2. Transportation trials

TechCare

Overview of 5 trials carried out during transport (all sectors)

PARTNER	PILOT FARM	TRIAL N° - PERIOD	MAIN QUESTION(S) ADDRESSED
SRUC	SRUC (**boat**)	Trial n°1 – 01/06/23 to 30/11/23	• Can **sea and transport conditions** predict the impact on sheep welfare when transported at sea?
	Kirkton (**trailer**)	Trial n°2 – 19/01/2023; 10/01/2024; 29/01/2024	• Can **accelerometer data**, temperature and camera inform welfare issues potentially encountered by fat lambs (Scottish Blackface) sent to the abattoir by road on a trailer (~100 km of mountain road)?
UAB Universitat Autònoma de Barcelona	Facultat de Veterinaria UAB (**trailer**)	Trial n°1 – Oct 22 to Nov 22 Trial n°2 – Oct 23 to Nov 23	• Can **sensors be used to monitor trailer** transportation conditions of small ruminants? • What **effects** does **road transport stress** over a short journey (2 h) have on lambs and goat kids' welfare under **different densities**?
Agris	Bonassai (**truck**)	Trial n°1 – Nov 22 to Dec 22 Mar 23 to Apr 23	• Are thermo-hygrometers able to detect **heat/cold stress during transport** of lambs?





2. Transportation trials

1. Goat kids and lambs road transport with trailer
2. Sheep transport by sea

2. Transportation trials

Goat kids and lambs road transport with trailer

Gerardo Caja (UAB)

Integrating innovative TECHnologies along the value Chain
to improve small ruminant welfARE management

Transportation: Metabolic and sensor-based stress assessment of milk-fed goat kids and lambs transported by road at short-distances

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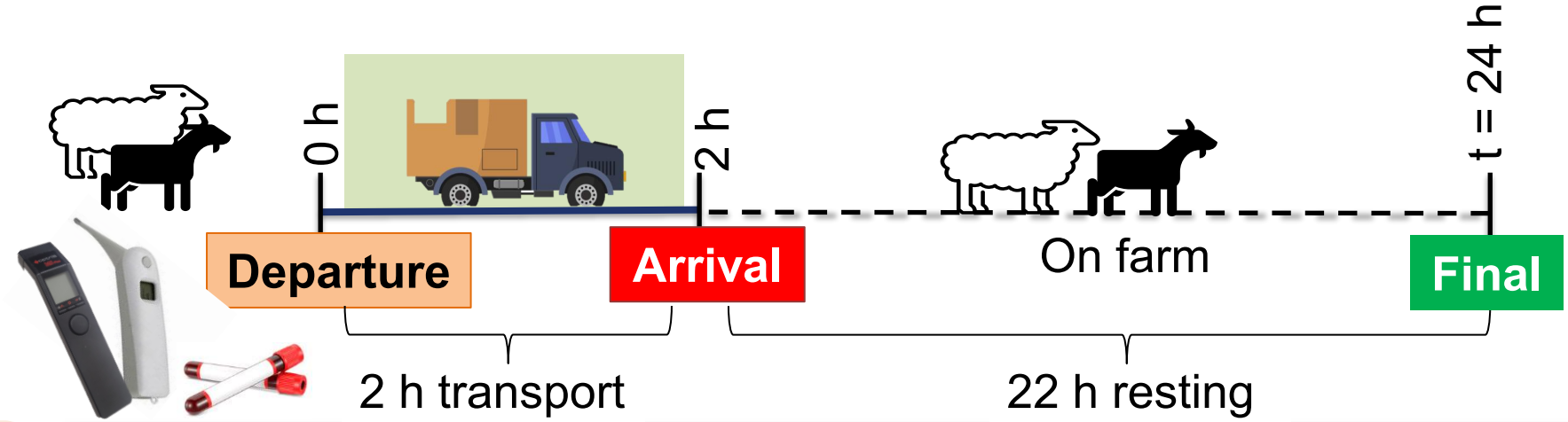
Rationale:

- Near 20 M head/yr of **suckling kids** (< 10 kg BW; "*cabrito*") and **suckling lambs** (<15 kg BW; "*lechal*") are sent to the abattoir over short journeys in the Mediterranean EU countries.
- Few information is available on suckling kids and lambs and the current Regulation (EC 1/2005) shows imprecisions….

Aim:

- Monitoring the transportation stress of light kids and lambs by **using physiological and PLF tools.**



TechCare: Monitoring transportation stress

- Space allowances for sheep and goat transported by road (EC 1/2005, *under revision*)

Species	BW, kg	m^2/animal	m^2/kg
Sheep unshorn	> 55	> 0.4	> 0.007
	< 55	0.3-0.4	0.006-0.007
Shorn & lambs	> 26	0.2-0.3	0.008-0.012
Small lambs[1]	**< 20**	**> 0.2**	**> 0.010**
Goats	> 55	> 0.4-0.75	0.007-0.014
	35-55	0.3-0.4	0.007-0.009
	< 35	0.2-0.3	0.006-0.009
Small kids (no data)	**< 10**	**> 0.1?**	**> 0.010?**

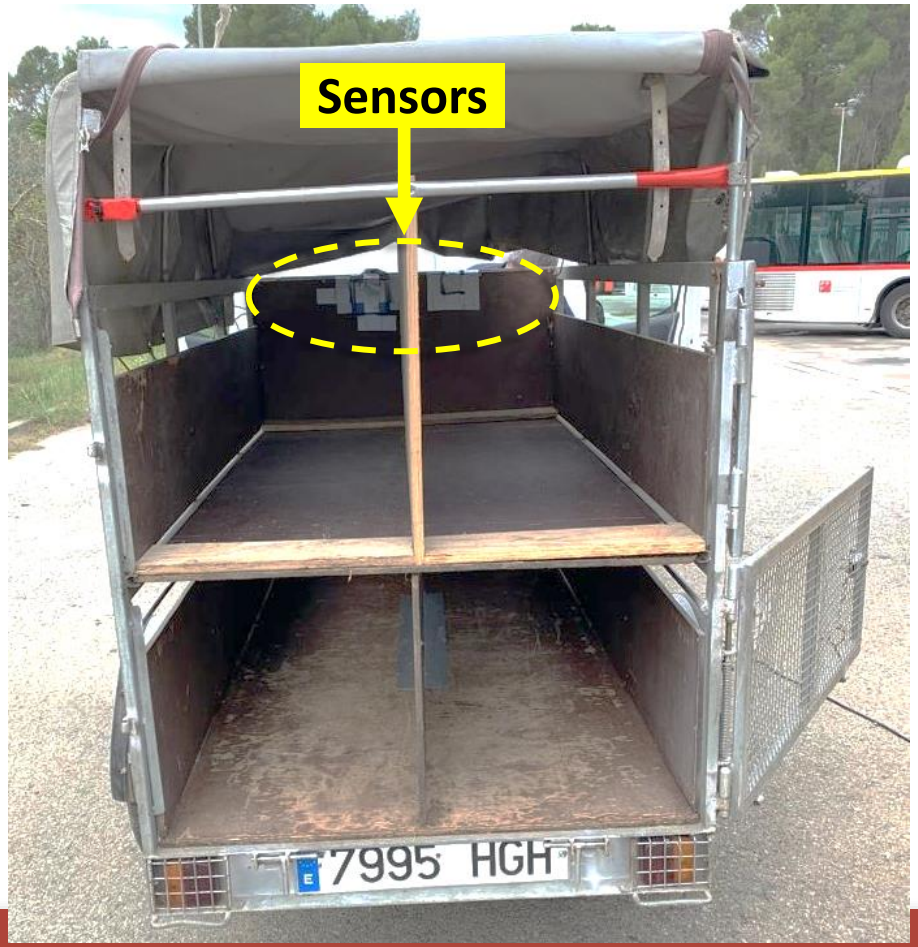
[1]Older than 1 wk (unless transported < 100 km). "*As an indication: for small lambs, an area of under 0.2 m^2 per animal may be provided*".

