The effect of udder precleaning on milk quality and yield

(Lina Jonsson, 2007)

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Abstract

This study was performed in Vietnam as a minor field study. The country has a fast growing demand of dairy products, but too few dairy cattle to produce enough quantity of milk. This problem is at present solved by import of milk from countries such as the United States, Australia and the Netherlands. The dairy sector is fairly new in Vietnam and the knowledge about dairy farming is rather poor. The Vietnamese farmers need to improve their knowledge in how to keep the dairy cattle, in order to increase the countries own dairy production. The udder health of the dairy cattle is one important factor in order to raise the milk yield. A way of measure the udder health and milk quality is by milk somatic cell count (SCC) and the total bacteria count (TBC). These two factors are affected by bacteria in the surrounding and a way of limiting them is by cleaning the teat before the milking is done. The aim with the current study was to examine if a proper cleaning before milking, would result in, a lower bacteria number, a reduced milk SCC and thereby a higher milk quality.

The experiment was performed by a change over design with four different treatments. The treatments was; hand milking and traditional precleaning, hand milking with properly precleaning, bucket machine milking with traditional precleaning and bucket machine milking with properly precleaning. The study was carried out 40 km north west of Ho Chi Minh City (HCMC) on 12 Holstein-Friesian cows. They were milked twice a day and the experimental period lasted for 40 days with 10 days within each treatment.

It was found that the hand milking treatments gave a higher yield in the afternoon milking compared with the machine milking ($P< 0.05$). The SCC was high for all four treatments, but no significant difference was found between the treatments. There was a large variation between different cows and also within the same animals but in different days. The TBC differed significant between the periods where period 2 had low values of bacteria. However, there was no significance found between the treatments.

Sammanfattning

Denna studie utfördes i södra Vietnam och var en Minor Field study. Vietnam har ett ökande behov av mjölkprodukter som den inhemska produktionen inte har kapacitet att mätta. På grund av detta importeras stora mängder mjölkprodukter från länder som USA, Australien och Nederländerna. För att öka den inhemska produktionen av mjölk måste lantbrukarna få ökade kunskaper i hur de ska hålla och sköta sina kor. En viktig faktor för att få en ökad mjölkmängd och bättre kvalitet på mjölken är kornas juverhälsa. Denna kan mätas genom antalet celler och antalet bakterier i mjölken. Dessa påverkas av bakterier som finns i kornas omgivning och ett sätt att minska antalet bakterier är att tvätta kornas spenar före mjölkning. Syftet med denna studie var att undersöka om väl genomförd tvättning av spenarna innan mjölkning leder till en bättre mjölkkvalité med ett lågt antal av bakterier och celler.

Försöket gjordes genom att fyra olika behandlingar växlades mellan 12 kor. Behandlingarna var; handmjölkning med respektive utan förtvätt av spenarna och maskinmjölkning med respektive utan förtvätt av spenarna. Tolv kor av Holstein-friesian korsningar fanns på en gård 40 km nordväst om Ho Chi Minh City (HCMC). De mjölkades två gånger per dag och hela provtagningen skedde i 40 dagar med 10 dagar i sträck i varje behandling.

Korna som mjölkades för hand hade en högre mjölkavkastning jämfört med de som mjölkades med maskin ($P< 0,05$). Celltalen var höga inom alla behandlingar, med det gick ej att se

någon signifikant skillnad mellan dem. Det var en stor variation mellan de olika kornas celltal och även inom samma ko, fast vid olika provtagningstillfällen. Det fanns en skillnad mellan de olika perioderna med avseende på det totala antalet bakterier och här är det speciellt den andra perioden som urskiljer sig med låga värden. Det fanns ingen signifikant skillnad av antalet bakterier mellan behandlingarna.

Introduction

The population of Vietnam was in July 2005; 80.3 million people and 66.5 % of them make their living on agriculture (FAO, 2005a). In the last ten years the economy of Vietnam has increased, but there is still a large part of the population in the rural areas that is poor (FAO, 2006b). The demand for milk products is increasing in Vietnam. The year 1990 the consumption kg/capita/year of milk was 0.47, 1995 was it 2.05 and in 2001 it had increased to 7.50. The demand increases faster than the expansion of the milk production in the country. As a consequence, 90% of the yearly consumed milk and dairy product for local demands has to be imported (Tuyen & Giao, 2002). The main part of this import is from the United States, Australia, South Korea and Netherlands (FAS Worldwide, 2006).

