Reduced Feed Intake in Cows After Peroral Calcium Supplements

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Introduction

Peroral calcium-supplements are widely used to prevent and/or cure milk fever in cows. These calcium supplements normally contain $CaCl_2$, $2H_2O$ which is a chemical with irritative effect. In an experiment with two different Ca-supplements, it was shown that one of these had an irritative/ulcerogenic effect on the rumen wall (3). Other cows had a reduced feed intake rate after treatment with the same Ca-supplement.

Some practitioners have also observed that Ca-treated cows could have a reduced appetite and sometimes also diarrhea. A reduced feed intake about calving is undesirable because a high producing cow needs a high feed intake to avoid ketosis caused by a large mobilization of energy from the body. Therefore an experiment was made to show if there is a reduced daily feed intake in cows treated with different Ca-supplements when the cows are fed *ad libitum.*

Materials and Methods

Experimental design

The experiment was carried out as a latin square with four cows, four periods and four treatments. The design is shown in Table 1. There were eight days between each treatment.

Table 1 Experimental design.

Period/Cow	1	2	3	4
1	Water	Ca-oil	Ca-gel	Ca-capsule
2	Ca-oil	Ca-gel	Ca-capsule	Water
3	Ca-capsule	Water	Ca-oil	Ca-gel
4	Ca-gel	Ca-capsule	Water	Ca-oil

Experimental animals

The four cows in the experiment were cows with a high feed intake. Three of them were older cows and one was in its first lactation. The feed intake before the experiment was from 16 kg DM to 24 kg DM per day, average was 20 kg DM.

Experimental treatments

The four treatments were pure water and three different commercially available $CaCl_2$-containing products. All were made for peroral administration. The four treatments were:

1) Pure water, (1 1)
2) Ca-oil, (200 g $CaCl_2$, $2H_2O$ emulgated in 380 g soya bean oil and 200 g water + 20 g aroma-mixture) (Calol, Gunnar Kjems APS, DK-1173 Copenhagen).
3) Ca-capsule, (126 g $CaCl_2$, $2H_2O$, 45 g $CaSO_4$ 7 g $MgCl_2$ and 2 g calciumstearat. The capsule is covered with 10 g animal fat).
4) Ca-gel, (200 g $CaCl_2$, $2H_2O$ in a hydroxyethylcellulose-gel) (H. Lundbeck A/S, DK-2500 Valby).

The cows were given four doses in each treatment. The first dose was given late in the afternoon and the three doses the following day at 0700, 1200 and 1700 hours. However, this is not the recommended time schedule for the use of the three products. The recommendation says four doses in 48 hours.

Feeding procedure

Twice a day the cows were fed a mixed feed containing 52% of dry matter (DM) as grass silage, 37% DM as fodderbeets and 11% DM as concentrates rich on protein. This mixture was fed *ad libitum* with at least 10% extra. The cows were fed other concentrates according to yield. Two cows had 3.8 kg, one 2.4 kg and one 1.2 kg per day. The feed intake was measured every day and the refusals were analyzed for DM, to eliminate a difference in DM content of the feed digested and the feed left over.

Calculation and statistics

The reduction in feed intake after administration of Ca-supplements or water is calculated as the difference between the feed intake when the cows are treated and the average feed intake of the 3 days before and 3 days after the treatments. The statistical model contains the effect of cow, period, and treatment.

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Results

The results are shown in Table 2 and in Figure 1.

Table 2 Normal feed intake and reduction when treated with different Ca-supplements or water.

	Normal Feed Intake		Reduction		% Reduction	
Treatment	kg DM	FU*	kg DM	FU	DM	Fu
Water	19.2	18.0	0.9	0.8	4.7	4.6
Ca-oil**	18.6	17.4	2.2	2.1	12.2	11.9
Ca-capsule	19.1	17.9	2.1	1.9	11.5	11.0
Ca-gel	18.8	17.7	3.1	2.8	16.7	16.1

* Fu = Feed unit. 1 feed unit = 1 kg barley

** The energy in the soya bean oil is not included (about 2.4 FU)

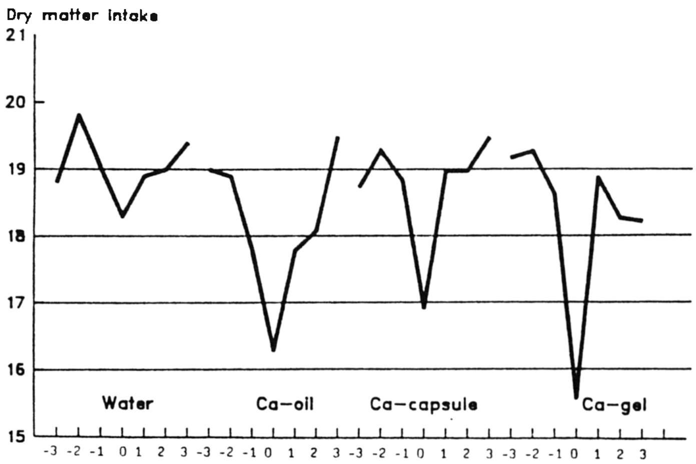

Figure 1 Feed intake before (day -3, -2, and -1), at (day 0) and after (day 1,2 and 3) treatment with different Ca-products or water.

