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# Transition Period in Dairy Cattle

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Peripartum period in cattle is characterized by a number of physiological and behavioral changes in response to a sharp rise in nutritional requirements, which are necessary to sustain the last phases of fetal development as well as the production of milk and colostrum for calf. Transition period is the time period from three weeks prior parturition to three weeks after calving. Maximum disease cases (shortly after parturition) corresponds with the time of highest negative energy balance (NEB), the peak in blood levels of non-esterified fatty acids and the increased milk yield. Pre-partum diets with negative dietary cation-anion differences and adequate energy may help dairy cows function better throughout the transition. In order to identify early illness indicators, diagnosing clinical and subclinical conditions and focusing health care to prevent health and productivity damage, dairy cows must be closely observed during transition time period.

**Key words:** transition period, negative energy balance, dairy cows, non-esterified fatty acids

## Introduction

Dairy industry in livestock sector plays crucial role. Worldwide consumption of milk and milk derived products continuously increasing and accepted by large proportion of human population. The provision of both necessary and nonessential nutrients for the optimum human body growth, development and sustenance has been advocated to the nutritional role of milk. Since milk supplies vital macro- and micronutrients, it is a commonly consumed beverage that is necessary to the diets of several million people globally. For uninterrupted secretion of milk, health of dairy cattle should be properly monitored during its productive life cycle.

There is a lot of research on the challenges confronted by transition dairy cows going through calving to lactation. The transition period in dairy cows is characterized by the intricate interaction of several mechanisms, such as immunological activation, inflammatory responses and metabolic and hormonal alterations. Transition period is the time period from three weeks prior parturition to three weeks after calving. On the other hand, the majority of prospective research on transition dairy cows concentrates on things that happen right after giving birth. This is due to the fact that in the postpartum phase major significant physiological changes occur such as calving, uterine involution, galactogenesis and milk secretion. This shift in body physiology makes dairy cattle susceptible to various metabolic and infectious diseases which directly hampers economic survival of dairy enterprise.

The level of immune dysfunction and metabolic modification dairy cows experiencing during the periparturient phase directly affects the risk ratio of both infectious and metabolic disorders in the early stages of lactation. Therefore, the development of ailment (metabolic or infectious) at this physiological stage may further complicate the dairy cows' metabolism and affect leukocyte function, paving pathway for other diseases. This ferocious cycle raises the expense of medications and may reduce animal fertility, which frequently leads to the culling of the animals and economic losses.

In contemporary dairy herds, metabolic diseases affecting early lactation cows are a pertinent concern since they might impact farmers' profits by raising medication costs and lowering milk supply. It can be difficult to determine the origin of metabolic abnormalities in dairy cows that are afflicted in the early stages of lactation since these animals sometimes develop many diseases in a short period of time. Therefore, the best course of action to address metabolic problems in early lactation may be prevention. A large body of recent research indicates that systemic inflammation and prepartum immunological dysfunctions are predisposing variables in the etiology of metabolic problems in early lactation. Therefore, knowing the process underlying prepartum immunological dysfunctions could enhance the ability to prevent disease from happening.

## Ketosis model

Ketosis is commonly encountered metabolic disease in early lactation in high yielding dairy cattle characterized by negative energy balance (NEB). The prepartal trends of plasma analytes in cows with sub clinical ketosis during the early stages of lactation indicated the presence of liver damage, renal impairment and inflammation that occurred many weeks prior to calving. In addition it was observed during the dry phase, that leukocytes from cows with subclinical ketosis in early lactation produced higher interferon-γ (IFN-γ) in response to an ex-vivo challenge with *Mycobacterium avium*. In such case, there is likely a connection between compromised immunological responses during the dry phase and the development of sub clinical ketosis during the first stages of lactation. Increased production of IFN-γ by leucocytes due to their activation may result in development of insulin resistance during the dry period, which would explain the concurrent rise in glucose, non-esterified fatty acid (NEFA) and beta-hydroxy butyrate (BHB) plasma concentrations prior to calving resulting in decreased dry matter intake. The NEB in the early stages of lactation is exacerbated by this feed intake reduction as well as the energy need associated with the immune system's activity during the dry period of lactation cycle. Severe NEB prior to the starting of lactation could be hypothesized as a prevailing factor in all metabolic disorders arising in dairy cows in early lactation. Thus, the function exerted by modified immune response during the dry period in the subclinical ketosis model could probably stretch to other early lactation ailments.