The major part of the dairy production, 90 %, comes from crossbreds between a local bred and Holstein-Friesian (HF) cattle. The F1 and F2 animals of this crosses (first and second generation) produces 3 000 to 3 500 litres of milk in a 305 days lactation, see table 1. This crossbred is mainly located in the surroundings of Hanoi and Ho Chi Minh City (HCMC), but also in provinces like Long An (Tuyen & Giao, 2002). A common way to breed the HF crossbred cattle is to use a cow that is a crossing between Sindhi and Yellow cattle (a Lai Sind cross) and a HF as bull. There are also a pure HF population, 5 000 animals in 2002, originating mainly from Cuba and Australia. These pure HF are mostly kept in special exotic dairy cattle farms (Tuyen & Giao, 2002).

The total number of dairy cattle in Vietnam were 50 000 animals in the year of 2002. In this numbers it is only the pure HF and the crossbreds with this breed that are included (Tuyen & Giao, 2002). In 2005 the number of dairy cattle had increased to slightly more than 100 000 animals (FAS Worldwide, 2006).

Except for the increasing demand of dairy products in the country, the development of dairy cattle is also benefiting for the farmers. The farmer gets economical benefits and the dairy processing plants creates work opportunities in rural areas (Tuyen & Giao, 2002). A study made by Suzuki *et al.* (2006) showed that the income from the dairy cattle were 40 % of the total income for the smallholder farms. The most common way to keep the dairy cattle in Vietnam is by backyard farming. This means that a small number of animals are being kept around the house, 2-15 cattle (Man, 2001). On an average farm, the work is done by the farmer and his family.

In order to develop the dairy production and meet up with the local demand of products in order to decrees the import, the Vietnamese government created the Dairy Development Plan of Vietnam, 2002- 2010. The goal is to increase the number of dairy cattle to 200 000 animals in the year of 2010 and be able to meet the local demand of dairy products to 40 %. This goal will be reached by a two step breeding program. The first step is to increase the body size and growth rate of the cattle in order to get a better productivity on the farm. The second step is to continue with the crossbreds of a Holstein-Frisian bull and an improved local cow (Tuyen & Giao, 2002).

Table 1. Milk yield and location of the different cattle breeds

Cattle breed	Milk yield (litres on a 305 days lactation)	Location in Vietnam
F1 and F2 HF	3 000- 3 500	Hanoi, HCMC and provinces close to the Mekong delta, like Long An.
Lai Sind cross	1 000- 1 200	Hanoi and HCMC
Pure HF	4 200- 4 500	-

(Tyen & Giao, 2002)

Tuyen & Giao, (2002) also mentions that the farmers needs to improve their knowledge in; how to manage a dairy cattle, udder health hygiene, a clean milk collection and the preservation of the milk. This has also been found by Suzuki *et al.* (2005), who did a survey in the northern part of Vietnam and a third of the cattle had *ad libitum* access to drinking water and since the farmers were unused to the exotic breed it was thought that they underestimated the cattle demand of water supply. The base of this problem is that the use of cattle as only a milk producer is a rather new part of the Vietnams agriculture (Tuyen & Giao, 2002).

Background

Mastitis

As mentioned above, one major limiting factor for increasing the dairy production is problems with how to manage the cattle, the quality of the milk and low milk yield. The udder health of the cow is affecting and interacting in all of the mentioned areas. Udder health disorders causes early culling, a lower quality of the milk, less milk produced and sufferings for the animal (Sandholm, 1995).

The udder defence mechanisms from unwanted pathogens

The mechanical protection of the udder is the first line of defence for the udder from an infection in the mammary gland. The diameter and length of the teat are one factor that are of value for the protection of the mammary gland from micro organisms. Furstenberg's rosette, keratin, teat sphincter and the length and diameter of the teat canal are also important (Sandholm, 1995). More exterior characters as the udder depth, fore udder attachment and also the milkability are said to be of significance (Schukken *et a,.* 1997).

The immune defence reacts different depending on what kind of microorganism that have entered the mammary gland. The two types are called innate immunity and adaptive immunity (Sandholm, 1995).

The innate immunity works by macrophages and neutrophils that ingest and destroys the pathogens. This is the second line of defence (Grönlund 2004). The macrophages are always present in the milk. When an infection occurs the macrophages are also able to produce endogenous mediators, interleukins, to make other kind of leukocytes aware of the intrusion. The innate immunity also works by soluble components such as minerals and lactoferrin. The bindings of iron by lactoferrin will reduce the ability for the micro organisms to reproduce. The innate immunity works against gram-negative bacteria as *E. coli*, and it is of most importance the first day after the occurrence of an infection (Sandholm, 1995).

