



Integrating innovative **TECH**nologies along the value Chain
to improve small ruminant **welfARE** management

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Monitoring the stress of light lambs and goat kids transported over short journeys - *by G. Caja and A. Elhadi (UAB)*



Photo 1: Animal trailer on the roads during the transport trial © UAB

The European regulation for animal transport (EC 1/2005) indicates the requirements to be met according to species and conditions during long journeys (8-14 h). A range of temperatures ($5-30 \pm 5^{\circ}\text{C}$) and minimum spaces are recommended according to the age and weight of the animals. For small lambs (>1 week and <20 kg), the space should be >0.2 m²/head (>0.010 m²/kgBW), but it is not known if this is adequate for suckling lambs travelling to abattoir to be slaughtered as “lechal” (30-45 d and 10-14 kgBW). Moreover, the regulation does not include recommendations for suckling goat kids, also slaughtered as “lechal” at light weights (30-60 d and 9-12 kgBW).

More than 3 million of lambs and kids of these categories are travelling to be slaughtered every year only in Spain but the “lechal” (milk fed) category is also typical of other Mediterranean countries.

For this reason, two experiments were carried out in the UAB in Spain with the aim of evaluating the impact of transport density on several stress indicators of light suckling kids and lambs transported over short journeys.

In the 1st experiment, 25 suckling goat kids (9.5 ± 0.4 kg BW, Murciano-Granadina breed) were used to evaluate the effects of 2 space densities for road transport over a short journey (2 h). Space densities for kids were: low (0.018 m²/kgBW; n = 10) and high (0.013 m²/kgBW; n = 15).

In the 2nd experiment, 20 lambs (13.9 ± 0.4 kg BW) of 2 breeds (Manchega; n = 10; Lacaune; n =10) were used to

evaluate the effects of 2 space densities for a similar road transport over a short journey (2 h). Densities were: low (0.016 m²/kgBW; n = 8) and high (0.011 m²/kgBW; n = 12).

In both experiments, the trip was done on national roads at moderate speed using a trailer (1.8×1.0×1.3m; 2 floors and 4 compartments of 0.9 m²; Photo 1), equipped with sensors (temperature, humidity, sound and acceleration). A second accelerometer was placed in the driver's cabin. Animals were weighed, temperature measured, and blood sampled at h 0 (uploading), h 2 (downloading) and h 24 (resting) from departure. Only Manchega lambs were slaughtered after arrival and their carcasses evaluated.

Acceleration peaks in the z-axis during transport were much higher in the trailer than in the cabin (11.8 vs. 1.5 g; Figure 2). Similarly, high noise peaks were recorded in the trailer (volume >500 dB and frequency >1400 Hz) which should be considered as stressful.

