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CHANGES OF QUALITY OF SEMIHARD CHEESES DEPENDING ON THE SOMATIC CELL COUNT (SCC)

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The quality of milk is influenced, beside seasonal variations, by the state of health of the mammary gland. Subclinical forms of mastitis cause changes in milk chloride content, decreases in milk fat and lactose, and increases in the activity of proteolytic and lipolytic enzymes. These changes in milk quality cause certain problems in cheese manufacture. The aim of this work was to investigate the relationship between increasing somatic cell count (SCC) in pooled milk samples and the quality of semihard cheeses.

The results obtained confirmed that the time of coagulation of milk directly depended on SCC. The quality of cheese curd and cheeese produced from milk samples with different SCC also depended on SCC. The decrease of pH during cheese manufacture was slower in cheese curd with higher SCC. Analysis of whey demonstrated increasing loss of proteins in the whey with higher SCC. These results confirmed that physicochemical and bioecological processes are different in milk with increased SCC, which results in changes in the quality of cheese.

Key words: Somatic cells, cheese, milk

INTRODUCTION

The quality of milk products directly depends on the quality of the milk used, which varies with season, diet and stoge of lactation. Besides these factors the quality of milk is highly influenced by the state of health of the mammary gland.

The somatic cell count (SCC) is the most useful parameter of mammary gland health status. Brolund. (1985) established that the diagnostic importance of SCC in milk, depends on the method of investigation, stage of lactation, time of sampling, volume of milk and type of pathogenic bacteria (Schukken et al., 1989).

Subclinical forms of mastitis in the milk industry lead to major economic problems, because loss of milk during lactation may be as high as 20% (Tyler et al., 1989, Petrović, 1984). Besides the loss of milk very important, changes also occur in its composition, which may be expressed as a change in the chloride level and decreased percentages of milk fat, lactose and dry matter, while the activity of and proteolitic lipolitic enzimes may be increased (Fox et al., 1985, Preez et al. 1987, Renner 1975, Schaar et al., 1986, Heeschen et al., 1987, Murphy et al., 1989). Moreover, changes in casein, that occur during subclinical mastitis, are expressed as a decrease in α and β-casein and an increase in γ and κ- casein. These postsecretory consequences of increased proteolysis in mastitis milk (Bsrry et al., 1981) may result in 5-10 times greater amounts than in normal milk. Such changes in milk quality cause many problems in the milk industry like loss of quality, and weak syneresis of cheese curd and changes in the flavour and odour of the final cheese. The aim of this research was to determine the relationship between SCC of pooled milk samples and the quality of semihard cheeses.

MATERIAL AND METHODS

The material used in this investigation was pooled milk with different somatic cell counts (200, 300 and 700 thousand cells/ml). Milk samples were obtained by one milking from cows in one stable. All milk analyses were repeated six times. The composition of the milk was determined using Milko-Scan (MSc, Foss Electronics). Somatic cell count were determined on a Fossomatic apparatus, model 15600 (A/S N. Foss Electronics) The characteristics of the cheese curd and the quality of the cheese produced were defined using the methods reguired by the regulations.

RESULTS AND DISCUSSION

The suitability of milk samples with different SCC for cheese manufacture was determined in two phases. During the first phase the time of milk-clot formation, the characteristics of the cheese curd, and the composition of the whey were determined, and during the second phase the quality of the cheese.

Table 1. Time of milk-clot formation in dependance af SCC.

Parameters	time of milk-clot formation in milk samples with different SCC (000/ml)		
	200 X±s	300 X±s	700 X±s
time of milk-clot formation (sec)	1017±46	1081±88	1178±78

The results presented in Table 1. show that the mean time of milk-clot formation was 161 seconds longer in milk samples with the highest SCC, compared to milk with the lowest SCC. The characteristics of the milk-clot after coagulation are presented in Table 2.

Table 2. Characteristics of milk-clots after coagulation in relation to SCC.

Parameters	Characteristics of milk-clots after coagulation of milk with different SCC (000/ml)		
	200	300	700
	$\bar{X}\pm s$	$\bar{X}\pm s$	$\bar{X}\pm s$
Total solids	27,32±4,76	27,94±1,98	24,45±1,28
Water	72,68±4,76	72,06±1,78	76,54±1,22
Fat	14,75±3,18	13,58+2,09	11,66±0,57
Fat/TS	53,79±2,26	48,55±5,67	49,78±2,06
Solid non fat	12,57±1,58	14,36±1,73	12,78±1,74
pH	6,67±0,11	6,73±0,15	6,82±0,07

The chemical characteristics of milk-clots after coagulation showed a direct association with SCC in the milk. The milk clot dry matter, fat and fat in dry matter showed differences as high as 10% between the samples with high SCC compared to the samples with normal SCC.

During the second phase alterations in the composition of the milk-clot after pressing as well as changes in young cheese were investigated. Differences in the composition of the whey obtained after the milk-clot removal are presented in Table 3.

Table 3. Composition of whey in relation to SCC.