Material & methods:

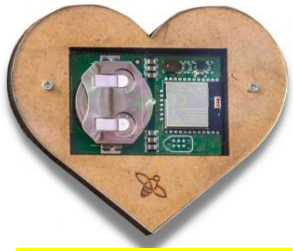
- **Trailer:** Approved for animal transport (2-floor and 1-axle; EUCAR, C-7-GW 750 kg, Mataró, Spain; 1.8 × 1.0 × 1.3 m), **4 compartments** of **0.9 m² each.**
- Sensors: 3A accelerometers, T-RH and sound

Driver's cabin vs. Trailer

2 x 3A accelerometers



Data logger (T & RH)



Sound sensor

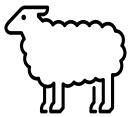
UAB Universitat Autònoma de Barcelona

Material & methods:

- Transport densities for **kids** in 3 trips (**n = 75**)

Density	High	Low
Kids, n	**45** (25♀ + 20♂)	**30** (14♀ + 16♂)
BW, kg	9.28 ± 0.20	9.42 ± 0.27
Space, m²/kg BW	**0.013**	**0.018**
Space, m²/animal	0.122 (130%)	0.169 (180%)

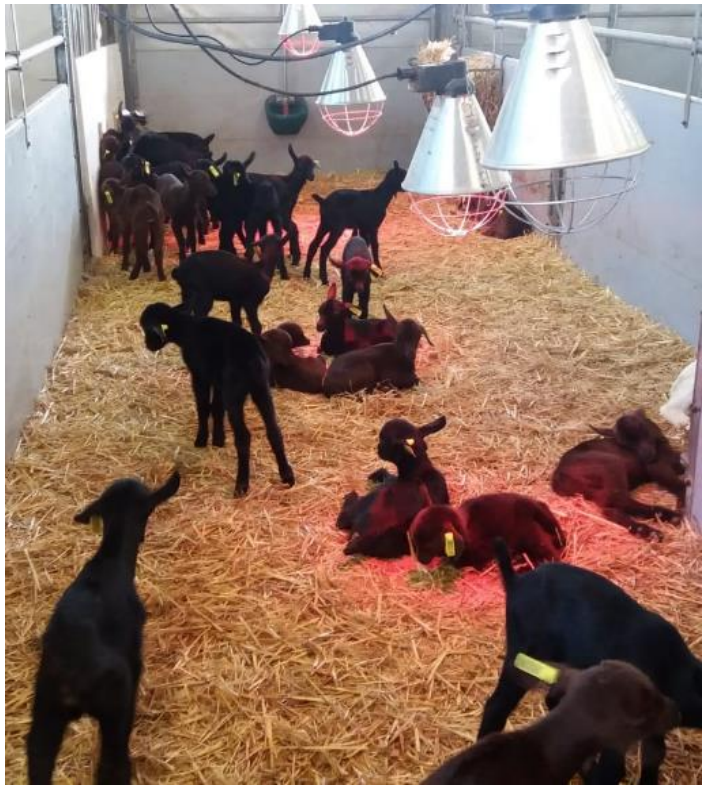
- Transport densities for **lambs** in 4 trips (**n = 80**)



Density	Standard	Low
Lambs, n	**48** (22♀+ 26♂)	**32** (18♀ + 14♂)
BW, kg	13.73 ± 0.18	13.72 ± 0.13
Space, m²/kg	**0.011**	**0.016**
Space, m²/animal	0.149 (110%)	0.219 (160%)

Material & methods: **Kid's** transport (n = 75)

- Road and trip description: **3 trips** (Oct-Nov, 2022-2023)



Duration	**1 h 56 min**
Distance, km	119 ± 2
Speed, km/h	62 ± 1
Unevenness, m	575

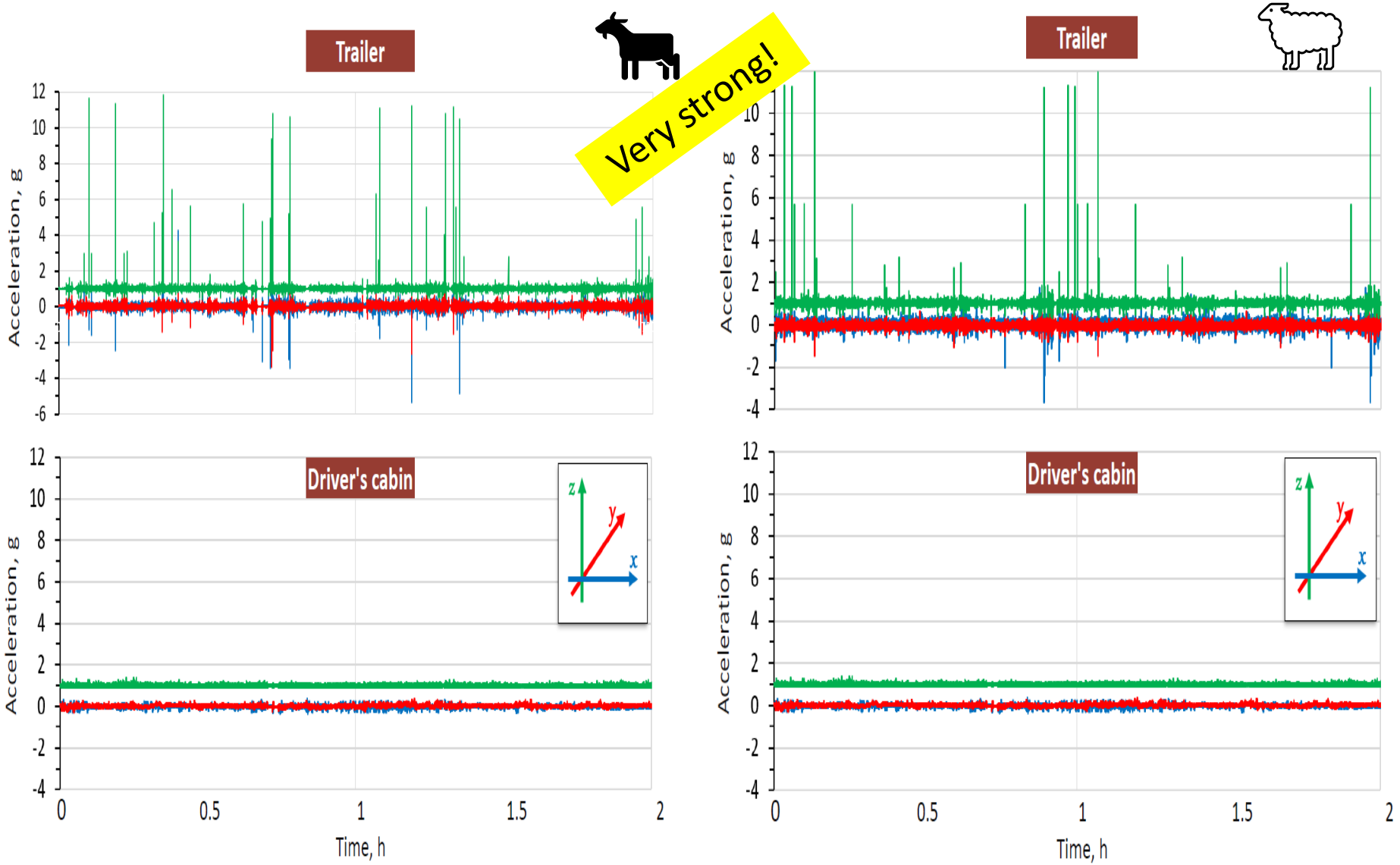
Material & methods: **Lamb's** transport (n = 80)

