Cow comfort in transition dairy cows

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Summary

- Most clinical diseases in lactating dairy cows occur within the first 30 DIM. Meeting behavioral needs, nutritional requirements, and ensuring thermal comfort for transition cows reduce disease risks and improve cow performance.
- Cow comfort entails ensuring access to quality water and feed, maintaining facilities to provide a clean, dry living environment and thermal comfort, implementing herd management practices that reduce fear and distress, considering cow's behavioral needs and preventing injuries and diseases.
- Optimum facility design and maintenance and best herd management practices increase lying time, reduce lameness risks and improve cow comfort and performance**.**
- Prevent metabolic and associated diseases by maintaining a moderate BCS of cows during late lactation and dry period, rapidly increase in DMI after parturition, and appropriate mineral and vitamin nutrition.

The "make or break" period

The transition (periparturient) period of dairy cows is commonly defined as the three weeks prior to and after parturition[1]. However, for disease prevention purposes, other authors suggested this period should also consider the last few weeks of lactation and the entire dry period[2]. Regardless, the transition from low nutrient requirements during the non-lactating, late gestation period; to a ~30% decrease of dry matter intake (DMI) around calving and massive increase in nutrient requirements for colostrum and milk production is characterized by significant metabolic changes.

Metabolic changes during the transition period entail increased body reserves mobilization, increased glucose utilization and production of ketone bodies, increased bone resorption to meet calcium demands, among others. While most of these changes are normal in healthy, high-producing cows, if exacerbated they could result in metabolic diseases (fatty liver, ketosis, milk fever), that are associated with other diseases (e.g., retained placenta, metritis) and decreased performance (Fig. 1).

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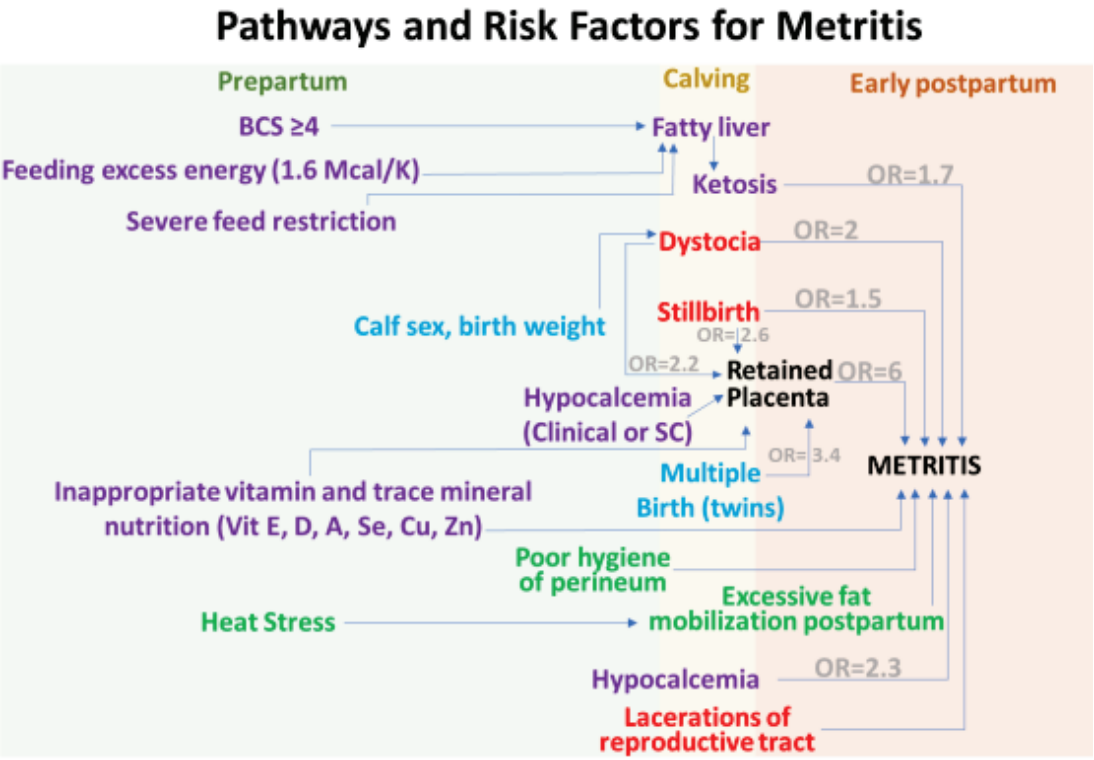

Figure 1. Pathways and risk factors for metritis. Obesity, feed restrictions, inappropriate energy, protein, mineral and vitamin nutrition, among other risk factors, increase the risk of metabolic diseases that in turn increase the risk of metritis. Image from Pineiro and Schuenemann, 2021[3-13].