The adaptive immunity, the third line of defence, function by lymphocytes, B- and T-cells. The first time a pathogen is recognized in the mammary gland a large response of antibodies, produced by the B-cells, will bind to the antigen on the micro organism. The micro organisms are then phagocytised by macrophages that are bound to the other side on the antigen. The second time a micro organism reinfects the mammary gland the immune response acts faster. *S. aureus* is an example of bacteria that alert these functions in the mammary gland. The T-cells are acting by helping the macrophages with intracellular killing, T-helper, or the T-cytotoxic that lysis cells that are infected (Sandholm, 1995).

An infection in the udder is called mastitis. Mastitis can occur in a clinical and subclinical form. The clinical form is more common in the beginning of lactation and is often caused by gram negative bacteria, especially E.coli. Subclinical mastitis occurs often by gram positive bacteria such as *S.aureus*, *S.ubertis* and *S.dysgalactiae*. In subclinical cases of mastitis the defence mechanism in the udder failure to eliminate all the bacteria and they are chronically present in the mammary gland (Sandholm, 1995). Since the milk producing glands are infected, the production of milk is less than in uninfected glands (Phillips, 2001).

Somatic cell count in milk

A way of measure mastitis is by the milk somatic cell counts (SCC). In a healthy mammary gland the milk constitutes of 5-20% of neutrophils. But during an infection the milk SCC consist of more than 95 % of neutrophils (Detilleux *et a.,* 1997). An udder with less than 100 000 cells /ml is defined as healthy (Pyörälä, 2003). In EU the SCC of the bulk tank milk have to be less than 400 000 cells/ml, otherwise the farmer will have less money for the milk (Phillips 2001). The reason for this is that milk from a cow that has mastitis has a lower quality, the milk has a lower shelf life and will be less useful when making dairy products of it, compared to milk from a healthy cow (Barabano *et al,.* 2006).

Effect of high SCC on milk quality

In an udder infected with either clinical- or subclinical mastitis the milk yield decreases and also the solid-non-fat content of the milk (Castle & Watkins, 1984). The enzymes that are used to synthesize milk are decreased, while the enzymes that take care of the udder inflammation are increased. It is a huge increase in the amount of enzymes that are created by phagocytes during an infection (Pyörälä, 2003).

Protein

Mastitis causes different changes in the composition of milk. The total amount of casein in the milk is decreased, however if only seen to the κ-casein, this is increased. The α- lactalbumin and β-lactoglubulin is decreased. The whey proteins and the immunoglobulin are highly increased (Pyörälä, 2003). The casein part is of value for making dairy products. The main part of the calcium is bound to the casein which also makes milk high in SCC less valued from a nutrition perspective (Ogola *et al.,* 2007). There is a reduction in the amount of casein in the milk already at 375 000 cells /ml and the storage time for the milk is reduced (Santos *et al.* 2003). Urech *et al.* (1999) showed in an experiment that the total amount of protein increased during subclinical mastitis. The proportion of whey proteins increased as a result of the increased amount of blood proteins, BSA and Ig. In the casein proportion of proteins it is mostly the γ- CN that increased. They also found that the residual milk was higher in cows with subclinical mastitis. It was 21.8 % in a quarters with clinical mastitis compared with 8.8 % in healthy quarters.

Fat

As the levels of SCC in milk increase, the proportion of free fatty acids (FFA) in milk increases. This can be due to a higher lipolytic activity (Pyörälä, 2003). It has been shown that macrophages from milk can secrete lipolytic enzymes. The enzyme can break down the fat globular membrane and by this the FFA in the milk will increase. The FFA decrease the quality of the milk by reducing its storage time (Azzara & Dimic, 1985).

Lactose

The value of the lactose concentration in healthy milk is very stable. The reason for this is that the lactose that works as osmolarity in the mammary gland (Sjaastad *et al.,* 2004). With an increasing SCC in milk the lactose proportion will decrease (Pyörälä, 2003).

Prevention of masitis during milking

In order to prevent mastitis it is important to clean the teats before the milking start. Environmental factors such as mud, moisture and manure are crucial sources to subclinical mastitis. An experiment that compared the dirtiness of the udder with the milks SCC, showed that cows with cleaner udder had milk with a lower SCC. Cow with dirty udder were also more likely to have a major phatogenes that could be isolated from their milk (Schreiner & Reugg, 2003). A recommended way of cleaning the teats before milking is by using a cleaning solution for the purpose and individual towels on the teats (Phillips, 2001).