- Road and trip description: **4 trips** (Oct-Nov, 2022-2023)

Duration	**2 h 01 min**
Distance, km	116 ± 2
Speed, km/h	57 ± 2
Unevenness, m	581

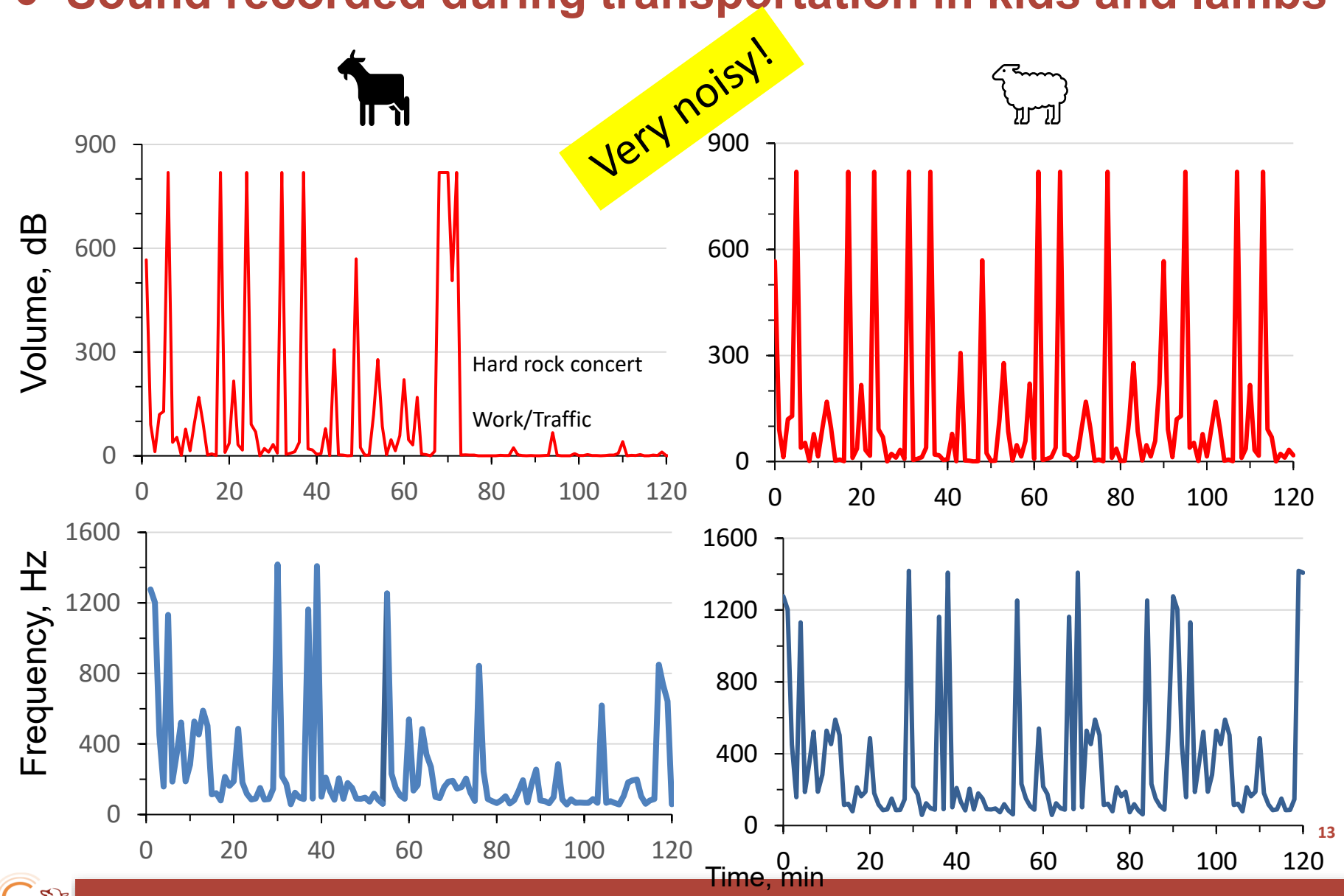
TechCare: Monitoring transportation stress

