

Designing the Group Maternity Pen: Insights from the Cow's Perspective

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Abstract

Designing maternity pens for dairy cows is met with many challenges, including space constraints, the need to monitor the calving process, and accommodating the cows' maternal behavior. Historically, the maternity pen has been designed for ease and convenience of farm management to keep pens clean and easily monitor the calving process. This focus on human convenience for managing the maternity pen may not be ideal for the cow. Although there may not be a perfect maternity pen design, these facilities should accommodate the cow's natural behaviors as she approaches calving. New research has provided insights into the behaviors of cows as calving approaches, which can help improve management and housing for cows before giving birth.

Introduction

The transition period, defined as the 3 weeks before to the 3 weeks after calving, is a critical time for cows in which they are at a high risk of disease. It has been estimated that between 30 to 50% of cows experience metabolic (e.g. ketosis and hypocalcemia) or infectious disease (e.g. metritis and mastitis) during the transition period (see LeBlanc, 2010 for a review). These diseases are an animal welfare concern for dairy cows and have economic repercussions for producers in

the form of treatment, increased culling, and milk loss (Esposito et al., 2014). Up to this point, a majority of transition cow research has focused on nutrition and management strategies (reviewed by LeBlanc et al., 2006; Sepúlveda-Varas et al., 2013). It has been suggested that a better understanding of maternal behavior in the periparturient period may provide insight into the high incidence of disease during the transition period (Sepúlveda-Varas et al., 2013). This presentation will describe recent research that has focused on developing a stronger understanding of the cow's innate behaviors before calving (see Proudfoot, 2019 for a detailed review).

Management of Transition Dairy Cows

Management and grouping of transition dairy cows is largely based on farm size and nutritional strategy (Overton and Waldron, 2004). Cows are moved into the close-up pen (an area where the cow starts her close-up period, approximately 3 weeks before calving) to facilitate feeding a diet that is specifically formulated to support the cow as she prepares to give birth (Overton and Waldron, 2004). In the US, 64.3% of calvings occur in group maternity pens while 31.1% of calvings occur in individual calving pens (USDA, 2014). For some herds, cows enter group maternity pens (the maternity pen is any pen where a cow gives birth to her calf), at the start of their close-up period and stay

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until after calving, while others herds move cows out the close-up and into individual maternity pens when calving is imminent (Cook, 2019). Generally, maternity pens are located in high traffic areas to increase monitoring capabilities of farm workers to make sure a cow's labor is progressing normally. However, management strategies for close-up and maternity areas that are based on diet, grouping strategies, and easy monitoring may not be a desirable calving pen for the cow. An understanding of maternal behaviors and the motivations of cows at calving is needed to help us design more ideal close-up and maternity pens.

Behavior Around Parturition

Behavioral changes in preparation for calving

As calving approaches, cows begin to express a suite of maternal behaviors to ensure calf survival, which begins with the delivery of a live calf. In a natural setting, these behaviors include restlessness and seeking isolation to find a desirable calving site to ensure a successful delivery (reviewed by Rørvang et al., 2018b). In wild ungulates, following the birth of the calf, calf survival is dependent on the formation of the cow-calf bond because the calf relies on the dam for nutrition and protection from predators (Leuthold, 1977). Although in modern dairy production, calves are removed from the dam following birth and post-calving, pre-calving maternal behavior has not been eliminated and facilities should be designed to accommodate these behaviors.

At the onset of labor, dairy and beef cows on pasture seek isolation away from the herd to find a secluded place to calve with visual cover (Lidfors et al., 1994). In theory, isolation seeking in ungulates may serve as an anti-predatory strategy (Leuthold, 1977) and reduce disturbances from other cows around

calving to facilitate formation of the cow-calf bond. However, in modern dairy facilities, there is less room for cows to be secluded at calving in both group and individual pens than in pasture environments. Group pens contain more than one cow housed at variable stocking densities, which may make it difficult for a pre-parturient cow to separate from penmates because of a lack of space. In addition, other cows may be attracted to the odor and pheromones emitted during labor that may attract them to the laboring cow (Jensen and Rørvang, 2018). Other cows may also spend time licking alien calves in group pens (Edwards, 1983), creating more disturbances for cows during labor. In individual maternity pens, cows are separated from the rest of the group to give birth. However, they are sometimes designed with space constraints and located in high traffic areas of the barn where the calving process can be easily monitored. Depending on the presence of cows in maternity pens and human activity in the barn, it may be difficult for indoor-housed dairy cows to perform innate isolation seeking behavior at calving.

Isolation seeking behavior in indoor facilities

Recent research suggests that indoor-housed cows have retained the motivation to hide during labor when housed individually (Proudfoot et al., 2014a,b). For example, when given the choice between an open bedded pack area and a 'sheltered' area to seclude themselves, 81% of cows calved within the hide during the day (Proudfoot et al., 2014a). In a follow-up study, researchers found that when housed in an individual maternity pen, 79% of cows sought a secluded 'corner' to give birth if available (Proudfoot et al., 2014b; Figure 1). The results from these studies indicate that cows have retained the motivation to hide at calving in individual calving pens and may be more motivated to hide during the daytime.