## Dry-off period

During dry-off period there are changes in the redistribution of nutrients, alterations in the rumen papillary structure and in the mammary tissue physiology. Dry-off cause dairy cows to become inflamed throughout their bodies and the worst inflammatory conditions occur when milking is interrupted in cows whose average milk supply was more than 15 L/d in the week before dry-off. It has been proposed that leukocytes during the mammary gland's involution phase may have a role in the development of inflammatory disorders that follow dry-off. Further metabolic alterations in high-yielding cows may also result from increased milk and parenchymatous tissue being re-assimilated in their mammary glands. These fresh insights into the inflammatory conditions which dairy cows face during dry-off raise the possibility that this management strategy may have something to do with the genesis of immunological dysfunctions that develop during transition period.

## Genetics

While systemic inflammations that coincide with the end of milk removal may have an impact on how leukocytes operate during the dry phase, current research rules out the dry-off as the main source of immunological dysfunctions that impact transition cows that dairy. The various inflammatory conditions during dry-off may be explained by variations in the expression of inflammatory biomarkers influenced by genetics. In dairy cattle, the expression of two inflammatory biomarkers associated with the acute phase response, paraoxonase and ceruloplasmin, is largely regulated in a cis manner. This noteworthy hereditary correlation was found in two Italian dairy breeds, namely Italian Holstein and Italian Simmental, differ greatly in their immune-metabolic condition, selection histories and productivity levels. Although it is yet unclear how genotype affects dairy cows' ability to successfully adjust to the new lactation.

## Distressing factors

The energy concentration of the ration fed to dairy cows, particularly in the far-off phase, is one dietary component that may have an impact on how well they adjust to the new lactation. Dairy cows which are overfed during this stage may accumulate more adipose tissue. The most notable alterations were seen in the pathways associated with lipid deposition, insulin sensitivity and immunological functions. These findings imply that overfeeding during the dry phase may act as a risk factor for metabolic problems linked to lipid mobilization and immune system impairment during the early stages of lactation. In addition to the impact of energy levels on leukocyte function, dietary modifications may also compromise the immune systems of dairy cows as they approach the start of a new lactation by altering the integrity of their gastrointestinal tracts. The physiological adaptation of the rumen volume to the growing fetus (before parturition) and the empty uterus (during early lactation) causes abrupt variations in the rate at which digesta passes through the gastrointestinal tract in dairy cows around calving. Both the altered passing rate and fermentation rates of the feed contribute to change the fermentation patterns along with the gut of transition cows, leading to physiological changes in pH. Moreover, rumen epithelial cells interact with dietary-driven variations in the rumen pH and microbiome composition to control the entry of several immune mediators into the rumen through saliva. The complex relationship between the host immune system, fore-stomach epithelium and rumen bacterial composition are known to be critically dependent on these immune mediators.

Heat stress causes significant drops in milk yield and DMI in dairy cows. Only 50% of the milk yield losses observed under heat stress may be attributed to decreased feed consumption, which results in reduced energy availability, according to recent studies. Additionally, compared to animals raised in thermoneutral conditions, heat-stressed cows exhibit higher amounts of insulin and cortisol in their plasma, a decrease in plasma NEFA and a greater loss of body weight, indicating that heat stress produces an insulin resistance state. Recent research on dairy cows shows that heat stress, which can happen at any duration during the dry season, has a significant impact on the pre- and postpartum health of the cows and may jeopardize their functioning even following calving. Heat stress in cattle during the dry season affects the development of the mammary glands prior to calving, the metabolism of the early lactation period and the production of milk in the later lactation. Additionally, late-gestational heat stress in dairy cattle has a deleterious effect on fetal growth, placental development and the immunological competence of the calf.

## Management

Any strategy aimed at enhancing the well-being and productivity of dairy cows must include management techniques that enable a smooth transition into lactation.

***Adequate energy diet:*** During the early stages of lactation, many nutritional techniques are employed to reduce energy deficiencies and excessive lipid mobilization. It's critical to identify cows or groups of cows at an early age who are more prone to have metabolic illnesses after giving birth in order to intervene early and stop the diseases from developing.