- **3A acceleration during transportation in kids and lambs**

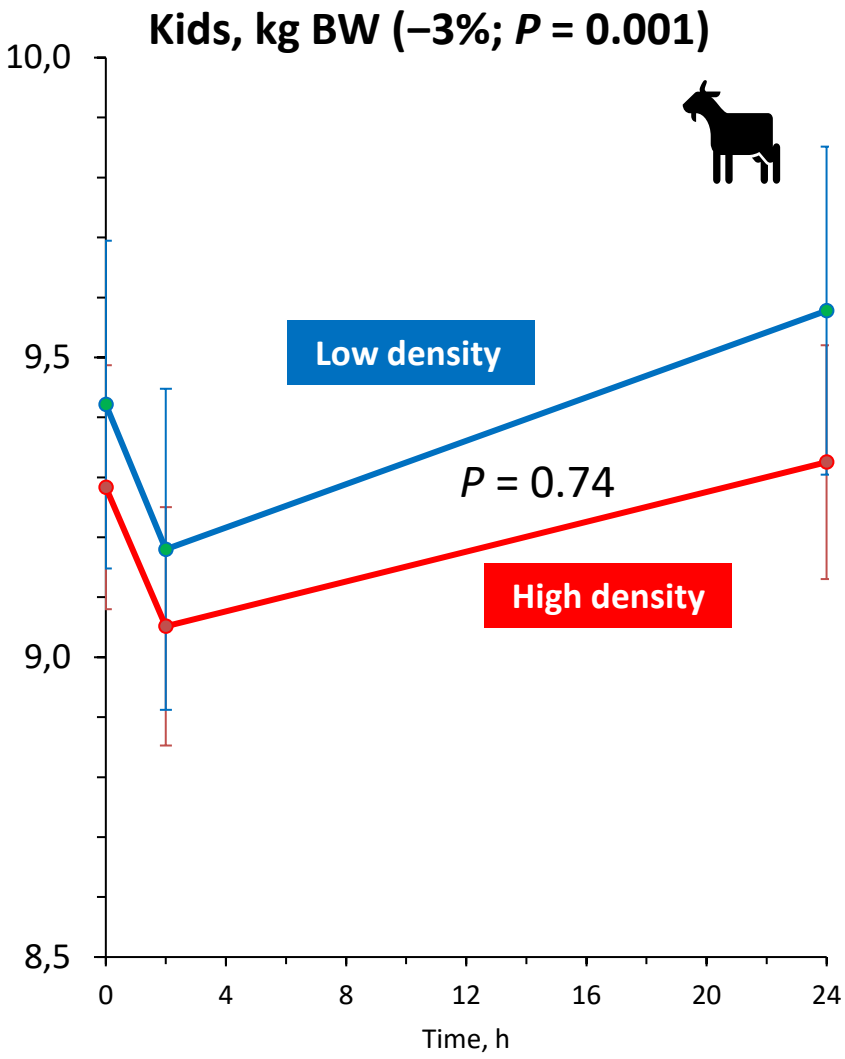


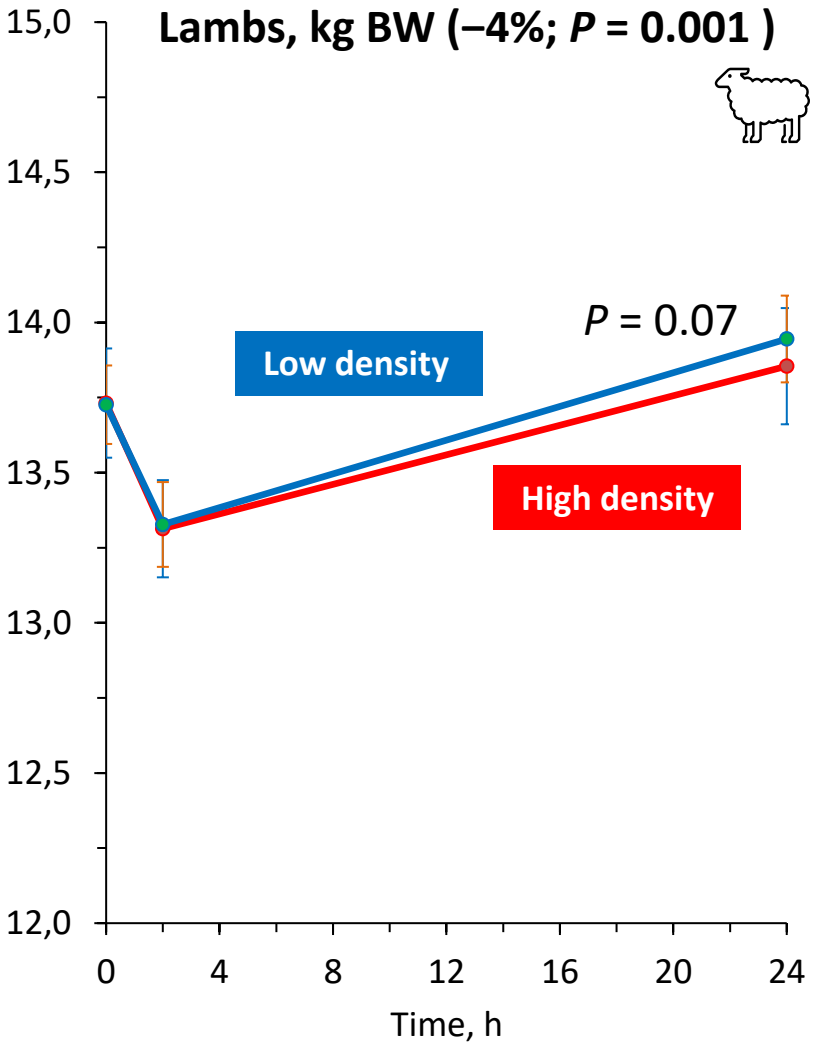
TechCare: Monitoring transportation stress