The effect of milking by hand or with a machine on the milk composition

How the udder is being milked, can make a difference in how much of the milk solids that is produced. In an experiment where handmilking (twice a day) was compared with machine milking, it was found significant differences in the amount of fat, lactose and protein that were excreted in the afternoon milking. The hand milking resulted in an enhancement of the solids. The difference between the two ways of milking was extra obvious in the fat content of the milk. Hence it was shown that the last 10 ml of milk after each milking had an increase fat content both in the morning and evening milking (Svennersten *et al.,* 1990).

Aim

The aim with the present study was to examine if a proper cleaning before milking, by hand or milking with bucket machine, would result in a higher milk quality, a lower bacteria number and a reduced milk somatic cell count (SCC).

Material and Method

The experiment, which was a part of a PhD thesis, was performed in Vietnam, at a small house holder farm 40 km north west of Ho Chi Minh City, in the Dong Nai province, see picture 1. The area has a tropical climate, hence the temperature is above 25 degrees during the day and night. In this part of Vietnam it is very common to keep dairy cows (Tuyen et al. 2002).

Animals, housing and feeding

The cows were kept on a concrete platform, with a metal roof and open walls. The farm had 15 cows, 12 of them were lactating and used in this experiment. The cows were loose-housed and only tied-up during the milking. The cows and the barn is showed in picture 2. The cows

were normally milked with a bucket machine. They were feed concentrate twice a day depending on the cow's individual needs. The cows were also feed fresh grass *ad lib.* The 12 cows were in the age of 4 to 9 year and in lactation month from 3 to 11. The cows were all F3 generation of HF. The F1 is a cross breed with 50% HF and 50% local yellow and red Shindi. The F2 is 75 % HF, and the F3 is 87,5 % HF (Tuyen & Giao, 2002).

Picture 1. A map of Vietnam (Sitesatlas, 2008).

Picture 2. The cows are tied up in the barn during milking (Lina Jonsson, 2007).

Experimental design

The 12 cows were milked with four different treatments:

- A: Hand milking, with traditional precleaning
- B: Hand milking, with properly precleaning
- C: Bucket machine milked, with traditional precleaning
- D: Bucket machine milked, with properly precleaning

Properly precleaning means that the teats were cleaned with a towel which was wetted in a commercial teat cleaning solution. The teats were cleaned with a method that starts by cleaning the teat tip, then the whole teat and last the teat tip again. One corner of the towel was used for one teat. One towel was not used for more than one cow. The milker was always assisted with a clean towel, in order to reduce the contamination risk.

The traditionall precleaning means that one towel was wetted in water ones, and then used for cleaning, for all the cows without changing the towel or rewetted it. The cleaning was not performed by some special pattern.

The different treatments were performed in 10 days. The first 6 days were adaptation days, and during day 7 to 10 samples were taken. The cows were randomised into the four different treatment by a change over design (table 2), with three replicates and four periods.

Table 2. The Change over design for the 4 treatments

Periods	**Cow number**											
	1	2	3	4	5	6	7	8	9	10	11	12
1	D	C	B	A	B	A	D	C	C	D	A	B
2	A	B	C	D	A	B	C	D	A	B	C	D
3	B	A	D	C	C	D	A	B	D	C	B	A
4	C	D	A	B	D	C	B	A	B	A	D	C

Milking routine

During day 1 to 10 the cows were milked by their ordinary and same milker. The milking procedure started with all cows tied-up at their respectively places. The cows and the floor were then cleaned with a water tube with a high pressure. If the cows were dirty up on their sides of the udder and the sides of the stomach, it was washed too. If the cow were in treatment with properly precleaning, an assistant gave the milker a soaked towel from the bucket with cleaning solution. When the wet precleaning procedure was performed, the assistant gave the milker a dry towel. The assistant handled the towels to the milker in order to reduce the contamination risk. After cleaning, the bucket milking machine was attached to the teats, respectively the hand milking started. If the cows were in the treatment of traditionally precleaning, no more cleaning were preformed after the washing with the water tube before respectively milking started.

At the end of every milking with the bucket machine, the milker pressured the clou against the ground so the udder was stretched. The bucket milking machine had a pressure of 38-40 kPa during the milking.