Transition cow health and comfort

Although cow comfort became a popular term in the dairy industry it is often not well defined and poorly understood. Oxford Languages defines comfort as "*a state of physical ease and freedom from pain or constraint*". Cow comfort and cow welfare are similar concepts that entail:

1) Access to quality water and feed to meet nutritional demands.

2) Facility design and maintenance to provide thermal comfort and a clean and dry living environment.

3) Herd management practices that minimize fear and distress and consider cow's time budgets and behavioral needs.

4) Preventing diseases and injuries and promptly diagnosing and treating diseases to minimize pain.

Most diseases that occur during lactation will take place within the first month after calving[14]. Approximately, one in every three cows develop at least one clinical disease during the first 21 DIM[15]. Nutrition, management practices and facility design and maintenance to meet the behavioral needs, nutritional requirements, and thermal comfort of transition cows are paramount to reduce disease risks and enhance their performance (Fig. 2).

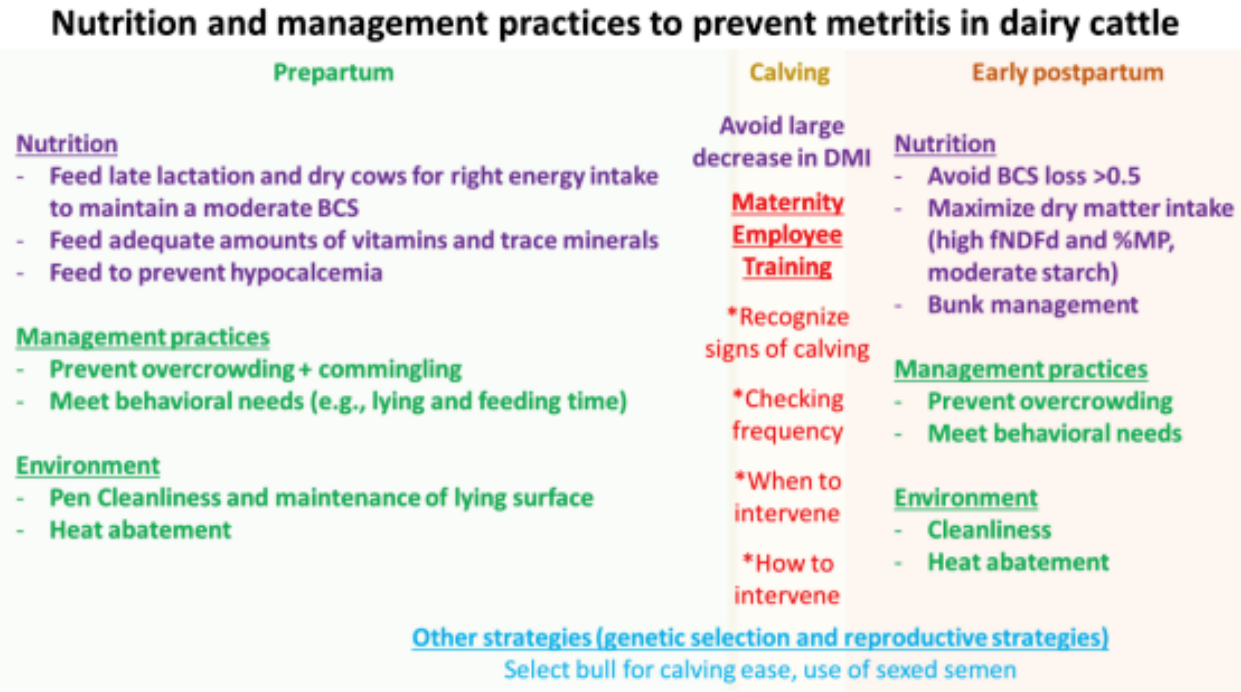

Figure 2. Pathways and risk factors for metritis. Obesity, feed restrictions, inappropriate energy, protein, mineral and vitamin nutrition, among other risk factors, increase the risk of metabolic diseases that in turn increase the risk of metritis. Image from Piñeiro and Schuenemann, 2021[16].

