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Transition Cow Nutrition and Management

The transition period is defined as the 4 weeks before and after calving. During this period, cows undergo a transition from a state of non-lactating to lactating. If the cow fails to adapt in this period, they have an increased risk of the diseases listed below and a flow on effect of poor fertility and production.

1. Hypocalcaemia (Milk fever)
2. Hypomagnesaemia
3. Ketosis and fatty liver
4. Udder oedema (flag)
5. Abomasal displacement
6. Retained foetal membranes/ metritis

The main aims for transition cow management are:

- Reduce ruminal disruption (lactic acidosis and sub-acute ruminal acidosis (SARA))
    - Note: Changes to rumen microbial populations are rapid (7-10days), however full development of ruminal papillae takes much longer (3-6weeks).
- Minimize lipid mobilization disorders (ketosis, pregnancy toxaemia and fatty liver)
- Minimize macromolecule deficiencies (mainly hypocalcaemia (milk fever), Hypomagnesaemia (grass tetany) and Hypophospataemia (low phosphorus)).
- Avoid immunosuppression (associated with a lack of protein and energy and other micronutrients).

Table below from Dairy Australia's Transition Cow Management (2020) outlines the targets for cow health problems (percentage of cases of calving cows within 14 days of calving)

Health problem	Target	Seek help if
Milk fever	1% (old cows >8yrs: 2%)	>3%
Clinical ketosis	<1%	>2%
Abomasal displacements (left or right)	<1%	>2%
Clinical mastitis	<5 cases / 100 cows / first 30 days	>5 cases / 100 cows / first 30 days
Lameness (Sprecher locomotion scale 1-5)	<2% with > Score 2	>4% with > Score 2
Hypomagnesaemia (Grass Tetany)	0%	1 case
Retained placenta >24 hrs after calving	<4%	>6%
Vaginal discharge after 14 days	<3%	>10%
Calvings requiring assistance	<2%	>3%
Clinical acidosis	0%	1%

** Based on the following data sets: Morton, Curtis, Beckett, Moss, Stevenson.*

The components of the transition nutrition to that need to be considered are:

- Energy and protein
- Macrominerals and DCAD
- Microminerals
- Rumen modifiers
- Buffers

Protein and Energy

During the late stages of pregnancy, the demand of the foetal-placental unit and the developing mammary gland there is an increase in the demand for glucose and amino-acids, with the latter requiring additional fatty acids. Therefore, these demands can put the cow at risk of mobilizing significant amount of body fat and protein reserves.

Pre-calving diets with positive metabolisable protein and energy and those cows in greater body condition score (BCS) at calving are able to cope with the demands of the early lactation and have reduced incidence of metabolic conditions and increase subsequent milk production. It is also noted that cows in higher BCS at calving also had a shorter calving to first oestrus interval.

Amino acids such as methionine and lysine are often considered the rate limiting amino acids, and fed at a ratio of 3:1. Methionine is also important for the formation of low density lipoproteins that are necessary for the export of stored fat in the liver.

Feeding of fats in the pre- and early post-partum period have not been recommended due to the potential to reduce dry matter (DM) intake. However, with the addition of certain fats to the pre- and early post-partum period there is potential for a reduction in plasma NEFA and liver triglycerides with an improved pregnancy rates in cows after 110d lactation.

Macromolecules and DCAD

Calcium: Cows tightly regulate the calcium blood concentrations (through the hormones calcitonin and para-thyroid hormone) and can only afford to lose 50% of the blood calcium pool before a crisis of hypocalcaemia. Limiting the pre-calving intake of calcium to 20-60g per day has been associated with a reduced incidence of hypocalcaemia.

Magnesium: Magnesium has a major function in membrane stability, skeletal and cardiac muscle function, enzyme function and nervous tissue function. It is also important for calcium homoestasis (in the release of parathyroid hormone and the synthesis of Vitamin D3 (1-25(OH)D3)).

