

# Face2Vet

A Clinical Update

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## Post-Partum Transition Nutrition in Dairy Animals

### Post-Partum Transition The Critical Window for Dairy Health

Dear Vets,

Post-partum transition period is one of the most critical and vulnerable stage in productive life of dairy animals. Spanning weeks immediately after calving, this phase is characterised by profound metabolic, endocrine and physiological adjustments as the animal shifts from gestation to milk production.

This period demands particular attention due to the high incidence of metabolic disorders such as negative energy balance (NEB), ketosis, hypocalcaemia and fatty liver. These conditions not only compromise animal welfare but also significantly affect milk yield, reproductive efficiency and farm profitability.

A sound understanding of the metabolic adaptations, nutrient demands and risk factors associated with transition period is essential for designing effective intervention strategies. Nutritional management serves as a cornerstone in mitigating metabolic stress, supporting immune function and ensuring smooth adaptation to lactation.

This issue focuses on post-partum transition nutrition in dairy animals. We invite you to read this issue and share your valuable feedback and insights by scanning the QR code below or reaching out to us at [face2vet@intaspharma.com](mailto:face2vet@intaspharma.com).

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### Introduction

Post-partum period represents a critical phase in the life of dairy animals, marked by profound physiological and metabolic adjustments following calving. During this time, animals are particularly vulnerable to a range of metabolic and infectious disorders, which adversely impact productivity, reproductive performance and overall health.

Transition period, spanning late gestation through early lactation is widely regarded as the most challenging stage in a dairy animal's life. This phase is characterised by a rapid escalation in nutrient requirements driven by fetal growth, colostrum synthesis and initiation of milk production. In early lactation, energy demands may increase up to threefold, while calcium requirements rise sharply to support lactogenesis. However, this increased demand occurs alongside a decline in voluntary feed intake, predisposing animals to negative energy balance (NEB) and increasing risk of metabolic disorders.

To maximise productivity and maintain animal health, greater emphasis must be placed on nutritional management of transition animals. Appropriate nutritional strategies during this period are essential for facilitating metabolic adaptation, maintaining optimal body condition and improving both productive and reproductive outcomes. Therefore, a comprehensive understanding of the transition phase and its associated metabolic changes is crucial for designing effective post-partum nutritional management programs.

### Transition Period

Transition period is from 21 days before to 21 days after calving, when cows shift from a dry (non-lactating) to lactating state.

- During this time, cows undergo major physiological, metabolic and nutritional changes.
- Nutrient demand increases due to foetal growth and start of milk production.
- Around 80% of metabolic and production diseases occur during this period.
- It is a critical phase that affects the cow's future health, milk yield and reproduction.

