

SELENIUM-DEPENDENT GROWTH INHIBITION OF MASTITIS PATHOGENS IN COW'S MILK

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SUMMARY

Adequate selenium (Se) status is needed for maintenance udder health of dairy cows. However, the mechanisms by which Se is supporting health of cows' udder are still unclear. Current work is focused on Se-dependent growth suppression of mastitis pathogens in bovine milk.

Keywords: selenium, bovine, mastitis, antimicrobial effect

INTRODUCTION

Bovine mastitis is a disease of major welfare concern, causing high economic losses today's dairy industry. Use of antimicrobial drugs has not solved mastitis which appears to be as common today as before the introduction of antimicrobial drugs. Knowledge about factors and mechanisms influencing immune defense of cows' udder is giving a possibility to improve udder health. Adequate Se status is one of the factors needed for maintenance udder health of dairy cows. However, the mechanism by which Se promotes better health of mammary gland is still unclear. Objective of our study is to clarify the role of Se in mammary gland defense. Study is focused on the Se-dependent growth suppression of mastitis pathogens in milk.

MATERIAL AND METHODS

Two Se feeding experiments (studies 1 and 2) were carried out on Se-deficient dairy cows in Estonia. Cows were allocated into Se-supplementation (n=25 in study 1, n=39 in study 2) and nonsupplemented groups (n=25 in study 1, n=16 in study 2). The Se-supplementation groups received 0.2 ppm organic Se in the form of Se-yeast in their daily diet for 8 weeks. The nonsupplemented cows received their standard diet with no Se supplementation. Blood and quarter milk samples were collected before and after 8 weeks Se supplementation. From whole blood selenoenzyme glutathione peroxidase (GPx) activity was analysed. Microbiological examination and analyses of somatic cell count were carried out from milk samples. Whey was prepared from milk of 12 cows without signs of mastitis during 8 weeks experimental period for analyses of Se-dependent antimicrobial factor. Samples originated from study 2. Whey was fractionated by high-performance liquid chromatography in purpose to localize Se-dependent antimicrobial component. Fractions were collected between 1 minutes interval and tested for

growth inhibitory activity against *S. aureus* strain by using turbidimetric method (Malbe et al. 2006).

RESULTS

Mean GPx activity of all cows was low before starting of Se-supplementation, being 0.232 $\mu\text{kat/L}$ Hb in study 1, and 0.645 $\mu\text{kat/L}$ Hb in study 2. Se-supplementation during 8 weeks increased mean GPx activity to 3.014 $\mu\text{kat/L}$ Hb in study 1, and to 3.867 $\mu\text{kat/L}$ Hb in study 2. GPx activity in control groups remained low. In study 1, percentage of udder quarters infected with mastitis pathogens decreased from 22.9 to 13.0 in Se-supplemented group and increased from 21.3 to 25.6 in nonsupplemented cows (Malbe et al. 1995). In study 2 Se supplementation was effective in helping to maintain quarters uninfected. Cows' udder was more prone to be infected when GPx activity in blood was below 3.3 $\mu\text{kat/L}$ Hb (Malbe et al. 2003). Also, whey became *S. aureus* growth inhibiting in cows whose GPx activity in blood exceeded 4 $\mu\text{kat/g}$ Hb. Inhibition of growth rate of *S. aureus* was traced in two fractions out of 8 studied in detail (Study 2, Malbe et al. 2006).

DISCUSSION

Results of our studies indicate that daily supplementation of 0.2 ppm Se in the form of Se-yeast increase host defence against invading bacteria. However, the effect of Se-supplementation on mastitis pathogens depends on severity of Se-deficiency on cows. Study 1 was organized on cows with severe Se-deficiency and Se-supplementation had clear effect on improvement of pathogens infected udder quarters. On cows with moderate Se-deficiency in study 2, Se-supplementation was mostly effective in mastitis prophylaxis and had little or no effect on improvement of those udder quarters which were pathogen-infected at the start of the study. Eight weeks Se-supplementation induced changes in milk composition and whey became *S. aureus* growth restricting. The growth of *S. aureus* was inhibited by whey fractions from animals whose GPx activity in blood exceeded 4 $\mu\text{kat/g}$ Hb. This significant inhibiting effect on bacterial growth suggests that there is Se-dependent antibacterial activity in whey. Our findings are in accordance with earlier report that Se-supplementation had an inhibiting effect on *in vitro* bacterial growth in whole whey of cows (Ali-Vehmas et al. 1997).

CONCLUSION

Adequate Se status in cows' is needed for suppressing growth of mastitis pathogens in milk, which is possibly connected with presence of Se-dependent antibacterial component in whey.

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