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N-acetyl-β-D-glucosaminidase (NAGase) in Porcine Milk

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Raekallio, M.: N-acetyl-β-D-glucosaminidase (NAGase) in porcine milk. Acta vet. scand. 1987, 28, 173–176. – Sow milk contains a high basal level of the lysosomal enzyme N-acetyl-β-D-glucosaminidase (NAGase). The level is extremely high in colostrum. High basal levels seem to hide inflammatory changes. Therefore NAGase did not prove to be as good an indicator for porcine agalactia syndrome as reported for mastitic bovine or ovine milk.

MMA; porcine agalactia syndrome.

Introduction

Studies dealing with bovine milk (*Kitchen et al.* 1978, *Mattila & Sandholm* 1985) and ovine milk (*Maisi et al.* 1987) have shown that the N-acetyl-β-D-glukosaminidase (NAGase) level is a good indicator of acute and chronic mastitis. NAGase is a lysosomal enzyme released into milk during cellular damage within the mammary gland. Information regarding sow milk is lacking.

The purpose of the present study was to analyze whether measurement of milk NAGase could be applied to monitor inflammatory processes in milk from sows with agalactia, and whether milk NAGase is related to the growth and survival of piglets.

Material and methods

Milk samples were collected daily from 44 sows (Yorkshire and Y × Duroc) after farrowing by injecting 20 i.u. oxytocin intramuscularly before milking. Every teat was milked separately by hand. The sows were milked 1–8 times giving a total of 133 milkings and 1787 teat milk samples.

Rectal temperatures of the sows were monitored before milkings. Sows showing temperatures of more than 39.5°C with or without clinical symptoms (anorexia, lethargy, refluctance to nurse) were considered to be affected by agalactia.

There were 30 sows that were milked on day 1 and whose rectal temperature at that day were known.

The piglets were weighed at birth and again at the age of 20–22 days. The mean daily growth per piglet and per whole litter was calculated.

Milk N-acetyl-β-D-glucosaminidase (NAG ase) was analysed using the NAGase kit intended to be used for screening bovine milk for mastitis (Eflab, Finland) (*Mattila & Sandholm* 1985). The method is a microplate modification of the fluorogenic method of *Kitchen et al.* (1978). The substrate, 4-methyl-umbelliferyl-N-acetyl-β-D-glucosaminide was mixed with milk at ph 4.6 and the reaction was stopped after 15 min incubation at room temperature by raising the pH to 10.5. The resulting fluorescence was

measured by a microplate fluorometer, Fluoroskan (Eflab) (*Mattila et al.* 1986).
Statistical analysis was done using the minitab data program (*Minitab Inc.* 1983). Analysis of variance, correlation and regression analyses were used.

Results

NAGase levels in sow milk at early lactation proved to be about 10–20 times higher than reported for bovine milk. There was a constant decrease of the levels during the first week. A significanct negative correlation was found between the NAGase level and the time of collection after farrowing ($p < 0.001$) (Fig. 1).

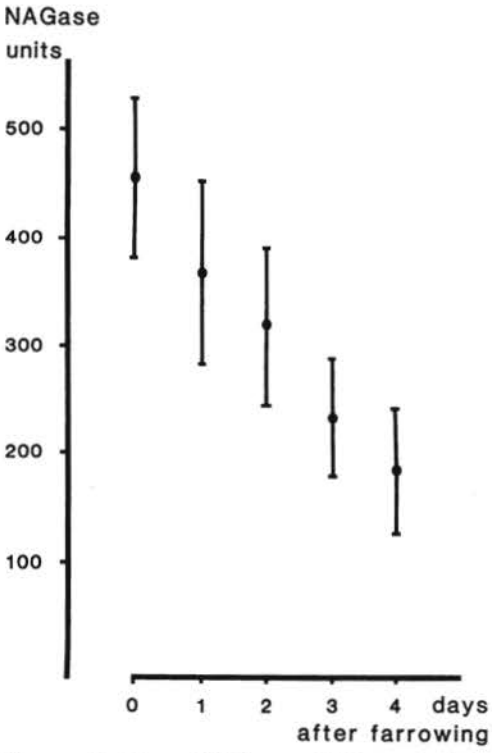

Figure 1. Mean NAGase activities and their standard deviations in porcine milk samples taken daily after farrowing.

