

# Production and Metabolic Response to the Addition of Live Yeast or Yeast Culture or No Yeast to Lactating Cows

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## Materials and Methods

Lactating cows (n=108) were fed a total mixed ration containing corn silage, alfalfa hay, rye silage and a grain mix containing ground corn, soybean meal, whole cottonseed, bypass protein, vitamins and minerals. Fresh cows were added to the group after calving. Cows were on a switch back trial as follows: no yeast three weeks, yeast culture three weeks, no yeast three weeks, live yeast three weeks then repeated. Daily milk weights were captured electronically.

## Results

There was a significant increase of abomasal displacements ( $p < 0.01$ ) in the no-yeast group. Milk- yield difference will be presented.

## Significance

Yeast feeding may be a factor in rumen and abomasal health in the early lactating cow

# A Case Description of Possible Vitamin-E Deficiency among Calves in a Large Danish Dairy Herd- Clinical Findings, Supplementation and Future Prevention

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## Introduction

The objective with the present report is to present a case of what seemed to be hypovitaminosis E among two ten-week-old dairy calves (mainly due to pneumonia) in a 900-cow Danish dairy herd.

The owner of a family-owned dairy facility in northern Jutland, Denmark responded to what he thought was a high rate of fatal non-responsive pneumonia among milk-fed, one- to ten-week-old dairy calves and called for experts from the Danish Agricultural Advisory Service, Danish Cattle Federation.

## Materials and Methods

All calves were single-housed in outdoor hutches until they were three to four weeks old whereafter calves were placed in mixed gender in outdoor hutches (super hutches) in groups of six to seven in an "all-in all-out" system for an additional seven weeks. Herd management included administration of four liters of unpasteurised colostrum administered by an esophageal tube feeder within four hours of birth. Thereafter daily, six liters of whole milk (waste milk excluding antibiotic milk) in single hutches and eight liters in the first four

weeks and five liters the following two weeks were after they were weaned during one week.

Passive immunization was monitored by ELISA (Midland BioProducts®) on whole blood from five calves every two months, and the specific gravity of all colostrum portions was monitored by "Colostrometer" (Kruuse, Denmark®). All milk was fed in bowls or long troughs, and fresh water was offered *ad lib* from day one. Calf starter (Kalve Starter®, Aarhusegnens Andel, Denmark) was offered fresh daily and *ad lib* for the first eight weeks of age.

The expert performed clinical examination of both healthy and sick calves and attended five post-mortem examinations performed in-field by the local herd veterinarian.

Clinical screening of all milk-fed calves revealed that approximately 8% of the calves had typical signs of pneumonia and 34% had diarrhea. No other obvious signs of disease were observed. Mortality rate of own calves from birth to weaning was approximately 12%, which is well above normal (3%) for this herd. Results from postmortem examinations revealed fluid around the enlarged heart and lungs and bronchointerstitial pneumonias, in addition to hemorrhagic and pale areas in the "flabby" heart muscle, but otherwise nothing abnormal. One of many possible reasons could be low stress tolerance and immune function deficit due to hypovitaminosis E. Vitamin E is important for maturation of the immune system and a potent peroxy-radical scavenger that prevents free-radical damage to polyunsaturated fatty acids (PUFAs) in membrane phospholipids and plasma lipoproteins. In cows, transplacental transmission of vitamin E is limited. Calves are born with very low blood concentrations of vitamin E and therefore depend on colostrum and milk as the main sources. Generally, whole milk contains between 0.8-1.2 mg  $\alpha$ -tocopherol/kg.

Since  $\alpha$ -tocopherol levels in blood serum are considered to provide good information on the vitamin E status of animals, it was decided to initiate blood sampling and subsequent vitamin E analysis. Vitamin E content in the calf starter was analyzed as well. The content was 190 mg  $\alpha$ -tocopherol/kg of a 1:1 mixture of all-rac- $\alpha$ -tocopheryl acetate and RRR- $\alpha$ -tocopheryl acetate.

Vitamin E in plasma and feed was determined by high-pressure liquid chromatography (HPLC) at the Danish Institute of Agricultural Sciences. Plasma samples were saponified with KOH in alcohol, and the tocopherols were subsequently extracted with heptane and finally quantified by HPLC. Following separation by HPLC, tocopherols were detected by fluorescence, where the amount of fluorescence is proportional to the amount of vitamin in the sample. Quantification was based on comparison with external standards.

## Results

### *August 30, 2005: First blood sampling*

The first 10 blood samples were collected August 20, 2005. Eight samples from seven week-old calves showed an average  $\alpha$ -tocopherol concentration of 0.86  $\mu$ g/ml plasma  $\alpha$ -tocopherol (range 0.2-2.4). The last two samples from nine-day-old calves, showed a value of 0.4 and 0.8  $\mu$ g/ml plasma  $\alpha$ -tocopherol, respectively. As a consequence of the low plasma  $\alpha$ -tocopherol levels, it was decided to increase the amount of vitamin E in the calf starter, and despite the low  $\alpha$ -tocopherol concentration in whole-milk-fed calves, it was expected that whole milk would fulfill their vitamin E requirement.