Picture 3. Behind the bucket milking machine is the milker taking a milk sample on cow number 1 (Lina Jonsson, 2007).

The hand milking was performed with one hand on the teat, with the thumb folded around the teat. In the end of milking, the second hand squeezed the upper part of the teat. The milk was collected in a plastic bucket with a diameter of 50 centimetres. The bucket milking machine was cleaned by letting water from the cows drinking trough circulate the system for about 60 seconds. The outside were mechanically cleaned with a reused towel soaked in water from the drinking trough.

Sampling and data collection

The samples were taken both at bucket and quarter level. Picture 3 shows the sampling at quarter level. At bucket level analyses were made for composition, total bacteria count (TBC) and SCC. At quarter level the composition, SCC and swab samples were analysed (table 3). Milk yield was measured all milkings, day 1 to 10.

Table 3. Sampling schedule that illustrates at what day the samples was taken. Am means the morning milking and pm means the afternoon milking

Day 7	Day 8	Day 9	Day 10
Am and pm: Bucket: • Yield • Comp. • TBC	**Am and pm:** Bucket: • Yield • Comp. • SCC • TBC	**Am and pm:** Bucket: • Yield • Comp. • SCC • TBC	**Am and pm:** Bucket: • Yield • Comp. • SCC • TBC
Only Am: Swab skin	Quarter strip: ○ Comp.	**Only Am:** Swab skin	Quarter strip: o Comp. o SCC (pm)
			Only Am: Quarter strip: Bakt.

The bucket samples were taken with a metal spoon, after the milking was done. The milk was steered before the samples were taken, in order to make the milk more homogenised. The quarter samples were taken by hand, when the regular milking was done. The quarter milk samples for bacteria were taken antiseptically. All milk samples were collected in small plastic jars. The once for bacteria samples were sterile.

The swab samples were taken three times for the cows with treatments that included properly precleaning; before the precleaning, after the preacleaning and after the milking were ended. If the cows had the treatments with traditionally cleaning, swab samples were taken twice; before and after milking. The samples were taken with a compress soaked in distilled water. At the first sample the compress were stroked to the teat until the teat looked clean. This normally rewired two compresses. At the second and third samples the compress was only stroked a couple of times on the teat (the compress were stored in plastic bags put on ice). All samples were stored on ice directly after they were taken and put in a freezer 15 minutes after all samples were taken.

Analyses

Milk analysis

The bacteriological samples were cultivated and counted by Laboratory of Veterinary Services (Dong Nai Province, Vietnam). The bacteria parameters of interest were TBC, Staphylococci, Streptococci and coli form. The composition of the milk; fat, protein, lactose, solid non fat and dry matter were analysed with mid infrared spectroscopy (Farm Milk Analyzer, Miris AB, Uppsala Sweden). The SCC were measured with fluorescent method, a cell counter DCC (DeLaval cell counter, DeLaval, Tumba Sweden).

Statistical analysis

A few days before the experiment started, one of the selected cows died. No replacement cow was available at the farm. Hence the experiment was preformed with 11 cows. During the fourth period the 9th day the electricity supply were shut down during the afternoon milking.

This resulted in that all cows were milked by hand that afternoon and the data from this day was excluded from the statistical analyse. The data from TBC in the morning at period 2 day 8 were also excluded from the statistical analyse due to technical problems.

The statistical analysis was done using the Mixed procedure with ANOVA in SAS 9.1 (SAS Institute inc., 2004). To compare the different treatments the following model was used;
Y = Period Treatment Day Period*Day Treatment*Day,

For the milking methods the following model was used:
Y=Period Milkingmethod Precleaning Milkingmethod*Precleaning Day Period*Day.
To obtain normal distribution, the data on SSC and TBC were transformed into 10 logarithmic (log_{10}) values before the analysis. The data are presented as least square means with its standard error.

Result

The result that is presented in this report is only a restricted part of all data that were collected during the experiment. The complete part of the result will be presented in a PhD thesis (done by Vo Lam).

Yield

The hand milked method gave a higher milk yield (P< 0.05) than the machine milked method, in the afternoon. This difference was not found during the morning milking.

The amount of milk in the different treatments is illustrated in figure 1. These values were not found to be significant.