## Metabolic Changes

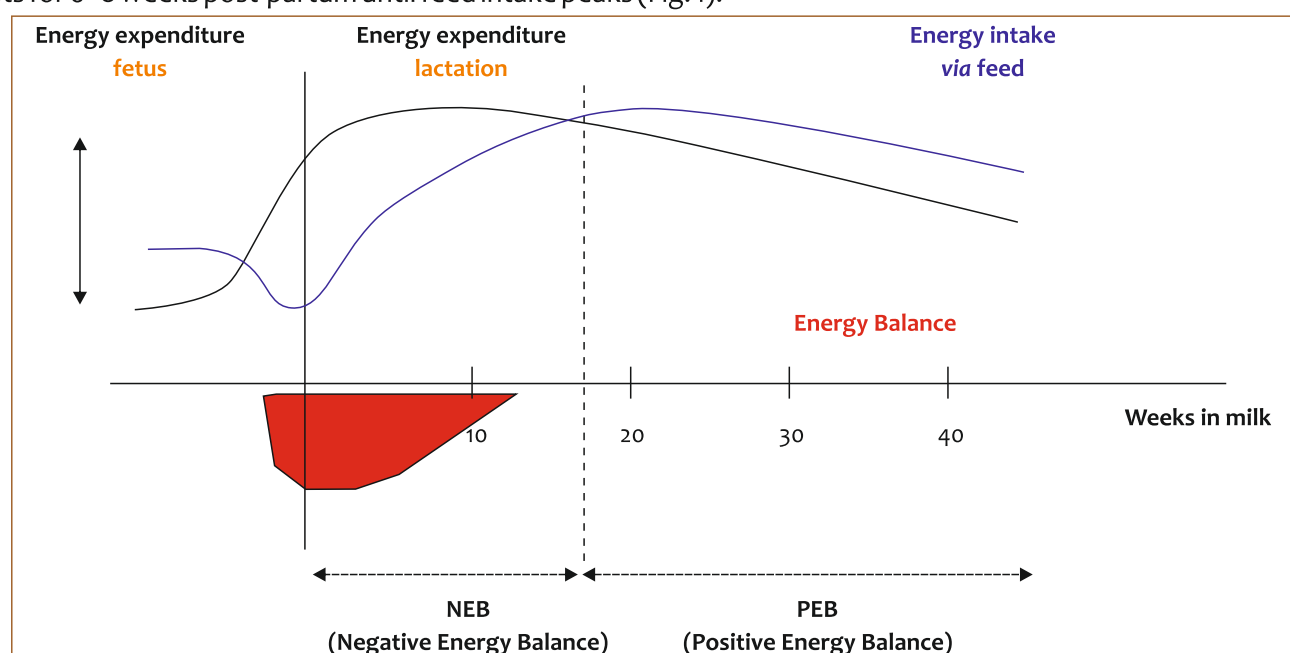
Transition period is a highly dynamic and physiologically demanding phase in dairy animals. The key challenge during this period is the mismatch between rapidly increasing nutrient requirements for milk production and simultaneous decline in feed intake. This imbalance initiates a cascade of metabolic adaptations, many of which are essential for survival but can predispose cows to metabolic disorders and infectious diseases if not managed properly.

### Dry Matter Intake (DMI) and Negative Energy Balance (NEB)

One of the earliest and most significant changes during the transition period is a progressive decline in dry matter intake (DMI), beginning approximately three weeks before calving.

- This decline is primarily driven by physical and hormonal factors.
- The rapidly growing foetus and associated uterine expansion reduces rumen capacity, physically limiting feed intake.
- At the same time, hormonal changes particularly reductions in insulin sensitivity alter appetite.
- Prepartum DMI generally falls within 1.7–2.0% of body weight; some studies also indicate a reduction of up to 30–35% in the final weeks of gestation, with the steepest decline occurring in last few days before calving.
- Environmental stressors such as heat stress, overcrowding and poor housing conditions can further exacerbate this reduction.

At calving, nutrient demands increase dramatically due to initiation of milk synthesis, yet DMI does not immediately recover. This leads to a state of negative energy balance (NEB), in which energy output exceeds intake. NEB typically persists for 6–8 weeks post-partum until feed intake peaks (Fig. 1).



**Fig. 1: Dynamics of Energy Intake, Energy Expenditure and Energy Balance in Dairy Animals Across Transition Period (Bossaert, 2010)**

### Body Condition Score

Body condition score (BCS) reflects the energy reserves of an animal and is a critical determinant of how effectively an animal copes with NEB.

- During early lactation, animals compensate for insufficient dietary energy by mobilising stored body fat and to a lesser extent, muscle protein.
- This mobilisation leads to a decline in BCS after calving.
- While some loss is physiologically normal, excessive loss indicates severe energy deficiency and is associated with impaired health, reduced milk production efficiency and delayed reproductive recovery.

Over conditioned (with high body fat) animals (BCS greater than 4 on a 1 to 5 point scale) are particularly vulnerable. They tend to exhibit reduced feed intake before calving, followed by excessive fat mobilisation post-partum, increasing their risk of disorders such as ketosis and fatty liver. In contrast, animals with optimal BCS (2.75 to 3.25) at calving adapt more efficiently to metabolic stress (Table 1).

