

INTERRELATIONSHIP OF ZINC AND MAGNESIUM IN CATTLE

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Zinc is a trace element that is indispensable for cattle. A deficiency of zinc is frequently apparent also in the feeding (1, 6, 7). HAARANEN (2) has proved that calcium rations bigger than the normal requirement may increase the zinc requirement of milk cows. A similar phenomenon has been observed in experiments with pigs. Further, HAARANEN (2) has noted that copper rations smaller than the normal requirement promote zinc deficiency disturbances. This discovery is related to the findings of KIRCHGESSNER and WESER (4). When the supply of copper is sub-optimal, the absorption of several other trace elements becomes weaker.

This article deals with the interrelationship of zinc and magnesium in cattle. The research material is the same as in the publication of HAARANEN and HYPPÖLÄ (1). It covers 3 121 milk cows on 426 farms. The data has been collected by the inseminators.

Visible symptoms of zinc deficiency are general exhaustion, hairlessness, itch, hair licking and digestive disturbances. As zinc is a component of both the follicle stimulating hormone (FSH) and the luteinizing hormone (LH), special attention was paid to the fertility disturbances. The results are presented in the table below. The percentages indicate the number of cases per 100 cows per year.

| | Total material | | | Cows given mineral salt with Mg | | |
|--|----------------|-----------------|-----------------|---------------------------------|-----------------|-----------------|
| | Itching cows | Nonitching cows | Difference | Itching cows | Nonitching cows | Difference |
| Number of cows | 348 | 2773 | | 88 | 446 | |
| Latest estrus in time and the first insemination resulted in pregnancy | 43.4 ± 2.7 % | 57.9 ± 0.94 % | 14.5 ± 2.8*** % | 36.4 ± 5.2 % | 59.0 ± 2.3 % | 22.6 ± 5.7*** % |
| Weakening or non-appearance of the estrus | 12.9 ± 1.8 * | 4.1 ± 0.37 * | 8.8 ± 1.8*** * | 22.7 ± 4.5 * | 3.8 ± 0.9 * | 18.9 ± 4.6*** * |
| Cystous degeneration in ovary | 11.5 ± 1.7 * | 8.6 ± 0.53 * | 2.9 ± 1.8 * | 19.3 ± 4.2 * | 6.5 ± 1.2 * | 12.8 ± 4.4** * |
| Uterine inflammation | 4.9 ± 1.2 * | 2.2 ± 0.28 * | 2.7 ± 1.2* * | 8.0 ± 2.9 * | 2.5 ± 0.7 * | 5.5 ± 3.0* * |
| Retention of afterbirth | 12.4 ± 1.8 * | 8.8 ± 0.54 * | 3.6 ± 1.9 * | 15.9 ± 3.9 * | 5.8 ± 1.0 * | 10.1 ± 4.0* * |
| Ketosis | 9.7 ± 1.6 * | 8.2 ± 0.52 * | 1.5 ± 1.7 * | 15.9 ± 3.9 * | 6.3 ± 1.2 * | 9.6 ± 4.1* * |
| Milk fever | 9.2 ± 1.6 * | 7.2 ± 0.49 * | 2.0 ± 1.6 * | 14.8 ± 3.8 * | 6.7 ± 1.2 * | 8.1 ± 4.0* * |

As for the non-itching cows, it can be concluded that if the giving of Mg has had any effect on the fertility of the cow and on the other abnormal conditions dealt with in the table, this effect has been slightly positive, whereas the frequency of disturbances has been very high in the itching cows given Mg supplementation. It has, in fact, been much higher than in the itching cows of the total material. Particularly striking is the great increase in the estrus disturbances, in the itching cows receiving Mg it was sixfold, whereas in the total material it was threefold compared with the healthy cows. Respectively, the frequency of other disturbances was two- or threefold in the itching cows that had been given Mg, and in the total material approximately one and a half times as high as in the healthy cows.

Itch can also be caused by other factors than by an absolute or relative zinc deficiency. These factors are little known as yet in Finland. Further, they are not known to have any effect on fertility. What has been said above about itching cows applies in practice also to cows suffering from a zinc deficiency.

On the other hand, it has been proved in practice that when the cows have been given relatively big rations of magnesium, no signs of zinc deficiency have appeared if the cows have been given more zinc at the same time. Thus, a magnesium ration bigger than the normal requirement obviously increases the requirement of zinc in the same way as is the case with calcium.

LEASE (5) has found that if chickens have received Zn amounts smaller than the normal requirement, a Mg amount bigger than the normal requirement retards their growth, causes serious deformities in the legs and increases the mortality rate. This result of the antagonism of zinc and magnesium conforms with the results in cows.

S u m m a r y

Studies with dairy cattle have proved that magnesium or an excess of magnesium is an antagonist of Zn in cases where the zinc ration of the cow is suboptimal. An excess of magnesium requires more zinc. An absolute or relative zinc deficiency causes non-estrus in dairy cattle and also increases the susceptibility to other fertility and health disturbances.

REFERENCES

- (1) HAARANEN S & HYPPÖLÄ K, 1961 Cure, prevention of dairy cattle itch and hairlicking with zinc. *Feedstuffs* 33, No. 46 (Nov. 18): 28
- (2) HAARANEN S, 1963 Some observations on the zinc requirement of cattle for the prevention of itch and hair licking at different calcium levels in the feed. *Nord. Vet.-Med.* 15: 536-542.
- (3) HAARANEN S, 1965 Some observations on the occurrence of the itch and hair licking in cattle at different zinc and copper levels in the feed. *Ibid.* 17: 36-38.
- (4) KIRCHGESSNER M & WESER U, 1963 Trace elements in the metabolism of growing pigs given different amounts of Cu. *Ref. Z. Tierphysiol., Tierern. Futtermittelkunde* 18: 181-186.

- (5) LEASE J G, 1965 Interrelationship of zinc and magnesium. Poultry Sci., 44: 1393.
- (6) LEGG S P & SEARS L, 1960 Zinc sulphate treatment of parakeratosis in cattle. Nature 186: 1061.
- (7) MILLER W J & MILLER K J, 1960 Development of zinc deficiency in Holstein calves fed a purified diet. J. Dairy Sci. 43: 1854.

SELOSTUS:

SINKIN JA MAGNESIUMIN VUOROVAIKUTUS LEHMÄLLÄ

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Keinosiementäjien toimesta kerätystä, 3 121 lehmää 426 karjassa käsittävästä aineistosta kävi ilmi, että vaikka magnesium-lisäyksellä oli tilastollisesti epävarmaa positiivista vaikutussuuntaa lehmien yleiskuntoon ja hedelmällisyyteen, niin kutkana ja karvannuoluna esiintyvää sinkinpuutetta kärsivillä lehmillä magnesium-lisä oli suuresti lisännyt häiriöfrekvenssiä. Erikoisesti kiimahäiriöt moninkertaistuivat, mutta myös munasarjan rakkularappeumatapaukset, kohtutulehdukset, jälkeisten jäämiset, ketoosi ja poikimishalvaus 2—3-kertaistuivat. Häiriöfrekvenssi oli magnesium-lisää saaneilla sinkinpuutoslehmillä suurempi kuin yleensä sinkinpuutoslehmillä. Täten on magnesium antagonistinen sinkille silloin, kun sinkin saanti on sen tarvetta selvästi pienempi. Magnesium-ylimäärä lisää sinkin tarvetta.