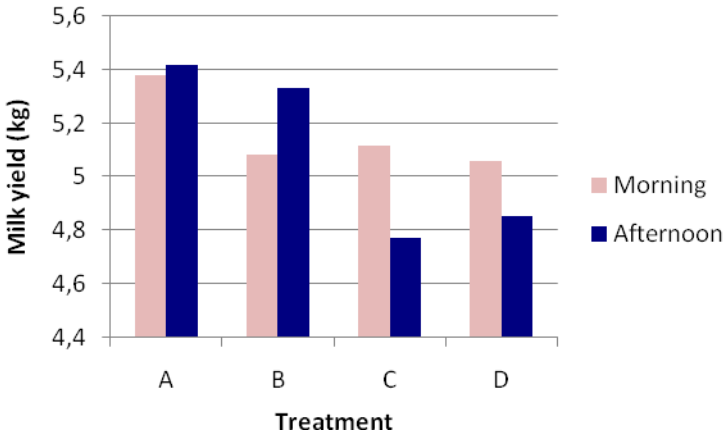

Fig. 1. Mean values of the milk yield, at morning- and afternoon milking. Treatment A is hand milking, with traditional precleaning, B is hand milking, with properly precleaning, C is bucket machine milked, with traditional precleaning and D is bucket machine milked, with properly precleaning.

Somatic cell count and total bacteria count

The SCC was high in all treatments. The SCC for the different treatments is showed in table 4. There was no significant differences between the milk SCC of the different treatments in the morning or in the afternoon milking.

Table 4. The mean values of the SCC from the morning and afternoon milking. The original values of SCC are showed in within brackets and the $\log_{10}$ SCC values without brackets. The treatments were; (A) hand milking, with traditional precleaning, (B) hand milking, with properly precleaning, (C) bucket machine milked, with traditional precleaning and (D) bucket machine milked, with properly precleaning

	Treatments				
SCC	A	B	C	D	SE
Morning	3.00 (1 005 070)	2.92 (840 620)	2.86 (729 790)	2.86 (730 470)	0.06
Afternoon	3.05 (1 117 900)	2.96 (918 970)	2.98 (953 970)	2.93 (859 600)	0.05

During the morning milking the machine milked cows had a tendency (P= 0.13) to lower milk SCC, 733 x 10^3 cells/ ml milk compared to the hand milked cows, 915 x 10^3 cells/ ml milk. This could not be shown in the afternoon milking.

There was a large variation between cows, between sampling period and there was also a large variation within the three sample days, in the levels of the SCC, see fig. 2.

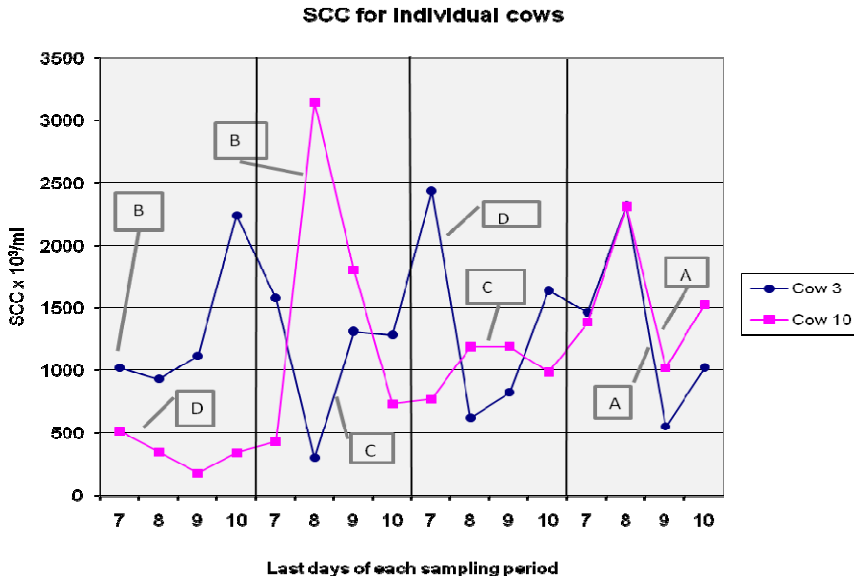

Fig 2. The individual SCC x10^3 for cow 3 and cow 10 during the afternoon milking. A represent hand milking, with traditional precleaning, B represent hand milking, with properly precleaning, C is bucket machine milked, with traditional precleaning and D is bucket machine milked, with properly precleaning.

There was a significant difference, in TBC between the 4 periods, both in the morning milking (P< 0.01) and the afternoon milking (P< 0.001). It is particularly the mean value from period 2 that is lower compared to the three other periods, see table.5

There was no significance found in the total bacteria count (TBC) between the different treatments or the different milking methods.