**Table 1: Body Condition Scores**

| Physiological Periods                       | BCS (scale 1 to 5) |         |         |
|---------------------------------------------|--------------------|---------|---------|
|                                             | Ideal              | Minimum | Maximum |
| Calving                                     | 3.25               | 3.00    | 3.50    |
| First phase of lactation (1 to 100 days)    | 2.75               | 2.50    | 3.00    |
| Second phase of lactation (101 to 200 days) | 3.00               | 2.75    | 3.25    |
| Third phase of lactation ( $\geq 201$ days) | 3.25               | 3.00    | 3.50    |
| Dry Period (60 to 1 day before calving)     | 3.25               | 3.00    | 3.50    |

The goal is to limit BCS loss to no more than one-unit post-partum by ensuring adequate nutrition and maximising feed intake during the transition period.

### Nutrient Requirements and Metabolic Demand

Onset of lactation represents a dramatic metabolic shift, as the mammary gland becomes a dominant organ for nutrient utilisation. Compared to late gestation, the demand for key nutrients increases sharply:

- Glucose is required in large quantities for lactose synthesis, which drives milk volume.
- Fatty acids are needed for milk fat synthesis.
- Amino acids support the synthesis of milk proteins and cellular functions.

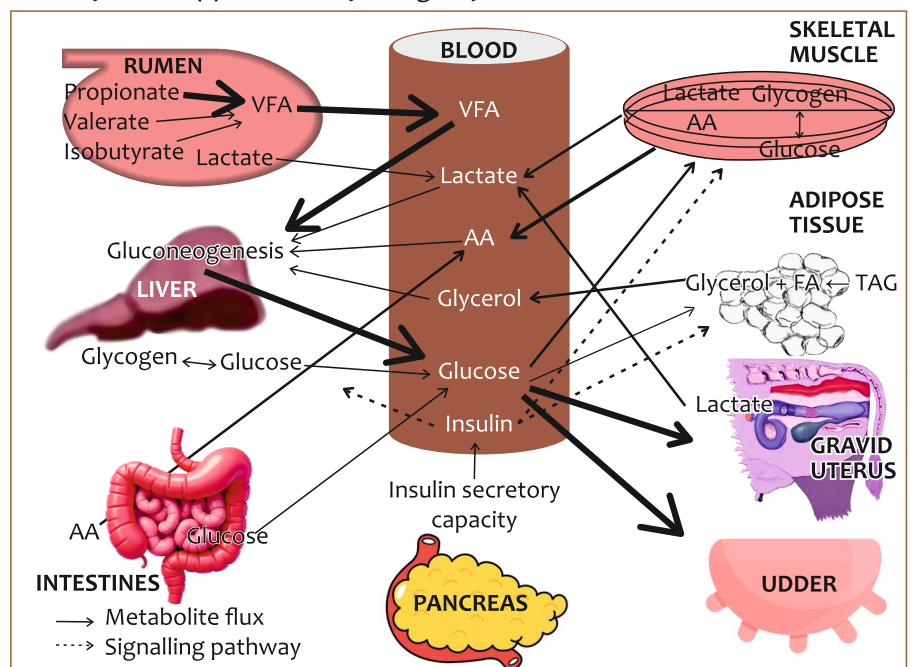
For instance, a cow producing approximately 30 kg of milk in early lactation requires nearly three times more glucose, over four times more fatty acids and twice the amount of amino acids compared to late pregnancy.

In addition to mammary gland, other organs such as liver and gastrointestinal tract undergo structural and functional changes, increasing their metabolic activity and nutrient demands.

### Energy Metabolism and Glucose Dynamics

Energy metabolism during early lactation is characterised by a significant shortage of readily available glucose. Following calving, glucose demand increases rapidly to support lactation, particularly for lactose synthesis, which is the primary determinant of milk yield. However, this increased demand is not matched by dietary supply due to reduced feed intake during the transition period.

