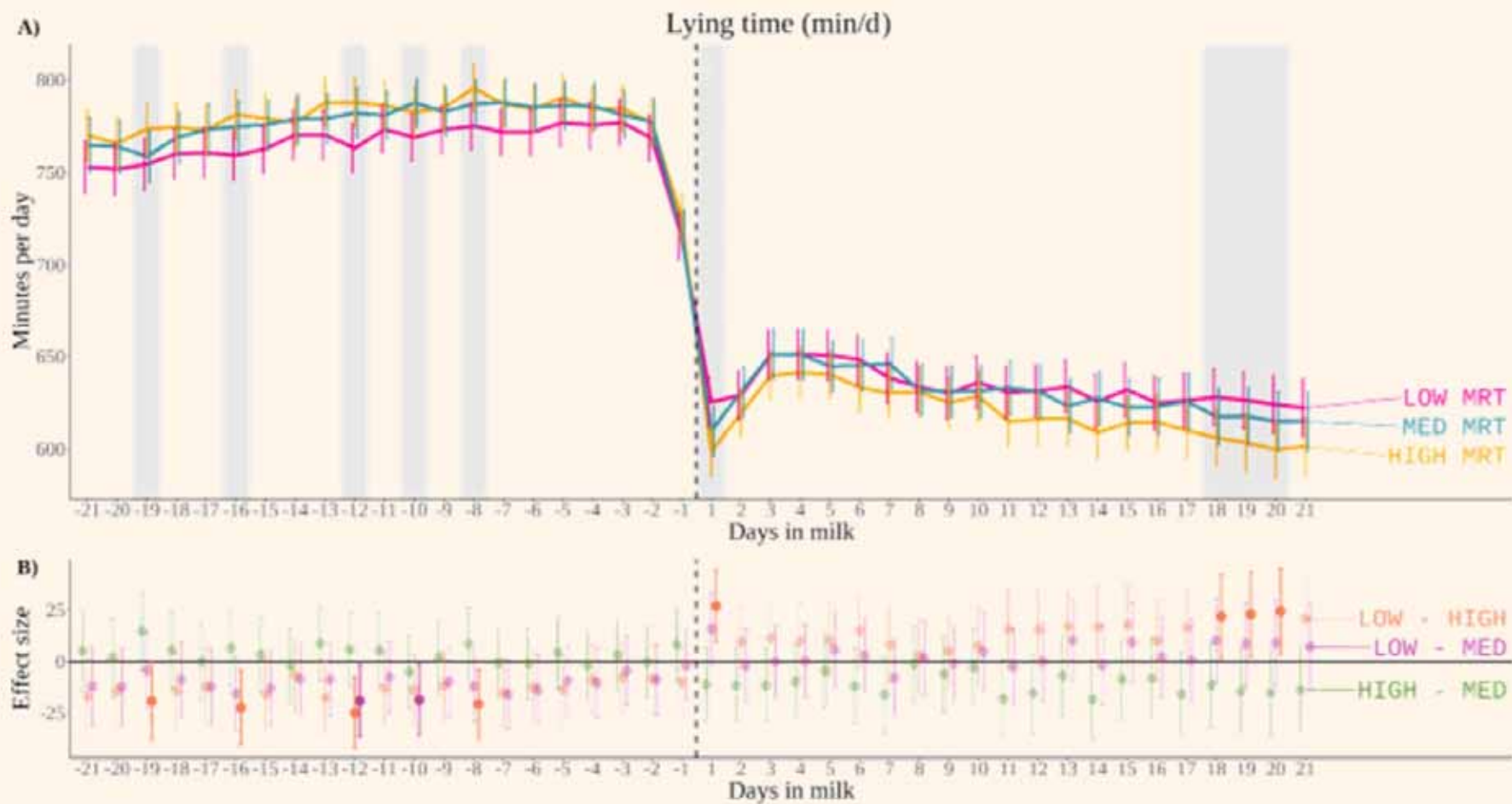
³Department of Population Health Sciences, Division Farm Animal Health, Faculty of Veterinary Medicine, Utrecht University, 3508 TD Utrecht, the Netherlands

