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Enhanced Growth of E. Coli in Whey from Sows with Agalactia Syndrome

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Raekallio, M.: Enhanced growth of E. coli in whey from sows with agalactia syndrome. Acta vet. scand. 1987, 28, 177–180. – E. coli strains were inoculated into porcine whey samples. Replication rates and the final number of bacteria increased when grown in samples collected from sows affected by the agalactiae syndrome as compared with control samples from healthy ones. The bacteria grew especially well in samples collected on the day of farrowing.
The results suggest that milk collected at the very early stages of lactation and from sows affected by agalactia supports growth of E. coli. This might make the mammary glands more sensitive to infections caused by coliform bacteria although the causal relationship remains to be resolved.

MMA; porcine agalactia syndrome.

Introduction

In vitro studies have indicated that mastitic bovine milk and whey are growth-supporting for mastitic pathogens. This might be a factor tilting the host-microbe balance during mastitis in favour of bacteria (*Mattila et al.* 1984, *Malkamäki et al.* 1986). In vitro bacterial growth studies have not been reported for sow milk or whey.

The basic aim of the present study was to analyze in vitro bacterial growth in whey at early lactation of sows affected by agalactia and to compare bacterial growth in samples from healthy sows.

Materials 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 by hand. The sows were milked 1–8 times giving a total of 116 composite milk samples. In addition, every teat was milked separately on 17 sows. Rectal temperatures of the sows were monitored before milkings. Sows having a temperature of more than 39.5°C with or without clinical symptoms (anorexia, lethargy, reluctant to nurse) were considered to be affected by agalactia. The sows showing clinical symptoms were treated conservatively (sulpha-trimethoprim, dexamethasone, oxytocin) (*Stork* 1980, *Wagner* 1982).

Thirty sows were milked on day 1 and had their rectal temperature taken on the same day.

Milk lactoserum was prepared by high speed centrifugation (45000 g/60 min/4°C). Each whey sample (100 µl) was mixed with an equal volume of Escherichia coli suspension (suspended in 0.9 % saline to yield 10^7 CFU/ml) (*Mattila et al.* 1986). The 2 strains of E. coli used were isolated from sow milk.

The increase in turbidity was monitored by the Bioscreen microplate turbidometer (Labsystems, Finland) at 37°C during 20 h. The samples were measured every 10 min and shaken after every measurement.
Statistical analysis was done using the Minitab data program (*Minitab Inc.* 1983). Analysis of variance, correlation and regression analyses were used. Logarithmic transformations were used for generation times because of the skewed distribution of the original data.

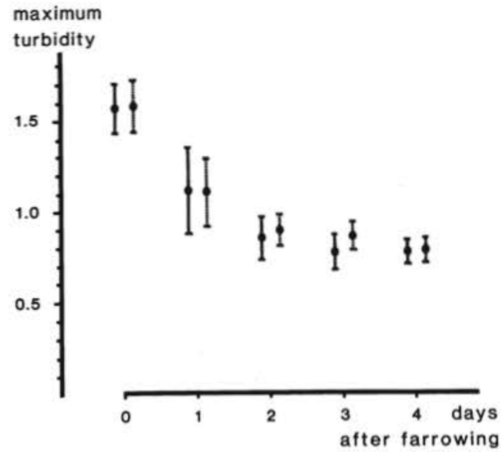

Figure 2. Maximum turbidities (means and standard deviations) of 2 strains of E. coli. The bacteria were inoculated into whey prepared from sow milk samples taken daily after farrowing. strain 1 ———; strain 2 ······.

Results

There was a significant correlation ($p < 0.001$) between growth patterns of the 2 strains of E. coli using maximum turbidities and the natural logarithms of the generation times as parameters for bacterial growth.
The time after farrowing (days) showed negative correlation with the maximum turbidity ($p < 0.001$) and positive correlation with the generation time ($p < 0.001$). The bacteria grew better in whey collected at the

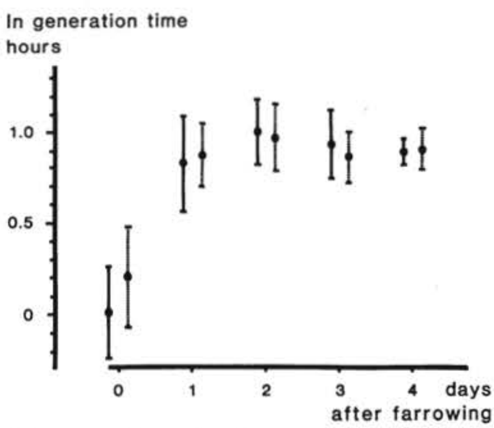

Figure 1. Generation times (means and standard deviations) on 2 strains of E. coli. The bacteria were inoculated into whey prepared from sow milk samples taken daily after farrowing. strain 1 ———; strain 2 ······.

