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Popular Article

Nutritional Management of High Yielder Cattle during Transition Period

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Transition period

The transition period, from 3 week before to 3 weeks after parturition, is critically important to health, production and profitability of dairy cows. The "transition" refers to dairy cows going from dry state to lactation state. During this period animal undergoes many significant changes for physiological, metabolic and nutritional. This period includes increase demand of nutrients due to increasing demands of the foetus and the onset of mammary gland activity (Bell, 1995). It has been observed that up to 80% of metabolic disorders experienced by dairy cows occur during the transition period. The transition period is very important in determining future health, milk production and reproductive status of the dairy cow.

Dry period- The purpose of dry period is to allow the cow's udder, an opportunity to regenerate secretary tissue and to allow the digestive system to recover from the stress of high levels of feed intake. Dry periods less than 45 days and greater than 60 days results in less production in the next lactation.

Lactation period- There are three main stages in the lactation cycle of the dairy cow.

1. Early lactation (14-100 days)

At the beginning of this phase, cows achieve peak milk production and feed intake is lagging behind. Cows are usually losing weight during this period.

2. Mid-lactation (100-200 days)

Mid-lactation period is the period from day 100 to day 200 after calving.

3. Late lactation (200-305 days)

This phase may begin 200 days after calving till the cow dries off. During this period, milk yield continues to decline and so does feed intake.

Challenges during transition period

1. Reduced feed intake

Reduced rumen size and high circulating estrogen are believed to be major factors that contributes to decreased dry matter intake around calving. Dry matter intake starts to decrease a few weeks before parturition with the lowest level occurring at calving. Dry matter intake declines about 30% prior to calving and about 20-30% below for the first few weeks post calving.

2. Negative energy balance

Energy balance is the difference between the energy consumed by the animal and the energy required by the animal. If Energy Balance is negative, the cow utilizes fat stores as an energy source and loses tissue weight. The greatest severity of Negative Energy Balance experienced during early lactation when body reserves are mobilized to overcome the energy deficit results in some body weight loss.

3. Metabolic and hormonal changes

During transition period, dairy animal undergoes endocrine and metabolic changes to meet the demand for milk production during early lactation. Some of the hormonal changes include an increase in Growth Hormone levels, which leads to more gluconeogenesis in the liver. This also leads to an increase in lipolysis, which makes the fatty acids ready to be used for making milk fat. Lipolysis and increasing levels of non-esterified fatty acids (NEFA) in dairy cows' blood are commonly linked to the accumulation of triglycerides (TG) in hepatocytes, as well as impaired liver function leading to an increase in ketone bodies production (Esposito *et al.*, 2014).

Nutritional management during transition period

A) Increasing energy rich ration

Feed intake decreases during peripartum but, at the same time, nutrient requirements are more. Increased nutrient density in the diet (reduced Forage: Concentrate) ratio increases dry matter intake. Feeding more concentrate before calving will allow the rumen bacteria to adapt to the concentrates that can be used during early lactation. Grain feeding stimulates the growth of the rumen papilla, which absorbs the acids produced during the grain feeding process. Concentrate feeding, results in

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increased propionate production, which is converted to glucose. It also decreases fat mobilization from storage, resulting in a decrease in blood fatty acids. This is beneficial and will help to avoid post-calving conditions such as ketosis and fatty liver. Reducing the fibre percentage in a prepartum diet promotes the growth of the rumen papilla, enhances the ability of the rumen to absorb volatile fatty acids (VFA), reduces the risk of VFA accumulation and prevents acidosis.

B) Increasing protein rich ration

Increasing pre-partum protein, body tissue reserves will enable the cattle to use these reserves more effectively after calving, thereby supporting lactation and reducing the risk of metabolic disorders. Under normal conditions there could be an excessive generation of ammonia in rumen from feed proteins and there may not be enough energy available in rumen to match that ammonia for its conversion into microbial protein. So, rumen bypass proteins are feed that have been treated or processed via various methods to decrease their ruminal degradation. The main objective is to provide greater amounts of essential amino acids to the productive ruminant. When the highly degradable cakes are protected from ruminal degradation, more amino acids reach lower tract and more supply of amino acids for synthesis of milk proteins (casein) in mammary gland and partly for the synthesis of glucose in liver. Only a few feeds are good sources of bypass protein, viz., cotton seed cake, coconut cake, safflower, sunflower, fish meal and maize grain.