There was no difference in milk NAGase levels on day 1 between the group of sows (n = 6) with elevated body temperatures (> 39.5°C) and those with normal temperature (n = 24) (the variation between the groups was smaller than within the groups). The mean daily growth of the piglets of the affected sows was less than that of the healthy sows ($p < 0.05$).
The NAGase level on day 3 showed negative correlation with the mean daily growth of the litter ($p < 0.05$). A low NAGase activity on day 3 ($p < 0.02$) and a small number of the piglets at the age of 3 weeks ($p < 0.001$) would predict a good piglet growth as inducted by the regression analysis. The number of piglets per litter and milk NAGase activity explained 34.4 % of the variation in mean daily growths.
The number of farrowings of the sow showed negative correlation with the mean daily growth of the litter ($p < 0.05$) and that of an average piglet from the litter ($p < 0.01$).
NAGase levels on day 1 ($p < 0.05$) and on day 2 ($p < 0.001$) showed positive correlation with the number of farrowings. NAGase on day 2 showed positive correlation with the duration of the gestation ($p < 0.05$).

Discussion

Mastitis caused by serologically heterogenous strains of E. coli is an important component of the sow agalactia syndrome (*Ross et al.* 1981, *Morkoç et al.* 1983, *Pedersen et al.* 1984). A severe acute general disease of the sow, accompanied by fever and hypogalactia, may also result from an endometritis puerperalis, especially after disturbed parturition (*Berner* 1984), but apparently the uterus is rarely involved in dysgalactia (*Morkoç et al.* 1983). A coliform mastitis is often present, as well, in clinically un-

affected sows with normal body temperatures (*Ross et al.* 1981, *Pedersen et al.* 1984), which might result in undetected hypogalactia. There have been no simple techniques to demonstrate inflammatory changes in milk samples of sows.

The mean daily growth of the litter and of the piglets were used as limited estimates of the milk production of the sow. *Lewis et al.* (1978) found that 34 % of the variation in weight gain could be attributed to variation in the milk yield. *Maffeo et al.* (1986) suggested that there would be a defect in the milk production of the sows with agalactia syndrome. It was expected that the milk production would decrease, too, in subclinical mastitis.

A significant negative correlation was found between the milk NAGase level and the mean daily growth of the litter. In addition, a low NAGase level on day 3 predicted good mean daily growth of the piglets as did a low number of piglets. High milk NAGase was supposed to indicate mastitic changes. It is, however, evident that the NAGase level is dependent on dilution effects from milk produced: A sow with a high milk production reflected as good growth of piglets will show a lower milk NAGase level than a sow with a lower milk production.

The basal milk NAGase level of the sows is many times higher than that of the unaffected cows (*Mattila & Sandholm* 1985). There seems to be other NAGase sources in sow milk than mastitic changes which may hide increases due to mastitis. This may explain the fact that no difference was found in milk NAGase levels between the sows with elevated body temperatures and the unaffected ones. However, the mean daily growth of the piglets of the affected sows was less, which may indicate suppressed milk production.

The time collection after farrowing and the age of the sow (number of farrowings) influenced the porcine milk NAGase level. These results are similar to those based on bovine milk, indicating that NAGase is high in colostrum (*Mattila & Sandholm* 1985).

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Sammanfattning

N-acetyl-β-D-glucosaminidas (NAGase) i suggmjölk.

N-acetyl-β-D-glucosaminidas (NAGase) analyserades i mjölk från friska suggor och suggor med agalakti syndrom. NAGase-enzymaktiviteten fungerar inte lika bra som inflammationsmarkör i suggmjölk som i ko- och fårmjölk. Enzymets grundnivå i suggmjölk är så hög, at den maskerar eventuella variationer förårsakade av inflammation.

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