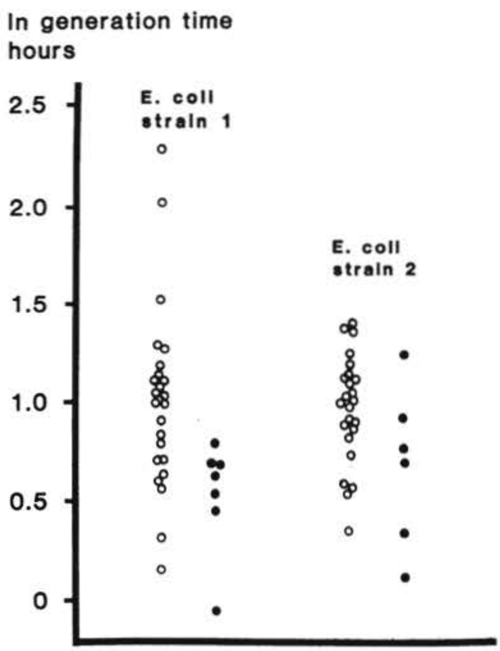

Figure 3. Generation times of 2 strains of E. coli. Bacteria were inoculated into sow whey collected 1 day after farrowing. ○ clinically healthy sows; ● sows with elevated body temperature.

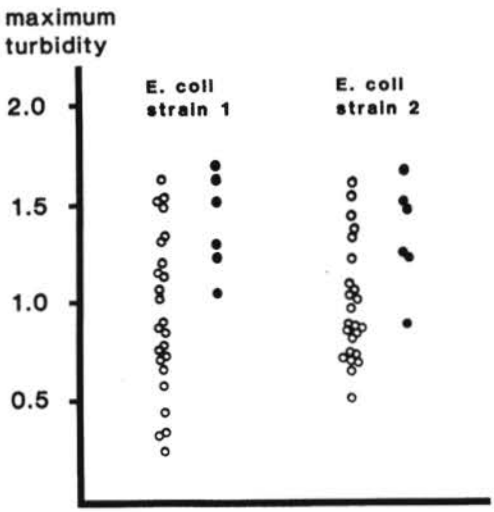

Figure 4. Maximum turbidities of 2 strains of E. coli. Bacteria were inoculated into sow whey collected 1 day after farrowing. ○ clinically healthy sows; ● sows with elevated body temperature.

day of farrowing than in samples collected later (Figs. 1 and 2).

The generation times (logarithmically transformed) in whey samples collected 1 day after parturition showed positive correlation with the duration of the gestation ($p < 0.05$).

When analyzing whey samples collected 1 day after farrowing, it was observed that bacteria grew significantly better in whey samples from sows with fever at that day (Group II, n = 24) (Figs. 3 and 4). The generation times were shorter ($p < 0.05$) and the maximum turbidities were higher ($p < 0.05$) for the sows affected by agalactia when examined with analysis of variance. This indicates that bacteria grew faster to yield higher populations in whey from agalactic sows.

Discussion

Mastitis caused by serologically heterogenous strains of E. coli is an important component of the porcine agalactia syndrome (*Ross et al.* 1981, *Morkoç et al.* 1983, *Pedersen et al.* 1984). The agalactic sows develop the clinical disease 12–36 h post partum (*Ringarp* 1960) most of them becoming affected within 1 day after farrowing (*Hermansson et al.* 1978).

In vitro analysis of bacterial growth in whey illustrates the initial situation in the bacterial microenvironment when introduced into milk. Before bacteria have had time to use their exoenxymes to digest casein and fat they have to adapt themselves into the whey phase.

E. coli strains grew significantly better in whey from the day of farrowing than in samples collected later. Bacteria grew also better in the whey from sows with fever and with or without clinical signs of the agalactia syndrome, which is similar to the results reported for mastitic and normal bovine milk (*Mattila et al.* 1984).

Enhanced growth of E. coli in whey from agalactia-affected sows and in samples collected on the day of farrowing may be explained in several ways. It is possible that the whey of normal sows is devoid of some key nutrients for bacteria, which would be present in mastitic milk and at the very early stages of lactation. Another explanation would be the fact that affected sows were devoid of some endogenous antibacterial factors.

A consequence of this might be that a sow, whose whey is supportive for bacterial growth, would be more sensitive to mammary infections, and that the sensitivity for agalactia could be predicted. The observation that the bacterial growth is enhanced on the day of farrowing is probably linked with the higher incidence of the agalactia syndrome during the first day post partum than later.

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Sammanfattning

Förbättrad tillväxt av E. coli i vassla från suggor med agalakti syndrom.

Tillväxten av E. coli i vassla från friska suggor och suggor mad agalakti syndrom (MMA) analyserades med tubidometer. Tillväxten var maximal under det första dygnet efter grisningen och minskade konstant under de följande dygnen. Bakterietillväksten var snabbare (kortare fördubblingstid) i vassla från suggor med agalakti syndrom än från friska suggor.

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