

Lameness, together with mastitis and impaired fertility, is one of the most important and economically challenging diseases in cattle. The health and function of the bovine claw depends upon multiple factors such as nutrition, feeding practices, trimming, flooring, bedding, ....

It is often forgotten or neglected that a good hoof health program starts with the young stock. Providing comfort housing, proper nutrition and supplements for calves and heifers will without any doubt help to reduce the lameness problems in the herd. When you make sure that young calves have optimal horn formation and claw positioning, you create a good solid basis for the future. On the contrary, a disturbed hoof development at a young age may lead to early culling. Formation of claw horn is a complex process which essentially depends on a balanced diet and a sufficient supply of vitamins, minerals and trace elements.

## Vitamins

Vitamins play an essential part in the claw horn formation. Deficiencies in vitamins with levels so low to cause obvious clinical symptoms, are relatively rare under modern farming conditions. More common are situations where levels are insufficient to allow optimal growth, production and performance. Under high productive conditions, the animals require optimal vitamin levels to support optimal growth and performance.

**Vitamin A** plays a crucial role in the maintenance of epithelial tissue, including claw horn. It is needed for normal growth and development of skeletal tissues. The role of vitamin A in keratinizing cells is tied to its action in gene expression <sup>1</sup>.

**Vitamin B** is essential for keratin-protein synthesis and the formation of long-chain fatty acids that make up the intercellular matrix of claw horn <sup>2</sup>.

The various roles of **vitamin E** in immune response, nerve, muscle function and antioxidant action make it a vital vitamin for the health of young, growing calves. Muscle function is directly related to movement and claw positioning. Vitamin E is involved in the maintenance of cellular membranes. This function is important for the integrity of keratinized tissues <sup>2</sup>.

Transition dairy cows fed low levels of vitamin E and subjected to undue stress at parturition incur higher levels of lameness than normal and produce poor horn tissue <sup>3</sup>.

One of the most important biological regulators of calcium metabolism is **vitamin D** (synonym calciferol) <sup>1</sup>. Any lack of vitamin D will certainly impact calcium metabolism and thus affect the keratinization process. Dark stables with increased confinement and no pasture at all may lead to reduced exposure to direct sunlight and can cause slight deficiencies in vitamin D <sup>4</sup>.





catalyzes the first step of carbohydrate synthesis. This process is responsible for gluconeogenesis and the production of cellular energy, an essential component in the production of quality horn tissue<sup>9</sup>.

## Amino Acids

Amino acids like **methionine** (Met) play key roles in establishing the structural integrity of the keratinocyte<sup>10,11</sup>.

## Conclusion

It's obvious that vitamins, minerals and amino acids are essential when it comes to hoof, bone, and muscle development as well as maintenance. Therefore, it is necessary to supplement animals of all ages (calves, heifers, dry and lactating cows) with adequate amounts of these elements. Increasing production levels and optimising growth curves come together with higher metabolic needs.

For more information on products containing vitamins, amino acids and minerals for oral use and for injection, which treatment schedule to use, please contact Kela for more information.

## Minerals

One of the macro-minerals of greatest interest relative to claw horn integrity is **calcium** (Ca). The differentiation of keratinocytes in claw horn epithelium requires Ca for the proper function of enzymes in biochemical pathways that ultimately result in the proper keratinization of horn cells<sup>3</sup>.

**Zinc** (Zn) has been identified as a key mineral in the processes of keratinization<sup>2,5,6</sup>. Zn is a component of over 200 enzyme systems, it has a role

in 3 key functions in the keratinization process – catalytic, structural and regulatory. Zinc also plays a key role in the formation of the structural proteins during the keratinization process<sup>7</sup>.

**Copper** (Cu) plays an important role as enzyme catalysts in keratin synthesis. Cattle suffering from a subclinical Cu deficiency are more susceptible to heel cracks, foot rot, and sole abscesses<sup>8</sup>.

**Manganese** plays a role in the activation of critical enzyme systems, such as pyruvate carboxylase, an enzyme that

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