

Effects of deck height during transport of weaners: in-vehicle conditions and clinical indicators



Leslie Foldager^{1,2,*}, K. Thodberg¹, G. Chen³, J. K. Kristensen⁴,
L. D. Jensen¹, M. Kaiser¹, C. Kobek-Kjeldager¹, L. Rong³, M. S. Herskin¹

¹ Aarhus University, Animal and Veterinary Sciences, Tjele, Denmark • ² Aarhus University, Bioinformatics Research Centre, Aarhus, Denmark •
³ Aarhus University, Civil and Architectural Engineering, Aarhus, Denmark • ⁴ Aarhus University, Electrical and Computer Engineering, Tjele, Denmark
* Correspondance: leslie@anivet.au.dk, <https://anivet.au.dk>, <https://birc.au.dk>

Introduction

Within EU, many pigs are born in one member state but raised and slaughtered in another; involving journeys lasting more than 8 hours. Denmark exports approx. 15 million pigs each year, majorly at a body weight around 30 kg [1] transported in vehicles with four or five decks (Fig. 1) at a deck height of approx. 70 or 60 cm, respectively. In 2022, the EFSA Panel on Animal Health and Welfare (AHAW) concluded that vertical space in the vehicles is important for animal welfare [2].



Fig. 1. Photo of the vehicle (4-deck lorry with 5-deck trailer) used for experimental trials. The photo shows a situation during the process of loading pigs onto the trailer with roof lifted, shutters for natural ventilation fully opened and separate shutters in front of the mechanical ventilation fans also pulled down. (Photo: Aarhus University)

Being part of a policy support request commissioned by the Danish Ministry of Food, Agriculture and Fisheries, the current study aimed to examine at what deck height the requirements from the Council Regulation (EC) No 1/2005 are met for pigs weighing 20-25 kg. The EC regulation states that there should be “adequate ventilation above the animals when they are in a naturally standing position, without on any account hindering their natural movement”. Part 1 of the study found that the height of weaners of 25 kg is approx. 44 cm [3] and it was hypothesised that lower deck height would lead to reduced ventilation and thus impact the microclimatic conditions by higher temperatures and higher concentration of CO₂.

Methods

The study was done in 4 blocks from 8 June 2021 to 15 March 2022 (block 1+2: warmer period; block 3+4: colder period) under conditions modelling Danish commercial practice by a series of 16 journeys of 8 h (short) and 16 journeys of 23 h (long). Fig. 2 sketches the experimental setup with deck heights 70 and 60 cm vs 90 and 80 cm in the 4-deck lorry and 5-deck trailer, respectively.

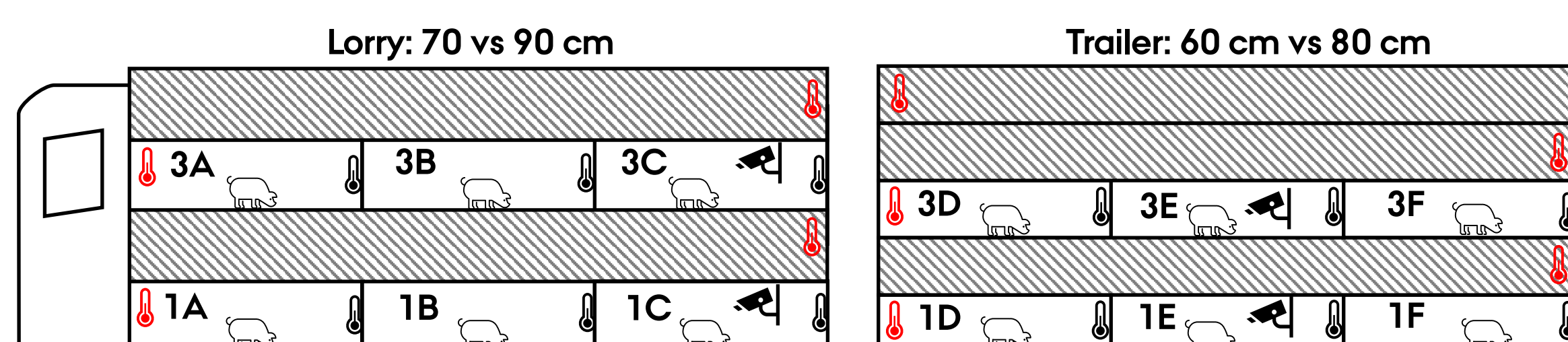


Fig. 2. Sketch of the experimental setup and the placement of sensors and video recorders.

- Empty decks
- Compartments with pigs and microclimatic logger (temperature and CO₂)
- Focal compartments with pigs, microclimatic logger and video recorder
- Embedded temperature sensors

Weight loss and skin lesions were considered via clinical examinations of 5 pigs from each of 4 focal compartments, and behaviour (standing, lying, aggression etc.) via video recordings in focal compartments.

GPS position (every 5 min), speed (avg. last 5 min), fans (on/off), shutters opening (cm), embedded temperature sensors (°C) etc. were recorded by the vehicle's DataCold 600 logger and LinkItAll platform. Weather data (hourly avg.) were retrieved for each GPS position via Python scripts from <https://openweathermap.org>. Temperature (°C, accuracy ± 0.5) and concentration of CO₂ (ppm, ± 50) were recorded in all compartments holding pigs using study loggers.

Results

No effects of deck height were found for clinical and behavioural observations; 3 pigs died (results not shown). Results for microclimate were similar on short and long journeys, and in lorry and trailer.

Table 1. Results for microclimate measures in the trailer on long journeys from linear mixed effects models with random effect of journey and AR(1) covariance structure within compartment.

