REDUCING THE SOMATIC CELL COUNT OF BOVINE MILK WITH DIETARY NaCl SUPPLEMENTATION

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Milk with high somatic cell counts (SCC) gives reduced profits for the dairy farmer, as milk companies punish producers for supplying contaminated milk. Additionally, the SCC is indicative of mastitic status (Brolund, 1985) due to the influx of leukocytes ingesting the invading bacteria in the infected mammary gland. Mastitis is one of the primary causes of production losses, and indeed impairs health and welfare in the dairy cow (Kaneene and Hurd, 1990; Janzen, 1970). A simple and inexpensive amelioration of these problems would be welcomed by milk producers. Previous work has been published on the reduction of SCC in milk from cows that have grazed pastures enriched with NaCl (Arney et al., 1995). The mechanism for this effect is not known. Na may assist the immunity system through interactions with other minerals or vitamins, raise the osmolarity of the milk causing cell loss from the udder to be reduced, ensure maintenance of sufficient Na levels when Na is lost from the animal during a mastitic event, or even have a direct bactericidal effect in the milk and in the mammary gland. Na may also enhance the absorption of other minerals from the gut that are important for immunity, such as zinc and copper. It is known that increasing the Na:K ratio in the diet enhances the absorption of magnesium from the rumen (Martens and Blume, 1986 and Martens et al, 1987). This experiment was designed to establish whether adding salt directly to dietary concentrates would also reduce the SCC of the milk of dairy cows. Of further interest was whether the dietary NaCl was influencing the spectrum and activity of the pathogens found in the milk. Different pathogens produce different mastitic diseases with different epidemiologies and different risk factors (Schukken et al., 1991). If we can isolate which, if any, of the mastitogenic pathogens are impaired by dietary salt intake, we can more easily understand the mechanism of this impairment and furthermore we can identify which forms of mastitis it would be worthwhile trying to arrest with this form of prophylaxis.

Method

Three groups of 12 lactating dairy cows were matched for milk yield, age and lactation stage. The trial took place during the overwintering period of 1994-5 for a period of three months, from February to April. All the animals were permanently housed in tied stalls throughout the period of the trial. Each group was fed an identical diet of 2.5 kg barley meal concentrate, 25 kg silage and 10 kg haylage. To this diet, the control group received no additional Na, while the two treatment groups received, respectively, a low Na dose (5 g/kg Na in DM) and a high Na dose (10 g/kg Na in DM). The Na was added to the concentrate, in the form of common salt, at a daily rate of 0, 200 and 400 g, to ensure that all the salt was eaten. No acceptance problems were noted; in the low Na group the concentrate-salt mix was eaten immediately, while occasionally this took a little longer with some of the animals in the high Na group.

Milk samples were analysed monthly by the Central Estonian Milk Testing Laboratory, for milk yields and cell counts as well as lactose and protein levels. Milk samples were analysed once during the trial for bacterial analysis. Samples were taken from each teat of each cow immediately post-milking in the morning milking period. The samples were placed in an ice box and immediately transported to the dairy product microbiology laboratory, where they were inoculated into culture media for assessment of lactophillic (*Lactococcus, Streptococcus and Lactobacilli* species) and propionophillic (*Freudenrichi and Shermanii* species) bacterial colonies and for total bacteria, including *Clostridia and Staphylococcus* species.

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Results and Discussion

Analysis of the somatic cell count data showed that cell counts from both the high and low Na treatment groups were under half those of the control group, 294, 304 and 633×10^3 cells ml^{-1} respectively, significant at the 95 % level, P = 0.046 (Table 1). Cell counts were measured for the month prior to the beginning of the trial, and these were not significantly different between the trial groups, so this difference in cell count was a trial effect, and was not caused by a pre-trial difference.

Previous work on the effect of adding Na to the diet of lactating dairy cows on somatic cell counts involved the application of NaCl to the pasture. This confirms that this effect is, at least partly, a direct result of the addition of NaCl to feed.

Analysis of the bacterial populations expressed in the milk of the trial cows was not statistically significant, partly because of the small sample size (samples were taken on one occasion only, a sample size of 36). However, possible trends were observed. Total bacterial counts and lactophillic counts were higher in the control cows and lowest of all in the high Na treatment group, while propionophillic bacteria counts were lowest in the control group and higher in both of the treatment groups (Table 2).