- Prepartum glucose requirements are typically around 1000–1100 g/day, but these increase sharply to approximately 2500 g/day by 21 days post-partum.
- Despite enhanced metabolic adaptations, a substantial glucose deficit persists during early lactation.
- During the first week after calving, this deficit may reach approximately 500 g/day.
- To compensate, the liver increases gluconeogenesis, a metabolic pathway that synthesises glucose from non-carbohydrate precursors (Fig. 2).
- The primary substrate for this process in ruminants is propionate; a volatile fatty acid produced during rumen fermentation.
- Additional substrates include amino acids derived from muscle protein, lactate and glycerol released from adipose tissue.
- Despite these adaptations, a temporary glucose deficit often persists, particularly during the first week post-partum.

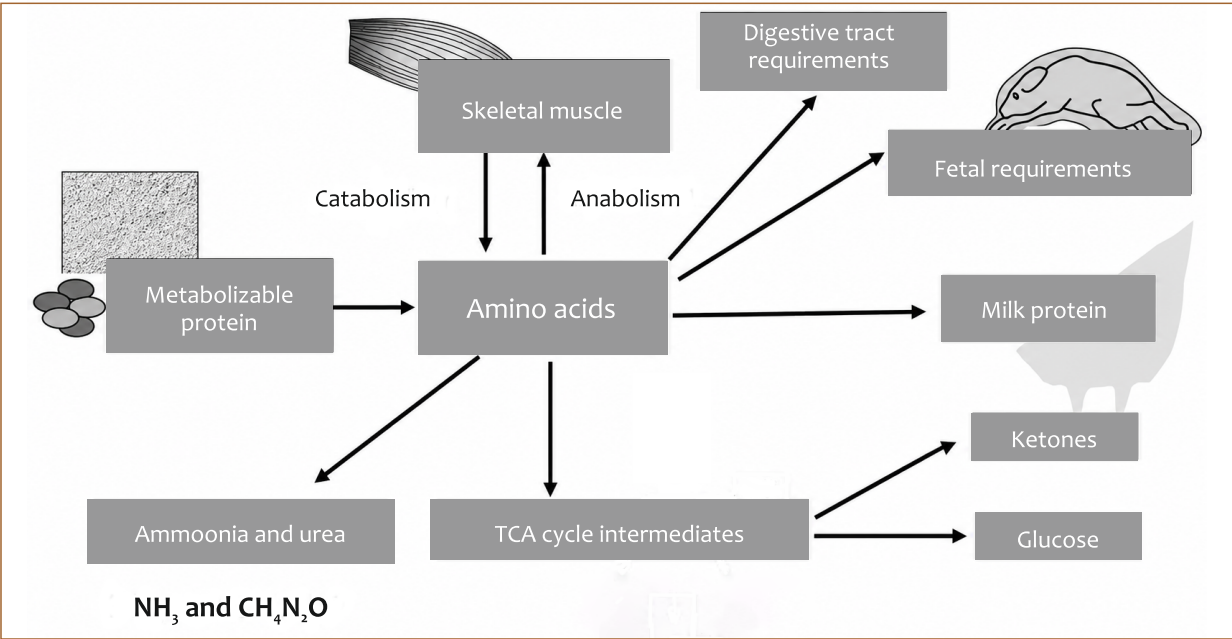


**Fig. 2: Overview of Glucose Metabolism in Ruminants (De Koster and Opsomer, 2013)**

- This deficit can impair lactose synthesis and reduce milk yield.
- Furthermore, glucose plays a vital role in reproductive function and prolonged deficiency can delay ovarian activity and estrus.

### Protein Metabolism and Amino Acid Utilisation

The demand for metabolizable protein increases substantially to support milk production, tissue repair and metabolic processes.