- **Sound recorded during transportation in kids and lambs**

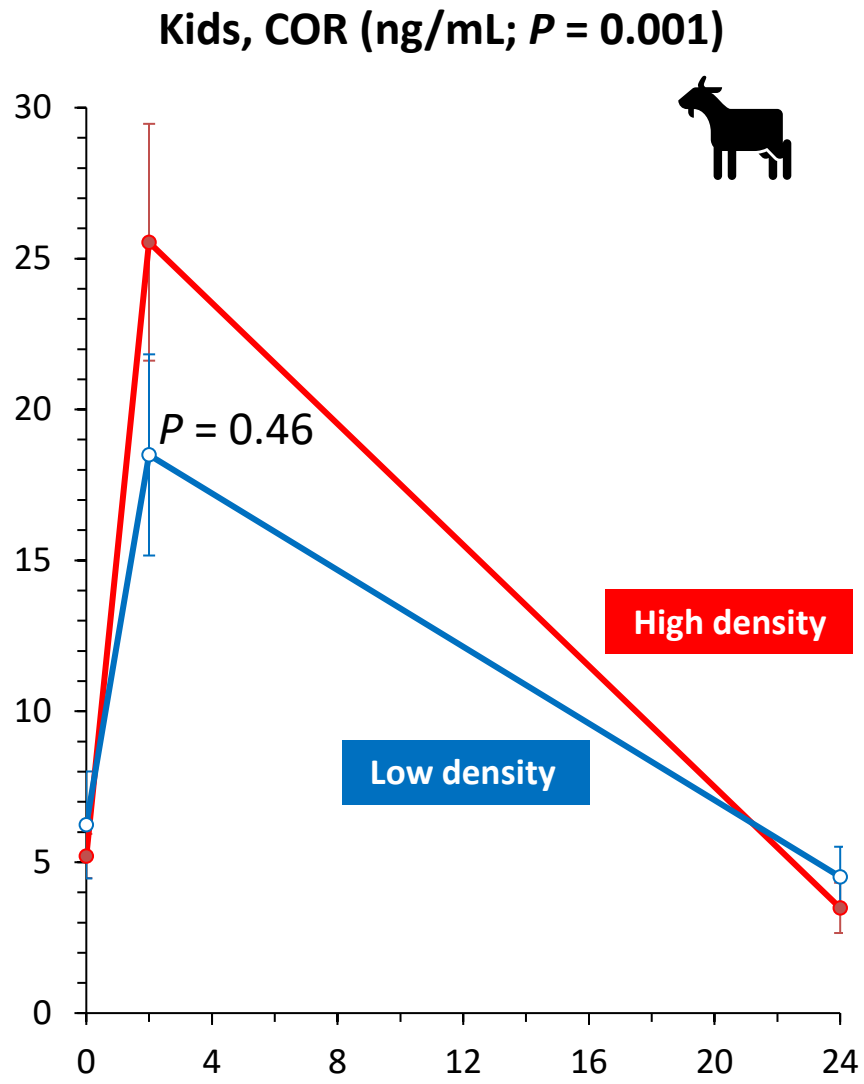


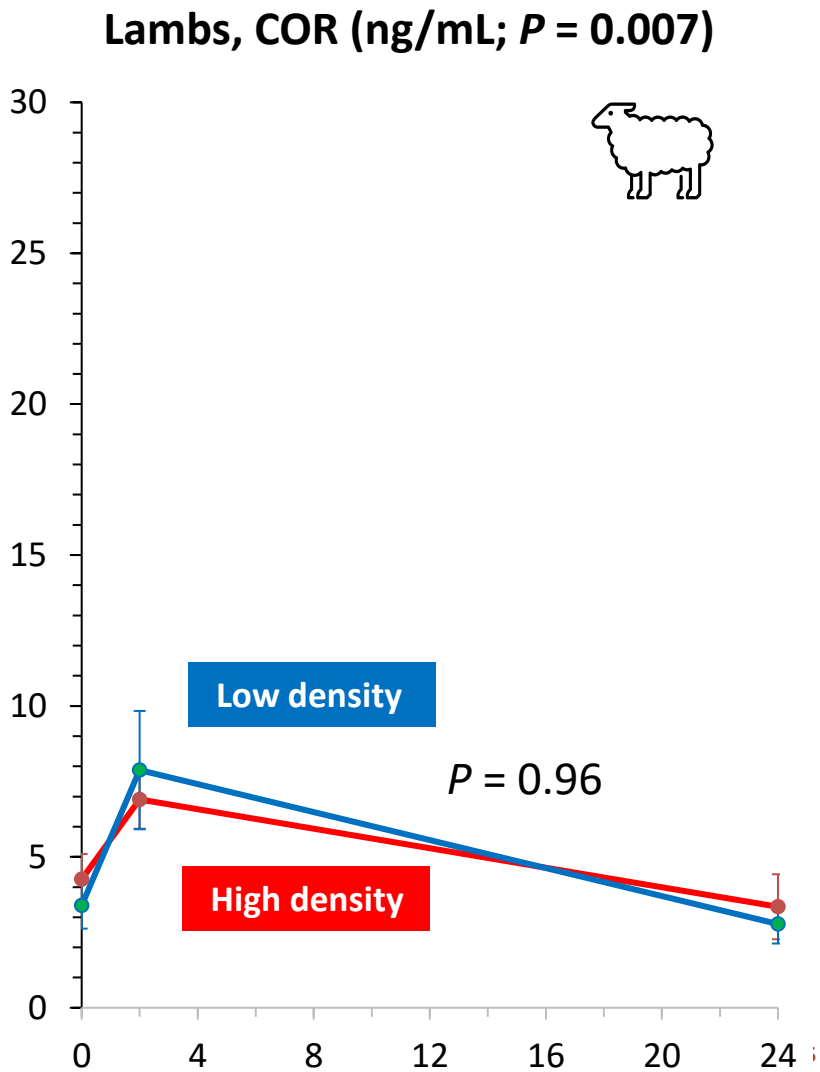
Body weight losses by effect of road transportation



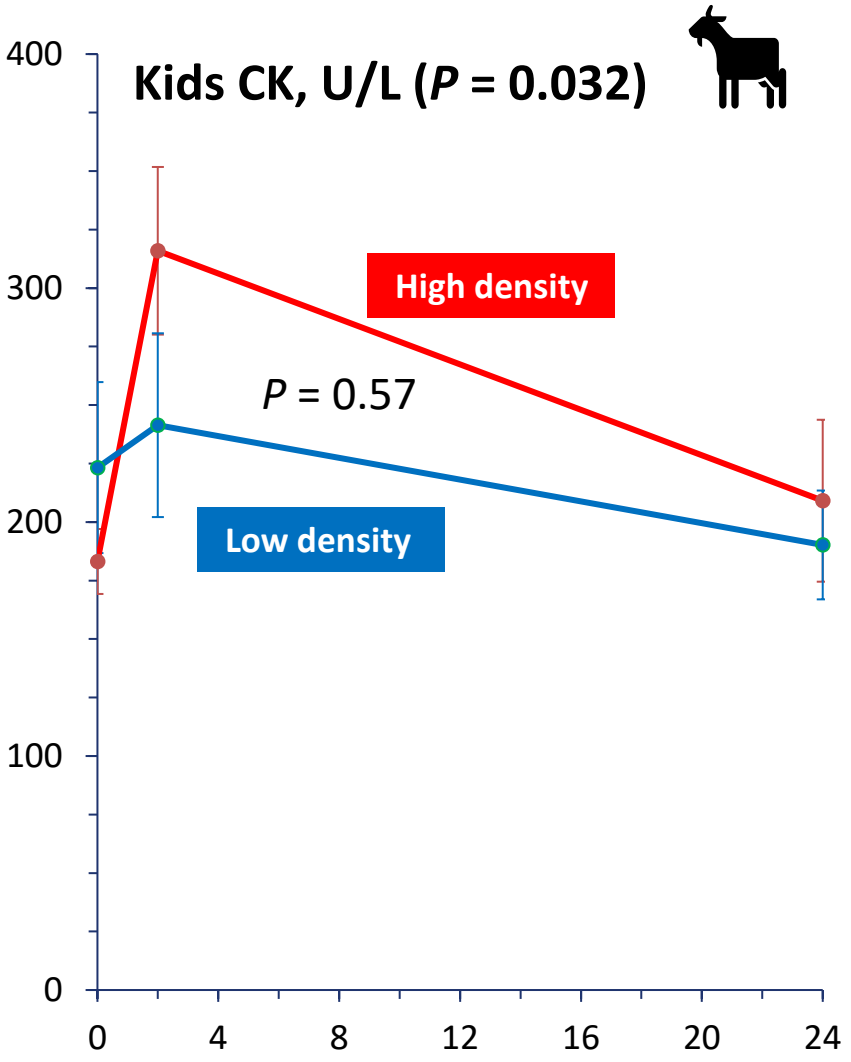


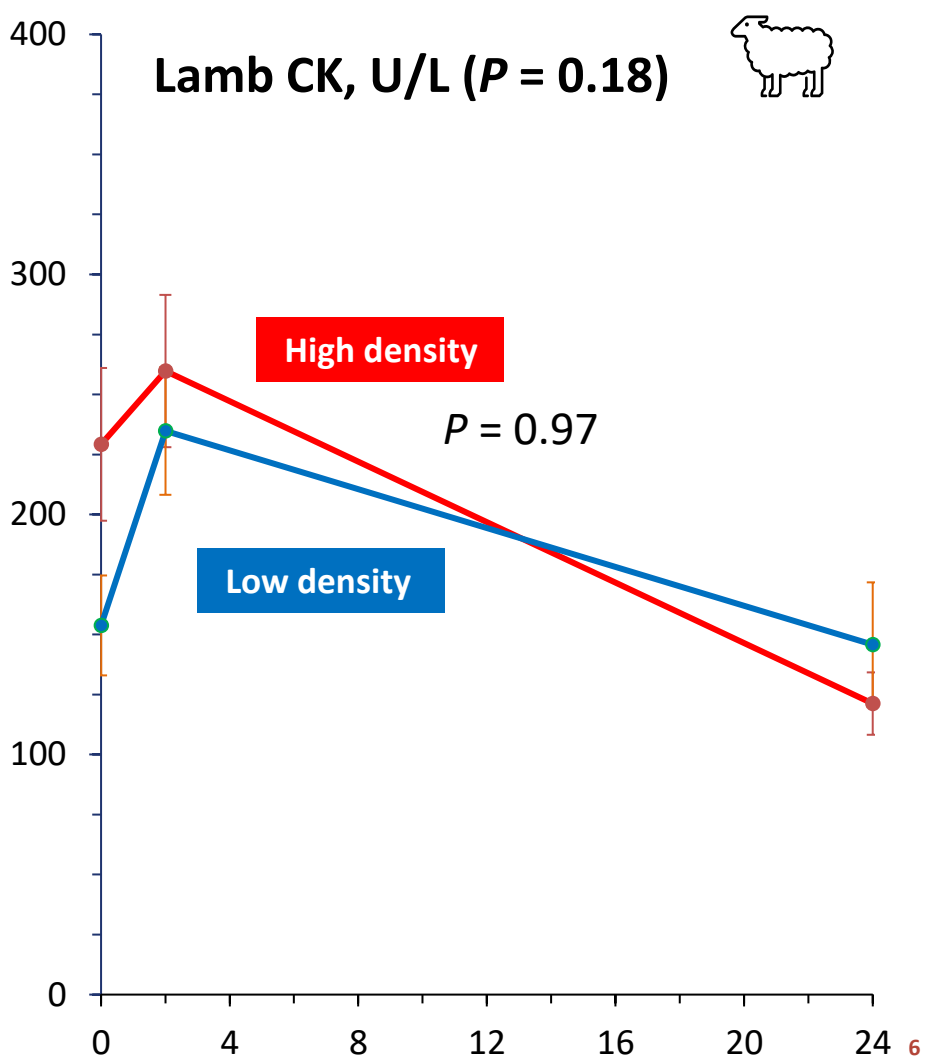
- **Serum cortisol by effect of road transportation**



