

## Vitamin and Mineral Content of Volac Calf Milk Replacer

Over recent years, calf nutrition programmes have been developed to improve calf growth and survival and the long-term performance of animals. In view of these changes to calf feeding, the level of vitamins and minerals needed to support faster growing calves has been reviewed, based on the latest scientific research. Based on the current data the content of vitamins D3 and E, and the trace minerals, manganese and iron, in Volac calf milk replacer have been revised. The level of the other vitamins and trace minerals has remained unchanged.

### Role of Vitamins and Trace Minerals

Vitamins and minerals (known as trace minerals when needed in small amounts) are required for normal metabolic processes and growth, and they also play an essential role in the immune function and health of an animal. Every calf is at risk of disease – it is therefore essential to have a good immune system that will be able to fight a pathogen, if a calf becomes infected. In addition to good colostrum management and an excellent level of cleanliness and hygiene, a good supply of vitamins and trace minerals must be maintained for optimal animal performance and to help support the immune system for when animals become challenged by disease.

### Vitamin D3 – a higher level is important during a disease challenge

Vitamin D is a nutrient required for normal skeletal growth and development – the body must have vitamin D to absorb calcium and promote bone growth, but it is also a key regulator of immune function. Studies in young children have suggested an association between vitamin D deficiency and an increased risk of respiratory infection<sup>1</sup>. The most common dietary form of vitamin D is vitamin D3.

A recent study inoculated 4-week old calves with bovine viral diarrhoea virus to investigate the effect of an infection on the calf's vitamin D level<sup>1</sup>. All calves were fed milk replacer containing 11 023 IU/kg DM of vitamin D3 and before the virus infection had a vitamin D status that exceeded the minimum concentration considered indicative of vitamin D adequacy in humans ( $\geq 30$  ng/ml)<sup>1</sup>. After the virus challenge, the vitamin D level of infected calves decreased to 22 ng/ml (indicative of vitamin D deficiency)<sup>1</sup>.

These results show that a disease challenge and mounting an immune response can lower the level of circulating vitamin D, compared to a healthy animal. The level of vitamin D3 in Volac calf milk replacer has been increased from 7500 IU/kg to 10 000 IU/kg to ensure that calves have enough vitamin D (i.e. vitamin D adequacy). This is particularly important for when calves face a disease challenge since an infection can severely compromise vitamin D status.

No risk has been associated with feeding calves milk containing high levels of vitamin D3. Calves fed different levels of milk replacer with 11 356 IU/kg of vitamin D3, to achieve growth rates of between 0.1 and 1.2 kg/d, all had plasma vitamin D levels within the normal range, up to 7 weeks of age<sup>2</sup>. Likewise, no toxicity risk was reported when feeding calves milk replacer with  $\geq 11$  023 IU/kg vitamin D3<sup>1</sup>.

### References

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**Vitamin E – a higher level is important for immune function in fast growing calves**

Vitamin E influences the health of most animal species - it is an antioxidant protecting body tissues from damage caused by substances called free radicals (by-products of the body's metabolism) which can harm cells, tissues and organs. Vitamin E also plays an important role in the immune system. Colostrum intake has a key role in establishing vitamin E levels at birth - if calves do not receive adequate colostrum, their vitamin E levels can be compromised. Following good colostrum intake, supplementation of calves with vitamin E enhances the functional capacities of the white blood cells (the cells of the immune system that are involved in protecting the body against disease) i.e. it improves the immune system response.

Calves with poor colostrum intake, or calves under conditions of stress or experiencing disease challenges, as well as fast growing calves, require higher intakes of vitamin E to support their immune system. Data have shown that 6-week old calves growing at 0.6 kg/d had blood vitamin E levels of 4348 ng/ml, yet calves growing at 1.2 kg/d had levels of only 2049 ng/ml<sup>2</sup>. In adult cows, a vitamin E level of 3000 ng/ml is considered necessary for optimal health. More recent data have also found that calves fed higher energy diets to support higher growth rates, had an increased vitamin E demand<sup>3</sup>. In addition to the impact of growth on vitamin E levels, an acute viral infection has also been associated with a rapid decrease in vitamin E status<sup>1</sup>.