There is a small reduction when pure water is used for peroral administration but the reduction is not significant. The reduction in DM intake when the three Ca-supplements are used is from 11.5% to 16.7%. This reduction, at the day of administration, is significant ($P < 0.05$). There is no significant difference between the 3 treatments but there is a tendency that the Ca-gel gives the greatest reduction. On the other hand the Ca-oil seems to give an effect for a longer period as shown in Figure 1. This effect on the following days is not significant and it is one cow in particular which is affected.

The energy intake is reduced almost proportionally with the feed intake. The reduction in feed intake is primarily a reduced intake of the mixed ration and not of the concentrates. The soya bean oil in the Ca-oil supplies a lot of energy. How much will depend on the digestibility of the fatty acids? If the digestibility is about 75% the energy supply is 3.2 FU, so even if there is a reduction for a longer period the total energy reduction will be very small.

Discussion

The possible mechanisms involved in the reduction of feed intake are:

1) the handling of the cows,
2) the increase in the osmotic pressure,
3) the effect of unsaturated fatty acids on rumen function,
4) the effect of etching of the rumen wall.

The reduction in feed intake when the cows were treated with pure water can only be due to the handling of the cows. The effect of that is very small and it is not of any importance.

After administration of the 3 Ca-supplements the osmotic pressure in the rumen will increase. If the rumen contains 80 1 the increase after 1 dose of Ca-gel or Ca-oil will be about 50 mOsmol/1. The Ca-capsule will increase the osmotic pressure by about 36 mOsmol/1 because of a lower content of $CaCl_2$. The normal osmotic pressure is 240-280 mOsmol/1 before feeding, increasing to 350-420 mOsmol/1 the first 2-3 hours after feeding. After 5-9 hours the osmotic pressure will be at normal level (1).

Above 350 mOsmol/1 there is an increasing negative effect on feed intake, and the effect of the osmotic pressure might explain the decrease in feed intake in this experiment. It is questionable if it is the only reason, because the feed intake would increase if the cows were fed a higher amount of concentrates and so would the osmotic pressure.

When unsaturated fatty acids are administered to the rumen there will be a great reduction in the cellulolytic activity. This will decrease the rate of passage of digesta and the digestibility of the feedstuff (2), and the result is a decrease in feed intake. In this experiment the Ca-oil has a tendency to decrease feed intake for a longer period than Ca-gel and Ca-capsule, and the inhibition of the bacterial activity might explain that.

Etching of the rumen wall could also be a reason for a decrease in feed intake. The Ca-gel used in this experiment has shown a serious etching effect (3), but it is impossible to decide if that has been the reason for the decrease in feed intake in this experiment.

Conclusion

There is no doubt that administration of these three Ca-supplements has reduced the feed intake, but a 10-15% reduction in one day is not of any importance, not even about calving. However, if the reduction increases with decreasing feeding level it might be serious for the cow. On the other hand it must be balanced against a higher incidence of milk fever if the Ca-supplements are not used. An experiment with cows treated at calving will be presented.

Summary

The influence on daily feed intake of treatment with three different commercially available $CaCl_2$-containing products and pure water was measured. The treatments were four perorally administered doses of 1) 1l. pure water, 2) Ca-oil containing 200 g $CaCl_2$ emulgated in soya bean oil, 3) Ca-capsule containing 126 g $CaCl_2$ and 45 g $CaSO_4$, 4) Ca-gel containing 200 g $CaCl_2$ in an ethylcellulose-gel. The treatment gave a reduction in DM intake of 4.7%, 12.2%, 11.5% and 16.7% respectively on the day of treatment. The energy intake was reduced about the same except for the Ca-oil treatment where the energy intake was not reduced due to the oil. The mechanisms causing the reduction might be 1) handling of the cows, 2) increase of the osmotic pressure, 3) fat depression in the rumen, 4) etching effect of the rumen wall.

References

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Abstract:

Effects of four hormone treatments after calving on uterine and cervical involution and ovarian activity in cows

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Uterine and cervical involution after calving was measured sequentially in 25 parous commercial Friesian cows by using electronic calipers and real-time ultrasound imaging, transrectally. Ovarian activity was monitored by using real-time ultrasound imaging and by the assay of milk progesterone concentrations. Peripheral plasma prostaglandin $F_{2\alpha}$ metabolite concentrations were assayed during this period. Five groups of five cows were treated intramuscularly, approximately 48 hours after calving, with either 100 mg progesterone in oil, 25 mg dinoprost tromethamine, 5 mg oestradiol benzoate, 1·2 mg of the long-acting oxytocin analogue carbetocin or 5 ml sterile water. There were no statistically significant differences between the intervals from calving to the completion of involution or between the intervals from calving to the first ovulation for the cows in the different groups. The mean PGFM concentrations in the peripheral circulation were significantly higher in the carbetocin-treated group, presumably owing to the stimulation of endogenous prostaglandin $F_{2\alpha}$ secretion. This study provides no evidence that a single treatment with any of the four hormones significantly affected the reproductive function of the cows after calving.