⁴College of Agriculture and Life Sciences, Cornell University, Ithaca, NY 14850

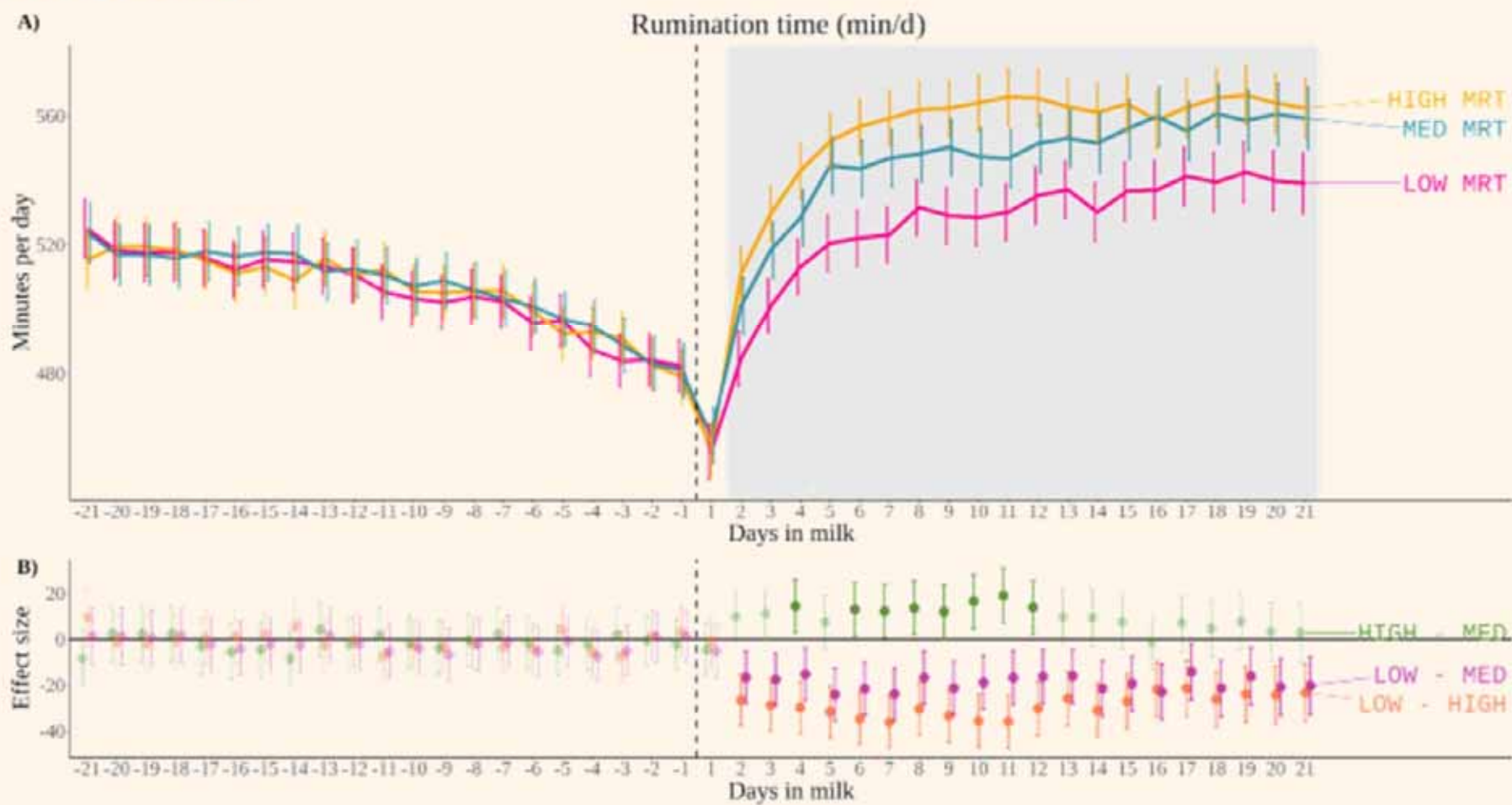
⁵Department of Animal Sciences and Aquatic Ecology, Faculty of Bioscience Engineering, Ghent University, 9000 Ghent, Belgium



Results



Results





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Heat stress in a temperate climate leads to adapted sensor-based behavioral patterns of dairy cows

P. R. Hut,^{1*}†  J. Scheurwater,^{1*} M. Nielen,¹  J. van den Broek,¹ and M. M. Hostens^{1,2} 

¹Department of Population Health Sciences, Division Farm Animal Health, Faculty of Veterinary Medicine, Utrecht University, PO Box 80151, 3508 TD Utrecht, the Netherlands

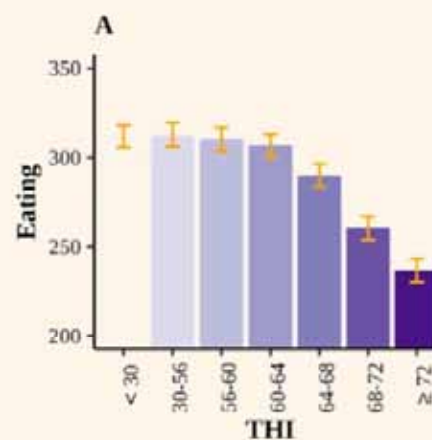
²Department of Animal Science and Aquatic Ecology, Ghent University, Coupure Links 653-Block F, B-9000 Ghent, Belgium