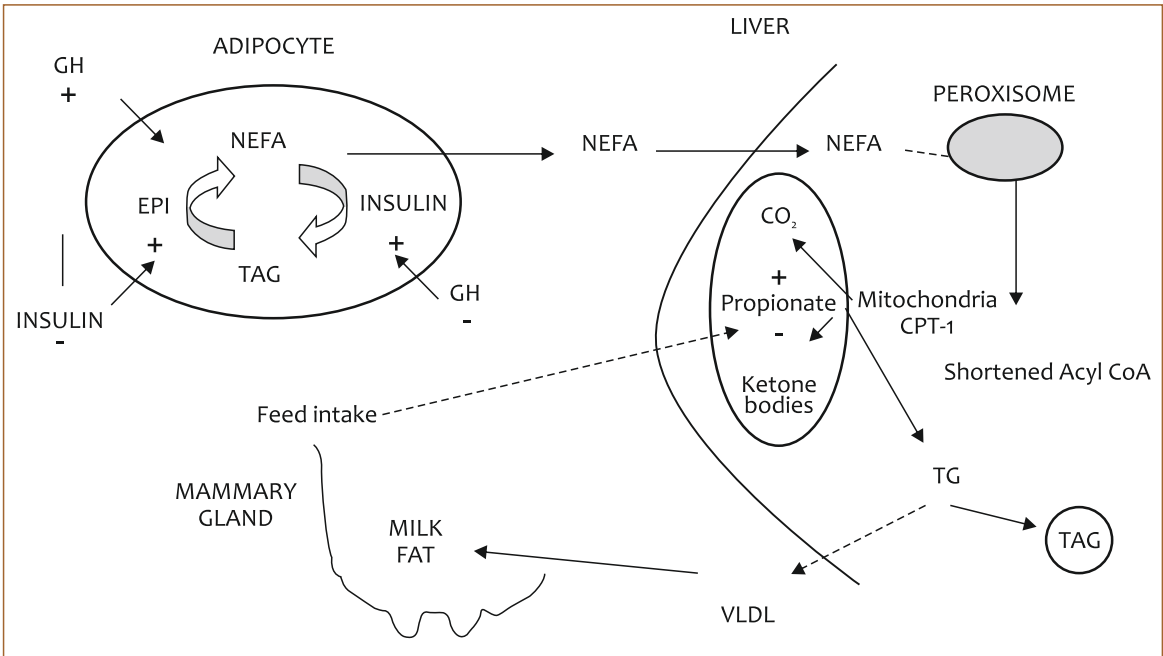
**Fig. 3: Sources and Uses of Amino Acids in Transition Dairy Cow (Boerman, 2021)**

- When dietary protein intake is insufficient, animals mobilise muscle protein to supply amino acids for gluconeogenesis and other functions (Fig. 3).
- However, since body protein reserves are limited, excessive mobilisation can compromise long-term productivity and health.

### Lipid Metabolism, Ketosis and Fatty Liver

Lipid metabolism is profoundly influenced by hormonal changes. A decrease in insulin levels, combined with increased secretion of growth hormone, creates a metabolic environment favouring lipolysis (fat breakdown) (Fig. 4).

As a result, stored triglycerides in adipose tissue are mobilised and released into circulation as non-esterified fatty acids (NEFA). These fatty acids are taken up by liver, where they can be:



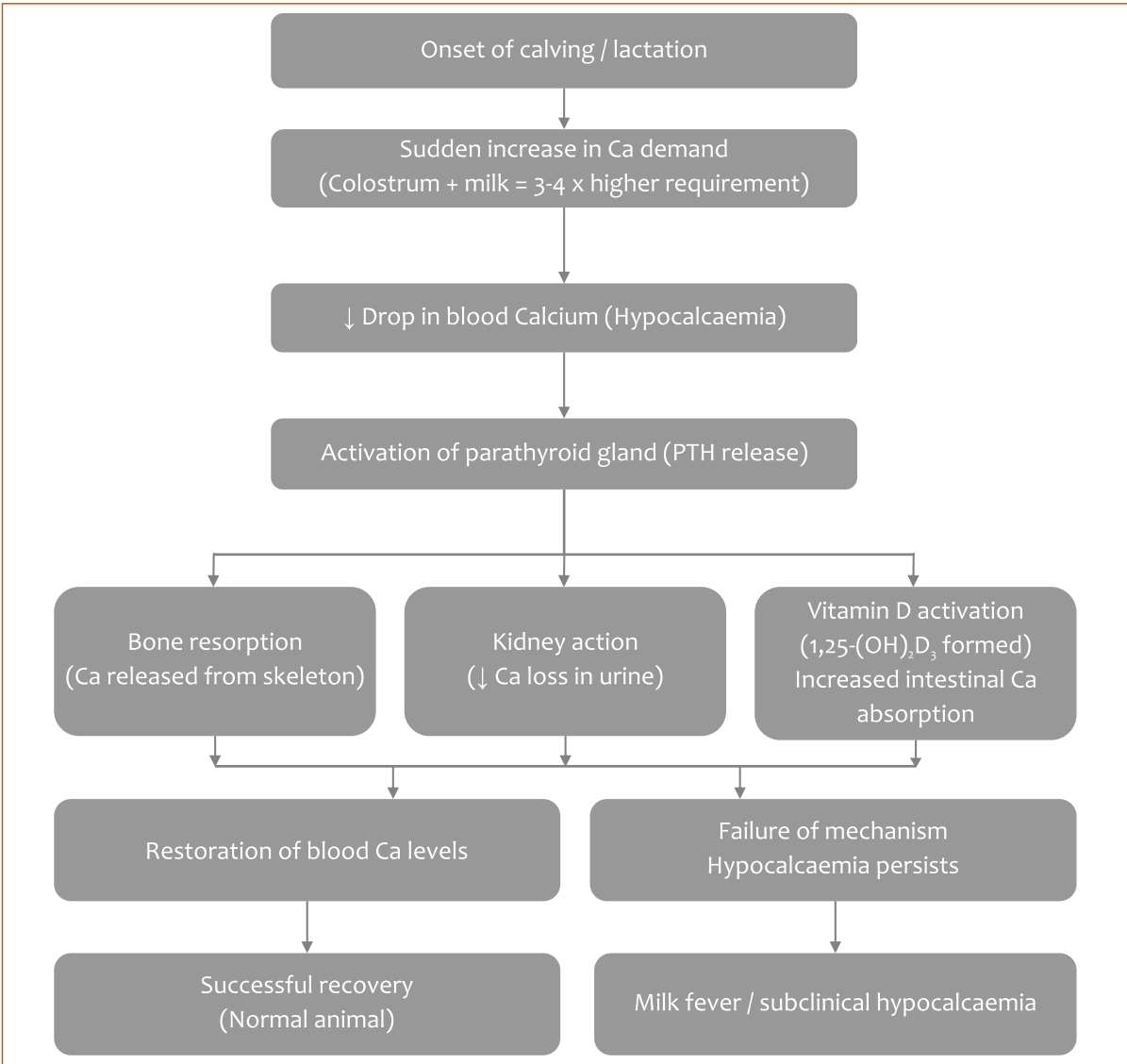
**Fig. 4: Lipid Metabolism in Transition Dairy Animal (Roche et al., 2013)**

- Oxidised for energy
- Converted into ketone bodies
- Re-esterified into triglycerides

When the liver's capacity to process NEFA is exceeded, ketone bodies accumulate, leading to ketosis, while triglycerides accumulate in liver, causing fatty liver syndrome. Both conditions impair metabolic efficiency and increase susceptibility to other diseases. Stress, inflammation and inadequate nutrition can intensify lipid mobilisation and worsen these metabolic disturbances.