Table.5. The mean values on the total bacteria count from the four periods of treatments, during both the morning- and afternoon milking. The original values of TBC are showed in within brackets and the $\log_{10}$ values without brackets

TBC	Period				
	1	2	3	4	SE
Morning	5.31^{a} (203704)	4.63^{b} (42993)	5.17^{ac} (153355)	4.78^{bc} (59717)	0.15
Afternoon	5.26 (183950)	4.25 (17619)	5.02 (104015)	4.66 (45383)	0.16

Different superscripts differ significantly (P<0.05)

Fat

The mean value of milk fat percentage from each treatment is illustrated in table 6. The treatment that gave the numerically highest percentage of fat was treatment B, (hand+clean) in both morning and afternoon milking. However, no significant difference was observed. The treatment where bucket machine and properly precleaning were preformed, treatment D, had the lowest amount of fat percentage (P= 0.15). The hand milking showed a small trend to give a higher fat procentage in the milk, compared with machine milking, during the afternoon milking (P= 0.13). This was not found during the morning milking.

Protein

The mean value for the protein percentage for treatment A and D during the morning milking had a tendency (P= 0.09) to a lower value than the other treatments, see table 6. It could also be seen a difference of the amount of protein between the different sampling days in both morning (P< 0.05) and afternoon (P<0.05).

Lactose

The lactose mean value for treatment A was lowest from the morning milking (P <0.05), see table 6. During the afternoon milking, treatment A had also the lowest amount of lactose (P < 0.05), and treatment B had the highest mean value.

Table 6. Mean values of fat, protein and lactose. Treatment A is hand milking, with traditional precleaning, B is hand milking, with properly precleaning, C is bucket machine milked, with traditional precleaning and D is bucket machine milked, with properly precleaning

	Treatments				
Parameters	A	B	C	D	SE
Fat (%)					
Morning	3.69	4.02	3.86	3.65	0.14
Afternoon	4.24	4.34	4.26	3.95	0.15
Protein (%)					
Morning	3.08	3.37	3.25	3.02	0.11
Afternoon	3.15	3.34	3.20	3.34	0.12
Lactose (%)					
Morning	4.39	4.54	4.64	4.59	0.076
Afternoon	4.29	4.48	4.59	4.44	0.079

Discussion

The hand milked cows gave a higher milk yield in the afternoon. This is supported by Svennersten *et al.* (1990) who showed this incensement of milk yield in the afternoon during hand milking. This could be due to the shorter interval between the morning milking to the afternoon milking, than what it is between the afternoon milking to the morning milking. The different stimuli from the hand milking (compared with the one from the machine) will be more clearly showed since it is also a lower amount of milk in the afternoon and it is therefore proportionally easier to see an increasing. Another theory why the increased yield was showed in the afternoon is that the cow from the beginning of the trial milks more during the morning milking and is due to this milked longer in the morning (in order to get all milk out). The stimuli of the udder are then longer in the morning than in the afternoon. The longer morning stimuli, stimulates more milk to be produced to the afternoon milking. The lower amount in the afternoon, from the start, creates a shorter stimulation of the udder during the afternoon and thereby a lower effect on the milk synthesis for the amount of milk that will be synthesized for the morning (Gorewit *et al.*1992). A well implemented prestimulation can also result in a more effective emptying of the udder, which can result in an increased milk yield (Sandrucci *et al.* 2007).

Since the finishing of each milking of each cow was done by palpation it is possible that a cow some days were milked on their residual milk and some days not. A recording of how long time each cow were milked, in order to compare with the milk yield, would have been useful. When milking by hand it is more difficult to use a time recording to compare the yield with, since it is difficult for the milker to milk the cows with the same speed all the time.

The present experiment was only preformed during 40 days, a rather short time to affect the SCC by the use of different precleaning methods. Since the experiment was planned with a change over design and the sampling started at the 7th day in the period, this created a rather short time for the treatment to make an effect on the cronical mastitis. Although the number of animals is not that many, it is possible that what is only showed as a tendency in this result could be significant if the number of animals would have been more. The SCC for the afternoon milking showed a trend to lower values for the treatments that included properly precleaning. This might indicate that the higher hygiene around these udders can result in a lower SCC. Seen over the whole experiment period, the milk SCC for all of the cows was much higher than the limit for what is concerned as a healthy udder, which is 100 000 cells/ml in Europe (Pyörälä, 2003). The big variation in milk SCC between the different cows makes it difficult to present any significant differences between the treatments. Although the high milk SCC shows that there is a problem with the health of the udder that needs to be further investigated.