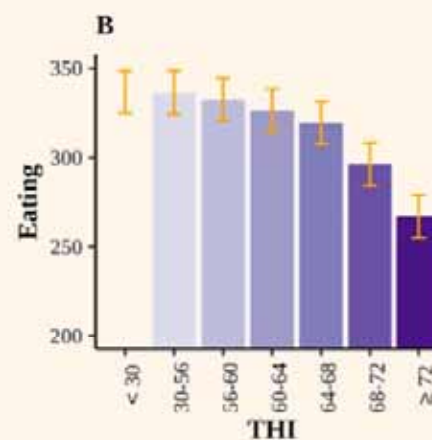
Results

Lactating

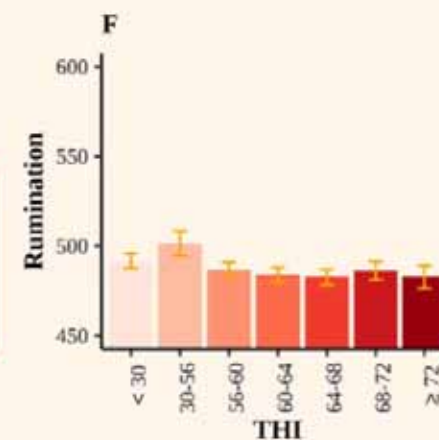
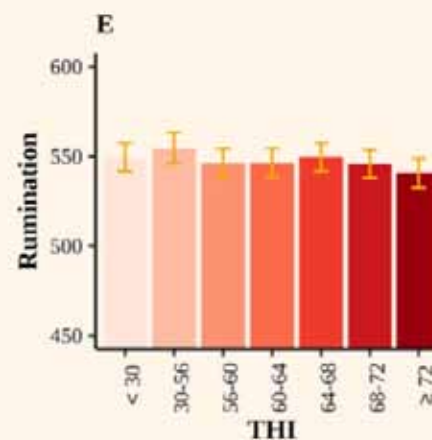
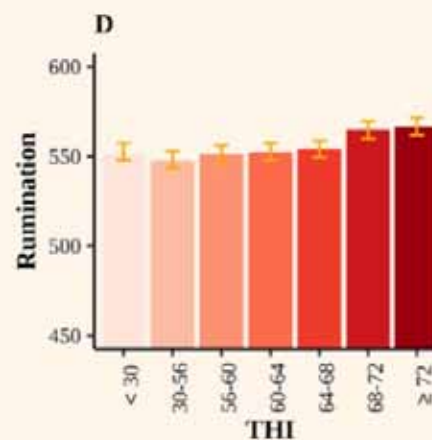
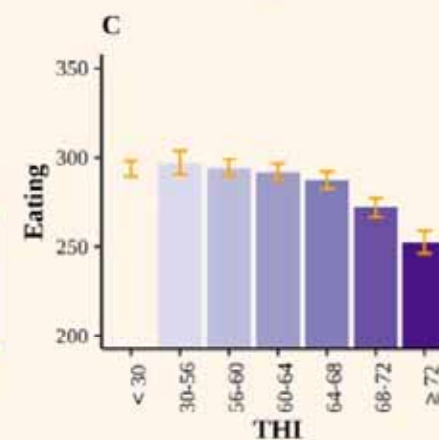
CMS



AMS



Dry





J. Dairy Sci. 104:4746–4763

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Associations between body condition score, locomotion score, and sensor-based time budgets of dairy cattle during the dry period and early lactation