**Mineral Metabolism and Calcium Homeostasis**

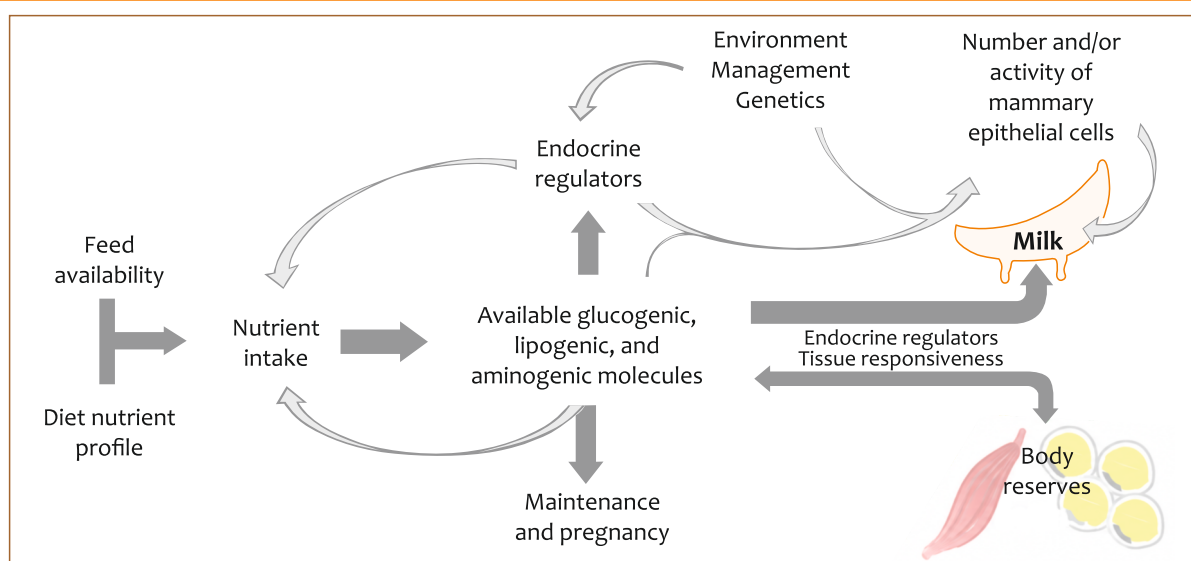
Transition places immense pressure on mineral metabolism, particularly calcium regulation. Calcium is essential for muscle function, nerve signalling and milk production. However, the animal's ability to mobilise calcium from bone and absorb it from the intestine does not immediately meet this demand, resulting in a decline in blood calcium levels (Fig. 5).



**Fig. 5: Calcium Dynamics in Dairy Animals**

**Endocrine Regulation and Nutrient Partitioning**

- Metabolic adaptations of transition period are regulated by hormonal changes.
- Declining insulin levels reduce glucose uptake by peripheral tissues, while increased growth hormone promotes the mobilisation of body reserves.
- At the same time, reduced expression of growth hormone receptors in liver limits the production of insulin-like growth factor-1 (IGF-1), altering growth and metabolic signalling pathways.
- These hormonal changes prioritise the partitioning of nutrients toward milk production, a process referred to as homeorhesis. While essential for lactation, this shift also contributes to metabolic stress if nutrient supply is inadequate (Fig. 6).



**Fig. 6: Nutrient Partitioning Dynamics in Relation to Milk Production and Body Reserve Balance (Plantoni and VandeHaar, 2023)**

Understanding these metabolic challenges provides the foundation for designing effective nutritional strategies during the post-partum period.

### Nutritional Management

During post-partum period, the animal experiences sharp increase in nutrient demand for milk production while nutrients feed intake often fails to meet these requirements, leading to negative energy balance (NEB). Proper nutritional management during this period is essential to maintain health, improve milk yield, support reproductive efficiency and minimise metabolic disorders. The overall strategy should focus on increasing dry matter intake (DMI), improving feed efficiency, balancing nutrients and supporting metabolic and immune functions.

#### Increasing Feed Intake

- One of the primary goals during the post-partum period is to maximise feed intake.
- High DMI helps reduce NEB and prevents excessive body weight loss.
- Palatable feeds enriched with aromatic compounds such as essential oils, herbs and spices can stimulate appetite.
- Feeding should be frequent, preferably 3 to 4 times a day.
- Additionally, free access to clean and fresh water is crucial, as water intake directly influences feed intake and milk production.

#### Improving Feed Conversion Efficiency

- This can be achieved by enhancing rumen function through the supplementation of yeast-based products, probiotics and functional additives such as glucans and nucleotides.
- These additives promote beneficial rumen microbes, improve digestibility and increase the production of volatile fatty acids, thereby enhancing energy availability and milk production.