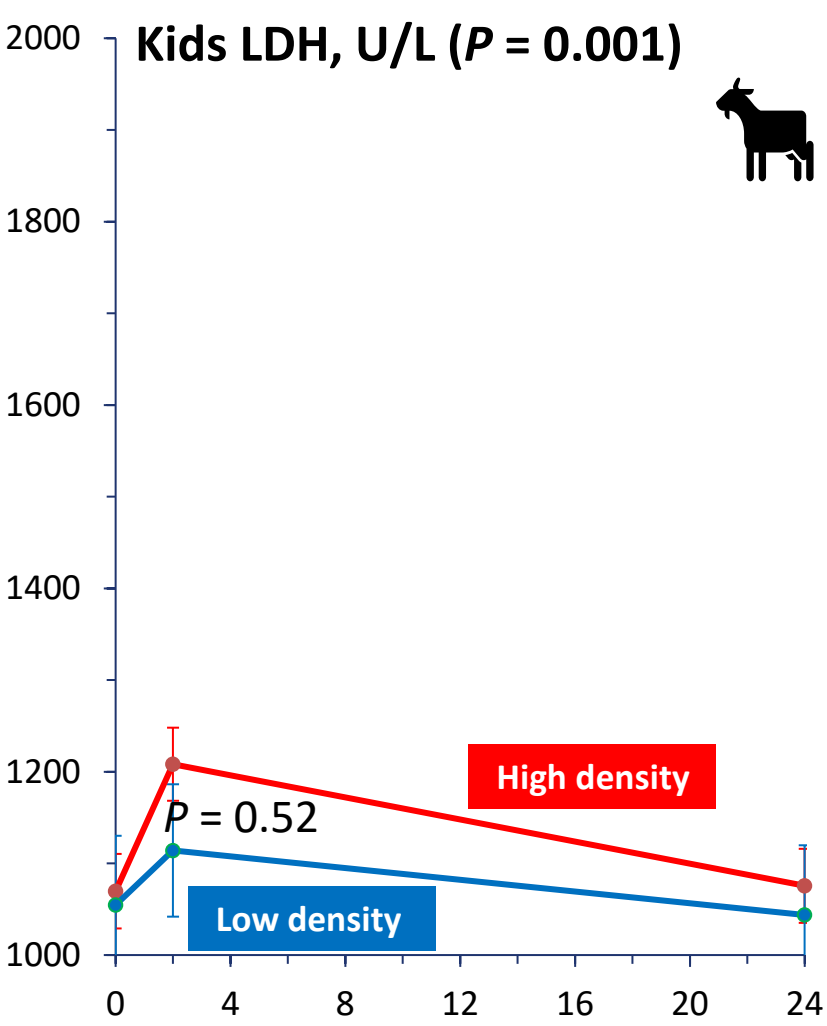


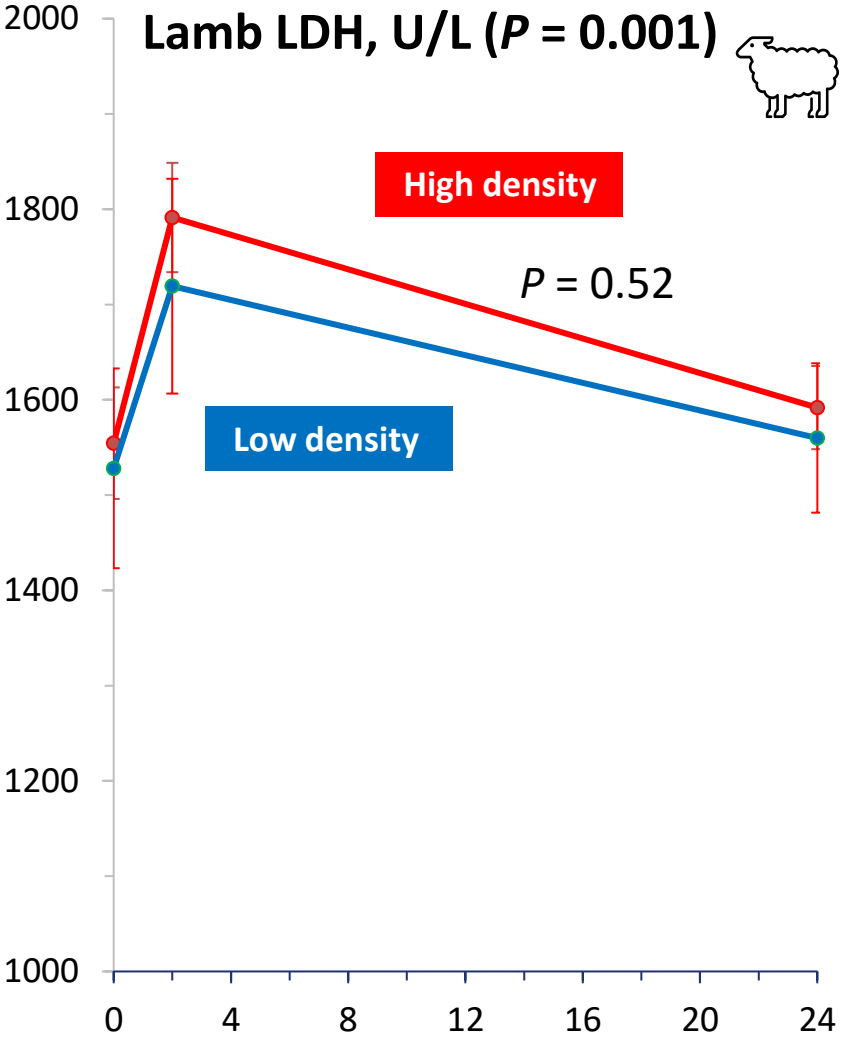
- **Serum creatine kinase (CK, U/L) by effect of road transp.**





- **Serum LDH by effect of road transportation**





Results: Effects of transport density in **kids** (n = 75)

