COPPER AND MOLYBDENUM IN NORTHERN URUGUAY: A MEDICAL GEOLOGY ISSUE

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Abstract: Copper, an essential metalloelement, is necessary for normal metabolism in animals and human beings. Recognized copper dependent enzymes as cytochrome c oxidase, superoxide dismutases and lysyl oxidase, among others, decrease their activity when copper level is low causing different disorders. Due to the different kind of signs associated with copper deficiency, veterinarians and physicians do not frequently realize that these disorders are caused by low copper levels, incurring in additional expenses for symptomatic treatments (vitamins, antibiotics, etc.). On the other hand, molybdenum is an essential trace element that controls Cu levels. Increased Mo concentrations relative to Cu in feeds produce copper deficiency due to the formation of not bioavailable species like CuMoO₄ and CuMoS₄, the latter formed in ruminants. It has been observed that Mo concentration in the environment is increasing due to the use of fertilizers that content this metal. As a part of our interdisciplinary work in medical geology, a distinctive group of signs like anemia, low weight, bone deformities, persistent diarrhea, infertility, low milk production, among others, currently called “growth syndrome” was observed in bovine and ovine herds, in the Cuenca Lechera II of Salto (Uruguay). Our previous studies showed that cows with growth syndrome had low serum level. In an attempt to solve these problems, injections of several copper complexes were tested as copper supplements. However, the activity of some of these compounds had a short duration and/or they have caused allergic reactions at the inoculation site. With the aim of studying the causes of this deficiency in animals, Cu and Mo analysis of forage samples obtained from different locations where the animals grazed were monthly taken by the hand clipping method based on animal selectivity. They were analyzed according to AOAC techniques where Cu was determined by FAAS and Mo by ETAAS. The results were evaluated by statistic programs (SAS, using Tuckey test with a probability of 5%). The seasonal occurrence in grass was also studied. Although there is no complete agreement with the copper requirements for cows, 10 mg/kg DM is usually considered adequate or recommended and for Mo 0.1-100 mg/kg DM. Almost all the samples were well under the recommended value for Cu and the Mo levels obtained in grass were in the lower limit admitted. Nevertheless, the correlation between copraemia levels in cows and copper level in grass shows that Mo affects the Cu bioavailability. Besides, for both metals a seasonal variation was observed, depending mainly on soil conditions and meteorological parameters. According to these results we are postulating mainly a primary Cu deficiency in the studied region emphasized by a secondary deficiency due to Mo traces.

Key words: copper, molybdenum, medical geology, minerals in grass