Subclinical ketosis in dairy cattle – the silent profit robber

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Successful calving, healthy metabolic functions postpartum and good milk performance in lactation depend highly on the transition period (three weeks before and after calving) of dairy cows where they should be able to manage energy intake and overcome negative energy balance.

Subclinical ketosis is one of the metabolic diseases associated with negative energy balance during the transition period. Subclinical ketosis is manifested by the elevated BHB (beta-hydroxybutyrate) concentration in blood, urine and milk in dairy cattle, especially in the first 2-3 weeks after calving. The prevalence of subclinical ketosis is around 9-34% in dairy cattle farms. According to Duffield (2000), subclinical ketosis may start at serum BHB above 1,000µmol/L. However, at exactly what level individual cows will express clinical signs are extremely variable.

Furthermore, there are studies in which the cut off value is expressed as 1,200µmol/L.

Subclinical ketosis causes losses through decreased milk production and association with periparturient diseases. Serum BHB concentrations of 1,200µmol/l or above in the first week following calving were associated with increased risks of subsequent abomasal displacement and metritis, whereas the critical BHB threshold in the second week postpartum for the risk of abomasal displacement was set at ≥1,800µmol/l.

The best threshold for predicting subsequent risk of clinical ketosis from serum obtained during week one and week two postpartum was 1,400µmol/L of BHBA.

Impacts on milk yield begin at BHB ≥1,200µmol/l for week one postpartum and ≥1,400µmol/L for week two postpartum. Duffield et al. (2009) has summarised the impact of elevated blood BHB on milk production in first and second week postpartum in Table 1.

Having increased blood BHB (≥1,800µmol/L) in the first week of lactation is associated with milk loss of 300kg/cow for the entire lactation. Simililarly, Gustafsson et al. (1993) reported a loss of 328kg milk (fat corrected milk) due to high blood BHB concentration.

As Leblanc (2010) summarised; subclinical ketosis in the first or second week after calving is associated with:

- 3-8 times increased risk of left displacement of abomasum.
- Three times greater risk of metritis when serum BHB in the week one postpartum was >1,200µmol/L.
- 4-6 times increased risk of clinical ketosis.
- Increased probability of subclinical endometritis at week four postpartum, increased duration and severity of mastitis.

All these above indicate that subclinical ketosis is a very important metabolic disease which can impact production in dairy cattle farms. It is mostly underestimated and overseen.

Postpartum period	Blood BHB µmol/L	Milk loss kg/day	P
Week 1	1200	1.22	<0.05
	1400	1.88	<0.01
	1600	1.76	<0.05
	1800	1.71	<0.05
Week 2	1400	1.39	<0.05
	1600	1.81	<0.05
	1800	2.29	<0.01
	2000	3.30	<0.001

Table 1. Milk loss due to subclinical ketosis (elevated blood BHB) in first and second week postpartum in dairy cattle.

Groups	n	Day 0-1	Day 3-10
Placebo	228	497 (384-646)	756 (533-1,263)
Catosal	244	500 (376-674)	683 (512-956)
p		>0.05	**<0.05**

Table 2. Median (interquartile range) serum BHB concentrations (µmol/L) at baseline (day 0-1) and follow-up (day 3-10) sample collections in mature cows (lactations ≥ 3) randomly assigned to receive either placebo or Catosal.

Recent studies

Catosal is a metabolic stimulant and energising product, containing butafosfan and vitamin B12. It has been widely used for a decade in food producing animals for the pre-

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Fig. 1. Rate of healthy animals (BHB <100µmol/L in milk) on 5 and 10 days after treatment with Catosal (the difference is significant on day 10, p<0.05).