In order to meet energy requirements, feeding controlled-energy feed reduces energy intake prior to parturition, prevents excess body weight gain and lessens the severity of the postpartum energy shortage. Controlled-energy meals are used throughout the dry season to enhance dairy cow production, facilitate a smoother transition and reduce health issues.
Strategies to prevent fatty liver include adding dietary fat to raise the dietary energy density and increasing the nutritional density of transition diets to increase propionate formation in the rumen. Feed additives that improve hepatic very low-density lipoprotein secretion (choline and methionine), modify hepatic fatty acid utilization (tallow and carnitine) and reduce adipose tissue lipid degradation (monensin, chromium and niacin), have been proposed as dietary approaches to treat and prevent fatty liver.
***Negative DCAB (Dietary Cation Anion Balance) of diet:*** In order to scale the elevated level of anions in circulation, the use of anionic salts to induce a negative dietary cation–anion difference (DCAD) lowers blood pH and triggers low calcium release from the bones into the extracellular fluid. The mobilized calcium from bones is eliminated by the kidneys until calving, when it is then utilized to fulfill the increased milk calcium requirement of lactation. Consequently, an increased ability to move calcium from the bones and the triggering of parathyroid hormone actions account for the advantageous benefits of negative DCAD diets fed during the dry period for early lactation dairy cows. Since feeding acidogenic diets causes metabolic acidosis, which is mostly responsible for the decrease in DMI, therefore it is vital to monitor metabolic acidosis when feeding anionic salts to cattle. The ideal urine pH range for dairy cattle feeding anionic salts during the dry season is between 5.5 and 6.2. This range allows one to measure the level of acidification brought on by the feeding of anionic salts throughout the dry period on an individual cow basis.

Additionally, enhancing cow comfort during the transition phase has a significant positive effect on dry matter intake, which enhances the welfare, well-being and productivity of dairy cows throughout the early stages of lactation. Factors like appropriate stocking density, adequate floor space, heat abatement systems, hygienic bedding materials, frequent and sufficient feeding schedules, water access and proper stall designs should also be considered equally important.

## Conclusion

The transition period is undoubtedly critical and challenging for both animal and rearing person. A smooth transition into lactation is necessary and beneficial to preserve health and meet production goals. Ensuring ideal welfare conditions and balanced feeds for the entire herd is the best way to manage a "good transition," as it helps reduce stressful events that could accumulate the metabolic problems around calving. The severity of NEB following calving may be reduced by calving by implementation of suitable diets that supply the necessary amounts of all essential nutrients while limiting total energy intake to requirements. Such diets have generally good impacts on metabolic health indicators, indicating that they may be able to mitigate the negative effects of periparturient illness on fertility. Providing an acidified negative DCAD diet prior to delivery, with the right amount of calcium in the diet can enhance reproductive performance. Notwithstanding these positive viewpoints on transition period management, it is evident that further research is needed to fully comprehend the physiological processes affecting dairy cows' metabolism during this critical stage of the lactation cycle. Since appropriate field decisions depend on a variety of factors, dairy farmers, veterinarians and nutritionists should take into account a combination of well-established tactics in order to improve cow performance.

## References

1. Caixeta, L. S., & Omontese, B. O. (2021). Monitoring and improving the metabolic health of dairy cows during the transition period. *Animals*, *11*(2), 352.

2. Cardoso, F. C., Kalscheur, K. F., & Drackley, J. K. (2020). Symposium review: Nutrition strategies for improved health, production, and fertility during the transition period. *Journal of dairy science*, *103*(6), 5684-5693.
3. Kerwin, A. L., Burhans, W. S., Nydam, D. V., & Overton, T. R. (2023). Transition Cow Nutrition and Management Strategies of Dairy Herds in the Northeastern United States: Associations of Nutritional Strategies with Analytes, Health, Milk Yield, and Reproduction. *Animals*, *13*(17), 2701.
4. Mezzetti, M., Cattaneo, L., Passamonti, M. M., Lopreiato, V., Minuti, A., & Trevisi, E. (2021). The transition period updated: A review of the new insights into the adaptation of dairy cows to the new lactation. *Dairy*, *2*(4), 617-636.
5. Mushfiq, S. R., Aabidy, M. H., & Rafed, R. (2023). Dairy Cows Transition Period Feeding and Management. *Journal for Research in Applied Sciences and Biotechnology*, *2*(4), 182-190.
6. Pascottini, O. B., Leroy, J. L., & Opsomer, G. (2020). Metabolic stress in the transition period of dairy cows: Focusing on the prepartum period. *Animals*, *10*(8), 1419.