P. R. Hut,^{1*} M. M. Hostens,^{1,2} M. J. Beijaard,¹ F. J. C. M. van Eerdenburg,¹ J. H. J. L. Hulsen,³

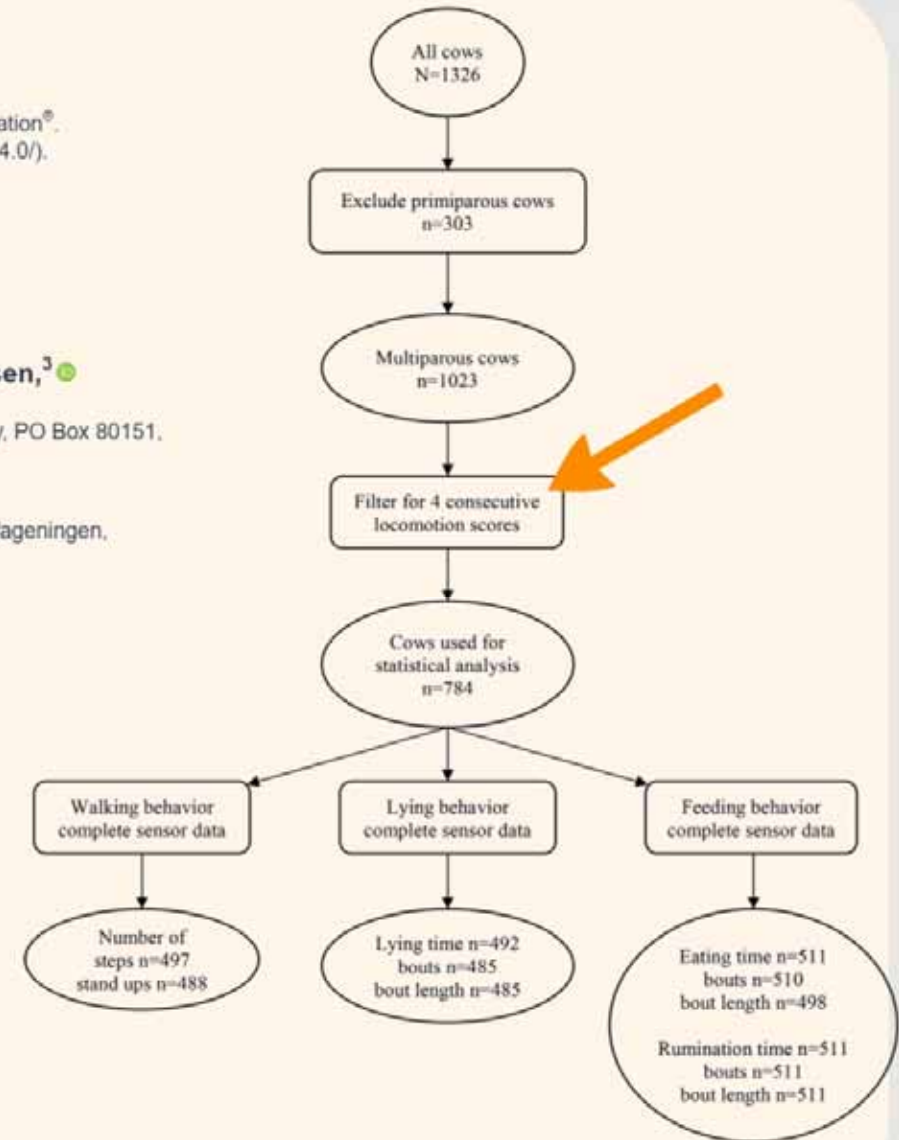
G. A. Hooijer,¹ E. N. Stassen,⁴ and M. Nielen¹

¹Department of Population Health Sciences, Division of Farm Animal Health, Faculty of Veterinary Medicine, Utrecht University, PO Box 80151, 3508 TD Utrecht, the Netherlands

²Department of Reproduction, Obstetrics and Herd Health, Ghent University, Salisburylaan 133, Merelbeke 9820, Belgium

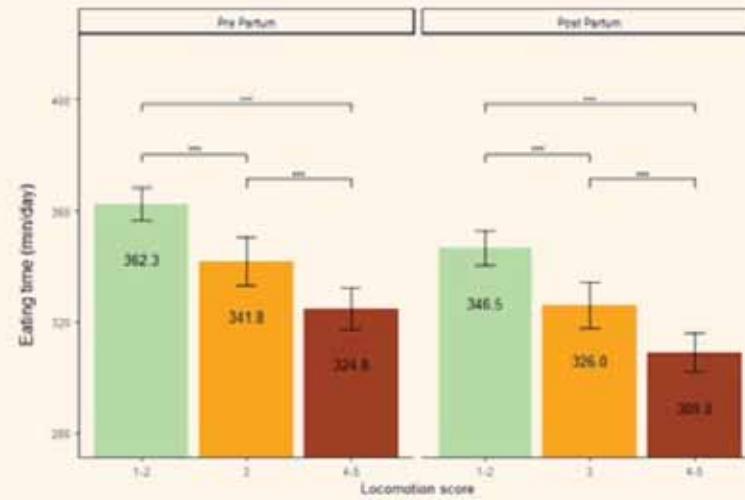
³Vetvice/Cowsignals, 4614 PC Bergen op Zoom, the Netherlands

⁴Adaptation Physiology Group, Department of Animal Sciences, Wageningen University & Research, PO Box 338, 6700 AH Wageningen, the Netherlands