#### Increasing Energy Density

- Increasing the energy density of ration is essential to compensate for reduced feed intake.
- Diets should contain adequate levels of energy, with net energy for lactation (NEL) of 1.56–1.62 Mcal/kg DM and about 16% crude protein.
- Energy rich feed ingredients such as cereals (maize, wheat), molasses, oilseeds and protected (bypass) fats can be incorporated.
- However, care must be taken to maintain a balance between energy and fibre to prevent metabolic disorders like acidosis and ketosis.

#### Dietary Protein Management

- Protein supply should focus not only on quantity but also on quality. Inclusion of rumen undegradable protein (UDP) sources such as corn gluten meal and cottonseed cake helps provide essential amino acids directly to the animal.
- Supplementation with rumen protected amino acids like methionine and lysine further enhances milk protein synthesis and improves reproduction.

## Minerals and Vitamins Management

- Mineral management, particularly calcium management is crucial to prevent hypocalcaemia (milk fever).
- Feeding a low-calcium diet prepartum followed by increased calcium supply post-partum, along with adequate magnesium and negative dietary cation-anion difference (DCAD) diets, helps maintain proper calcium metabolism.
- Vitamins such as A, D, E and antioxidants like selenium and  $\beta$ -carotene boost immune function and reduce the risk of diseases.

## Dietary Fibre Management for Rumen Health

- Fibre management is vital for maintaining rumen health.
- Adequate levels of NDF ( $\geq 28\%$ ) and physically effective fibre with proper particle size ensure proper rumination, saliva production and stable rumen pH.
- Both excessively fine and overly coarse particles should be avoided, as they can lead to acidosis or reduced feed efficiency.

## Feed Supplements and Additives

- Gluconeogenic precursors like glycerol and propylene glycol help prevent ketosis by increasing blood glucose levels.
- Probiotics and phytogenic additives further support gut health and feed efficiency.
- Nutritional support for liver function is essential to prevent fatty liver syndrome.
- Rumen protected choline and L-carnitine aid in fat metabolism and improve overall energy utilisation.
- Supplementation of bypass fat also provides a concentrated energy source without disturbing rumen fermentation.
- Proper feeding management practices, such as offering a total mixed ration (TMR), preventing feed sorting and ensuring consistent nutrient supply, are essential.
- Together, these strategies help improve milk yield, reproductive performance and overall animal health while enhancing farm profitability.

## Targeted Nutritional Supplementation

During early lactation, dairy animals face a negative energy balance due to high glucose demand for milk production. Gluconeogenic precursors help increase glucose availability, support lactose synthesis, improve energy metabolism, reduce body fat mobilization and lower the risk of ketosis.

- Gluconeogenic precursors fortified with amino acids, minerals, vitamins and galactagogue herbs (**E-Booster M**) help to optimise energy level to maximise milk yield, achieving early peak milk yield and helps to maintain body condition score.
- **E-Booster M** can be supplemented @ 100 ml once daily orally after parturition.

After calving, the sudden demand for calcium for colostrum and milk production can lead to hypocalcaemia. Adequate calcium supplementation supports muscle function, feed intake, rumen motility, reproduction and milk production.

- Supplementation with calcium, minerals, vitamins and galactagogue herbs (**Calshakti**) help to restore nutrient balance, improve productivity, promote faster postpartum recovery, enhance milk production and support overall health in dairy animals.
- **Calshakti** can be supplemented @ 100 ml once daily orally.

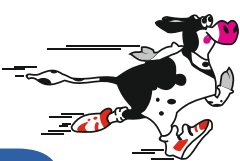
## Conclusion

Post-partum period represents one of the most challenging yet decisive phases in the life of a dairy animal, where the balance between nutrient demand and supply determines productivity, health and reproductive efficiency. The transition from late gestation to early lactation is marked by significant metabolic stress, negative energy balance and increased susceptibility to disorders such as ketosis, hypocalcaemia (Milk fever) and fatty liver. A well-planned nutritional strategy that focuses on maximising dry matter intake, providing balanced energy, protein and mineral nutrition and supporting metabolic as well as immune functions is essential to ensure a smooth transition. Effective post-partum nutritional management not only enhances milk yield but also improves reproductive performance, reduces disease incidence and ultimately contributes to the profitability and sustainability of dairy farming.

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