

### **Vitamins, Minerals and Amino acids in the dairy production**

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One of the main problems faced by cattle raising are metabolic diseases. Many of these diseases are of nutritional origin, besides the stressful effect for animal overexploitation, and the high production requirements that cause that nutritional support is not sufficient. Faced with this problem, a correct formulation of the ration, as well as a supplementation with minerals, vitamins and amino acids becomes essential (McDowell, 1984).

Amino acids are the precursor molecules of proteins, and must be properly provided to the animal, because a single amino acid unbalance causes a general unbalance of all essential amino acids. Methionine is the main limiting amino acid of dairy production (Fenderson y Bergen, 1975), which supplementation stimulates the synthesis of milk components, especially of protein and fat (Rulquin and Delaby, 1997; Robinson et al., 1998). Histidine is an amino acid related to the repair of muscle and cardiac tissue, and promotes hematopoiesis (Flores, 2005); is a limiting amino acid in the dairy production but on a smaller scale than methionine. Tryptophan is an essential amino acid with specific effects on food intake and weight gain, especially in the initial phase of production (Martínez, 2002).

Minerals play an important role in el metabolism, because despite they do not provide energy in the diet, they are essential for the synthesis and utilization of many essential nutrients. Sodium is intimately related to water metabolism at cellular level as well as in nutrient uptake, maintains osmotic pressure, regulates the acid-base balance and acts in the transmission of nerve impulses. Usually a lower sodium level can be observed during lactation due to the secretion of milk, in rapidly growing animals or in conditions of constant water loss (McDowell, 1984; Mufarrege, 2003; Flores, 2005)

Iron is a major component of hemoglobin, myoglobin and cytochrome, therefore it becomes a limiting factor for cellular respiration; that is why its deficiency produces anemia and relative changes in blood, with a concomitant loss of appetite and weight. Iron is also part of important enzymes, so its deficiency produces alterations in metabolism, and can reduce resistance to infections (Gómez and Fernández, 2001). Cobalt is a mineral required for the synthesis of Vitamin B12 by ruminal microorganisms, so its deficiency is closely related to growth, weight gain and the appearance of anemias (McDowell, 1984; Gómez and Fernández, 2001).

Vitamins are compounds that cannot be synthesized by the body and function as catalysts for the reactions of all physiological processes. Among the most important vitamins are the ones of B complex. The most important vitamin of B complex is cobalamin (Vitamin B12), which is intimately linked in the synthesis of DNA and RNA. Cobalamin is essential for red blood cell production, which carry oxygen throughout the body to be used in energy production and ATP (Merck, 2000). Remethylation of homocysteine to methionine is dependent on cobalamin, since the enzyme methionine synthase needs Vitamin B12 (Fenderson and Bergen, 1975). Vitamin B2 (Riboflavin), vitamin B3 (Niacin) and vitamin B6 (Pyridoxine) are related to the release of energy and nutrients assimilation, play an important role in the metabolism of carbohydrates, lipids and proteins, and act in the oxidation-reduction reactions. Its deficiencies are associated to anemias, weakness and neuromuscular disorders, digestive problems, dermatological, among others (Merck, 2000)

Between some research, highlights the work done by Tang (2002) where it was shown that after the application of an oily vaccine against FMD, which produces a strong post-vaccination stress, cows that were dosed with a commercial solution based on minerals, vitamins and amino acids (Hematofos B12 ®) recovered their normal production after 24 hours, in contrast to the ones not dosed which delayed 72 hours to normalize

its production. It has also been found that the application of minerals with complex B vitamins and amino acids (Hematofos B12 ®), increases by more than 19% the dairy production when applied weekly to cows in beginning of lactating (0 to 10 days postpartum) (Flores, 2007).

Olivera (2009), concluded that the use of a commercial injectable solution based on minerals, amino acids and vitamins (Hematofos B12 ®) increases significantly the productivity up to 952 grams of milk, besides the maintenance of body condition of cows in production after a period of 42 days with a weekly application. Another study found that the application during 90 days of this combination (Hematofos B12 ®) in improved cattle raised under an extensive production system in the region of Iquitos in Peru, can generate up to 54% increase on weight gain (Espinoza, 2004).

It is concluded so, that under periods of stress, illness, poor nutrition or unhelpful conditions for intake or absorption of these nutrients such as shepherding in unfavorable areas, the administration of a supplement that provides the listed nutrients can be of great help in improving and maintaining the production of our dairy cattle.

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