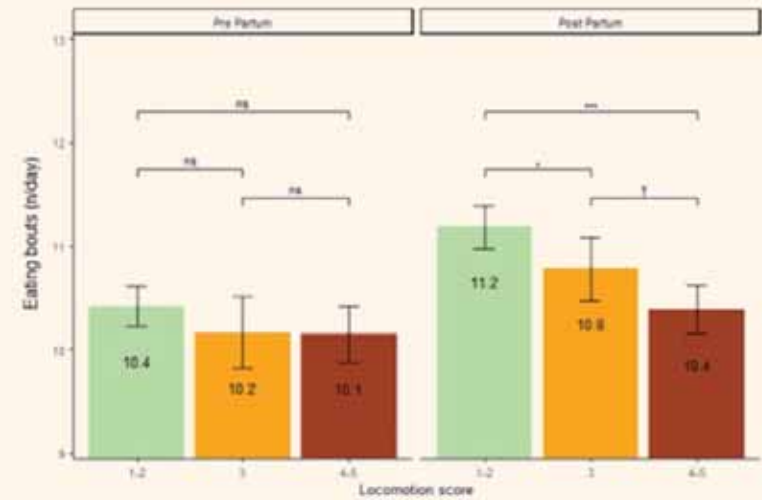


Results

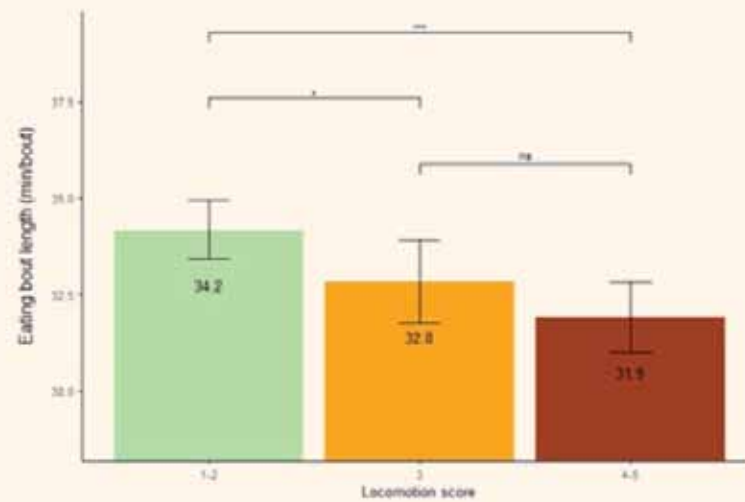
A



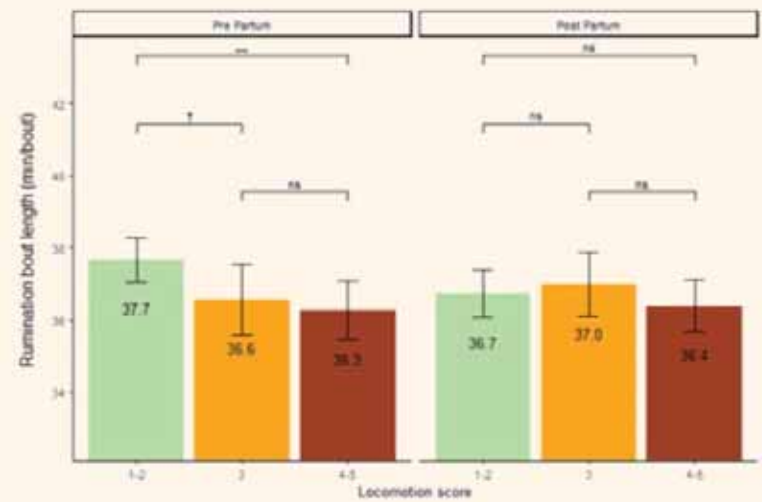
B



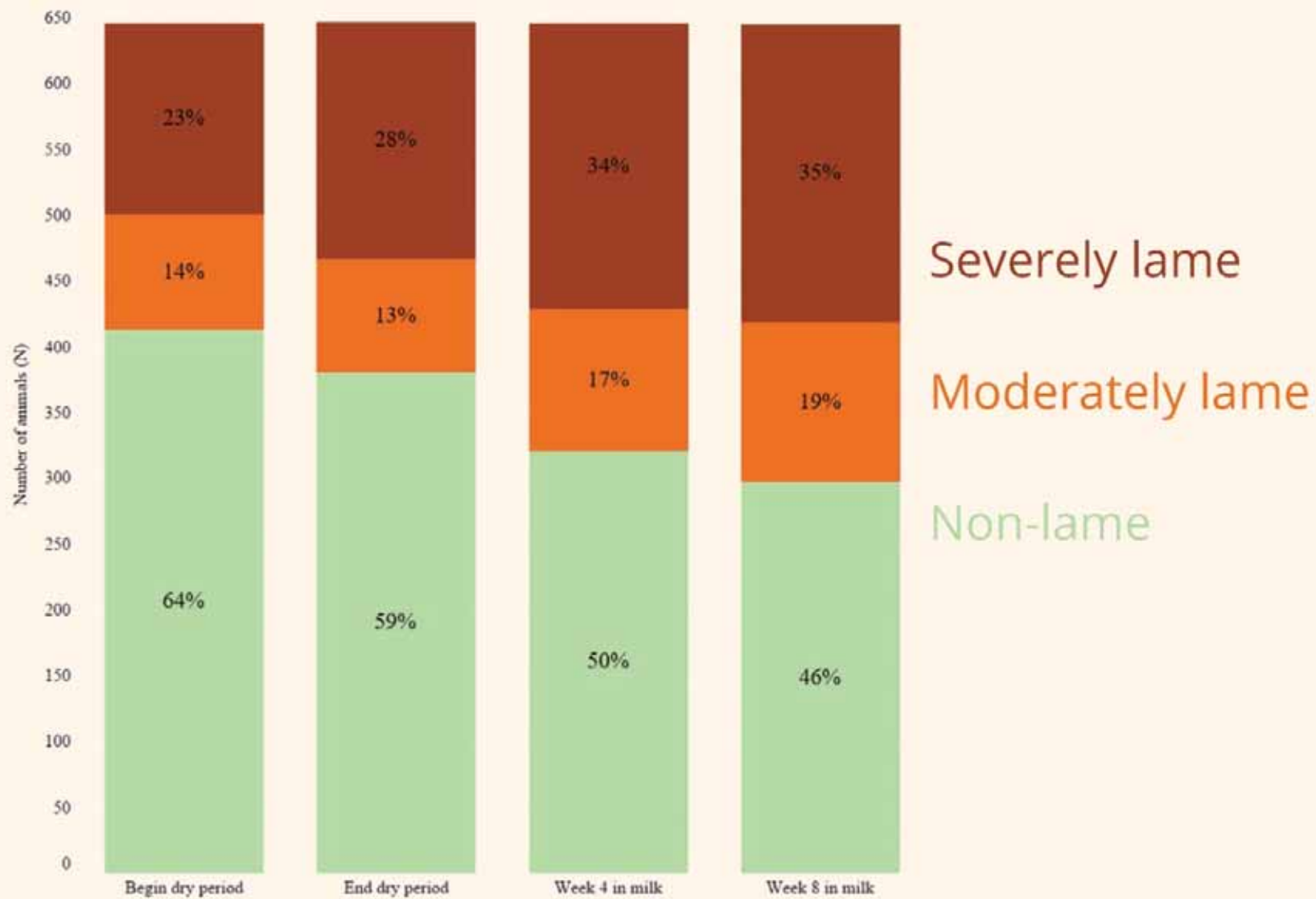
C



D



Results





A systematic review and meta-analysis of lameness scoring methods and the prevalence of lameness of dairy cows in Northwest Europe

