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PRECISENESS OF CHELATED MINERALS ON THE PERFORMANCE OF ANIMALS

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Abstract: Chelation is a bonding formed between a metal ion and legend. Chelating improves the absorption of the mineral from the digestive tract. The level of chelated minerals in livestock feeding is typically added at 25-30% of the total mineral in a feed. Chelated minerals have improvement in reproduction, health, soundness and growth. Natural feed with strong chelating properties includes dry melt residues and molasses. The anti-nutritive effect of oxalates - chelating with calcium lead to hypocalcemia, tetany, eventually death when high doses of oxalates is consumed. Chelates are costlier, recently have seen increased usage in horse and dairy cattle feeds.

Introduction

Chelation refers to a bonding formed between a metal ion (mineral) and legend (protein or amino acid). A mineral complex is a mixture the mineral and organic compound. The process of chelating improves the absorption of the mineral from the digestive tract. How this improvement is actually achieved is unknown at this time but it has been suggested that the chelated mineral is more soluble and can cross the intestinal wall more easily, (Rompala & Halley, 1995).

Chelated Mineral

A chelated mineral is a mineral such as copper, zinc, manganese, cobalt or iron (there are others) that is bonded to "small proteins", peptides or amino acids. The level of chelated minerals in livestock feeding is typically added at 25-30% of the total mineral in a feed. The difference in absorption of chelated trace minerals is comparison to the inorganic form. This information is summarized in Table 1 (Jackson, 1993).

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Table 1 Relative availability (%) of chelated minerals compared to typical inorganic mineral sources (Jackson, 1993)

Form of Mineral	Copper	Zinc	Manganese
Inorganic	100	100	100
Chelated	140	125	121

Effect of Chelated minerals in animals

The benefit of using chelated minerals for livestock has improving in reproduction, health, soundness and growth. A chelated mineral for cattle has focused on the pregnant cattle and the young growing calves for improved immunity (less disease or sickness), reproductive performance (shorter days open, higher conception rates, or less embryonic loss), and herd health. Mares receiving trace mineral supplementation in a combined inorganic/chelated product had a tendency for a reduction in the number of cycles bred and in the number of services per mare. However, there was no effect in conception rate (Ott and Asquith, 1994). Other researchers have suggested improvements in reproductive performance in barren or open mares by reducing time to first cycle or reducing early embryonic loss when chelates were fed. In yearlings, addition of chelated mineral product (which supplied a portion of copper, zinc and manganese as chelates) resulted in an improved hoof growth. There was no increase in strength of the hoof wall but growth was enhanced (Ley *et al*., 1990). It is well known that providing adequate levels of trace minerals is required for proper immune function. Because of the increased availability of chelated products it is thought that their use will enhance immune function, (Vandergrift, 1993).

Interaction between minerals and other substances

The factors include the concentration and composition of the protein in the diet, and the contents of fat, carbohydrates and nutrients, stimulating or therapeutic additives (vitamins, antibiotics, antioxidants, complex forming substances, alkaloids, glycosides, *etc*.)

Vitamin D affects the absorption of calcium, Phosphorus, magnesium, zinc and other elements. Fat affects the absorption of calcium and magnesium. The protein level and protein source determines the degree of utilization of phosphorus, magnesium, zinc, copper and other elements in the feed of ruminants thus excess molybdenum stimulates the elimination of urea nitrogen from the organism, reduces the biosynthesis of muscle protein, and impairs the favour of the meat.

In the digestive tract, minerals may form newborn with organic compounds, the strength of these bonds being a function not only in the elements but also the subtracts of special interest are internally, complex compounds –chelates- which the complex forming atom is bound to the ligands both by primary and secondary valiancy forces. Such metallo organic chelates may stimulate or on the other hand, may inhibit the absorption of the minerals. The legends in such compounds may be amino acids (especially lysine, cystine, cysteine and histidine), polypeptides proteins, porpyrine derivatives and other heterocyclic compounds, organic acids (amino acetic, oxalic, citric, malic, formic and in particular phytic acid and its derivatives). Natural feed with strong chelating properties includes dry melt residues and molasses.

Chelates interfering utilization of mineral elements

1. Phytic acid

It is a cyclohexane compound with six phosphate groups (inositol phosphate). The vegetable feed ingredients, which are rich in protein, are also generally found rich in phytate content as in Soybean meal, Sesame meal, Rape seed meal, Cotton seed meal. Phytic acid is a strong chelating agent that can bind divalent metal ions to form complex phytate. This renders mineral unavailable for intestinal absorption. Poor bioavailability of zinc, calcium, magnesium, and iron has been reported in diets containing high phytate levels. About 40–60% of the phosphorus in the cereal grasses are unavailable - tied - phytate molecules. Phytate - interest in a non-specific fashion with - proteins - phytate will inhibit number of digestive enzymes such as pepsin, pancreatic and amylase. This leads to a negative effect on the digestibility of proteins and carbohydrates. This also results from the chelating of calcium ions, which are essential for the activity of trypsin and amylase.

Determination

The most wide spread method for phytate assay are based - measurement of phosphorus involving preliminary separation from inorganic phosphate by precipitation with iron. A colorimetric method has been recently described which permits the direct determination of phytate in crude seed extracts without preliminary purification.

Detoxification

The phytate content of beans can be significantly reduced by simply allowing slurry of the ground beans to undergo autolysins, by adding a preparation of a fungal phytase. Addition of the enzyme phytase to legumes can increase phosphorus digestibility considerably.

2. Oxalic acid

In both the vegetable and animal kingdoms, oxalic acid is found as free and in salt form. Plants, which are particularly rich in oxalates, are Beet, Spinach, Plants of *Araceae* family, and Grasses like buffalo grass, pangola grass, elephant grass, etc. oxalic acid salts formed with K and Na are soluble and absorbed through the gastro intestinal tract. In plants, having very acid cell content (pH-2.0); the oxalate is present as soluble K oxalate. Oxalic acid salts of Ca and Mg are insoluble crystals, which are not absorbed; Plant having a slightly acid cell medium (pH–6.0) contains soluble Na oxalate and insoluble Ca and Mg oxalates.

Anti-nutritive effects

1. The anti-nutritive effect of oxalates - chelating with calcium lead to Hypocalcemia, Tetany, Eventually death when high doses of oxalates is consumed.
2. When intake is low, poor bone growth and poor egg shell formation in poultry are observed.
3. The calcium oxalate may crystallize with in the blood vessels and cause vascular necrosis and hemorrhage.
4. The precipitation of calcium oxalate crystals within the renal tubules lead to anuria, uremia and acute renal failure.

Ruminants

Oxalates are less toxic, Oxalate degrading aerobic bacteria has been isolated from rumen content, Split the oxalate to CO_2 and formate, and the hydrogen from formic acid is used to synthesis of methane.

Conclusion

There is not use 100% of the mineral from chelates because price becomes a factor, as chelated minerals are expensive. Chelated mineral products have been available for many years and more recently have seen increased usage in horse and dairy cattle feeds and enhance its absorption, improved animal immune function, reproduction performance.

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