Phosphorus: Phosphorus levels have been associated with levels of hypocalcaemia seen. High levels of phosphorus have been associated with increased milk fever risk. Plasma phosphorus levels are directly regulated by plasma phosphorus levels and Vitamin D3 (1-25(OH)D3) indirectly regulated by PTH/calcium negative feedback loop.

Dietary Cation Anion Difference (DCAD): The DCAD theory of the control hypocalcaemia is based on the Strong Ion Model of acid /base balance. The strong ions consist of cations (Na+, K+, Mg^{2+} and Ca^{2+}) and anions (Cl- and SO_4^{2-}). The application of DCAD theory to prevent milk fever aims to reduce (SID+), therefore lowering the plasma/ blood pH, resulting in a strong metabolic acidosis. This can be achieved by feeding strong cations or anions. Strong cations are absorbed to a lesser extent from the GIT than strong anions. This results in a relative excess of absorbed anions compared to cations lowering the (SID+). Note: salt (NaCl) and KCl have a net effect of zero on the (SID+) as NA+ and K+ are almost 100% absorbed by the intestines.

Overall, the acidotic state (of the blood) allows a higher concentration of ionized calcium, where both bone metabolism and dietary absorption of calcium are more active.

The most appropriate DCAD level of 0mEq/kg or less is ideal.

Current recommendations for these macromolecules in the diet are:

- Calcium – 0.4-0.6%
- Magnesium – 0.45%
- Phosphorus - < 0.4%

Length of exposure to the DCAD diet: The optimum time spent on the transition diet is around 21 days prior to calving. For this to occur very accurate calving dates are required, therefore early and accurate pregnancy testing is required.

Micro-minerals: Trace minerals are important for immune function and is an area that requires further research. Of recent time chromium (Cr) is important as it may reduce insulin resistance and subsequently decreases plasma NEFA, liver triglyceride levels and improve productivity in the post calving period.

Rumen modifiers: Rumen modifiers directly act on the microbial population and the proportion of volatile fatty acids produced, thus playing an important role in rumen adaption. They are particularly important for dairy cattle being fed a grain diet.

Sodium monensin (Rumensin) an ionophor rumen modifier- acts by increasing the propionate producing bacteria, with a reduction of methane output and a sparing effect on ruminal protein digestion. Feeding Sodium monensin in the pre- and post-partum period have been shown to improve energy balance and subsequent milk yield.

Virginiamycin (Eskalin) an antibiotic rumen modifier- reduces lactic acid production through the selective inhibition of *lactobacillus spp* and *streptococcus bovis*.

Tylosin (Tylan) an antibiotic rumen modifier- reduces lactic acid production and L- lactate)

Buffers: Buffers are often used to reduce the risk of acidosis. When adding buffers into a ration, there is a need to consider their effects on DCAD. For this reason, magnesium oxide is commonly used as a magnesium supplement and a neutralizing agent. Pre-calving one common buffer used is red seaweed (Acid Buf), which is a product containing 30% calcium and 60% magnesium and is DCAD neutral. Added at a rate of 40-80g/cow/day can maintain a rumen pH of 5-7. Once the cows have calved the buffer sodium bicarbonate is suitable for use.

Dairy Australia's recommendations for the far-off, transition and fresh cow diets