Wesley Wessels,¹ Eddie A. M. Bokkers,^{2*} Imke J. M. de Boer,² Ellen Meijer,¹
T. Bas Rodenburg,¹ Miel Hostens,³ and Gerrit Koop^{1*}

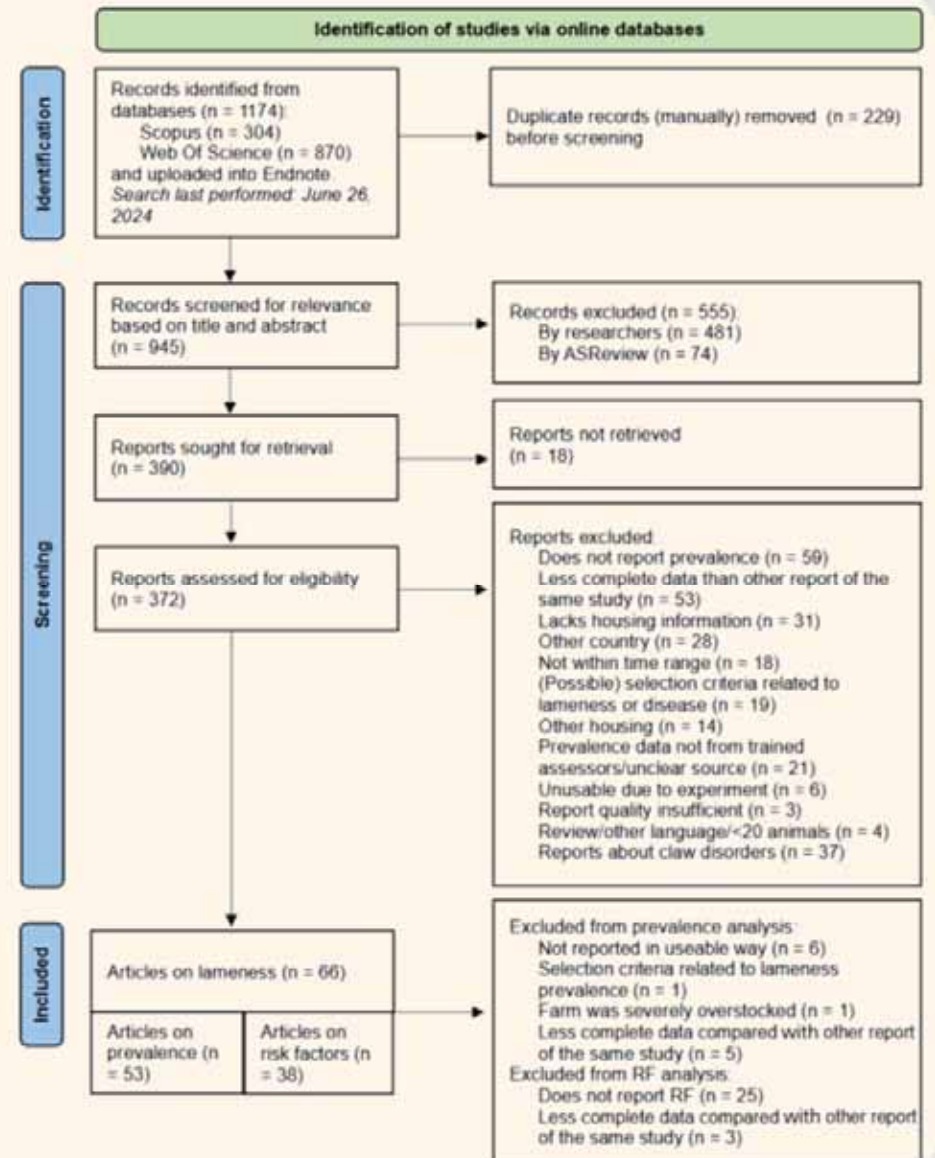
¹Department of Population Health Sciences, Faculty of Veterinary Medicine, Utrecht University, 3584 CL Utrecht, the Netherlands