To achieve first calving at 24 months of age, with adequate body size, a calf must grow at around 0.7 to 0.8 kg per day. To help ensure fast growing calves, as well as those exposed to disease challenges, have enough vitamin E to support their immune system, the level of vitamin E in Volac calf milk replacer has been increased from 250 IU/kg to 500 IU/kg.

No risk has been associated with feeding calves milk containing high levels of vitamin E. For example, no toxicity has been reported when calves were injected with 1500 IU at birth, and subsequently fed milk supplemented with 500 IU per day for 5 weeks<sup>3</sup>.

**Manganese – vital for bone and joint development in fast growing calves**

Manganese is important for enzyme systems and normal bone function. The level of manganese in Volac milk replacer has been increased from 30 mg/kg to 40 mg/kg due to the important role of trace minerals (including manganese) in the immune system<sup>4</sup>.

No risk has been associated with feeding calves milk containing 40 mg/kg of manganese. For example, feeding 3-day old calves with milk replacer containing up to 200 mg/kg of manganese over 5 weeks had no negative effects<sup>5</sup>. In addition, good calf performance has been reported when feeding a milk replacer with 50 mg/kg of manganese<sup>6,7</sup>.

**Iron – increases haemoglobin levels and improves oxygen transport**

Iron is important for the normal development of newborn calves. It is an essential component of proteins involved in oxygen transport and utilisation, especially haemoglobin (in the blood) and myoglobin (in the muscles). It enables the haemoglobin in the red blood cells, to carry oxygen throughout the body and deliver it to the cells and tissues.

Data have shown that supplementing Holstein calves fed milk with iron for 28 days resulted in higher red blood cell counts and increased haemoglobin levels compared to calves fed milk with no iron supplement<sup>8</sup>. Similarly, a more recent study has found that supplementing calves fed milk with iron from 1 to 28 days increased red blood cell count and hemoglobin levels, and increased total body weight gain at 35 days of age<sup>9</sup>. In view of the

benefits of iron on blood quality and growth, the level of iron in Volac calf milk replacer has been increased from 80 mg/kg to 100 mg/kg.

No risk has been associated with feeding calves milk containing high levels of iron. Feeding a total of 900 g milk powder (containing 100 mg/kg of iron) per day will provide the calf with 90 mg per day of iron. It has been shown that feeding calves whole milk and supplementing with 250 mg iron per day from 1 to 28 days<sup>9</sup>, or 150 mg iron per day for 28 days<sup>8</sup> has no negative effect on calf health or performance. In addition, good calf performance has been reported when feeding a milk replacer with 100 mg/kg of iron<sup>6,10</sup>.

Vitamins and trace minerals are important for calf growth and development, but they also play an essential role in the immune system. Excellent colostrum management coupled with feeding a good level of high quality milk replacer, that has been balanced with the optimum level of vitamins and trace minerals, will help ensure calves grow well and remain healthy.

**Vitamins and minerals**

Name	Amount per kg feed
Vitamin A	25 000 IU
Vitamin D3	10 000 IU
Vitamin E	500 IU
Vitamin K3	3 mg
Vitamin B1	5 mg
Vitamin B2	3 mg
Vitamin B6	3 mg
Vitamin B12	60 mcg
Vitamin C	100mg
Nicotinic Acid	20mg
Biotin	50mcg
Pantothenic Acid	10mg
Iron	100 mg
Copper	10 mg
Manganese	40 mg
Zinc	50 mg
Selenium	0.4 mg

67% increase

67% increase

25% increase

33% increase

Important in the process of bone development and immune system. New level assists immune status of the calf in the face of a disease challenge.

An important antioxidant. Higher growth plane calves respond well to increased vitamin E.

Improving blood quality (haemoglobin production) and therefore oxygenation.

Vital for bone and joint development - especially in fast growing calves.