EFFECT OF VARIATIONS IN SOMATIC CELL COUNT ON CHEESE YIELD ON THE STARA PLANINA IN SERBIA

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ABSTRACT
Milk somatic cell count is a constant topic of discussion within the dairy industry. It can be a complex and confusing issue, yet it is important that dairy producers understand the importance of somatic cell counts and the relationships between cell counts and other factors. Somatic cell counts have legal, animal health, milk quality and productivity implications and each is important. Years of study of this topic have provided scientists a good understanding of the infection process and the normal body response. The influence of variation in milk composition, SCC, psychotropic bacteria count and chemical composition of milk were investigated. Milk was collected from a group of 10 to 15 cows at a single milking and separately from each cow, cooled at 4 °C and a SCC was determined for milk from each cow with microscopic methods. The SCC of the combined milk on day first was detected. During the manufactured of cheese whey titratable acidity and curd pH were examined. Standard plate and psychrotrophic bacteria count were determined for each batch of raw milk used for cheese making. Variation in milk composition and milk SCC caused changes in the coagulation time of milk. The somatic cell count of milk (SCC), which increases dramatically in mastitis, is also known to influence the ripening and quality of cheese, due to greatly elevated levels of plasmid and lysosomes are cellular organelles that contain hydrolase enzymes - derived proteolytic enzymes.

Keywords: *somatic cells, cheese yield, Stara Planina.*

1. INTRODUCTION

Mastitis causes economic losses for dairy farmers due to reduced milk yields (1, 5). During mastitis, milk SCC increases, and milk composition and functional composition change (3, 2). Dairy cows have evolved a complex internal body system that enables them to defend and rid themselves of threats such as those posed by invading bacteria. They have the ability to mobilize and direct bacteria fighting cells to the udder if a bacterial infection commences in the gland. These cells termed," somatic cells or leucocytes" move to the infection site and initially act to minimize the infection and then eventually they help eliminate it. Somatic cells are equipped with a variety of tools to accomplish this task initial step taken by the body in limiting the extent of an infection is determining when to move somatic cells to the infected region. Whenever infection develops there is inevitably some tissue damage which releases a variety of different chemical compounds into the system. The body detects and interprets the presence of such materials as a call to action and very rapidly, large quantities of somatic cells are directed to the infection site. Once at the infection site they have to locate the invading bacteria. Again the body has evolved a mechanism that is quite effective in doing so. It is not absolutely foolproof and a cell may mistake a milk fat droplet for bacteria, but for the most part, it can recognize the bacteria and move in on them. Somatic cells, after contacting the bacteria, tend to lock on and envelope or internalize the bacteria. This process of internalization is referred to as phagocytosis. Once bacteria are internalized the cells proceed to destroy them by using various mechanisms including a number of enzymes capable of digesting bacterial components. When successful they can stop an infection before it becomes severe enough to cause major problems and that is the desired result. High SCC milk produced by cows with mastitis will give lower cheese yield and (7, 8) increased loss of milk. Reduced cheese yield and an increased incidence of cheese quality defects from high SCC milks cause economic losses for cheese manufacturers. The objective of this study was to determine the quantitative relationship between milk SCC and Katchaval cheeses yield, cheese yield losses and cheese composition over the range from less than 100.000 to approximately 400.000 cells/ml of milk.

2. MATERIAL AND METHODS

Milk was collected separately from each Simmental breed cows, cooled at 4 °C and a SCC was determined for milk from each cow with microscopic methods. After collecting raw milk samples, SCC tests were applied within 24 h by direct microscopy. Used strain was composed of 0.6 g of certified methylene blue chloride to 52 ml of 95% ethyl alcohol, 44 ml of tetrachlorethane and 4 ml glacial acetic acid. Total number of fields counted per slide was 40 and the Working Factor (WF) was 13255. Milk was collected from a group of 10 to 15 cows at a singl milking. The SCC of the combined milk on day first was detected. 19 batches of milk with SCC ranging from less than 100.000 to

400.000 cells/ml were used. Milk was tested for protein (total nitrogen) by Kjeldahl (4, 6), % of fat and % of casein (9, 10). Standard plate and psychotropic bacteria count were determined for each batch of raw milk used for cheese making. All analyses of milks were done in duplicate. For milk samples analyzed during the cheese making process, buffers used for standardizing the pH meter and electrode in its storage solution were tempered to the same temperature as the milk and whey samples (31 to 38 °C).

High milk SCC is associated with increased rennet coagulation time and a slower rate of curd firming during cheese making. The level of activity of endogenous proteases in milk increase during mastitis .The enzyme plasmin is important in dairy product processing because of its heat stability. Plasmin may play a role in gelatin and spoilage of cheese, and dairy products. Very significant proportion of proteolitic damage occurs to milk casein happens in the mammary gland prior to milking.

3. RESULTS AND DISCUSSION

For ease of summary and presentation of the results, average values are presented for three ranges of milk SCC less or equal to 100.000, 130.000 to 400.000 cells/ml. Average days in milk were similar for cows producing milk in two SCC ranges in Table 1.

Table 1. Number of butches of milk for cheese making, SCC.

SCC x 1000cells/ml	Number of batch of milk for cheese making	SCC x 1000cells/ml
Less to 100	10	67
From 130 to 500	6	408
Up to 400	3	814

It must be noted that milk at different SCC levels and within SCC levels were collected from different groups of cows and, therefore total milk fat and protein levels be expected to vary independent of milk SCC. In another research of milk composition was designed to determine the impact of SCC on milk fat and protein percentages, the protein percentage increased and percentage of fat decreased slightly with increased milk SCC Table 2.