Although cows are motivated to hide at calving, the amount of coverage provided by a hide at calving does not appear to be an important factor to cows when selecting a calving site. For example, researchers provided cows with 3 hide options in individual maternity pens of varying coverage from the group pen: and tall and narrow (1.8 x 1.5m), low and wide (1 x 2.5m), tall and wide (1.8 x 2.5m) (Rørvang et al., 2017). The authors expected cows to prefer the most secluded environment; however, cows with normal duration of labor generally had no preference for hide shape. Comparatively, cows with prolonged labors (an average of 159 minutes of stage II labor) sought the most secluded calving space. Limited research has been performed to determine the motivation of cows in indoor group maternity pens to isolate themselves at calving. Preliminary data from our group's most recent work in this area will be presented.

Management and Housing Cows During Parturition

Maternity pens should ideally create an environment where the calf has a successful start to life and the cow has a successful start to her lactation. The environment should be clean and dry, and facilitate natural calving behaviors of the cow. Cows go through hormonal and behavioral changes at calving and it is important to understand the needs of the calving cow in both systems.

Managing the cow using individual maternity pens

Managing cows in individual maternity pens has both its advantages and challenges as compared to group calving pens. Individual pens may be easier to clean and are often located in high traffic areas where it is easier to monitor cows during calving. Individual maternity pens

also reduce disturbances from other cows during calving (Edwards, 1983). However, as herd animals, it may be stressful for cows to be kept in social isolation in unfamiliar surroundings (Rushen et al., 1999). Additionally, cows kept in individual maternity pens for more than 3 days are at a higher risk of ketosis and displaced abomasum (Nordlund et al., 2006). Due in part to these findings, cows are kept in individual pens for a minimal amount of time. To avoid keeping cows in individual pens for too long, the practice of cows being moved into calving pens “just in time” when signs of calving are clear, including the presence of the amniotic sac or feet are visible outside the vulva, is sometimes used.

Previous research has explored the appropriate time to move cows from group pens into individual maternity pens. Proudfoot et al. (2013) found that cows moved into individual maternity pens before labor (on average 74 hours before calving) and during early stage I labor (on average 11 hours before calving) had normal duration of stage II labor, comparatively, cows moved during late stage I labor (on average 2 hours before calving) had a longer than normal duration of labor by approximately 30 minutes. This increase in labor length suggests the normal labor process was disrupted when cows were moved during labor. A longer duration of stage II labor has been associated with stillbirths (Gundelach et al., 2009) and dystocia (Schuenemann et al., 2011), thus, farms that use individual maternity pens should move cows when signs of early labor are visible. One major challenge of using individual calving pens is identifying cows in labor and moving them at the appropriate time. If close-up pens are not regularly monitored for cows in labor, the likelihood of cows calving in unwanted areas, such as the freestall, is greatly increased.

Management of cows in group maternity pens

Calving in group maternity pens allows cows to stay in a familiar environment and doesn't disrupt the progression of labor. However, cows may encounter more social challenges when calving in group pens, and depending on the stocking density of group pens, it may be difficult for cows to isolate at calving. Current recommendations for stocking density in group maternity pens is based on anecdotal evidence and is highly variable ranging from 9.3 m² to 18.6 m² per cow (Cook and Norlund, 2004; Graves, 2006). Space is a common constraint for producers when designing maternity pens. However, insufficient space in group maternity pens may limit a cow's ability to perform motivated calving behaviors.

Previous studies which have explored stocking density in the pre-calving period have focused on stocking density at the feedbunk. Overstocking at the feedbunk during the close-up period increases agonistic behaviors between cows (Proudfoot et al., 2009; Huzzey et al., 2012) and is may be especially problematic for cows of a lower social status (Huzzey et al., 2012). However, there is evidence that cows prioritize lying over eating when one resource is limited (Munksgaard et al., 2005), as such, lying space may also be important in pre-calving environments. Thus, more research assessing the appropriate stocking density of group maternity pens is still needed.

Research assessing the impact of group housing on maternal behavior, including isolation-seeking, of dairy cows is also limited. Findings for cow motivation to use manmade hides at calving are highly variable. Jensen and Rørvang (2018) created cubicle hides located on the walls of a group maternity pen that had equal dimensions but either a narrow (1.5 m) or wide opening (3 m) to the group pen. Only 10% of

cows used a hide at calving, while the remainder calved in the group pen. However, cows spent more time in a secluded area with a wide opening before and after calving. These findings suggest that secluded areas may be important to cows in the time period around calving and not only during the labor process.

In another study, group housed cows were motivated to seclude at calving but were unwilling to work for access to secluded areas (Rørvang et al., 2018a). A group maternity pen was designed with cubicle hides bordering the outside of the group pen and cows were able to enter the cubicles at any time. Each hide had a gate that was either permanently tied open or cows had to push to open and was closed behind the cow, prohibiting more than one cow occupying the hide at a time. Approximately 50% of the cows in the study moved from the group pen into a hide to give birth. However, cows were more likely to calve in the hide if the gate was permanently tied open. The findings suggest that cows may be motivated to hide at calving but are not willing to work to gain access to this space.