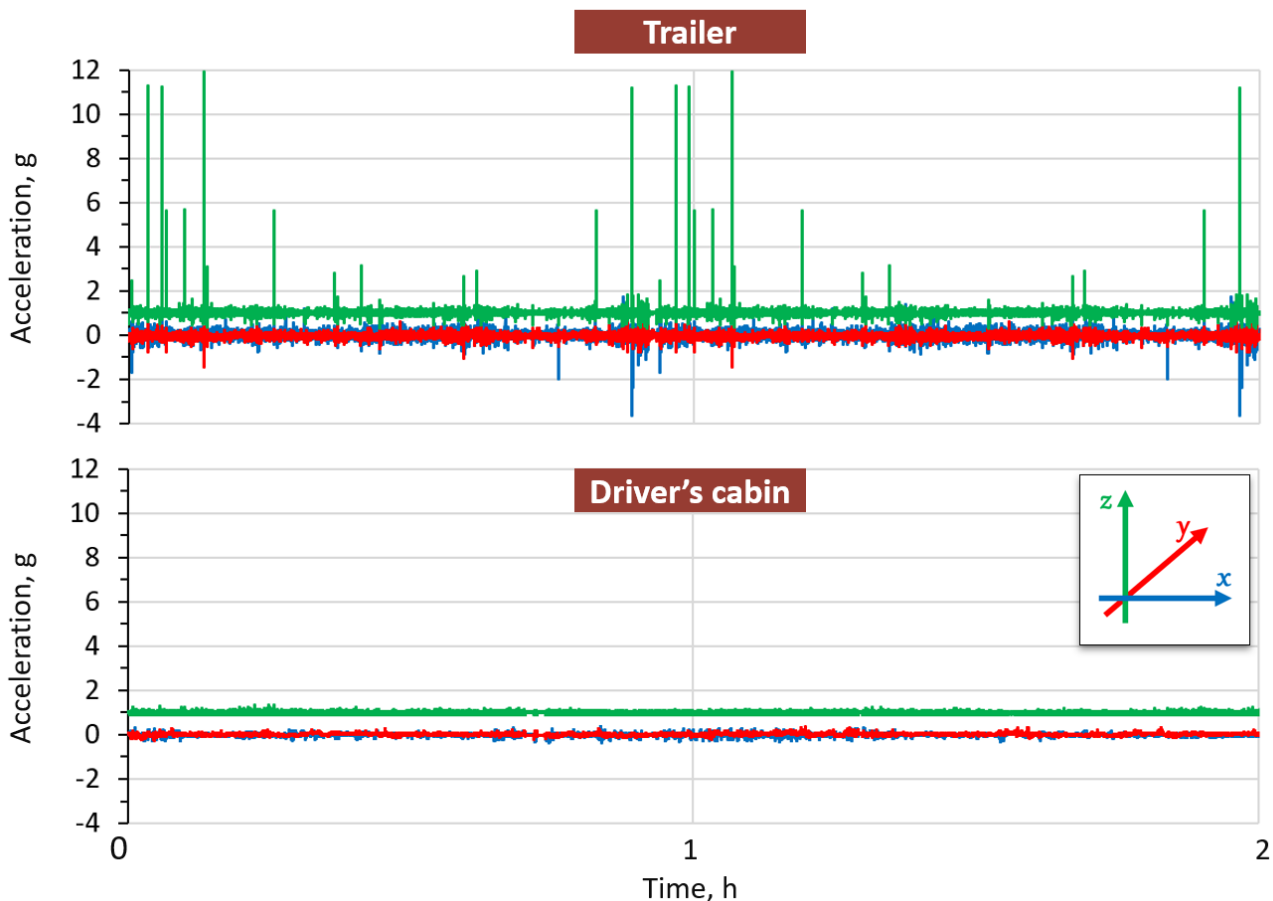


Figure 2: Acceleration differences during transport between the trailer and the driver's cabin

Weight of goat kids decreased during transport and recovered after resting. A non-significant weight loss was detected in the lambs after transport, without differences by breed, sex or transport density. Despite the mild ambient conditions during the journey (21°C and 57%RH, on average), rectal temperature decreased during transport, which was -0.2°C in the goat kids, and greater in the Lacaune vs. Manchega lambs (-0.68 vs. -0.26°C ; respectively) agreeing their fleece traits, but without effect of density. All metabolic indicators increased by effect of transport, which indicated a situation of metabolic stress aggravated by cold conditions (12% of the kids showed shivering at arrival). High density during transport only increased serum creatine kinase (71%) and tended to increase lactate dehydrogenase in the kids. However, lactate dehydrogenase increased in the high-density lambs (+14%), without other significant effects. Lamb carcasses of the slaughtered Manchega lambs differed in color, which was

darker in the low density lambs. In conclusion, space densities of 0.015 and 0.010 m²/kgBW, respectively for suckling goat kids and lambs, seem to be adequate for short journey transport. Nevertheless, relevant deficiencies in temperature, noise and vibration were detected when officially approved trailers for lamb and kids transport, were used.

Finally, closed trailers, with regulated ventilation and temperature, and reduced noise conditions, and with efficient shock absorbers, are recommended to improve transport in young kids and lambs.



Figure 3: Mireia Sort, winner of a Young Scientists Prize in the AIDA meeting in Zaragoza, Spain © UAB

These studies were presented in the XX Jornadas de Producción Animal in Aula Dei, Zaragoza (Spain) the past 13-14 of June:

- Sort, M., Elhadi, A., Costa, R., Recio, A., Salama, A. A. K. y Caja, G. 2023. Estrés de transporte a corta distancia en cabritos lechales. XX Jornadas AIDA, Book of proceedings, p. 4.

- Jesús, J. C., Elhadi, A., Costa, R., Recio, A., Salama, A. A. K. y Caja, G. 2023. Estrés de transporte a corta distancia en corderos lechales. XX Jornadas AIDA, Book of proceedings, p. 6.

The student Mireia Sort, who presented the kid's study in the meeting, deserved one of the AIDA Prizes to Young Scientists (Figure 3).

