Monitoring of transition period feeding improves health

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Nutrition during the transition period plays a key role in preventing the most important culling reasons and improving the economy of milk production.

Almost half of all cullings are derived from unbalanced feeding solutions of transition period and in many countries cows calve only around 2.5 times during their lifetime. Heifer rearing is expensive and around 1.5 lactations are required in order to cover all rearing costs. In many cases cows will be culled after the second calving leading to too short a repayment period.

Cows face many challenges during the transition period. Post calving feed intake increases more slowly than milk yield exposing cows to negative energy balance. Cows tend to suffer suppressed immune status around calving affecting many common health problems such as mastitis and poor fertility.

High concentrate proportion is also a well known and widely occurring problem during early lactation. Reducing dietary cation-anion balance has been used as one type of strategy to decrease the prevalence of calving related health problems.

Controlling the cation-anion difference has been used not only to prevent milk fever but also to prevent subclinical hypocalcaemia, which may be responsible for problems such as mastitis, metritis, retained placenta and uterine involution. The risk of mastitis is increased in hypocalcaemic animals due to inadequate closure of the teat sphincters caused by attenuation of smooth muscle. Anionic rations has also been shown to reduce the extent of negative energy balance (NEB) around calving by improving dry matter intake post-calving as a consequence of better calcium homeostasis.

Group	DCAD* (meqv/kg DM)	Urine pH Day -14	Day -7	Day -1
Control	+ 377	8.5	8.5	8.5
Test primiparous	+ 97	8.5	8.4	8.4
Test multiparous	+ 94	8.4	8.4	8.4

*Dietary cation-anion difference

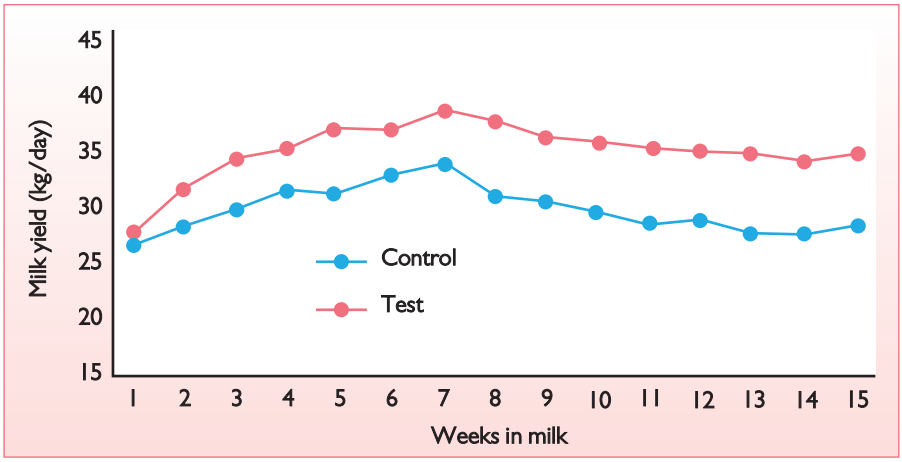
Table 1. Urine pH levels before calving.

In addition, subclinical hypocalcaemia has been shown to impair calcium mobilisation and decrease calcium stores in immune cells resulting in a blunted immune cell activation signal. Feeding anionic salts have been shown to decrease blood pH causing metabolic acidosis and permitting parathyroid hormone (PTH) to act.

The result is increased release of bone calcium and production of 1,25-dihydroxyvitamin D to increase intestinal calcium absorption. For those using the addition of anionic salts to try and prevent milk fever and hypocalcaemia, three key monitoring criteria have been suggested:

- That the dietary-cation anion difference (DCAD) for dry cows is between -100 and -150 meqv./kg DM.
- That urine pH for cows fed using the DCAD strategy is 6.0-7.0.
- That dietary calcium concentration is 0,99-1.50% of the diet.

Fig. 1. Milk production during the first 100 days after calving (n = 2320).



New feeding concept

Hankkija-Maatalous Ltd in Finland has recently developed a new feeding concept for transition cows.

The new feeding concept focuses on optimising dietary cation-anion and mineral element balance of prepartum diet, supporting cows immune status around calving and preventing negative energy balance post calving.

The new concept was tested at University of Life Sciences in Estonia with two different special feeds. Acetona DryStrong is a pelleted supplemental feed containing anionic salts and minerals. The product has a low DCAD. Acetona EnergyPower is a glucogenic feed supplement containing raw materials for blood glucose synthesis.

In trials the product has increased propionic acid production in the rumen. Both Acetona products contain inactivated and hydrolysed brewery yeast (Progut Rumen).

Progut Rumen has been shown in previous studies to improve cows' immune status and colostrum quality and to enhance rumen fermentation. Altogether 30 Holstein Friesian cows were divided into two different groups (control and test). The average number of calvings in control and test groups were 2.40 and 2.20 respectively and cows were followed for 121 days (21 days before calving and 100 days after).

Feeding was based on conventional alfalfa-grass silage-TMR ration supplemented with hay, straw, barley, maize and rapeseed cake.

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Control cows got close up diet 21 days before calving and two different lactation diets (0-21d and 21-100d). Test cows got the same dry and lactating diets supplemented with Acetona DryStrong three weeks before calving and Acetona EnergyPower eight weeks after calving.