Variable	Levels	Temperature (°C) ^{M1}		CO ₂ (ppm) ^{M2}	
		Mean ± SE	P-value	Mean ± SE	P-value
Height (deck)	60 cm	20 ± 0.3	0.151	2580 ± 184	0.176
	80 cm	20 ± 0.3		2250 ± 183	
Compartment	1D	23 ± 0.6	< 0.001	4110 ± 317	< 0.001
	1E	19 ± 0.6		1840 ± 319	
	1F	17 ± 0.6		1520 ± 318	
	3D	24 ± 0.6		3920 ± 317	
	3E	20 ± 0.6		1720 ± 318	
	3F	17 ± 0.6		1390 ± 317	
State (vehicle)	Driving	20 ± 0.2	0.863	2420 ± 130	0.433
	Stopped	20 ± 0.2		2420 ± 130	

M1) Temperature ~ Compartment + Height + Block + State + WeaTemp + WindSp + Drive:Speed + Compartment:WeaTemp + Block:WeaTemp + Compartment:Drive:Speed + Block:Drive:Speed + WeaTemp:Drive:Speed + WindSp:Drive:Speed

M2) CO₂ ~ Compartment + Height + Block + State + Block:Drive:Speed

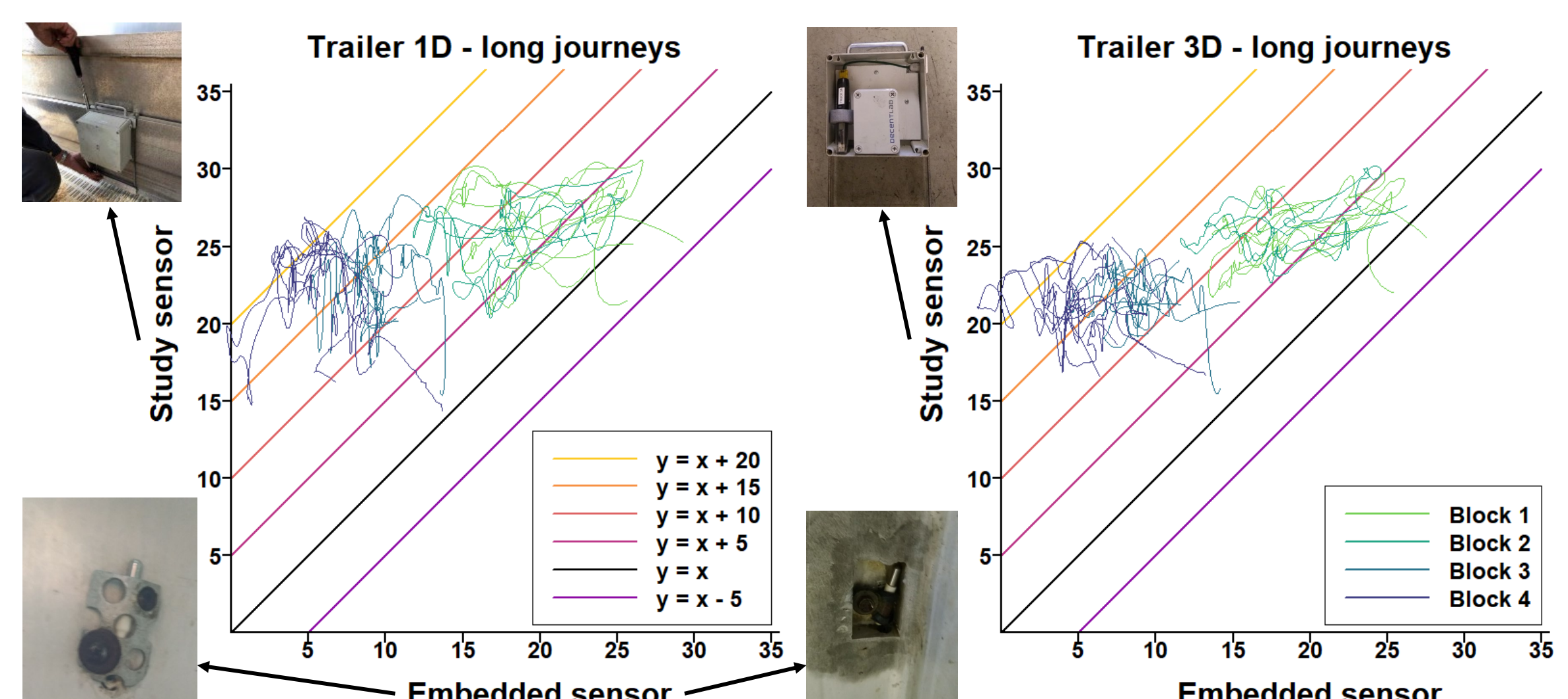


Fig. 3. Comparison of measurements in front compartments of the trailer (1D and 3D) from all 16 long journeys between embedded temperature sensors (x-axis) mounted in the outer aluminium walls and the study loggers (y-axis) mounted centrally on the partitioning walls, see also Fig. 2.

Discussion and conclusions

Deck height had few and minor effects on the chosen indicators of good ventilation during transport. The “horizontal” position of compartments influenced microclimatic conditions significantly with lower temperature and CO₂ concentration in rear- than in front-end compartments. Relatively large differences were observed between the embedded temperature sensors in the outer walls of the vehicles and the study sensors near the animals. This calls for further investigation and is being part of a follow-up study, see poster 70.13 (Rong et al.).

References

- Dahl-Pedersen and Herskin (2023), J. Appl. Anim. Welf. Sci. **26**, 102-115.
- EFSA AHAW Panel et al. (2022), EFSA Journal **20**, 7445, 108 pp.
- Kaiser, Foldager and Herskin (2023), J. Anim. Sci. **101**, 1-9.



AARHUS
UNIVERSITY

DEPARTMENT OF ANIMAL AND VETERINARY SCIENCES