Table 1. Somatic cell counts in milk / Piima somaatiliste rakkude arv

Treatments Katserühmad	Pre-trial period $x10^3$ ml^{-1} Katse-eelsel perioodil	Median Trial Cell Counts $x10^3$ ml^{-1} / Keskmine rakkude arv
Control / Kontroll	713[a]	633[b]
Low sodium supplementation Mõõdukalt NaCl	698[a]	304[c]
High sodium supplementation Rohkesti NaCl	569[a]	294[c]

[a] There was no significant difference between these groups, P = 0.794.
[b+c] Were significantly different at the 95% level, P = 0.046
[*] As this data was not normally distributed the Mood Median non-parametric test was used for analysis.

Table 2. Bacterial populations in milk / Bakterite arv piimas

Treatments Katserühmad	Total bacteria $x10^4$ ml^{-1} Koguarv	Lactophillic Bacteria ml^{-1} Laktofiilsed	Propionophillic Bacteria $x10^3$ ml^{-1} Propionofiilsed
Control / Kontroll	92.80	11.00	10.48
Low sodium supplementation Mõõdukalt NaCl	84.14	10.286	14.16
High sodium supplementation Rohkesti NaCl	75.00	9.286	12.27

[*]There was no significant difference between treatments for this data

While these results were not significant, they do suggest a trend in the effect of NaCl in the diet on different bacterial populations. A further trial is presently being conducted to confirm any such effect and identify more clearly which bacterial species are primarily affected. This would be important in clarifying the identification of the mechanism by which dietary salt reduces the somatic cell count of milk in dairy cows, and also to identify which mastitic pathogens can be arrested by this prophylactic treatment.

Milk yields decreased in all treatments in the experiment as the animals' lactations progressed. Yields were higher in both of the treatment groups than in the control, although these differences were not significant (Table 3). One possible reason why these results were not significant may be because the yields of mastitic cows were not taken into account, and therefore low-yielding mastitic animals were removed from each group's results. The numbers of cows thus removed were 5, 3 and 2 from the

control, low and high NaCl treatments respectively. Therefore, more low-yielding cows were removed from the data set of the control group than the treatment groups. It is not of course statistically significant, but it is of interest that fewer cows in the treatment groups were deemed by the farmer to be mastitic than in the control group. Compared to pre-trial yields, both the treatment groups also showed a reduced decrease in yields in the trial.

Table 3. Milk yields over the trial period / Katselehmade piimatoodang

Treatments Katserühmad	Trial milk yields (kg day^{-1}) Keskmine piimatoodang (kg/p)	Change in milk yields from pre-trial to trial period (kg day^{-1}) Piimatoodangu muutus võrreldes katse-eelse perioodiga
Control / Kontroll	8.906	-1.224
Low Sodium Treatment Mõõdukalt NaCl	8.922	-0.896
High Sodium Treatment Rohkesti NaCl	10.139	-1.001

*There was no significant difference at the 95% level between treatments, P = 0.291

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Somaatiliste rakkude vähendamine lehmade piimas NaCl lisasöötmise teel

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Kokkuvõte

Autorite poolt läbi viidud varasemad katsed on näidanud, et karjatades lehmi NaCl-ga väetatud karjamaal, väheneb piimas somaatiliste rakkude arv. Käesoleva katsega püüti selgitada, kas somaatiliste rakkude arv väheneb piimas ka siis, kui manustada NaCl koos jõusöödaga.

Katse korraldati Eerika katselaudas 1994/95. a. talveperioodil ning kestis kolm kuud. Analoogide põhimõttel moodustati kolm rühma (igas 12 lehma), kes said keedusoola näol kas 0, 5 või 10 g Na ühe kilogrammi söödaratsiooni kuivaine kohta. Katseperioodil langes somaatiliste rakkude arv mõlemas katserühmas poole võrra ($P<0,05$). Ka bakterite üldarv ning laktofiilsete bakterite sisaldus oli mõlema katserühma lehmade piimas väiksem kui kontrollrühma lehmade piimas. Seevastu propionofiilsete bakterite sisaldus näitas seoses NaCl söötmisega suurenemise tendentsi. Siiski ei osutunud need muutused statistiliselt usutavateks. Usutavaks ei osutunud ka rühmadevahelised piimatoodangu erinevused.