

Negative Energy Balance in Dairy Cows : Silent Trigger of Metabolic Disorders

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Abstract

Negative Energy Balance (NEB) is one of the most important nutritional challenges faced by high-producing dairy cows, particularly during the transition period and early lactation. At the time of calving, the cow's demand for energy increases rapidly because of the initiation of milk production, while feed intake does not increase at the same rate. As a result, the animal obtains less energy from the diet than it requires and enters a state of negative energy balance. To meet its energy requirements, the cow mobilizes stored body fat, resulting in increased concentrations of non-esterified fatty acids (NEFA) in the blood. Excessive mobilization of body fat can overwhelm the liver and contribute to the development of ketosis, fatty liver and other metabolic disturbances. NEB may also impair immunity, reproductive efficiency and milk production. Early identification through body condition scoring, monitoring of feed intake and measurement of blood or milk ketones can help reduce its consequences. Proper transition-cow nutrition, maintenance of appropriate body condition, adequate dry matter intake and careful post-calving management are essential for preventing severe NEB. Therefore, understanding and managing NEB is an important component of profitable and sustainable dairy production.

Introduction

The period extending from approximately three weeks before calving to three weeks after calving is commonly referred to as the transition period. This is one of the most critical periods in the life of a dairy cow because major physiological, nutritional and metabolic changes occur during this time. Energy balance can be represented as A certain degree of NEB is a normal physiological adaptation during early lactation. However, excessive or prolonged NEB can become harmful and increase the risk of metabolic and reproductive problems. Before calving, the cow's nutrient requirements are mainly associated with maintenance, fetal growth and preparation of the mammary gland. After calving, however, the demand for nutrients increases dramatically because the mammary gland begins producing milk. The major problem is that dry matter intake (DMI) does not increase as rapidly as the energy requirement for milk production. Consequently, the cow experiences a shortage of dietary energy. This condition is called Negative Energy Balance

(NEB).

Why Does Negative Energy Balance Occur-

Increased milk production-Milk synthesis requires large quantities of glucose, fatty acids, amino acids, minerals and other nutrients. As milk yield increases after calving, the cow's energy requirement rises rapidly.

Reduced dry matter intake-Feed intake commonly decreases around calving because of hormonal changes, reduced rumen capacity due to the growing fetus, stress and changes in feeding behaviour.

Mobilization of body fat-When dietary energy is insufficient, the cow begins to mobilize stored body fat. Triglycerides stored in adipose tissue are broken down and release.

Other contributing factors-Poor-quality or poorly balanced ration, Sudden dietary changes, Excessive body condition at calving, Heat stress, Metabolic disorders, Lameness, Mastitis and other diseases, Poor feed availability or management.

Clinical Sign- Loss of body condition, Excessive

weight loss, Reduced feed intake, Reduced rumination, Decreased milk production, Lethargy, Reduced activity, Poor appetite, Dull appearance, Reduced reproductive performance.

Subclinical ketosis is particularly difficult to recognize because obvious clinical signs may be absent. Changes in rumination, milk production or behavior may provide early warning signs.

Diagnosis and Treatment- Blood tests, NEFA, BHBA, Glucose, Liver-associated biochemical indicators, Milk testing, BHBA or other ketone testing can be used for herd-level screening.

Urine testing

Urinary ketone tests can provide a convenient field-based assessment. Cow-level observations- Body condition score, Dry matter intake, Milk yield, Rumination, Body weight changes, General health, Blood BHBA, NEFA and related metabolic measurements are among the important tools used for monitoring energy metabolism and ketosis risk.

Prevention and Nutritional Management-

The management objective should be to support a smooth transition from pregnancy to lactation.

1. Maintain optimum body condition: Avoid excessive body condition before calving. Over-conditioned cows are more susceptible to excessive fat mobilization.

2. Maximize dry matter intake: Fresh cows should have continuous access to palatable, good-quality feed and clean water.

3. Provide a balanced transition diet: The ration should supply adequate-Energy, Protein, Effective fibre, Minerals, Vitamins Micronutrients.

4. Avoid sudden dietary changes: Gradual adaptation of the rumen to the lactation diet is important.

5. Maintain good feed management: Fresh feed, adequate feeding space, clean feed bunks and consistent feeding schedules can support intake.

6. Reduce environmental stress: Heat stress, overcrowding and poor housing can reduce feed intake and worsen energy deficiency.

7. Monitor high-risk cows- Particular attention should be given to-Over-conditioned cows, Multiparous cows, Cows with previous ketosis, Cows with reduced feed intake, Cows with postpartum diseases.

8. Consider targeted nutritional interventions- Depending on farm conditions and veterinary/nutritional advice, nutritional strategies may include appropriate use of glucogenic

precursors, rumen-protected nutrients and selected feed additives. Choline, for example, has been investigated for its role in hepatic lipid transport and reducing liver fat accumulation.

Conclusion

Negative Energy Balance is one of the central metabolic challenges of the transition period in dairy cows. It develops when the rapidly increasing energy requirement for lactation exceeds the energy supplied through feed intake. A moderate degree of NEB is a normal physiological adaptation. However, excessive NEB can initiate a cascade of metabolic changes involving increased fat mobilization, elevated NEFA, ketone-body production and hepatic lipid accumulation. The consequences may extend beyond ketosis and fatty liver to include impaired immunity, postpartum disease, reduced milk production and compromised reproductive performance. Therefore, NEB should be viewed not simply as an energy shortage but as a central metabolic signal that connects nutrition with the overall health and productivity of the dairy cow.

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