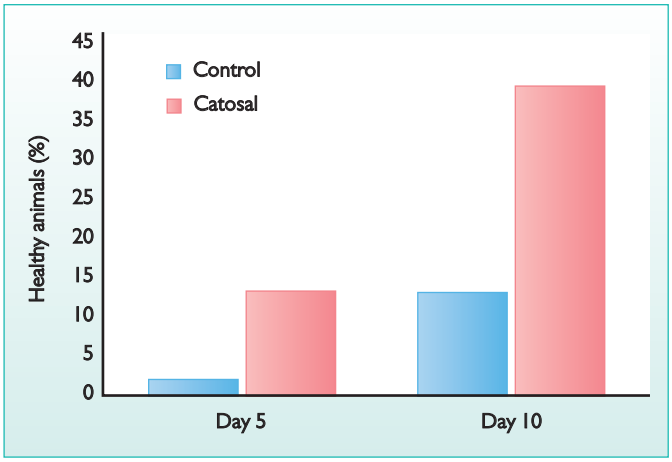
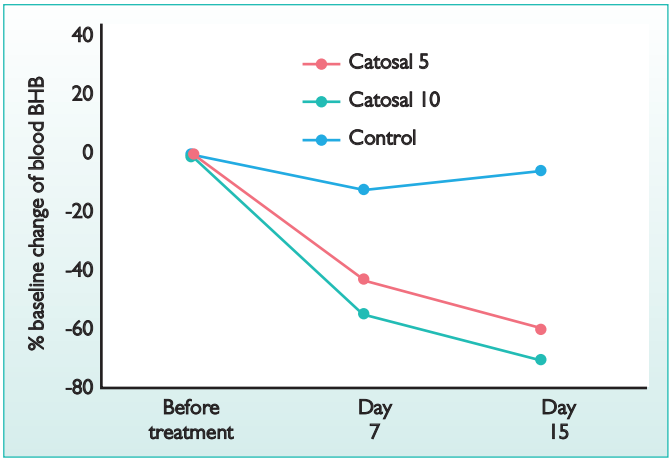


Fig. 2. Effect of different dosage of Catosal on blood BHB (baseline change). On day 7 and 10 post-treatment the difference between control and treatment groups is significant (p<0.05).



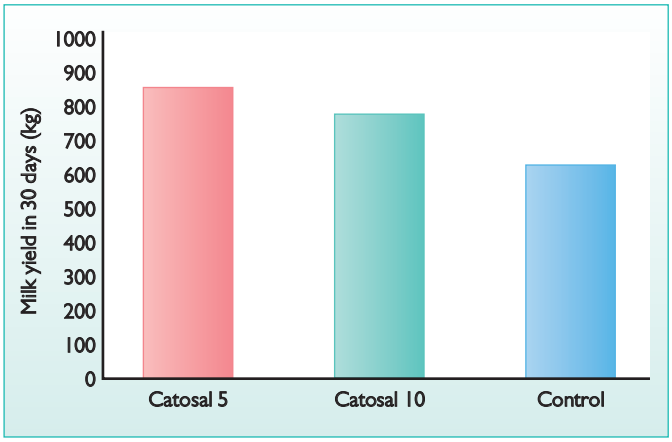


Fig. 3. Effect of Catosal in cows with subclinical ketosis on 30-day milk yield (Sahal et al. 2011).

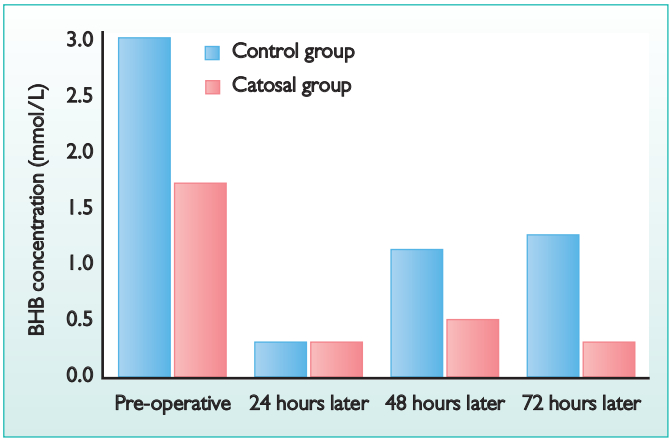


Fig. 4. Effect of Catosal pre-treatment just before surgical operation of LAD on blood BHB concentration (Fürll et al .2006).

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vention and supportive treatment of metabolic and reproductive diseases.

A recent study on the mode of action of Catosal revealed that it regulates the ACSL1 enzyme which is involved in fatty acid oxidation in the liver. A lot of evidence has been found on the efficacy of Catosal in controlling subclinical ketosis in dairy cows.

Rollin et al. (2010) studied the effect of two treatments with Catosal (25ml/cow, subcutaneously) at calving and 24 hours later in over 1,000 primiparous and multiparous dairy cattle in the USA.

Treatment with Catosal decreased the concentrations of BHB in the blood significantly (Table 2) and reduced the incidence of retained placenta in cows in the third lactation, normally classified as high risk cows.

