

Could Vitamin E and Selenium Deficiency be Impacting your Calf Health?

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Veterinarians are often called to investigate outbreaks of neonatal calf disease, often scours and/or pneumonia. There are a number of possible bacterial, viral, and parasitic agents that can infect the calf. To take appropriate treatment and prevention actions it is important to find out which ones play a primary role in each particular outbreak.

Calves are born with some disease resistance but most is acquired after birth via the ingestion of colostrum. Taking blood samples from calves allows us to test for the level antibodies calves have received from colostrum. We can increase the amount of specific antibodies in colostrum by injecting cows with “calf scour” vaccines prior to calving. Other common options to boost immunity are oral antibody preparations and vaccines given to newborn calves.

There are important management factors which can substantially reduce a calf’s resistance and predispose it to infection. Poor air quality, wet or dirty bedding, crowding, mixing calves of different ages, dirty feeding equipment and poor mixing of milk replacers can all make a calf more susceptible to infection and to getting sick.

Even after addressing most of the management factors, there are times when infection challenge still overwhelms the resistance of the calves. In these cases, we need to look further at fine-tuning some of the nutritional factors that impact on the calf’s immune system, such as the natural anti-oxidants required for adequate immune function.

Vitamin E and the trace mineral selenium are known to be significant anti-oxidants in cattle. In the dairy cow, low levels may contribute to having more clinical mastitis, udder edema, retained placenta, metritis, reduced fertility and fresh cow metabolic issues.

Vitamin E has a very limited ability to cross the placenta to the calf, but is passed on via the cow’s colostrum. If a cow is deficient, then her ability to provide adequate levels to the calf is severely compromised.

Why do Vitamin E and Selenium matter in a dairy calf?

Traditionally, low levels of vitamin E and selenium were associated with “white muscle disease” in young and growing calves. In recent years, we are diagnosing less of this in our area (northern Ontario), but are still suspicious that we see low blood levels in calves from herds experiencing neonatal calf health issues. Swedish work looking at herds with high calf mortality (>6%) in 1 to 90 day old calves showed that these herds had lower serum levels of vitamin E in their calves compared to herds with low (<1%) death loss.

A recent (spring 2019) paper from Dr. Ken Leslie’s Ontario group also demonstrated that newborns given an injection of vitamin E and selenium had a reduced likelihood of requiring treatment for calf diarrhea.

In the summer of 2019, a study was conducted in Ontario to assess the rate of failure of passive transfer of colostrum antibodies among Ontario dairy calves. Within our practice area, over 90% (46/51) of calves tested showed adequate colostrum intake. On 15 of our participating dairies, we collected additional samples from one calf on each to assess Vitamin E and selenium levels. Level

fed to dry cows was taken directly from the herd feed sheets, and consumption rates were verified against it where possible. The results of this testing are in the table below.

	Selenium	Vitamin E
Level Supplied to Dry Cows (daily level per cow)	4.8 mg	1706 IU
Normal blood reference range (from AHL information)	0.2 to 1.2 ug/ml	7.0 to 23 umol/L
Average blood level of tested calves	0.128 (range 0.05 to 0.23)	4.04 (range 1.1 to 7.2)
Number of calves within normal blood range	1 out of 15	1 out of 10

This study does not involve enough calves to be scientifically significant, though a definite trend to low calf blood selenium and E levels is apparent. It is possible that the low levels are negatively impacting immune system function in these calves, predisposing them to more sickness. Exactly how much of an impact it is having will require additional research. For the dairies involved in this study, we've started recommended administering an injection of vitamin E and selenium to all newborn calves. With more dairies feeding commercial milk replacers (MR), this becomes even more important.

How much is enough? The 2001 National Research Council for Dairy Cattle vitamin E recommendation is approximately 500 IU daily for lactating cows, and 1000 IU for dry cows. Little information exists on how much E/Se young calves require, especially those receiving milk replacer, rather than whole milk. As milk volumes fed increase it becomes increasingly difficult to be sure young calves are consuming enough calf starter at a young age to provide supplemental E/selenium by this route. More research is needed into supplying adequate E/selenium via MR for today's bigger, better fed, and rapidly growing dairy calf.

Supplemental selenium is legally limited to 0.3 mg/kg of dry matter which results in approximately 7 mg daily for lactating cows and 3.5 mg for dry cows. This limitation on level fed is due to concerns over selenium toxicity in areas where selenium is abundant, such as Western Canada and the Midwest United States and due to transfer to milk at higher levels. E/se products carry both milk and meat withhold times. It can be common in some areas that producers are including maximum allowable selenium levels, yet are still testing cows that show severe deficiencies. Reasons for persistent deficiency may be inadequate ration formulation, inadequate or uneven dry matter consumption in group fed cows, interference of absorption by other dietary components, the level of deficiency of selenium in soils and forage and the impact of the metabolic state of the cow on absorption.

One other factor may be the form of the selenium used for ration supplementation. There are suggestions that organic selenium (selenomethionine) is better absorbed by the cow, and transfers more easily to her calf than conventional dietary or injectable selenium sources (selenate or selenite). There is a slight cost premium to the organic selenium, and exactly how much better it is has not been determined.

In areas where selenium deficiency is severe, veterinarians, nutritionists, and producers need to test cows, feeds and evaluate ration formulation and delivery. If you suspect your calves are deficient you should consult with your herd management team.

Commonly, minerals can contain up to 60 mg of selenium per kg of mineral. If delivered free choice, dry cows will consume approximately 50 grams of mineral daily to receive 3 mg of selenium daily. To deliver higher levels, the mineral consumption would need to be increased. Specifics of how this could be accomplished should come from your veterinarian/nutritionist team.

Some producers provide added vitamin E/selenium in a transition cow pellet. Nutritionists are again limited in their maximum selenium level, and these products are typically labelled to not be used with supplemental sources of selenium. If your animals are blood testing low for selenium at the maximum legal level, you should talk to your veterinarian.

A third method of bolstering vitamin E and selenium levels is through the use of injectable products. Two common products contain 3 mg/ml selenium and 136 IU/ ml Vitamin E. A typical Holstein cow would receive a single 15 ml injection approximately 2 to 3 weeks prior to calving, translating to a total dose of 45 mg of selenium and 2040 IU of Vitamin E. A third product contains 5 mg/ml selenium and 68 IU/ ml of selenium. It is also given as a single injection but at a lower dose (typically about 8 mls for an average Holstein) which delivers 40 mgs of selenium and 544 IU of vitamin E. The downside of injection is the need to handle heavily pregnant cows, and the potential for the cow to suffer an anaphylactic reaction to the product. Talk to your veterinarian about options to minimize this risk as well as appropriate meat and milk withdrawals.

Given the extremely low selenium and vitamin E blood levels for calves in our practice, we are comfortable recommending a maximum selenium level dry cow pellet or mineral and advocate for a minimum of 2000 IU of vitamin E daily (3000 IU even better) in the dry cow ration. We also recommend a treatment dose (2 mls per 100 lbs birthweight) of injectable vitamin E and selenium to all newborns.

It should be interesting to resample some of these herds next summer to assess the impact of these changes. It is obvious that much research still needs to be done in fine tuning our recommendations.

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