Behavioral needs and thermal comfort

Lying down or resting is a key behavioral requirement. When cows experience a period of simultaneous restrictions in feed and stall availability followed by allowance, they will prioritize resting over feeding time to make up for lost resting time[17,18]. While lying down, cows typically sleep for about 4 h/d[19]. Lying time restrictions contribute to decreased feeding time and increased cow's stress and hoof diseases risks[20,21]. Furthermore, blood flow of the mammary gland increases by 30% when cows are lying down compared to standing and there is limited evidence suggesting increasing lying time would increase milk yield of healthy cows[22]. However, at least during the early postpartum period, there is no correlation between lying time and milk yield[23] (Fig. 3).

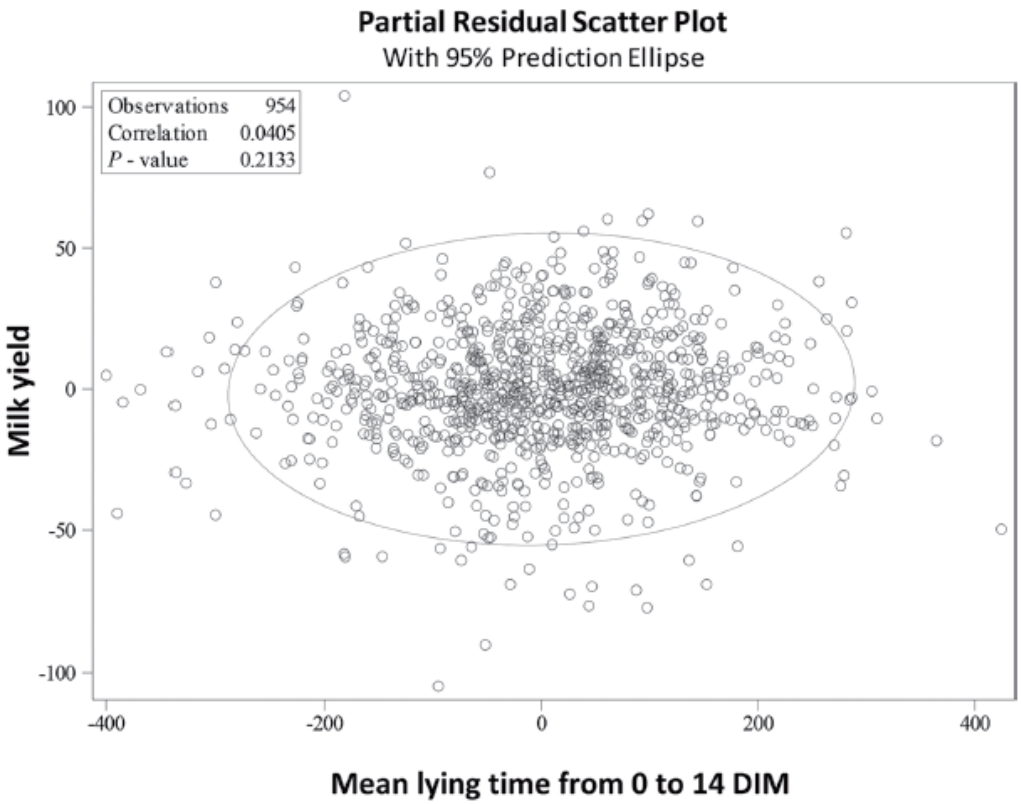

Figure 3. Partial correlation between milk yield at the first DHIA test and lying time for the first 14 DIM adjusted by six confounding variables. There is no correlation between lying time and milk production during early lactation. Image from Piñeiro et al., 2019[23].