An unexpected result was the difference in TBC between the four periods. The amount of bacteria that can grow is affected by the climate. The whole experimental period was during the beginning of the rainy season, but there were not any major weather differences between the periods. The amount of bacteria in the udder is also depending on in which lactation the cow is in, this was showed by Bacic *et al.*(1968). The number of bacteria is increasing with the number of lactations. According to Jayarao *et al.* (2004) does not only a high number of bacteria in the udder affect the health of the cows, with the increased risk of mastitis, it will also reduce the quality of the milk. A high frequency of mastitis that is treated with antibiotic will increase the risk of traces of antibiotic in the milk, which also reduces the milk quality. A theory for the lower amount of TBC in period 2 compared to period 1 could be that during period 1 there was not enough routine in the way the samples were taken. The TBC was also

lower for period 4, this might be due to the fact that experiment had lasted for a long time and the total number of bacterias in the barn was reduced over all. Since the experiment had run for a time, all of the cows had in the beginning of this period experienced the properly precleaning treatment.

The trend of a higher fat percentage during hand milking that was observed in the present study, was also found by Svennersten *et al.* (1990). The amount of fat increases in the end of the milking. The residual milk contains a much higher fat percentages than the normal milk. If the hand milked udder is milked on the residual milk, this could give reason to the higher fat amount. Another theory might be that the stimulation that the hand gives on the udder and teat tip gives a better udder emptying.

The difference between the sampling days in milk protein content could be explained by differences in the feed that the cows were given. The concentrate was fermented in large buckets that were standing in the sun for several days before they were empty. It is a risk that the feed contained non palatable micro organisms that inhibit the feed intake of the cows at some of the feeding opportunities. The feed trough that was used contained crakes that leftover feed was trapped in and had started to grow. This might also reduce the appetite of the cows. Another factor that reduced the feed intake of cow was the heat and the humidity. At some afternoons when the temperature and humidity was very high the cows showed signs of being heat stressed. They were breathing short and quick and rejected the concentrate.

Since the amount of lactose in milk from a healthy udder is very stable and an infected udder has a reduced amount of lactose this could be used as an indicator on the udder health. The percentage of lactose was lowest for treatment A, both in the morning and afternoon milking. It is possible that this indicates that the milk has a lower quality and might be more contaminated than the milk of the other treatments. The A treatment includes several steps where bacteria can enter the milk and udder. For example, the hand of the milker, the open bucket that the milk is collected in and the absence of cleaning the udder before milking and thereby reducing the dirt and bacteria from the udder. Although to the data do not support this theory by significant differences, there is a trend for higher SCC-values for the traditional precleaning during the afternoon milking. As mentioned above, if the treatments would have last for a longer time this might have been more than a trend. The TBC on the other hand would have showed some effects of the treatments despite the short time. This might have been the case, but it is possible that the largest contamination took place somewhere else in the chain. For example if the biggest contamination happened to all treatments and it was so big that is erased the smaller differences in TBC that the treatments might have caused.

A big contamination risk is insufficient cleaning of the equipment. At this farm, the claw of the bucket milking machine was flushed through in the cows water trough after the milking was done. If the washing would have been preformed with some kind of solution and for a longer time, the bacteria growth in the milking machine would be reduced.

Before the milking started the cows were cleaned. This was done by flushing them with water on their udders but also up on their back. The water from the wet fur on the back could during the milking rinse down on the side and on the udder, into the milking claw or down at the hands if the cows were hand milked. For the comfort of the animals this is a positive thing, they get cleaned and cooled down. But the time for cleaning would be better after milking, and only clean the udder directly before milking to prevent dirty water to rinse down from the back.

The bucket milking machine did not have an indicator on when the milking was finished, this was done by palpitations of the udder. In the end of each milking the claw, on the milking machine, was pushed down or drawn to the side in a way of trying to get more milk from the udder, this can damage the udder tissue and make it more woundable to bacteria (Spencer, 1989).

Conclusion

In conclusion, precleaning before milking will probably result in a lower SCC and a higher milk quality. This study can however only show some trends that indicate this. It was found that milking by hand gave a higher milk yield in the afternoon milking, compared with machine milking. It was also shown that the Vietnamese dairy cattle, in total, have a very high SCC.

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The picture at the front page and picture number 2 and 3 is taken by me during the performance of the trial, in the spring of 2007.