To date, the separated area for cows to seek isolation during labor used dimensions of that were similar in design (e.g., a cubicle of L-shape). This type of design may not be optimal for cows seeking seclusion at calving. It is possible that cows view hides as a resource, thus dominant cows perform resource guarding behavior. If there is competition for the hide, cows may be less likely to use the hide at calving because they are unwilling to work for access to resources at calving (Rørvang et al., 2018a). More research is needed to explore the optimal design of a secluded area in a group maternity pen.

Conclusions and Recommendations

Maternity pens should be ideally be located in quiet areas of the barn where there is minimal activity. Adequate space allowance should be provided in indoor maternity pens (individual or group) to facilitate isolation behaviors at calving and to improve cleanliness of the area. Cows should ideally be provided the opportunity to hide at calving using manmade resources, although the appropriate design of these hides may vary depending on maternity pen type (individual or group). Secluded areas for cows can be created using many resources (e.g., hay bales, plywood, shade cloth, curtains, etc.) with the end goal of creating a space where a cow can feel isolated from penmates or caretakers working in the barn.

Farms that use “just in time” calving should create clear protocols on the appropriate time to move cows to individual maternity pens. Cows should be moved into individual maternity pens when signs of early labor are visible (e.g. raised tail, restless behavior, and relaxed pelvic ligaments) to avoid increasing the duration of stage II labor. However, this practice requires consistent monitoring of close-up pens and when mismanaged can result in cows calving in unwanted areas which has negative impacts on both the cow and calf.

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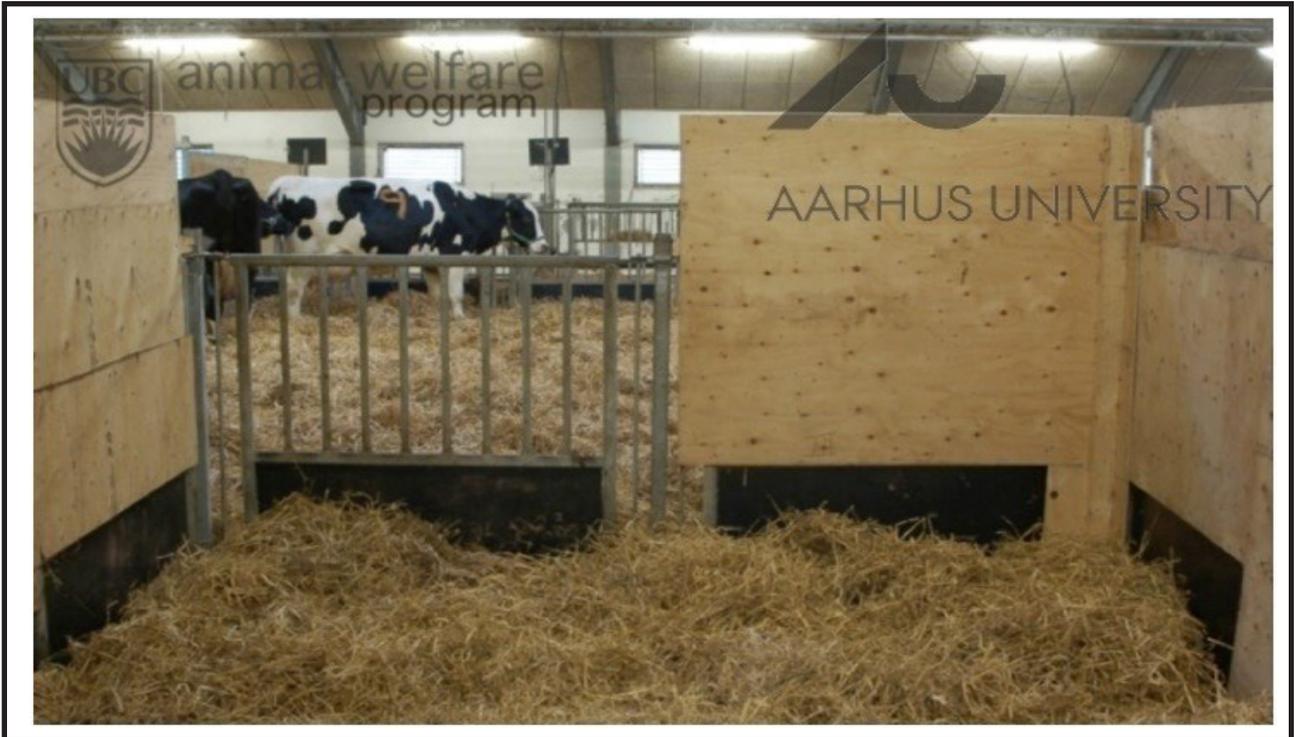


Figure 1. Design of a partially covered individual maternity pen. Covered areas were created with plywood.