Animal welfare in transport studies: Transport of sheep on sea crossing– by C. Dwyer (SRUC)

Several journeys are often required in the life of livestock, e.g. to allow access to better grazing, trade in breeding stock and for fattening or for transport to markets and for slaughter. In some European countries this can also include transport of animals by ferry over sea when moving from islands to mainland. In Scotland these journeys are made by sheep particularly in the autumn from the Northern Isles to the mainland to access winter grazing. TechCare partners, SRUC, are involved in a study to combine analysis of existing data on animal transports and specific data collection on several ferry crossings where temperature, humidity and motion measures of the vessel will be related to animal behavioural responses during and after the journey. The project is jointly funded by TechCare and Scottish Government and will focus on the movement of sheep from the Shetland Isles and cattle from the Orkney islands, journeys which can take between 9-15 hours. The welfare of sheep making these journeys, and the value that making PLF assessments of the conditions under which they travel to assess risk factors for their welfare, is the specific focus of the TechCare component of this study. Over the last 20 years animals have travelled in specialised 'cassettes' in groups of approximately 35 sheep

per pen. These cassettes allow animals to be given access to food and water, provide bedding, collect effluent and permit ventilation. Anecdotal evidence suggests that the animals travel very well in these conditions but may sometimes appear 'tired' if the crossings are rough, suggesting that sea conditions can be a factor in livestock welfare on ferry journeys. However, there is little objective scientific evidence to understand the animal's experience of these types of journeys, and whether management can be modified to improve animal welfare. It is this evidence gap that this project is designed to address. Currently, sensors to monitor boat movements and to measure temperature and humidity at various points on the deck where the animals will travel, are being fitted to ferries and pilot data collection is underway to assess ferry movements. Cameras that can monitor the behaviour of sheep during the journey will be placed in the cassettes and ammonia and noise exposure will be monitored. Following pilot data collection, the main data collection on accompanied journeys by animals will be made on up to 6 occasions, monitoring a number of different cassettes placed in different locations on the deck. Video evidence will be analysed to assess the time sheep spend eating, drinking, ruminating and lying on a crossing, and to assess whether animals lose balance or fall during a crossing. These data will be compared to sensor-based measures of the forces animals experience during ferry transport and to match these to the animal's welfare experience during transit. The use of PLF technology in this project will be critical to understanding the types of sea conditions that can impact on sheep welfare. Being able to provide evidence-based advice on when animal welfare will be most impacted by journey conditions will be important for providing animal welfare policy that protects livelihoods as well as animal welfare.



Example of cassette system when unloaded at the ferry port. (Photo ©: Cathy Dwyer, SRUC)

British Grassland Society Summer Farm Walk – by J. Wright and R. Small (Breedr)



On the 27th of July Breedr attended the British Grassland Society Summer Farm walk in Anglesey in North Wales. A Breedr farmer, Dylan Jones, was hosting part of the farm walk on his farm Castellior. The farm is just over 800 acres and they finish beef cattle (mainly dairy cross) and fatten lambs during the summer. Over the past few years Dylan has been working towards reaching net zero and in a recent carbon audit has almost reached this target. Dylan has been a long term user of Breedr and believes it has really transformed their business. He uses it to closely monitor the performance of his fattening cattle and sheep. Knowing the purchase price

and their growth rates provides him with the data to make informed management decisions of when to sell the animals and make sufficient profit. Dylan's farm in particular is a real exemplar of introducing new management practices to improve welfare and productivity.



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TechCare Partner Team: AGRIS

Agris

Agencia pro sa chirca in agricultura
 Agenzia regionale per la ricerca in agricoltura



REGIONE AUTONOMA
 DE SARDIGNA
 REGIONE AUTONOMA
 DELLA SARDEGNA

Agris Sardegna is the regional research agency of Sardinia (Italy). The mission of Agris is to support sustainable agriculture in Sardinia by research and technology transfer in the areas of herbaceous crops, fruit and cork production, livestock and aquaculture.

Agris has 800 staff, among them 100 are researchers. The Agency owns several experimental farms, four of them devoted to livestock: beef cattle (Foresta Burgos) beef cattle and sheep (Macomer), sheep (Monastir) and (Bonassai). Bonassai is the main livestock centre with all the main laboratories: genetics, nutrition, reproduction,



aquaculture, livestock production systems, chemistry and microbiology of animal products. Some 1300 dairy sheep are raised at Bonassai farm, all belonging to Sarda breed. Within the TechCare framework, Agris, is collaborating to gather the stakeholders' opinions on the main welfare issue of dairy sheep supply chain and to identify the most relevant technologies to monitor and improve welfare management. To this aim, Agris has been leading the literature research and the database set up. Agris is also collaborating on testing prototypes and adapting already existing technologies to dairy sheep systems. Bonassai is also among the pilot farms where early warning systems of welfare monitoring are being evaluated.

Short profile of the team involved in the TechCare project:



Mauro Decandia: Agronomist, researcher, team leader of the Nutrition research sector at Agris. He has participated in several training courses in the field of animal nutrition and feeding behaviour of small ruminants in various international research centres and universities (CIHEAM, Zaragoza, Spain; INAPG, Paris, France; ARO, Heit Dagan, Israel). Main research areas: nutrition and feeding behaviour of small ruminants, precision livestock system, estimation of environmental impacts of animal farming. Role in the Techcare project: contact person for AGRIS.