Nutrient	Total diet analysis (dry matter basis)		
	Far-off dry cows (More than four weeks pre-calving)	Transition cows (Last four weeks pre-calving)	Fresh cows (first four weeks post-calving)
Neutral Detergent Fibre % (NDF)	> 36%	>36%	>32%
Physically effective NDF %	30%	25-30%	>19%
Crude protein (CP) %	>12%	14-16%	16-19%
Degradability of CP	80%	65-70%	65-70%
Metabolisable energy intake per day (MJ)	90-100	100-120	160
Estimated energy density (MJ ME / kg DM)	10 (9)*	11	11.5-12
Starch %	Up to 18%	18-22	22-24
Sugar %	Up to 4%	4-6	6-8
Fat %	3%	4-5%	4-5%
Calcium %	0.4%	0.4 to 0.6%	0.8 to 1.0%
Phosphorus %	0.25%	0.25 to 0.4%	0.4%
Magnesium %	0.3%	0.45%	0.3%
DCAD^ Meq/kg	<150	<80	>250
Selenium mg/kg	0.3	0.3	0.3
Copper mg/kg	10	15	20
Cobalt mg/kg	0.11	0.11	0.11
Zinc mg/kg	40	48	48
Manganese mg/kg	12	15	15
Iodine mg/kg	0.6	0.6	0.6
Vitamin A iu/g	2000	3200	3200
Vitamin D iu/g	1000	#	1000
Vitamin E iu/g	15	30#	15

Approaches to transition feeding

There are 6 common approaches to transition feeding on Australian dairy farms. These include:

Transition feeding practice	***Risk/ benefit/ comment***
Pasture /Hay	High risk of milk fever, grass tetany (pasture dominate) High risk of low production and preg toxaemia (hay dominate)
Pasture/Hay/Anionic salts in fodder or water	Aids in controlling milk fever and grass tetany - Mg sulphate, Mg chloride, molasses on silage or hay - Mg salts in water
Pasture/Hay/ Grain-based concentrate	Grain adapts the rumen to grain and provides energy and metabolizable protein
Pasture/Hay /Anionic salts/ Concentrate	Lowers DCAD and markedly reduces the risk of metabolic diseases
Pasture/ Hay/ Professionally formulated, commercially produced anionic transition supplement (Lead feed)	Reduces DCAD more readily and provides all components of fully integrated transition diet
TMR/PMR	Reduces DCAD more readily and provides all components of fully integrated transition diet

Potential risks of improving the transition cow diet in the pre-partum period include mastitis, poor colostrum production and possible increase in calf birth weight that may increase the calving assistance rate.

Transition cow management simplified

A basic summary of the transition cow diet is outlined below:

Diet

- Lead feed concentrate fed at 3kg/head/day.
- Provision of ad lib oaten/cereal hay
- Minimize green feed (pasture intake) to 2kg DM/ cow/ day

Management

- Offer diet for a minimum of 21 days
- Do not feed diet for more than 5 weeks
- Allow enough trough space/ cow = ideally 0.75m/ cow
- Access to clean fresh water
- Separating heifers from cows
- Separating subordinated cows from dominate cows

Transition Cow Monitoring

To investigate transition cow herd health we are able to perform metabolic profiles on the springers, freshly calved cows and milkers. The information gained can be used to determine if there is a transition issue and where we can investigate further/ provided recommendations.

	Test	Cows to be sampled	Targets	Alarm levels
Springers				
	Urine pH	Cows and heifers on close up ration greater than 7 days	pH 6.5-7	Average below or above
Fresh	NEFA	Cows within 2-14 days after calving	< 0.4 mmol	>10% of cows sampled
	Blood calcium	Multiparous cows 12-24hrs of calving	> 8mg/dl	>30% of cows sampled
	BOHB	Cows and heifers 5-50 DIM that have not been sick or treated with propylene glycol	< 1400mmol/l	> 10% of animals sampled
	BUN	Lactating cows 5-10 DIM if fed a different ration	6mmol/L	Average below or above
Milking Herd	Ruminal pH	Lactating cows 5 to 50 DIM if slug feeding Lactating cows 5 to 150DIM if fed a TMR	< 5.5	> 25% of animals sampled
	BUN	Lactating cows at various stages If feeding in different groups each group should be sampled	6-6.5mmol/l	Average below or above

Reference:

Dairy Australia, 2020, Transition Cow Management, A review for nutritional professionals, veterinarians and farm advisers, accessed from: https://www.dairyaustralia.com.au/resource-repository/2020/07/09/transition-cow-management-professional-review#.YG1M_OgzbD4

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