²Animal Production Systems Group, Wageningen University & Research, 6700AH Wageningen, the Netherlands

³Department of Animal Science, Cornell University, Ithaca, NY 14853

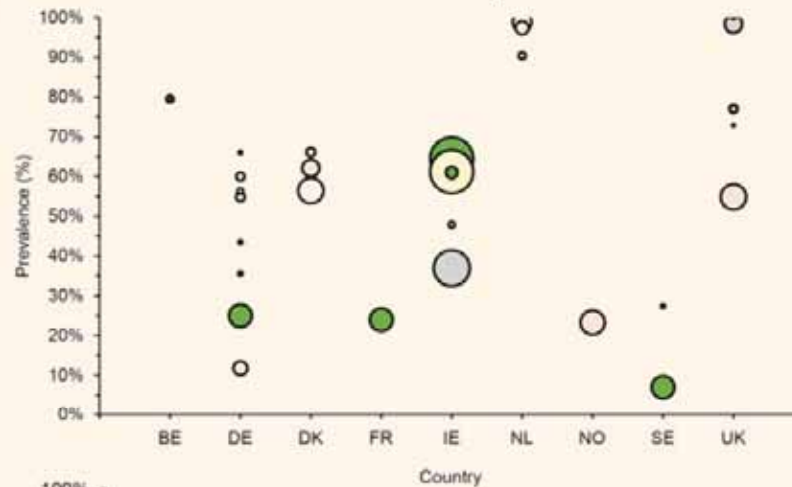
NOTES

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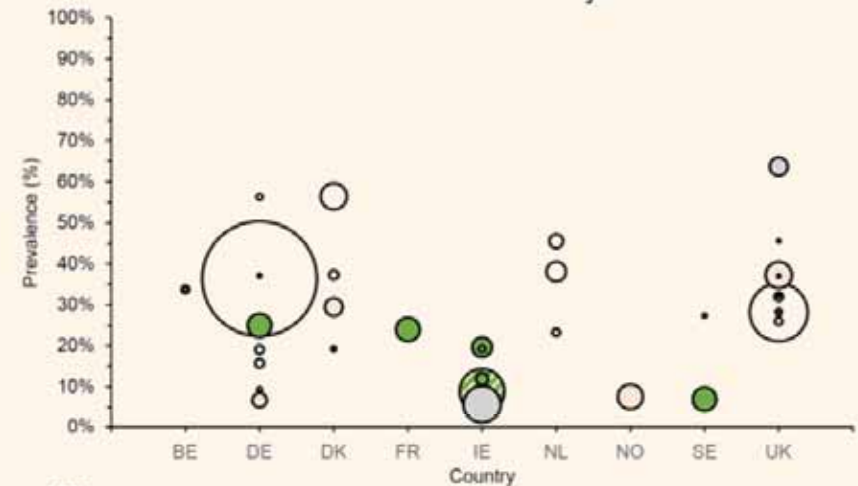


