MILKING PROCEDURES HAVING AN IMPACT ON MILK SCC

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SUMMARY

Herds with high somatic cell count (SCC) to adopt a short-term goal of reducing SCC as quickly as possible so that milk can be legally marketable and dairy cattle breeding sustainable. Cow's sire, enterprise, lactation, milking equipment and milking operator were fixed in data- base. The duration of each element of the working process was recorded. From these data analysis we can draw that adequate pre- milking preparation of the cow was essential to milk somatic cell count as well as over-milking ($P<0.001$). The delay in application of the milking unit increased milk SCC ($P<0.001$).

Key words: somatic cell count, milk quality, affecting factors, milking procedures

INTRODUCTION

Livestock farming systems researchers have developed concepts, methods and tools to address the livestock farming activity as a whole. The success of the modern dairy farm will be dependent on the profitable production of high quality milk. Important factors for the prevention of high milk somatic cell count (SCC) are: post-milking teat disinfection, dry cow therapy, good milking management, treatment of clinical mastitis with antibiotics, and culling of problem cows (Barkema et al., 1998). Researchers (Merril et al., 1987) have determined that a twelve hours interval is the optimal milking interval in the case of twice-daily milking. A correct milking routine includes different working operations: cleaning udders and teats, manual pre-stimulation, fore-milking, attachment of milking unit to cow, removal of milking unit and effective post-milking teat disinfection (teat dipping). The investigations (Calhoun, 1995) have indicated that more than 50% of the working time is spent on milking. Improper and careless milking may result in decreased milk let-down, increased incidence of udder diseases and low milk quality, which are ultimately causing considerable economic loss for dairy producers.

SCC or a parameter derived from this, count is often used to distinguish between infected and uninfected quarters. It has been found that 200,000 cells/ml is the most practical threshold to determine the profitability of dairy farms (Heald et al., 2000; Rogers, 1995). Somatic cells are also present in milk of healthy cows, and the increase in SCC is a normal cellular defence against udder infections (Koivula, 2005). The year 1979 was the beginning of SCC registering in Estonia and from 1987 these data are measured and registered monthly in Estonian milk recording scheme (Pentjärv and Uba, 2004). More and more attention is paid to milk quality. After the accession of the Estonia to the European Union (EU), the demands on milk quality were in compliance with the EU legal limit of 400,000 cells/ml. Similar levels are required in New Zealand and Australia, where Canada established the requirement of a SCC<500,000 cells/ml (Sargeant et al., 1998; Norman et al., 2000).

Estonia faces several problems with SCC affecting milk quality and udder health. In 2005, 26% of cows were culled due to udder diseases and mean milk SCC was between 361,000–435,000 cells/ml on dairy farms in Estonia (Jõudluskontrolli…., 2006). These circumstances give reasons to investigate the influence of milking procedures on SCC in milk.

MATERIAL AND METHODS

Data were collected from five dairy cattle farms, where cows were milked with pipeline milking system. These agricultural enterprises were interested in monitoring and analysis of milkers' working time consumption, to make sure they follow the machine milking regulations. On three farms the cows were milked using the De Laval and on two farms with Rezekne pipeline milking equipment. The De Laval milking system was supplied with automatic cluster remover (ACR).On all dairy cattle farms the cows were milked twice daily.

Monitoring of the work activities of 24 milking operators, who milked the cows selected for our trials, was carried out immediately after control-milking. The duration of each element of the working process was recorded. Data on milk yield, fat and protein content and SCC were collected. The milking routine included the following:

1. Premilking udder and teats preparation (cleaning, washing, drying, massaging and stripping for early detection of clinical mastitis), 2. Cluster attachment, 3. Control of the milking unit and the cow's udder during milking, 4. Over-milking., 5. Machine stripping, 6. Shutting off the vacuum and cluster removal from the cow, 7. Washing of the milking unit, 8. Washing hands and cloth towel, 9. Teat dipping in the sanitising solution immediately after milking.

Additionally were registered the "transition", i. e. the time a milking operator proceeded from one work operation to another, and the moments when the operator was involved in other activities. Stoppages and undone work operations were also fixed.

MS Excel and SAS program was used for data processing.

EXPERIMENTAL DATA AND RESULTS

Present-day milking machines enable the operators to milk cows fast and so that all four udder quarters are milked out. At the same time the regulations of machine milking procedures must be followed. To ensure complete udder evacuation, it is essential to perform careful pre-milking udder preparation, which will induce the release of oxytocin (Bruckmaier, 1998). Randy et al. (1990) investigated milk SCC in 30 Virgina dairy cattle herds and were registered the udder preparation for milking. The analysis of the results revealed, that using of disposable paper towels reduces milk SCC, eliminating the possibility of bacteria transmission from infected cows to healthy ones. It is essential to attach milking unit to a cow promptly. When there is a durable delay in attach of milking unit then shorter will stay a milking time with milk ejection (Merrill et al., 1987; Barkema et al. 1998). After the unit attachment delay the milk ejection is slow, the udder is not emptied and the machine stripping is abnormally long-lasting (Etgen et al., 1987). If the cow is milked at the beginning and in the middle of lactation then it is suggested that the milking unit be attached within 50 seconds after beginning udder preparation. At the end of lactation, it is recommendable to attach the milking unit to a cow a little later (Bruckmaier, 2000).

