

Is Sleep Important for Dairy Cows?

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The importance of cow comfort and its relationship with lying behavior is widely accepted. Recent work from the Swedish University of Agricultural Sciences and the University of Helsinki provides a strong indication that a portion of a cow's lying time is spent sleeping. Stage of lactation can drive the amount that cows sleep as well as the time of day. It has been speculated that cows have a diurnal sleep pattern, meaning they are predominately active during the day, but it is unclear if this is due to a biological effect or management practices. A cursory review of the characteristics of sleep reveals that there is likely a link among lying time, sleep, cow health, welfare and productivity. However, our current understanding is that cows engage in the same sleep stages as humans, and these different states are similarly beneficial across species.

What is sleep?

A state where consciousness is reduced but is quickly reversible.

Different stages of sleep

Drowsing:

- State of alertness that occupies the grey area between fully conscious and asleep.
- One-third of a cow's day is spent drowsing.
- Rumination often coincides with drowsing.

Non-rapid eye movement (NREM) sleep:

- NREM sleep helps with energy conservation since the brain is least active during this state.
- Rumination often coincides with NREM sleep.

Rapid eye movement (REM) sleep:

- Although not fully understood, it has been suggested that the cells that promote immune memory are increased during the resting period.
 - Immune memory is the idea that when the body encounters a pathogen once, the body will generate a faster and stronger immune response when additional exposure occurs.
 - One speculation for this theory is that since the body uses less energy during the resting period, the energy saved can be directed toward immune cell production and activation.
- Although not directly seen in cows, in various other models, REM sleep helps maintain and establish brain connections during the critical stages of development.
 - Specifically, REM sleep allows the brain to turn experiences into memories. Even though the mechanisms between brain development and REM sleep are not entirely clear, enzymes that allow for memory retention are secreted only during REM sleep.



Figure 1: Dairy cow in a lying posture, which is often associated with sleep.

Sleep behavior and postures

- Drowsing is evident in cows from a quiet resting posture with their eyelids relaxed but can often be confounded with NREM sleep.
- During NREM sleep, cows lie down with their heads raised, making it hard to distinguish them from cows in other sleep states.
- REM sleep is identified by reduced muscle tone, specifically the neck in dairy cows.
- During REM sleep, cows can also have rapid eye movements and muscle twitches.
- Cows can achieve NREM sleep standing up, but REM sleep can only be achieved by lying down.
- Lying posture and behavior are useful in calves, but in cows, lying posture is a poor indicator of sleep stages, because drowsing and NREM sleep cannot be separated solely on behavioral estimates.

What do we know about sleep in dairy cows?

- Individually housed cows sleep roughly four hours a day and drowse for eight hours.

- Cows sleep more at night when the barn is least disruptive, but sleep can occur throughout the day.
 - However, this schedule may be disrupted by management activities, such as milking or feed delivery.

Sleep changes depending on age and stage of lactation

- Cows in early and peak lactation slept less in a 24-hour period than cows in their dry period.
- Cows in their dry period have longer NREM sleep. Since they eat a more roughage-based diet, they spend more time ruminating and less time in REM sleep.
- Cows in peak lactation have longer REM sleep, which might indicate its importance to overall productivity.

Sleep and the immune system

- As of now, there is no data on how sleep, or lack of sleep, impacts the cow, but research from various other models suggests sleep is likely critical to a cow's overall health and welfare.
 - For example, when men were sleep deprived from 10 p.m. to 3 a.m. for one night, the functionality and proliferation of natural killer cells (immune cells) were reduced, ultimately leading to a suppressed immune system.
- Sleep deprivation increases proinflammatory cytokines (immune signaling cell) that can lead to chronic low-grade inflammation, which can cause inflammatory diseases such as rheumatoid arthritis.

- Sleep deprivation increases the risk of cardiovascular disease, cancer and the common cold.
- Sleep deprivation will likely alter immune function, causing cows to shift resources away from production.
- While we are in the early stages of our understanding of sleep in dairy cows, there is the potential for sleep deprivation to have a major effect on cows and management strategies, such as bedding, stocking density and time away from the pen. The pen should be designed to accommodate clean, comfortable resting spaces that likely promote sleep.

Conclusions

- Although it is unknown if sleep is required in dairy cows, there are strong implications that cows need sleep to be productive and function.



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