Item	Low (0.018 m^2/kg)	High (0.013 m^2/kg)	± SE	Effect (*P* <)		
				Density	Time	Sex
Kids, n	30	45				
BW, kg	9.34	9.30	0.24	0.74	**0.001**	**0.001**
Temperatures						
Rectal, ºC	39.32	39.38	0.04	0.21	**0.008**	0.22
Lacrimal, ºC	34.87	35.25	0.17	**0.045**	0.12	0.53
Iris, ºC	34.84	35.27	0.19	0.07	**0.033**	0.55
Armpit, ºC	35.46	35.68	0.17	0.30	**0.007**	**0.07**
Blood serum						
CK, U/L	221	236	29	0.57	**0.032**	0.74
Cortisol, ng/mL	9.4	10.7	2.7	0.46	**0.001**	0.54
Glucose, mg/dL	123	117	6	0.13	**0.001**	0.68
LDH, U/L	1074	1111	61	0.55	**0.001**	0.66
FFA, mmol/L	0.260	0.323	0.028	**0.008**	**0.001**	0.78
Urea, mg/dL	18.1	18.9	0.9	0.32	**0.001**	**0.023**

Results: Effects of transport density in **kids** (n = 75)

Item	Low (0.018 m^2/kg)	High (0.013 m^2/kg)	± SE	Effect (*P* <)		
				Density	Time	Sex
Kids, n	30	45				
BW, kg	9.32		0.24	NS	**0.001**	**0.001**
Temperatures						
Rectal, ºC	39.35		0.04	NS	**0.008**	NS
Lacrimal, ºC	34.87	35.25	0.17	**0.045**	NS	NS
Iris, ºC	34.84	35.27	0.19	0.07	**0.033**	NS
Armpit, ºC	35.57		0.17	NS	**0.007**	0.07
Blood serum						
CK, U/L	229		29	NS	**0.032**	NS
Cortisol, ng/mL	10.1		2.7	NS	**0.001**	NS
Glucose, mg/dL	120		6	NS	**0.001**	NS
LDH, U/L	1093		61	NS	**0.001**	NS
FFA, mmol/L	0.260	0.323	0.028	**0.008**	**0.001**	NS
Urea, mg/dL	18.5		0.9	NS	**0.001**	**0.023**

Results: Effects of transport density in **lambs** (n = 80)

Item	Low (0.016 m^2/kg)	High (0.011 m^2/kg)	± SE	Effect (*P* <)		
				Density	Time	Sex
Lambs, n	32	48				
BW, kg	13.74	13.33	0.24	0.07	**0.001**	**0.027**
Temperatures						
Rectal, ºC	39.36	39.38	0.07	0.76	0.33	0.54
Lacrimal, ºC	34.53	34.39	0.34	0.66	**0.007**	0.31
Iris, ºC	34.62	34.88	0.33	0.40	0.78	0.32
Armpit, ºC	35.38	35.52	0.21	0.58	**0.001**	0.09
Blood serum						
CK, U/L	300	298	70	0.97	0.18	0.48
Cortisol, ng/mL	4.5	4.5	1.1	0.96	**0.007**	**0.026**
Glucose, mg/dL	119	115	5	0.29	**0.001**	**0.012**
LDH, U/L	1568	1625	90	0.52	0.16	**0.017**
FFA, mmol/L	0.239	0.241	0.037	0.95	**0.001**	0.27
Urea, mg/dL	27.3	24.5	1.2	**0.016**	0.06	**0.033**

Results: Effects of transport density in **lambs** (n = 80)

Item	Low (0.016 m^2/kg)	High (0.011 m^2/kg)	± SE	Effect (*P* <)		
				Density	Time	Sex
Lambs, n	32	48				
BW, kg	13.74	13.33	0.24	0.07	**0.001**	**0.027**
Temperatures						
Rectal, ºC	39.37		0.07	NS	NS	NS
Lacrimal, ºC	34.46		0.34	NS	**0.007**	NS
Iris, ºC	34.75		0.33	NS	NS	NS
Armpit, ºC	35.45		0.21	NS	**0.001**	0.09
Blood serum						
CK, U/L	299		70	NS	NS	NS
Cortisol, ng/mL	4.5		1.1	NS	**0.007**	**0.026**
Glucose, mg/dL	117		5	NS	**0.001**	**0.012**
LDH, U/L	1597		90	NS	NS	**0.017**
FFA, mmol/L	0.240		0.037	NS	**0.001**	NS
Urea, mg/dL	27.3	24.5	1.2	**0.016**	**0.06**	**0.033**

Conclusions:

- Despite travelling short journeys (2 h), suckling kids and lambs were highly **stressed** (peak of cortisol).
- Kids were more stressed than lambs.
- BW and metabolic indicators **recovered after resting**.
- Marked vertical acceleration (**shocks**) and loud sound (**noise**) were detected, needing reduction in trailers.
- Both kids and lambs showed **cold stress signs**, despite the mild weather during the journey (THI = 60-74), and **closed trailers** are recommended.
- The use of low densities **~0.016 m^2/kg** (6-8 kids/m^2 or 5-7 lambs/m^2), are recommended for kids and lambs.

Thanks for attention!

Integrating innovative TECHnologies along the value Chain to improve small ruminant welfARE management

https://techcare-project.eu/

More info: gerardo.caja@uab.cat

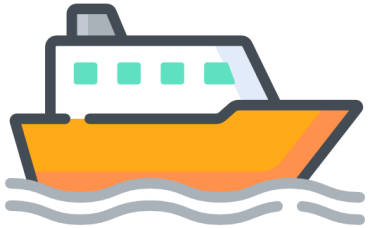
European Commission | Horizon 2020 European Union funding for Research & Innovation

European Union's Horizon 2020 research and innovation programme, Grant agreement No 862050

2. Transportation trials

Sheep transport by sea

Cathy Dwyer (SRUC)



The problem

TechCare

25,000
cattle pa

140,000 sheep pa

Sea journey = 9-15 h
'neutral' time

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Methods

- Three accompanied journeys of sheep from Shetland to Aberdeen
  - 36 compartments, 1236 lambs observed

During transport

- Vessel motion recorded using Lowell Mat1B motion sensor on deck and Omni MSR sensors in compartments (6 planes)
  - Move in 3 planes
  - Rotate in 3 planes
- Sound (volume) inside the compartments and on the decks
- Temperature and humidity in compartments and on the decks
- Air quality (ammonia)

Animal based measures

- Observations of 1 min every 20 minutes from video (mean 46 observations per journey)
- Recorded – standing/lying; idle, eating, drinking, ruminating or panting (laboured breathing), vocalising
- Involuntary responses to motion (counts): adjusting position, contact with walls or other animals, falls