Table 1. Durations of the basic milking procedures (sec)

Item8	Mean	Standard deviation	Minimum	Maximum
Udder preparation	24,0	6,8	11,0	49,0
Delay in milking unit attachment	5,9	8,9	0	47,0
Machine stripping	22,1	9,7	0	54,0
Over-milking	26,3	24,3	0	108,0

As soon as the milk flow has finished, the milking unit must be removed to prevent over-milking, which is one of the most considerable factor causing mastitis infection. Correct time for machine stripping is when the milk flow is changed incomplete and will start to decrease (Etgen et al., 1987; Randy et al., 1990; Timmermans, 1996). Over-milking may occur immediately after the unit attachment, when the cow's milk let-down reflex is not sufficiently initiated (Calhoun, 1995). Numerous studies have been carried out to investigate the optimum duration of machine stripping. Reneau (1986) recommends that the machine stripping last no more than 30 seconds, whereas Etgen et al. (1987), Barkema et al., (1998) and Calhoun (1995) suggest spending no more than 20 seconds. When the udder is prior adequately prepared for milking, 10–15 seconds of machine stripping per cow is sufficient.

If the udder preparation is insufficient, the machine stripping lengthens significantly (Etgen et al., 1987). Calhoun (1995) and Timmermans (1996) considered the long-lasting machine stripping to be characteristic to the work of these milking operators who devoted less time to udder preparation.

Over-milking of cows occurred with one milking operator using too many milking units i.e. four or more units in pipeline milking system (Calhoun, 1995).

Transition from conventional to machine milking increased the infection rate of mastitis. A teat dip was taken into use teat dip in the United States in 1916 to reduce risk of mastitis and the risk of spreading pathogens. Randy (1990), Nickerson et al. (1990), Etgen et al. (1987), Erskine et al. (1998) and Barkema et al. (1998) recommended to do post-milking teat dip to prevent udder diseases.

Schukken et al. (1992) were investigated the importance of post-milking teat dip in mastitis sickness reducing. In United States 74% of dairy cattle farmers applied post-milking teat dip. They considered essential to apply post-milking teat dip and designated that better results were got when pathogens were *Streptococcus agalactiae* and *Staphylococcus aureus*. Some authors as Randy et al. (1990), Timmermans (1996) and Erskine et al. (1998) recommended to apply post-milking teat dip in cows with increased SCC in milk. On the other hand, Roest (1995) considered useful that post-milking teat dip are applied in all milking cows in each milking immediately after cluster removing. Table 1 presents the duration of the basic work procedures of a milking operator. Operators were devoted to udder preparation meanly 24 seconds, which is less than physiological demands of machine milking. At that some cows were prepared only 11 seconds and the udder preparation was limited then reserved cleaning of teats and foremilk was not strip out.

Attachment of milking unit to a cow was often delayed.

Even 54 seconds were devoted to machine stripping. These milking operators, who economized in pre-milking udder preparation, devoted more time to machine stripping.

It was also studied how the milking operators are able to monitor milking units. As shown in Table 1, they did not manage following each milking unit with sufficient attention, as far as over-milking was observed in several cows. The maximum duration of over-milking was 108 seconds. Teat dipping was used by 19 milking operators out of the 24 participating in the monitoring focused on the work operations of the milking operators. In all cases the method used for post-milking teat dipping was a teat dip in deso cup filled with the disinfectant solution.

Relationships between work operations performed during machine milking were studied (table 2).

Table 2. Connections between working operations doing in machine milking

Item	Machine stripping	Over-milking	Delay
Udder preparation	–0,294***	–0,429***	–0,235***
Delay in application of a milking unit	0,356***	0,432***	
Over-milking	0,597***		

***P<0.001

The shorter was the pre-milking udder preparation, the more time took the machine stripping (r=–0.294***).

A significant positive correlation (r=0,356***) was observed between the delay in application of a milking unit and machine stripping. It is also apparent from the data in Table 2 that if milking operator ignores a single milking procedure, this will influence the rest of milking procedures as well.

Table 3. Correlation between the items

Item	Udder preparation	Delay in application of a milking unit	Machine stripping	Over-milking
SCC, 10^3/ml	–0,304***	0,192***	0,267***	0,422***

*** – P<0.001

Correlation analysis was used to estimate the importance of a certain routine to be followed in a milking process. Table 3 reveals the correlations between the items. All the basic milking procedures influenced the milk SCC. A significant connection was between over-milking time and SCC (P<0.001). Hence, the less the milking machines were followed, the higher was SCC per millilitre of milk, resulting from over-milking of teats. In practice, it is important to make sure how many milking units can be adequately handled by one milking operator during milking process.

A significant relationship was observed between udder preparation for milking and milk SCC. The shorter was the udder preparation for milking, the higher was milk SCC (P<0.001). From these data analysis observed, that the delay in applying the milking unit influence the milk SCC (P<0.001).

There was detected connection between machine stripping and milk SCC. Whatever more time a milking operator was spent to machine stripping then higher was milk somatic cell count (P<0.001).

CONCLUSIONS

The data analysis indicated that all the basic milking procedures affected milk SCC. A significant relationship was observed between over-milking and milk SCC (P<0.001). The shorter was the udder preparation for milking, the higher was the milk SCC (P<0.001), which proves that the delay in applying the milking unit to the cow has an impact on milk SCC (P<0.001). The more time a milking operator spent on machine stripping, the higher was the milk somatic cell count (P<0.001).

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