Results

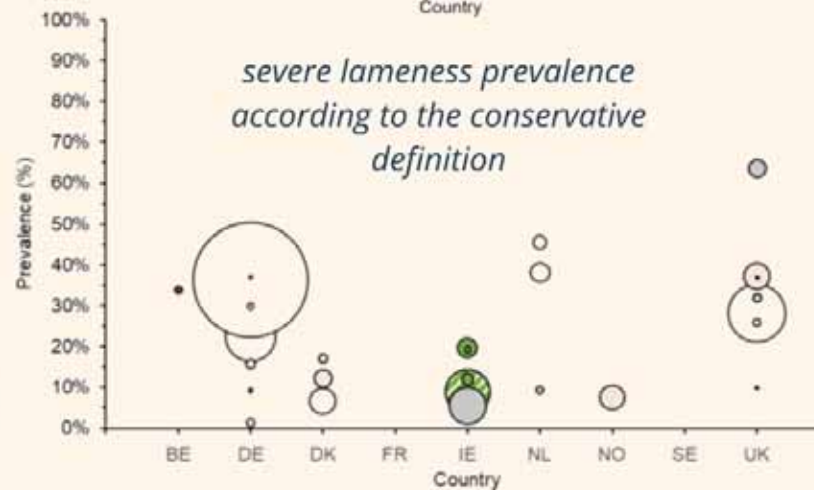
lameness prevalence according to the conservative definition



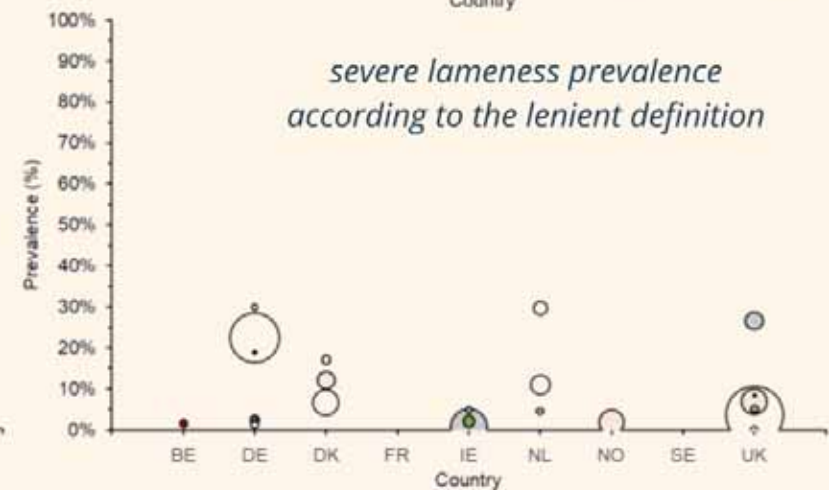
lameness prevalence according to the lenient definition



severe lameness prevalence according to the conservative definition



severe lameness prevalence according to the lenient definition



In lenient classification, some slight gait irregularities were allowed for the sound level

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Associate Prof. Dr. DVM Miel Hostens
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Professor of Digital Dairy Management
and Data Analytics

INVITED REVIEW: Using sensor technologies to quantify rumination: development of reference standards and validation for animal welfare and health recording

Celien Kemel¹, Christa Egger-Danner², Ilka Klaas³, Luiz F. Brito⁴, Katharina Schodl², Jeffrey M. Bewley⁵, Victor E. Cabrera⁶, Marie J. Haskell⁷, Michael Iwersen⁸, Bjorg Heringstad⁹, Katharina F. Stock¹⁰, Anna Stygar¹¹, Robert Fourdraine¹², Nicolas Gengler¹³, Miel Hostens¹⁴, Elsa Vasseur¹⁵

Goal of the review

Fast commercial
adoption to support
decision making at
farm level



Need for more robust
validation to support
decision making at
industry level



Contents lists available at [ScienceDirect](#)

Animal

The international journal of animal biosciences

Review: Using animal welfare to frame discussion on dairy farm technology

Daniel M. Weary^{*}, Marina A.G. von Keyserlingk

Animal Welfare Program, Faculty of Land and Food Systems, The University of British Columbia, 2357 Main Mall, Vancouver, B.C V6T 1Z4, Canada

- Technology adoption on dairy farms has surged over the past 50 years.
- Their study aimed to link farm technologies to dairy cattle welfare through a systematic review of literature.
- Out of 380 papers reviewed, 28 met their criteria, highlighting the focus on welfare-relevant measures and technology assessments.
- The majority of these studies framed technology positively, emphasizing welfare benefits, but some lacked rigorous connections to specific outcomes.
- They advocate for balanced discussions on technology's potential benefits and harms to better address animal welfare complexities.

Goal of the review

- The review addresses gaps between fast commercial adoption and slow development of robust validation to use livestock sensing for welfare/health.
- Focus on rumination, as a starting point
- **Scientific basis for ICAR/IDF guidelines and validation protocol for novel sensor technologies**

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