Treatment of cows (n=79) with Catosal for five days at a dose of 25ml/animal by intramuscular administration in the second week after calving to treat subclinical ketosis (milk test >200µmol/l BHB) resulted in increased rates of healthy animals and milk production.

Fig. 1 presents the rate of healthy animals after treatment with Catosal. The prevalence of healthy cows based on the concentration of BHB in the milk (<100µmol/L) and milk production increased significantly within 10 days.

On day 10, mean milk production was 3.4 litres higher in the group treated with Catosal than in the untreated group.

The prevalence of subclinical ketosis (BHB ≥200µmol/L milk) in the control group was 48.6%, while it was only 23.8% in the Catosal treatment group.

Sahal et al. (2011) compared the effect of different dosages of Catosal in subclinical ketosis. Cattle (n=52) postpartum between first and second week were tested by Precision Xceed device on blood BHB concentration. Those who had blood BHB of 1,000-≤ 3,000µmol/L without clinical sign of ketosis were included in the study.

One group (Catosal 5) was treated with 5ml/100kg Catosal for four days, another group (Catosal 10) was treated with 10ml/100kg Catosal for four days. Control group cows were treated with injectable water for the same days.

All treatments were conducted intramuscularly. Both dosages of Catosal were able to bring down blood BHB significantly compared to the control group on days 7 and 15 post-treatment.

The dosage 10ml/100kg of Catosal looked better to decrease blood BHB on days 7 and 15 post-treatment (more than 60% decrease from baseline). Fig. 2 presents the change of blood BHB from baseline after treatments.

Total milk yield for 30 day in Catosal 5, Catosal 10 and control group was 863, 779 and 640kg respectively (Fig. 3). The difference between Catosal 5 and control ($p<0.01$) and Catosal 10 and control group ($p<0.05$) was significant.

The effect of Catosal treatment in cows that underwent the operation of left abomasal displacement (LAD) was studied by Fürll et al. (2006). Treatment of cows with 5ml Catosal for 100kg bw. intravenously Just two hours before surgical operation of LAD controlled the blood BHB concentration subsequently.

The blood BHB concentration increased in the control group animals without treatment of Catosal 48 and 72 hours after the operation (Fig. 4).

Cows with elevated blood BHB concentration (>1,000µmol/L) between one and two weeks postpartum (n=9-10 in each group) and without sign of ketosis were treated with Catosal or Asian originated generics of Catosal for four days intramuscularly at a dose of 5ml/100kg. A marked decrease in blood BHB was observed in Catosal group compared to control and generics (Fig. 5).

The conception rate of cows treated with Catosal was significantly higher than control group and generic 3 in the first insemination (Fig. 6).

Conclusion

Subclinical ketosis is an economically important disease and should not be underestimated since it has production and reproduction aspects.

Milk production loss (around 300kg per lactation), reproduction disturbances (low conception rate, increased artificial insemination), high risk for abomasum displacement, metritis and mastitis and clinical ketosis are important economic consequences of subclinical ketosis on dairy cattle farms.

The disease runs subclinically, therefore it might be called the silent profit robber because of the impact on the profitability of dairy farms.

Catosal, as a metabolic stimulant containing butafosfan and vitamin B12, has been shown to be very effective for the treatment of subclinical ketosis in dairy cattle in different studies that have been conducted worldwide. ■

Fig. 5. Baseline changes. Effect of Catosal and Asian originated generics (5ml/100kg intramuscular for four days) on the blood BHB concentration in cows (Deniz et al. 2010).

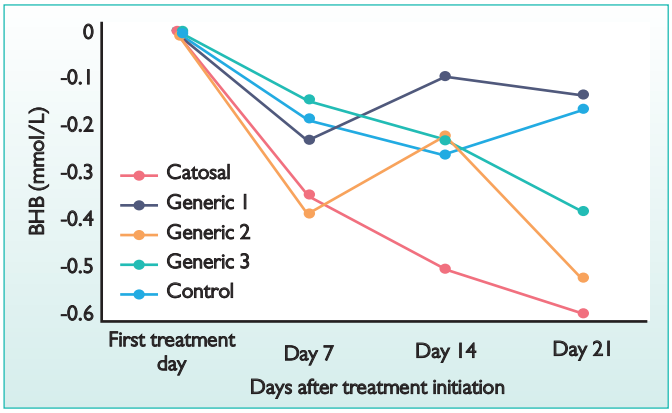

Fig. 6. Effect of Catosal and Asian originated generics on the conception rate of cows with subclinical ketosis (Deniz et al. 2010).