Valeria Giovanetti: Agronomist, PhD in Dairy Sheep and Goat Breeding Science and Technology. Researcher in the Nutrition research sector at Agris. He has collaborated with research institutions, IGER (UK), for the acquisition of knowledge on devices applied to the study of the feeding behaviour of small ruminants. She collaborates with universities, research centres and local IT companies for the implementation of digital devices applied to small and large ruminants for the study of grazing feeding behaviour. Role in the Techcare project: deputy contact person for Agris and national facilitator.



Marco Acciario: Agronomist, PhD in Science of Agricultural and Forestry Systems and Food Production. Researcher at the Nutrition research area in Agris. He deals with dairy sheep and cattle breeding systems, grazing behaviour of ruminants and meat quality of cattle and sheep. Currently, his work is oriented towards the use of GPS devices to study the grazing behaviour of ruminants on extensive pastures and agroforestry systems. Role in the Techcare project: collaborates on WP3 - Prototyping & PLF and WP5 Pilot and large-scale farms.

Stefano Picconi: Technician specialised in zootechnical and agronomic surveys at the Nutrition research sector. He participated in numerous experimental trials within the framework of various research projects. Role in the Techcare project: technical support in the activities of WP3 - Prototyping & PLF and WP5 Pilot and large-scale farms.



Carla Manca: Veterinary, PhD in Reproduction, production, animal welfare and safety of food of animal origin. Specialisation in Hygiene in the production, processing, marketing, and transport of food of animal origin and their derivatives. Researcher in the Livestock Systems research sector of Agris. Main research activities: characterisation and valorisation of meat from native breeds in Sardinia; use of the IR thermo-camera for animal welfare assessment. Role in the Techcare project: collaborating in the activities of WP1 - Stakeholder involvement and WP2 - Welfare.

Maria Dattena: Veterinary, Postgraduate Diploma and Master Philosophy at Massey University in Palmerston North (New Zealand). Researcher and team leader of the Reproduction research sector at Agris. Main research activities: Reproductive biotechnologies in particular in vitro production of embryos; freezing and vitrification of embryos and spermatozoa; production and isolation of embryonic and mesenchymal stem cells; reproductive techniques concerning artificial insemination, heat synchronisation, superovulation for embryo production and transfer. Role in the Techcare project: collaborates in the activities of WP2– Welfare



Marilia Gallus: Veterinary. Researcher in the Reproduction research sector at Agris. Main research activities: Reproductive biotechnologies in particular in vitro production of embryos; reproductive technologies related to artificial insemination and semen manipulation and preservation; low-impact reproductive systems and techniques such as heat synchronisation methods and artificial insemination without the use of hormones. Role in the Techcare project: collaborates in the activities of WP2 - Welfare and WP7 - Communication and dissemination.






Fabrizio Chessa: Agronomist, technical specialist in the Reproduction research sector. Expert in the processes of automation and digitisation of activities in the zootechnical field with regard to electronic identification and collection of animal data in Agris experimental farms. Role in the Techcare project: technical support to the activities of WP3 - Prototyping & PLF and WP5 Pilot and large-scale farms.



© Credit Marilia Gallus, AGRIS

TechCare in the news

List of past and upcoming events with TechCare partners attendance.

Event 	Date 	Location 	Partner 
			
NorthSheep 2023 Stand & Project leaflets distributed	7 June 2023	Ponteland, Northumberland, UK	SRUC
20 th Conference on Animal Production (AIDA): Presentations: 1) “Short distance transport stress in suckling kids” ; 2) “Short distance transport stress in suckling lambs” ; 3) “Prioritization of problems and precision devices for welfare management in dairy sheep”	13 – 14 June 2023	Zaragoza, Spain	UAB

<p>Sheep 2023 Open Day. Poster: “TechCare – Integrating innovative TECHNOLOGIES along the value Chain to improve small ruminant welfare management”.</p>	17 – 18 June 2023	Tipperary, Ireland	TEAGASC
<p>76th meeting of Italian Society of Veterinary Science (SISVET). Posters: 1) “TECHCARE project: an Italian pilot study on dairy sheep to test innovative technologies for welfare monitoring”; 2) “The use of DCC to identify intra mammary infections in Sarda dairy sheep”</p>	21 – 23 June 2023	Bari, Italy	AGRIS
→			
<p>74th EAAP Annual Meeting Session n. 39: “TechCare and ClearFarm: pilots on PLF tools for monitoring animal welfare”</p>	26 August – 1 September 2023	Lyon, France	Idele, INRAe, SRUC, MRI, NIBIO, UAB, PageUp, ARO, AGRIS, Teagasc, ELGO, BUAS





Coastal goat - Credit: Anna Rehnberg © NIBIO

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