### *October 15, 2005: Calf starter composition changed*

From October 15, the calf starter (Kalvestarter®, Aarhusegnens Andel, Denmark) composition was changed according to the source of vitamin E. Leci E was introduced as a natural source of vitamin E, replacing a 1:1 mixture of synthetic and natural  $\alpha$ -tocopheryl acetate ("Natural E 50%"). Hereby, not only the  $\alpha$ -tocopherol content in the calf starter was increased from 190 to 273 mg/kg, but the source was also shifted to a pure natural alcohol form (RRR- $\alpha$ -tocopherol). Our own laboratory results revealed as much as 367 mg  $\alpha$ -tocopherol/kg. Although the natural vitamin E in Leci E is alcohol bound, it is proven stable in commercial feeds.

### *October 31, 2005: Second Blood sampling*

Second blood sampling included 22 calves on October 31, 2005. Six of those calves were 14 days old and averaged 0.3  $\mu$ g/ml plasma  $\alpha$ -tocopherol (range 0.2-0.6). The remaining 16 calves were older (six to seven weeks) and averaged 1.2  $\mu$ g/ml plasma  $\alpha$ -tocopherol (range 0.5-1.9). Two calves sampled October 31 were also sampled on August 30 at nine days of age. Plasma  $\alpha$ -tocopherol in those two calves had increased from 0.4 and 0.8  $\mu$ g/ml to 0.9 and 1.7  $\mu$ g/ml. Thus, the change in the calf starter of vitamin E source and dosage generally increased vitamin E status in plasma by 40%.

### *November 17, 2005: Oral supplementation of all calves with oral 500 IU $\alpha$ -tocopherol day:*

Although increasing the vitamin E content and changing the vitamin E source of the starter diet increased vitamin E status of the calves, the vitamin E concentration was not increased as much as desired and the vitamin status of the whole-milk-fed calves was unaffected. Therefore, daily oral supplementation with 500 IU  $\alpha$ -tocopherol (Natur-E Micelle®, Pharmalett, Denmark) to all milk-fed calves was initiated on November 17.

#### *November 25, 2005: Third blood sampling*

At the third blood sampling date, November 25, the same 22 calves as sampled October 31 were sampled again, in addition to 10, less than one-week-old calves that had not been previously sampled. This time, plasma was also analyzed for retinol concentration.

Calves that had been sampled on October 31 at 14 days of age (now approximately six weeks old) had increased their plasma  $\alpha$ -tocopherol concentrations dramatically to an average of 5.4  $\mu\text{g}/\text{ml}$  (range 3.2-8.2), as an effect of the combined feeding of natural vitamin E both in whole milk and starter diet. Another 16 calves, sampled on November 25 (now 10-11 weeks), now had plasma  $\alpha$ -tocopherol average of 1.6 (range 0.7-3.6), a 33% increase compared to the previous sampling. Ten calves, less than one week old, had an  $\alpha$ -tocopherol average of 4.3 (range 2.4-6.6).

Plasma retinol concentrations ranged from 0.11-0.31  $\mu\text{g}/\text{ml}$  and averaged 0.20  $\mu\text{g}/\text{ml}$ . The highest plasma retinol concentrations were seen among the oldest calves. Throughout December, the mortality rate again fell to approximately 5%, which is only slightly above normal in this herd.

### **Significance**

Seemingly, serum vitamin E status among calves at the initial blood sampling was subnormal, so those calves did suffer from, at least mild, hypovitaminosis E.

Increasing the level and changing the source of vitamin E in the calf starter increased vitamin E status of calves fed this diet but not among the pure-milk-fed calves. Oral administration of 500 IU  $\alpha$ -tocopherol/d to milk-fed calves increased serum vitamin E status well above the 3  $\mu\text{g}/\text{ml}$  plasma considered to be the minimum level for optimal immune function.

Since calves obviously are born with low depots of vitamin E, and since the correct colostrum management in this herd and relatively high levels of milk feeding could not alter vitamin E status in a favorable direction, vitamin E had to be added to the diet, via either the cow or the milk.

To find out the reason those doses of vitamin E are needed, diets were screened for possible vitamin E "thieves" such as PUFA and vitamin A. High dietary vitamin A for calves decreases tissue reserves of vitamin E. We found vitamin A in the starter to be 12000 IU/kg, which is fairly high and may have contributed to depressed serum vitamin E among older calves, but unlikely among very young calves, according to their very limited consumption of starter (~150g/d).

Unfortunately, the next step is beyond the scope of this report, but will be to take a closer look at vitamin E in the given milk, and if insufficient, possible ways to ensure sufficient amounts. If such analyses reveal sufficient amounts in the given milk, external factors must be investigated which could increase the calves' vitamin E levels.