INFLUENCE OF THE PHYSIOLOGICAL STATE ON THE MINERAL STATUS OF CATTLE HAIR

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Abstract

The mineral status of the cattle hair was assayed in 20 hair samples from pregnant cows and in 20 hair samples from lactating cows from the same farm. Calcium was determined with the complexonometric method; phosphorus was determined with the colorimetric method with ammonium molibdovanadate; magnesium was determined with the colorimetric method with titan yellow. The following values were determined: calcium 177.64± 19.44 mg/100g in pregnant cows and 151.86±13.06 mg/ 100g in lactating cows; phosphorus 15.92±3.84 mg/100g in pregnant cows and 10.70± 4.24 mg/100g in lactating cows; magnesium 47.89±6.32 mg/100g in pregnant cows and 40.21±2.08 mg/100g in lactating cows. The values for the three minerals were significantly lower in the hair samples from lactating cows than in the hair samples from the pregnant cows, which shows that these minerals are used intensely during lactation, sometimes exceeding the homeostatic capacity for retention in the skeleton and, implicitly, in the hair.

Key words: *cattle, hair, physiological state*

Introduction

The high incidence of mineral deficiency in cattle is caused by quantitative and/or qualitative nutritional imbalances. Generally, these pathological states have a subclinical, insidious evolution, and their detection is most times difficult and late.

In the attempt to maintain its mineral homeostasis, the animal organism uses its reserves located in the bones, liver and in other tissues, which it mobilizes. The biochemical parameters of the blood and of other biological fluids reflect the mineral status at the moment of sample processing (1, 4, 7, 8). The evaluation of the mineral status by hair sample analysis, unlike other methods of investigation, offers several advantages in terms of sampling, transportation, conservation, animal protection since it is a non-invasive method (3, 4, 8). The evaluation of mineral status by hair analyzis, as well as the blood metabolic profile tests, must take into consideration several exogenous or endogenous factors which may bear an influence on the analyzed parameters. Among these are the physiological status of the cows, which was proved to influence the status of minerals such as calcium, phosphorus, magnesium, copper (2, 3, 4, 5).

The purpose of the paper was to study the influence of the physiological state of the cows, pregnancy and lactation, on the calcium, phosphorus and magnesium levels in the hair.

Material and method

Two groups of 20 cows each with optimal production and reproduction parameters were formed in a dairy farm. The animals were clinically healthy and they were in different physiological states as follows:

- group 1 – pregnant cows during their last 3 months of pregnancy;

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- group 2 – lactating cows at peak lactation (months 3-4).

Hair samples were collected from the forehead area, amounting to 5-7 g. The hair was washed, degreased in ethylic ether, rinsed several times in distilled water and finally in bidistilled water and thereafter processed by dry mineralization. Calcium was determined with the complexonometric method; phosphorus was determined with the colorimetric method with ammonium molibdovanadate; magnesium was determined with the colorimetric method with titan yellow.

Results and discussion

Table 1 and Chart 1 show the results of the analyses.

Table 1

Trace mineral status in pregnant and lactating cows ($\overline{X} \pm S$)

Physiological state	Number of samples	Calcium mg/100 g	Phosphors mg/100g	Magnesium mg/100g
Pregnant cows	20	177.64±19.44	15.92±3.84	47.89±6.32
Lactating cows	20	151.86±13.06	10.70±4.24	40.21±2.08
T test		p<0.01	p<0.01	p<0.01

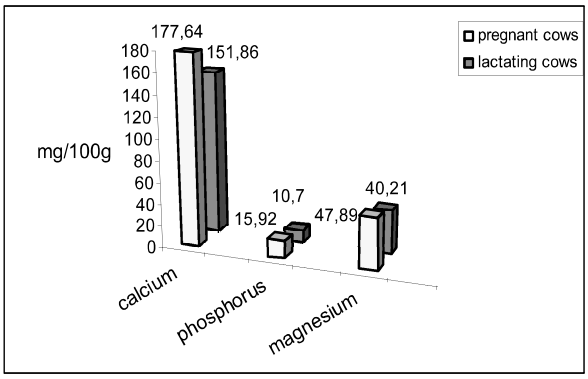

Chart. 1 Average values for calcium, phosphorus and magnesium in the hair samples from pregnant and lactating cows

The physiological limits of variation of calcium range between 100 and 230 mg/100g, of phosphorus between 13 and 19 mg/100g, and of magnesium between 40 and 85 mg/100g. The recorded values show that the physiological state of the animal obviously influences the level of calcium, phosphorus and magnesium in the hair of the dairy cows. The lower values if the surveyed trace minerals in the hair samples from lactating cows compared to the pregnant cows shows that these minerals, calcium particularly, are consumed in large amounts during lactation and may disturb the mineral homeostasis. It is thus known that one litre of cow milk contains about 1.25 g calcium and 0.95 g phosphorus (4), which makes the elimination of trace minerals to exceed their retention in the bones. Under the influence of lactation, particularly in the high yielding cows, the bone may undergo demineralization, phenomenon which can also be determined in the hair tissue (6). The decrease of blood calcium during late pregnancy and particularly during lactation may be regulated hormonally with parathormone, but only up to a given

level, after which a high hipocalcemia may cause clinical signs, paresis especially (2, 5, 6).

The level of hair calcium, phosphorus and magnesium may be an accurate marker for the evaluation of these trace elements' status in the organism.

Conclusions

1. The physiological status of the cows influenced significantly the levels of hair calcium, phosphorus and magnesium.

2. Significantly lower values of the hair calcium, phosphorus and magnesium were observed in the lactating cows compared to the pregnant cows ($p<0.01$).

3. The evaluation of Ca, P and Mg in the hair of dairy cows may be an accurate marker for the evaluation of these trace elements' status in case of marginal deficiency, when the bone may undergo early demineralization.

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