OPTIMISING HEALTH AND FERTILITY IN TRANSITION DAIRY COWS

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ABSTRACT

Dairy cows experience major physiological shifts during the transition period, making them vulnerable to diseases like fatty liver, metritis, and retained placenta. These health issues delay uterine involution, extend calving intervals, and reduce conception rates. Nutritional interventions including high-energy diets, calcium balancing, and the use of nutraceuticals can reduce negative energy balance and enhance immune function. Body condition scoring and inflammation control are key management tools. A well-managed transition phase supports improved fertility, milk yield, and farm economics.

KEYWORDS: Body condition score, Fertility, Inflammation, Nutrition, Transition period

INTRODUCTION

In recent decades, dairy cows have been subject to intense genetic selection to meet the increasing demand for milk. This selection perhaps predisposes the cows for metabolic and reproductive disorders in both pre and postpartum period. This period of approximately 6 weeks from late gestation to early lactation (3 weeks before to 3 weeks after calving), is generally defined as transition period. When the management of cow is not done properly during this particular period, dairy cows will be susceptible to many diseases like fatty liver syndrome, ketosis, milk fever, dystocia, torsion, cervico-vaginal prolapse, retention of fetal membranes, puerperal metritis, pyometra etc. If these disorders are not prevented, their consequences include reduced postpartum fertility, lower milk yield, and higher culling rates.

During pregnancy, homeorhetic processes regulate cow physiology to support fetal development, while postpartum brings major changes like lactation initiation, reproductive tract involution and ovarian activity resumption. Most health disorders in dairy cows occur after calving, impacting long-term performance. During this phase, farmers face significant financial losses due to reduced production and the costs associated with treating diseased animals, making dairy farming less profitable. Reproductive disorders delay uterine involution and the resumption of ovarian activity, which prolongs the voluntary waiting period (normal-60 days) and inter-calving interval (normally-1 year), further exacerbating the financial strain on farmers. In India, uterine infections alone result in an estimated annual loss of ₹ 3200 per animal (Jeyakumari et al. 2003).

So, there is a need to work on appropriate management of the animals during transition phase to optimize its reproductive performance and to prevent economic losses to the farmer.

NUTRITIONAL REQUIREMENTS

Feed intake during dry period is an important factor in determining health and productivity during the transition phase of cows. There is a sudden, multiple-fold increase in the requirements for energy, protein, and minerals. During 250 day of gestation to 4 days postpartum, demand for glucose increased by three times, amino acids by two times whereas fatty acids requirement increases five folds (Bell 1995). Furthermore, the demand for calcium almost quadruples on the day after parturition. At parturition, the concentration of α-tocopherol drops by half and remains low for 20 to 30 days. To allow these changes in nutrition partitioning to

occur, the cow relies on homeorhetic regulation. Increased hepatic gluconeogenesis, enhanced lipolysis of fat for absorption in milk, and utilisation as a fuel (NEFA) source by certain skeletal muscle during early lactation are signs of metabolic adaptations. Excessive lipolysis is not good for cows overall health and this can be prevented by increasing nutrient density ration during prepartum period to provide more energy. The National Research Council (NRC 2001) suggested feeding a diet containing roughly 1.25 Mcal/kg of NEL (Net energy for lactation) from dry off to approximately 21 days before calving, and feeding a diet containing 1.54 to 1.62 Mcal/kg of NEL during the last 3 weeks before parturition. Colostrum and milk synthesis requires >65 % calcium during lactation period. The required levels can be achieved with prepartum dietary strategy including low-Ca diets and Ca chelating compounds, so that after calving, homeostatic mechanism can provide adequate calcium for milk synthesis without clinical signs of hypocalcemia.

CONTROLLED INFLAMMATION

Calving is naturally an inflammatory process, and initiation of inflammation occurs just before a week of calving. Bradford et al. (2015) proposed that brief surges in inflammatory signals, which subside within the first 3-4 days of lactation, may aid in physiological adaptations at the end of pregnancy and the onset of lactation. The ability of cow to reduce inflammation after calving depends upon several factors like energy status, body condition score (during dry off and calving), plasma biomarkers levels (NEFA, BHBA, cortisol etc.), immune status, progesterone-estrogen ratio, housing management, herd size, season, etc.