There are various methods developed to protect the protein from rumen degradation without affecting its digestibility at the intestinal level. Heating causes denaturation of protein and this may be beneficial because of reduced ruminal degradation. Heat developed during expeller process of oil seed extraction and extrusion cooking is beneficial to ruminants. Formaldehyde treatment is also effective. The optimum level appears to be 0.5-1.5% for concentrate diets and 1.3-2% for hay.

Protected amino acids are, nowadays, added to diets, as feed additives. Several laboratories have devised encapsulation procedures to protect amino acids from ruminal degradation without impairing their intestinal release and absorption. Protection is given by coating or mixing methionine, for example, with a combination of fats or fatty acids and sometimes by addition of carbonates, kaolin, lecithin, glucose or other products. Another method of protection is structural manipulation of amino acids, e.g. glycosylation which make the resistant to ruminal degradation.

C) Supplementation of fat

Fat supplementation as a concentrated energy source will reduce plasma NEFA levels and liver triglycerides during the transition period. Supplementation of conjugated linoleic Acids (CLA) in the transition period and during early lactation is a promising way to reduce energy requirements during

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early lactation. Feeding bypass fat at a rate of 100-150 grams per day during the transition period may improve milk production and reproduction. Bypass fats have been developed based on the melting point of fatty acids and saponification of fatty acids.

D) Supplementation with glucogenic precursors

Propylene glycol and other glucose-enriching supplements can significantly inhibit fat mobilization and ketogenesis in the transitional period. Propylene glycol is metabolized by the liver to glucose, resulting in an increase in insulin levels in the bloodstream. Insulin acts on adipose tissue to reduce fat mobilization and occurrence of fatty liver.

E) Supplementation of feed additives

Niacin, a feed additive, has been found to be effective in preventing ketosis, likely due to its ability to reduce adipose tissue mobilization. Monensin, an inophore, increases propionate production and decreases BHBA (beta-hydroxybutyrate) production. Additionally, yeast culture can be used to maintain the pH and rumen environment while stimulating the digestion of fibre digesting bacteria, thereby improving digestibility and absorption of P, Mg, Ca, and Zn (Kinal *et al.*, 2005).

F) Macro minerals

Recent studies suggest that dietary cation-anion difference (DCAD) may play a significant role in controlling milk fever. Dietary cation-anion difference typically includes two cations (potassium and sodium) and two anions (chlorine and sulphur). Physiologically, DCAD influences the animal's acid-base homeostasis, calcium status around calving and mineral element utilization.

DCAD for late pregnant dry cows

In late pregnancy is to provide a ration with a low or negative DCAD to reduce the risk of hypocalcaemia and clinical milk fever around calving. Common Anionic salts are-Ammonium chloride, Magnesium chloride, Magnesium sulphate and Ammonium sulphate.

DCAD for lactating cows

In lactation rations, positive DCAD is effective and sufficient to achieve maximum feed intake and milk yield. Supplementation of cations may be beneficial for lactating dairy cows to neutralize tremendous amounts of acids produced in ruminal fermentation and systemic metabolism. Cationic salts are sodium bicarbonate or potassium carbonate.

G) Micro minerals

Chromium supplementation during the transition period may provide metabolic and production benefits by increasing insulin sensitivity of tissues. Copper supplementation of a diet reduced the peak clinical response during experimental *Escherichia coli* mastitis. Selenium and

Vitamin E are involved in antioxidant system.

Conclusion

The transition period is a critical period for health, production and reproduction of dairy animals. Nutritional management programs during this phase minimize the incidence of post calving disorders. The degree of Negative Energy Balance following can be reduced by designing and delivering suitable feed with supplementation. Such diets often have good impacts on metabolic health, reduce the effects of peripartum illness and improve productivity.

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