Calcium metabolism

Due to exceptionally high cation-anion difference of alfalfa-grass silage (627meqv/kg DM) and hay (513meqv/kg DM) the calculated DCAD stayed ata high level in the control (+377meqv/kg DM) and test group (+96meqv/kg DM). Test feeding decreased DCAD but was inadequate to affect urine pH level (Table 1).

It has been observed in earlier Acetona studies that DCAD must fall below 0 until urine pH decreases. However, clinical milk fever was observed from only one cow. Blood calcium level stayed at high level (between 10-11mg/dl) during the entire trial in both groups and there were no differences between treatments. The lowest calcium values (9.9 and 9.8mg/dl) were observed at day +1 after calving in both groups.

	No. of cows	Subclinical symptoms (%)		
		Retained placenta	Mastitis	Metritis
Control	14	21	36	71
Test	16	6	6	25

Table 2. Prevalence of subclinical milk fever related symptoms.

However, the symptoms of subclinical milk fever (retained placenta, mastitis and metritis) were common especially in the control group (Table 2). Test feeding remarkably decreased the amount of subclinical hypocalcaemia symptoms.

Altogether 79% of all cows in the control group had one or several subclinical symptoms, while similar observation was made only from 38% of the test cows. A similar result was seen in an earlier Acetona study where the observed numbers were 85% and 35% respectively. Acetona DryStrong contained 1.2% hydrolysed brewery yeast (Progut Rumen) which has been shown in earlier studies to stimulate immunity by increasing the levels of immunoglobulin A in colostrum and serum.

The effect of Progut Rumen on cows' immune status is difficult to asses in this study because Progut Rumen was used as a part of Acetona DryStrong. However, colostrum IgA content was improved on average 20.5% by test treatment although the difference was not statistically significant. In earlier Progut Rumen study, at the University of Helsinki, on average 30% higher colostrum IgA level was observed in test group.

Higher milk production

Cows in the test group had on average 5.6kg/day higher milk yield (34.6kg vs. 29.0kg) during the first 100 days after calving and the difference was highly significant ($p<0.001$) (Fig. 1).

It is noteworthy that multiparous cows in the test group already had 1.4kg/day higher production level (8414 vs. 8841kg) during the previous lactation.

However, taking into account the difference from the previous lactation test cows had still 4.2kg/day (5.6kg – 1.4kg) higher milk yield during the first 100 days after calving. Cows in the test group had remarkably less calving related health problems and lower SCC level, which are probably the primary reasons for the higher production level in this trial. For example Le Bras (2009) evaluated that SCC levels 300,000 and 400,000 decrease milk production 8% and 9% respectively.

Milk fat-% was lower in the test group during the first two months after calving but higher than the control group until the end of the trial. Milk fat yield (kg/day) was signif-

icantly higher (p = 0.017) in the test group (Table 3). Milk protein-% was lower in the Acetona group but milk protein yield (kg/day) was significantly higher (p = 0,043) in the test group.

Due to the small amount of samples (n = 74) a large variation in milk urea and somatic cell count (SCC) levels were observed. However, SCC tended to stay at a lower level in the test group during the entire trial (p = 0.156).

Blood glucose, NEFA and BHB analyses were used in order to evaluate cows' energy balance around calving. Blood glucose level decreased after calving and achieved the lowest level at day 21 in both groups.

The test group had lower blood glucose levels at day 21 (2.91 vs. 3.14mmol/l) and day 56 (3.23 vs. 3.47mmol/l) after calving but the differences were not statistically significant.

Blood NEFA achieved the highest level (0.28 mmol/l) at day one after calving in the test group. Blood NEFA level tended to decrease in the control group during the entire trial but was at a higher level (0.26 vs. 0.20 mmol/l) in the control group at day one. Blood BHB achieved the highest levels at day 21 in control (0.75 mmol/l) and test groups (0.88 mmol/l). The test group had higher blood BHB levels at day 21 and day 56 after calving but no statistical differences were observed.

Duffield and LeBlanc (2011) suggested > 0.4 mmol/L NEFA and >1.2-1.4 mmol/L BHB levels as targets for subclinical ketosis.

Conclusions

Test feeding increased milk protein and milk fat yields and has no effect on energy balance although milk yield increased remarkably.

The test feeding concept decreased the prevalence of subclinical milk fever symptoms around calving and indicatively improved colostrum IgA content and decreased somatic cell count level of milk.

The results suggest that reducing DCAD can be used as a strategy to prevent subclinical hypocalcaemia even if the urine pH is not always seemingly changing. Also, it can be concluded that the prevalence of clinical milk fever is not always a good indicator for evaluating the extension of subclinical hypocalcaemia and suppressed immunity around calving. ■

References are available from the author on request

Table 3. Milk fat and protein yields, milk urea and somatic cell count levels after calving (n = 74).

Treatment	Months in milk				p-value (average 1-4)
	1	2	3	4	
Fat yield (kg/day)					
Control	1.294	1.361	1.008	1.184	
Test	1.333	1.301	1.295	1.633	0.017
Protein yield (kg/day)					
Control	0.979	1.028	0.891	0.926	
Test	1.083	1.082	1.065	1.057	0.043
Urea (mg/dL)					
Control	283	211	212	202	
Test	243	236	214	295	0.816
Somatic cell count					
Control	155	239	498	2619	
Test	62	212	178	33	0.156