Lying time is affected by cow-level or intrinsic factors such as physiological and lactation stage, age and diseases[24]. Mid-lactation cows spend ~12 h/d lying down distributed in roughly 11 lying bouts of 65 min. each on average[25]. However, during the transition period lying time fluctuates remarkably. Pregnant dry cows might lie down for approximately 13 h/d, while postpartum cows may rest for about 11 h/d[26] (Fig. 4). Multiparous cows lie down roughly 2 h more compared to primiparous cows during the transition period. Diseased cows lie down more time compared to non-diseased cows during the first week after parturition[24]. Therefore, increased lying time does not necessarily equate to better cow comfort or welfare.

Optimum facility design and maintenance and best herd management practices increase lying time and cow comfort. These are herd-level or extrinsic factors that affect the lying and feeding time of cows[24,26]. The latter 2 behaviors combined account for roughly 70% of cows' time budgets, leaving only 30% for time standing in the stall and alley (including drinking time), and time milking and restraint for herd management practices. Therefore, herd management practices and facility design and maintenance should focus on minimizing time standing and away from the pen and resources and facilitating lying and feeding time.

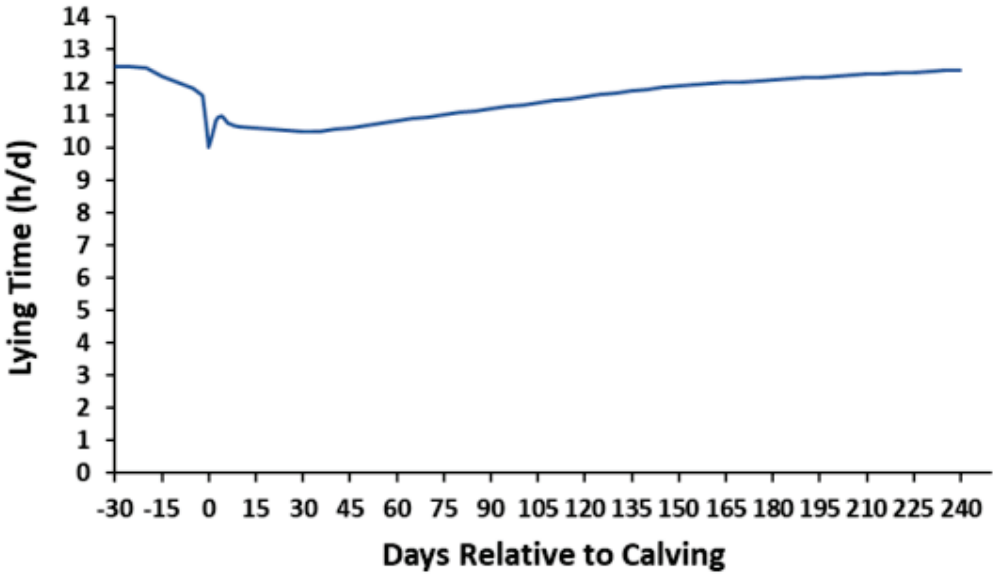

Figure 4. Schematic representation of cows lying time relative to parturition. Cows lie down more time prepartum compared to the early postpartum. Image from Piñeiro et al., 2018[26].

Stall base type, design and maintenance impact how much time dairy cows spend lying down. For instance, cows tend to lie down for longer periods in sand-bedded stalls compared to mattress stalls[25]. Additionally, herds using deep-bedded stalls have lower lameness prevalence than those with mattress stalls[27]. Adjusting stall width or removing certain components, like the brisket board, can increase lying time in free-stall barns[28]. Providing abundant, dry bedding material can enhance lying time. For each inch of sand lost beneath the rear curb, lying time decreases by roughly 0.5 h/d [29]. Moreover, cows tend to spend more time lying down in drier bedding material compared to wetter material (Fig. 5) [30].