Parameters	Composition of whey from milk with different SCC (000/ml).		
	200	300	700
	$\bar{X}\pm s$	$\bar{X}\pm s$	$\bar{X}\pm s$
Total solids	7,36±0,30	7,07±0,36	7,05±0,28
Fat	0,65±0,29	0,56±0,21	0,66±0,30
Total protein	0,96±0,02	0,96±0,02	1,03±0,02
pH	6,60±0,09	6,65±0,05	6,63±0,06

It was confirmed that milk fat and proteins were lost with the whey and that the loss was increased in milk with higher SCC. The unfavourable influence of milk with altered composition on the characteristics of the milk-clot after pressing are presented in Table 4.

The retention of water was highest in milk-clots obtained from milk with the highest SCC. In the same milk-clots the relationship between fat in the original sample and in the total solids was altered. An important observation is that the change in pH was the lowest in milk with the highest SCC. The characteristics of unripe cheese from milk with different SCC are presented in Table 5.

Table 4. Characteristics of milk-clots after pressing in relation to SCC.

Parameters	Characteristics of milk-clots from milk with different SCC (000/ml) afterpressing		
	200	300	700
	$\bar{X} \pm s$	$\bar{X} \pm s$	$\bar{X} \pm s$
Total solids	48,87±3,74	48,26±2,29	46,78±1,66
Water	51,13±3,74	51,73±2,29	53,22±1,66
Fat	25,00±4,24	24,50±3,53	22,02±2,82
Fat in total solids	50,07±4,74	50,76±3,94	47,89±/,26
Solid-non-fat	23,87±0,49	23,64±0,31	24,89±1,96
pH	6,60±0,14	6,66±0,15	6,71±0,02

Table 5. Chemical characteristics of unripe cheese manufactured from milk with different SCC (000/ml).

Parameters	Chemical composition of unripe cheese in relation to SCC (000/ml)		
	200	300	700
	$\bar{X} \pm s$	$\bar{X} \pm s$	$\bar{X} \pm s$
Total solids	57,07±1,35	56,40±1,29	55,08±0,54
Water	42,93±1,36	43.59±1,59	43,91±0,54
Fat	28,00±1,41	25,33±2,52	25,50±2,18
Fat in total solids	49,04±1,32	44,83±3,72	46,31±4,36
Solid-non-fat	29.07±0,05	31,07±1,76	29,75±2,56
pH	5,35±0,21	5,43±0,32	5,50±0,20

The changes in chemical composition which were observed in previous phases of cheese manufacture are also evident here. The percentage of water retention was increased and the percentage of dry matter was decreased in cheese manufactured from milk with increased SCC. Changes in cheese composition were evident in the quality of the fat in the original milk samples and in the cheese dry matter. Changes in the pH of unripe cheese show the activity of lactogenic microorganisms during milk processing and cheese manufacture. That activity of lactogenic microorganisms has great significance, during cheese manufacture, when the pH of the milk-clot decreases to a level that inhibits the growth of undesirable microorganisms in the cheese (Milić 1991).

When the pH remains at a level not enough to establish a sufficiently acid environment, there is a possibility for the development of other microorganisms, which may be pathogenic bacteria, if, according to the traditional way of cheese manufacture, cheese is produced from nonpasteurized milk. More intensive reproduction of microorganisms in cheese is encouraged by the water that remains after the unsatisfactory syneresis of the milk-clot. The results presented in this work show that undesirable changes in quality are evident if cheese is produced from milk with more than 300000 somatic cells/ml.

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PROMENE KVALITETA POLUTVRDIH SIREVA U ZAVISNOSTI OD BROJA SOMATSKIH ĆELIJA U MLEKU

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SADRŽAJ

Na kvalitet mleka pored sezonskih varijacija utiče i zdravstveno stanje mlečne žlezde. Subklinički mastiti prouzrokuju promene sastava mleka koje se ispoljavaju promenom količine hlora, smanjenom količinom masti i laktoze a povećava se aktivnost proteolitičkih i lipolitičkih enzima. Ove promene kvaliteta mleka uzrok su određenih problema u proizvodnji sireva.

Cilj rada je da se utvrdi zavisnost između povećanog broja somatskih ćelija u zbirnom mleku i kvaliteta polutvrdih sireva.

Dobijeni rezultati su potvrdili da je vreme koagulacije mleka direktno zavisilo od broja somatskih ćelija u mleku. Kvalitet gruša i sira dobijeni iz mleka

sa različitim brojem somatskih ćelija, takođe je zavisio od broja ćelija u mleku. Opadanje pH tokom proizvodnje sira je sporije u grušu sa povećanim brojem ćelija. Analizom surutke utvrđeno je da je zaostajanje belančevina veće u surutki sa većim brojem somatskih ćelija. Ovi rezultati su potvrdili da je mleko sa povećanim brojem somatskih ćelija promenjen supstrat u kojem se fizičko-hemijski i bioekološki procesi odvijaju različito što dovodi do promena u kvalitetu sira.