Table 2. Composition of milk used for manufactured cheese

SCC x 1000 cells/ml	Number of batches	Fat in %	Protein in %	Casein in %
SCC less 100	10	3,75	3,27	2,54
130 to 150	6	3,34	3,34	2,52
Up to 400	3	3,25	3,40	2,56

Milk bacteria count was low in Table 3 but average bacteria count in high SCC milks was high than low SCC milks even though milk cooling and handling conditions were identical. Total bacteria count and psychotropic bacteria count increased with increasing milk SCC. However milk psychotropic bacteria counts for all milks were lower than 3 x 10^{5} than the lowest level (i.e. 1x10^{7}) reported to cause decreased cheese yield. There is a relationship to the milk producing capability. Based on analysis of large amounts of data it is apparent that in second and later lactation cows each time the SCC doubles, above 200,000 cells/ml, the level of milk production drops approximately. Infected cows have elevated cell counts and diminished production due to tissue damage. When the somatic cells destroy bacteria, left behind are enzymes that have been involved in the process. These enzymes are often resistant to pasteurization procedures and can cause milk fat and protein damage. This can result in serious off-flavors in milk that consumers find objectionable. It also may reduce shelf life significantly, even when milk is kept properly refrigerated. Bacteria counts of raw milk used for cheese we making are shown on table 3.

Table 3. Bacteria counts of raw milk used for cheese making

SCC x 1000cells/ml	Number of batches	Psychotropic bacteria count cfu/ml x 1000
SCC less 100	10	1,5
130 to 150	6	5,6
Up to 500	3	6,6

At milk SCC les 100.000 cells/ml cheese yield efficiency were high. Cheese yield efficiency was significantly lower

when milk SCC was lows than 130.000 cells/ml.
Somatic cell counts are used as an index of milk quality for cow milk. Direct, as well as indirect, cell counting techniques have become invaluable in detecting and confirming mastitis. Variation in milk composition which is dependent on stage of lactation , age of cow, month of sampling, genetic variant, influences coagulating properties of milk. Changes in milk composition due to various degrees of mastitis, which are associated with levels of SCC, are well established (1, 2).
Cell counting on bulk milk is now carried out in most States where the results are generally used as an indicator of the level of mastitis in herds and helps to encourage farmer awareness of the disease. Complete examination of all quarters, including microbiology, is expensive, and is a major reason for the wide acceptance of the number of somatic cell (8, 9).
A significant decrease of casein due to increased SCC in milk may contribute to alteration in the cheese making process. Mastitis milk likely has inferior coagulation properties, which would lead too poor yield and quality of cheese. In Table 4 shows some of the changes in milk fat and related components as reported by Randolf and Irwin.

Table 4. Influence of mastitis on milk fat and related components

Measurement	MT< 10	MT<20	Change
Milk fat (%)	3,45	3,20	-
Phospholipids (mg/g fat)	4,78	3,55	-
Free fatty acids (mg/g fat)	23,27	34,10	+
Lipase activity	1,49	1,73	+
Acid degree value	0,64	1,17	+

The explanation for the significance of the milk fat changes is not completely clear. Decreased fat content could be explained by reduced fat synthesis due to injury to secretors cells. Phospholipids appear to be synthesized in the gland also, so the same explanation could be applied to their decline. Phospholipids content of the fat globule membrane is also reduced and thus may reduce protection of the fat against lipolysis. The increased lipase may be related to changes in the concentration of milk lipase secreted or to the incised leucocytes, which apparently have lipase activity. The lowered phospholipids and increased lipase content would support the suggestion that mastitis may contribute the development of hydrolytic rancidity in milk (3, 4).
Research has demonstrated that an uninfected cow can have a milk SCC well below 100,000/ml and herds, with low infection levels, may have overall herd cell counts below 100,000. Such levels are an indication of low infection rates and a general indication that many things are being done correctly. When the overall SCC reaches approximately 200,000/ml it is an indication that a certain low number of cows are infected. In table 5 summarizes the differences in milk.

Table 5. Measurement normal milk composition, high cell, difference and normal milk composition

Measurement	Normal milk composition (%)	High cells (%)	Difference (%)	% of Normal
Total solids	13,1	12,0	-1,1	92
Lactose	4,7	4,0	-0,7	85
Fat	4,2	3,7	-0,5	88
Chloride	0,91	147	+0,0056	161
Total protein	3,6	3,6	0	100
Caseins	2,8	2,3	-0,5	82
Whey protein	0,8	1,3	+0,5	162
Sodium	0,044	0,060	+0,016	136
pH	6,6	6,9	0,3	105
Potassium	0,172	0,157	-0,0157	91
Lipase activity	1,49	1,73	0,24	116
Acid degree value	0,64	1,17	0,53	183

High SCC levels are abnormal and undesirable. Elevated SCC levels may results from several factors or a combination of these factors: the mammary gland is infected with mastitis causing organisms, caw age and stage of lactation, stress and season, udder injury and indirect causes.

4. CONCLUSION

The number of somatic cell is very important for the yield of cheese and its quality. The result of this study and those of other investigators provide a better understanding of haw mastitis and increasing milk SCC influences cheese yield. It is clear from this study ant those (3,2,11,12) that milk produced by individual caws with milk SCC <- 100,000 cells/ml has different functional characteristics for cheese making than with milk with SCC >100.000 cells/ml.(6,7) This study has also demonstrated that milk age has an influence on cheese yield and cheese making , even when the total and psychrothrophic bacteria count of the milks are well below those considered to influence cheese yield negatively. One generally accepted conclusion is that the concentration of somatic cells, in the milk, is directly related to the infection status of the udder. High SCC milk may also produce a cheese that is of lesser quality. It is therefore in the best interest of everyone to produce milk with a low somatic cell count.

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