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Summary of Dissertation

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Sleep in farmed ungulates

Sleep is a fundamental biological process supporting cognitive function, immune regulation, and emotional regulation. Interest in sleep research among animal scientists is growing, particularly regarding its implications for the welfare of farmed ungulates. However, the literature has not yet been comprehensively synthesized, limiting our understanding of current knowledge and opportunities for future research.

Chapter 1 presents a narrative review connecting sleep with animal welfare in farmed ungulates, and using examples in other species, particularly laboratory rodents and humans, where research on sleep is more advanced. This chapter compares research on sleep in farmed ungulates with that conducted in other species to help identify opportunities for future work. Evidence from humans and laboratory animals suggest that sleep relates to biological functioning, affective states, and natural living. However, evidence from farmed ungulates remain scarce in the literature, highlighting important knowledge gaps.

Chapter 2 includes a scoping review with the objectives to: 1) map existing studies on sleep in farmed ungulates including publication trends, animal characteristics, and methods used to assess sleep, 2) explore the animal welfare implications of this research, and 3) identify knowledge gaps in need of future research. Three databases (CAB Abstracts, PubMed, and Scopus) were searched and resulted in the inclusion of 115 studies. Research increased overtime with 76% published after 2000. Bovine species were the most studied (42%), while adult (55%) and female (43%) the most life stage and sex represented. Sleep-like behaviour was the most used method (55%), although validation studies were limited. Observational studies primarily investigated associations between sleep and individual animal characteristics, while experimental studies focused on natural living and environment and biological functioning. Little research addressed affective states and cognition. Overall, findings highlight the need to validate sleep assessment methods and expand research into underexplored areas, particularly the relationships between sleep, affective states, and cognition in farmed ungulates.

Publications:

1. Dias, G. C. B., Freitas-de-Melo, A., Bottino, J. P., Frisch-Braga, M. J., Zanella, A. J., Osowski, G. V., Pérez-Clariget, R., & Ungerfeld, R. (2024). *Multiparous ewes have greater mating success when competing with nulliparous ones.* **Applied Animal Behaviour Science, 281**, 106443. Published December 2024. https://doi.org/10.1016/j.applanim.2024.106443
2. Dias, G., Ungerfeld, R., Freitas-de-Melo, A., & Zanella, A. (2026). *Older yet more attractive: Multiparous ewes are preferentially courted, and elicit more mountings and ejaculations than nulliparous ewes in group breeding.* **Animal Reproduction Science, 285**, 108047. Published online November 21, 2025; assigned to the February 2026 issue. https://doi.org/10.1016/j.anireprosci.2025.108047
3. Dias, G., Ternman, E., & Proudfoot, K. (2026). *Exploring sleep in farmed ungulates: A scoping review protocol.* **PLOS ONE, 21**(2), e0343334. Published February 23, 2026. https://doi.org/10.1371/journal.pone.0343334

Presentations:

1. Dias, G. C. B., Viana, V. S. S., Marcondes, M. I., & Rotta, P. P. (2019). *The increase in Brazilian dairy cattle article publications in high-impact factor journals in the last five years.* VII SIMLEITE (Viçosa, Brazil).
2. Dias, G. C. B., Morais, V. C. L., Marcondes, M. I., & Rotta, P. P. (2019). *Who is financing dairy cattle research in Brazil?* VII SIMLEITE (Viçosa, Brazil).
3. Dias, G. C. B., Marcondes, M. I., & Rotta, P. P. (2021). *A survey of research on dairy cattle in Brazil by region, state, and institute.* SIMLEITE (Viçosa, Brazil).
4. Dias, G. C. B., Raimundi, T. A. J., Marcondes, M. I., & Rotta, P. P. (2022). *The influence of the bedding material on dairy cows' behaviour.* Poster presentation, 55th Congress of the International Society for Applied Ethology (ISAE), Ohrid, North Macedonia.
5. Dias, G., Ternman, E., & Proudfoot, K. (2025). *Exploring sleep in farmed ungulates: A scoping review.* Oral presentation, ISAE North America Regional Meeting (Guelph).

Biographical Data

Born in Belo Horizonte, Brazil