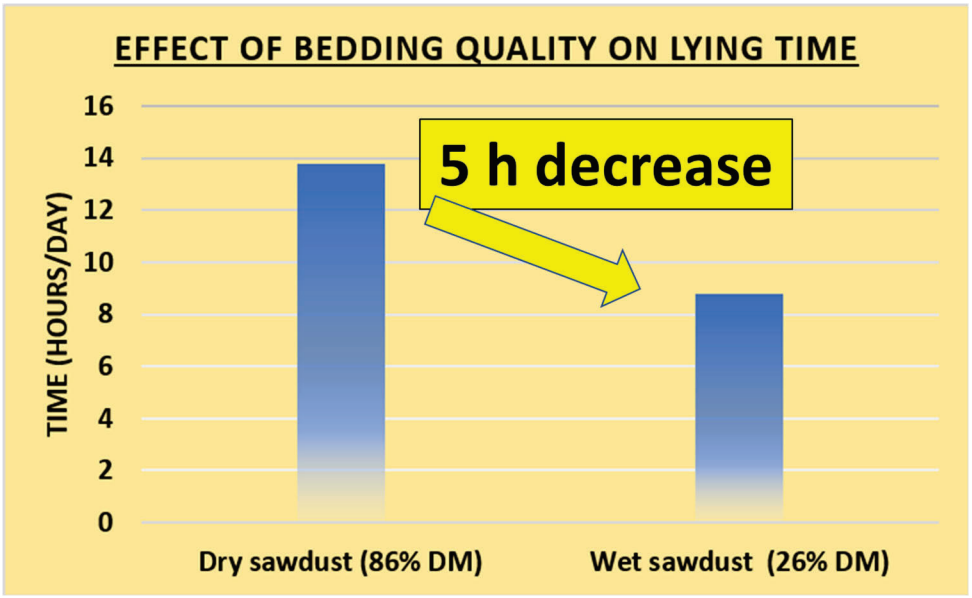

Figure 5. Effects of bedding quality on lying time of dairy cows. Compared to dry sawdust, wet sawdust decreased by 5 hours lying time. Adapted from Fregonesi et al., 2007[30].

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Providing adequate heat abatement to prevent heat stress, particularly in the resting area, increases lying time, thermal comfort and performance of dairy cows. During periods of heat stress, cows tend to stand up more frequently and for longer time to dissipate heat more effectively[31]. This prolonged standing time elevates the risk of lameness, and partially explains the significant correlation between heat stress and lameness in dairy cows.

Optimal management practices include effective grouping and regrouping strategies, such as housing primiparous and multiparous cows in different pens, avoiding frequent regrouping and maintaining appropriate stocking densities in pens and or among them. Moreover, it's crucial to minimize prolonged period with cows restraint and the time cows spend away from the pen for milking. Cows should spend less than three hours away from the pen daily. Time when the first cow leaves a pen for milking until the last cow from the same pen returns, if this takes more than 1.5 hours consider changes to decrease this time. These changes could entail reducing milking frequency, pen to parlor size ratio, stocking density, distance between the pen and parlor, or how soon cows are brought to the parlor prior to the previous pen being done milking.

Transition cow disease prevention

In the transition from late gestation to early lactation, dairy cows experience low DMI yet high nutrient demand, leading to negative energy balance (NEB) that starts days before calving and continues weeks after. Most healthy lactating dairy cows experience NEB and mild body condition score (BCS) loss in early lactation, but severe NEB (e.g., >0.5 BCS-points loss) predisposes to fatty liver and ketosis. Managing diets to prevent body fat accumulation in late lactation and dry period, preventing a large drop in DMI prior to parturition and promoting a rapid increase in DMI intake postpartum help prevent severe NEB and associated diseases[3].

Similarly, healthy lactating dairy cows may experience transient subclinical hypocalcemia after calving which does not affect their welfare or performance. However, conditions where this drop in blood calcium is exacerbated or prolonged are associated with other diseases and decreased performance. Strategies to prevent hypocalcemia include using unspecific calcium binders (Zeolite) or anionic salts prepartum. In addition, trace mineral and vitamin nutrition matter for disease prevention as they play a key role as antioxidants. For instance, supplementing vitamin E and selenium reduces the odds of cows having retained placenta by 50%[3].

Fatty liver and clinical ketosis and hypocalcemia are not only detrimental for cow performance but are also associated with decreased immune responses and other diseases (retained placenta, metritis, displaced abomasum). Therefore, preventing metabolic and associated diseases are key for cow comfort and performance. Do not overstock (<90%) and ensure the feed remains accessible to cows for over 22 hours daily, aiming for 5% feed refusals at the bunk and pushing feed every 2-3 hours. Always provide clean water, ensuring a minimum of 4 inches of water space per cow, especially in hot weather. Water flow at troughs should allow at least six lactating cows to drink simultaneously[3].

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