After loading


LC34
STEWART


At sea


Arrival

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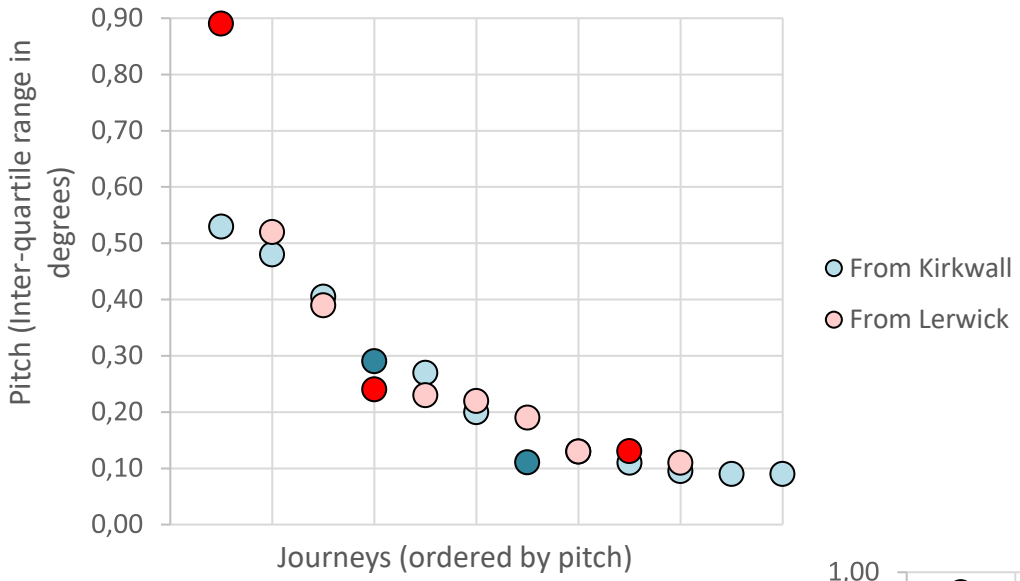
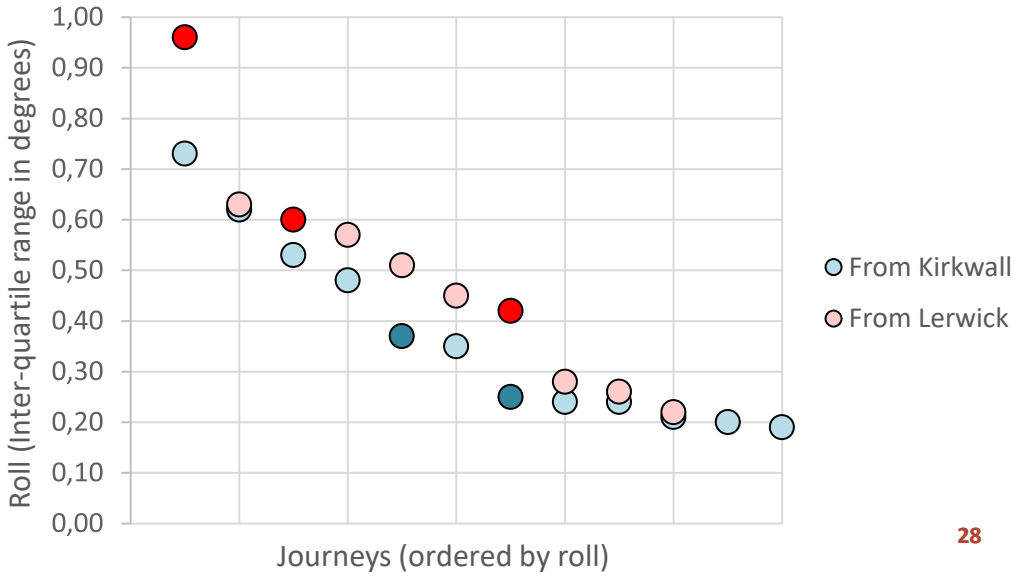
Sensor/tech outputs – vessel motion



Red dots signify sheep journeys from Shetland

Dark red are accompanied journeys



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Sensor/tech outputs – noise (dB)

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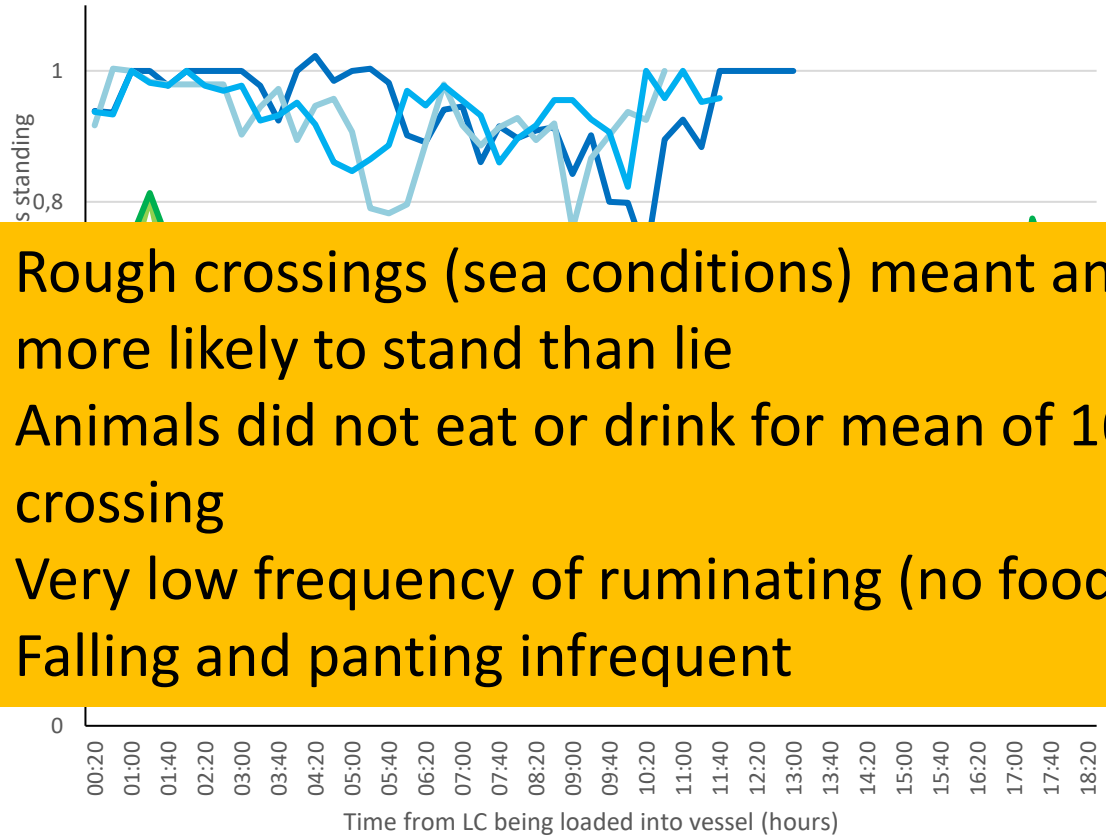
Lamb behaviour – journey 'roughness' (sea conditions)



- Rough crossings (sea conditions) meant animals were more likely to stand than lie
- Animals did not eat or drink for mean of 16.5 hr when crossing
- Very low frequency of ruminating (no food/nausea?)
- Falling and panting infrequent

No injuries that could be unambiguously related to ferry journey
Limited data on arrival as most lambs left in <1 h for next journey
Lambs tended to stand, and not drink or ruminate in lairage

Conclusions

- PLF sensors etc helped to assess the experience of the lambs on the journey
- Journeys were typically long, noisy, limited access to food and water, rapid onward travel
- Journeys typically not overly hot or humid and most relatively calm (did not cause falls/injuries)
- High sensory load for sheep
- On rough crossings sheep were more likely to stand and less likely to ruminate, some adjustment of posture
- Sea journeys are complex (options to alter route to avoid worst weather), no clear PLF measure that could allow assessment of potential welfare impact
- High pitch and roll may be more unpleasant for sheep