The immune system of cow is significantly challenged during the first four weeks after calving. After calving, there is an increase in neutrophilic infiltration and the production of pro-inflammatory mediators (IL-6, IL-8) in the uterus. The uterine immune response is upregulated during the peri-parturient phase and remains active until progesterone from the first post-partum ovulation causes it to decrease. While some level of inflammation is beneficial for lactating cows, excessive postpartum inflammation should be managed with anti-inflammatory medications and proper dietary management.

BODY CONDITION SCORE

Body condition score (BCS) plays a crucial role in managing health during the transition period. An optimal BCS range of 3–3.5 during the dry phase helps minimize postpartum issues. However, over-conditioned cows with excess fat (lipolysis) tend to have increased pro-inflammatory cytokines, such as TNF-α and IL-6, which elevate acute phase proteins (APP) like haptoglobin (Hp) and serum amyloid A (SAA). These proteins help in pathogen defense and tissue repair but are also linked to liver dysfunction and increased risk of metabolic diseases. Excessive lipolysis can cause burden on liver functioning.

Cows with lower BCS during the transition phase are more prone to health challenges, further highlighting the importance of balancing body condition to optimize lactation and metabolic function. Since a 1 BCS unit change corresponds to a 31 kg body weight shift. Proper BCS management during the dry period not only improves health outcomes but also enhances reproductive performance and milk yield.

EFFECT OF TRANSITION PERIOD DISORDERS ON FERTILITY

Transitional disorders in dairy cows can negatively impact reproductive performance, leading to longer times between calving and first insemination, increased open days, and lower conception rates. Cows with metabolic diseases like hypocalcemia, ketosis, and fatty liver are more prone to anoestrus, mastitis, and prolonged open days. Diminished uterine contractility in these cows can delay lochia removal and impair neutrophil function, further reducing postpartum fertility. Clinical endometritis can disrupt the ovarian cycle and delay uterine involution, leading to longer calving-to-conception intervals and higher culling rates. Cows with endometritis often require more services per pregnancy than those with metabolic diseases (Paiano et al. 2019). Retained fetal membranes also hinder uterine regeneration, contributing to delayed fertility.

MANAGEMENT AND NUTRITIONAL SUPPLEMENTATION DURING TRANSITION PERIOD

Effective transition management involves ensuring ample bunk space, balanced rations, and a low-stress environment to promote feeding. Monitoring tools like body condition scoring (BCS), daily health checks, and milk production tracking help identify health issues and performance drops early, enabling prompt

interventions. Dietary control of inflammation is important during the puerperal stage, as prepartum energy intake affects postpartum health and energy balance, with controlled energy intake improving liver function and health. A BCS of 3.0 for mature cows and 3.25 for heifers one month before calving is recommended to minimize BCS-related health issues. To counteract negative energy balance, higher energy diets are recommended before calving to maintain dry matter intake (DMI) and prevent postpartum complications (Janovick and Drackley, 2010). This approach helps balance energy requirements and reduces risks associated with excessive body condition.

Nutraceuticals, including fiber, probiotics, prebiotics, polyunsaturated fatty acids, antioxidants, and phytoactive substances, have gained attention for improving animal health, productivity and reproductive performance. Dietary fat supplementation is commonly used to boost energy density and reduce negative energy balance (NEB) in dairy cows. Polyunsaturated fatty acids (PUFAs) like n-3 and n-6 fatty acids positively impact fertility, immune function, and oocyte development. While high saturated fat intake can impair reproduction, PUFAs improve embryo implantation and immune response. Supplementing fat, especially in the pre- and postpartum periods, helps manage NEFA and prevent liver issues like fatty liver (Moallem 2018). Choline supplementation, particularly rumen-protected choline (RPC), improves reproductive performance, immune function, and reduces the risk of fatty liver (Arshad et al. 2020). Similarly, methionine enhances DMI, liver function, and inflammatory response, benefiting dairy cows during the transition phase. Betaine supplementation helps mitigate heat stress, improving conception rates and uterine health. Green tea extract, known for its antioxidant properties, reduces liver stress and reproductive disorders. Propylene glycol (PGLY) can improve energy status and insulin secretion, although its impact on conception rates remains uncertain.

CONCLUSION

In conclusion, proper management during the transition period is crucial for optimizing dairy cow health, reproduction, and productivity. Nutritional strategies, including controlled energy intake, fat supplementation, and the use of nutraceuticals, play a key role in preventing metabolic and reproductive disorders. Monitoring body condition, providing balanced rations, and minimizing stress can significantly enhance cow reproductive performance and ensures long-term profitability for dairy farmers.

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