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# The influence of somatic cell count on sheep milk composition and cheese-making properties

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**RIASSUNTO** – Influenza del contenuto in cellule somatiche sulla composizione del latte ovino e sulle caratteristiche del formaggio. *Allo scopo di valutare gli effetti del contenuto in cellule somatiche (CCS) sulla qualità del latte e del formaggio Pecorino, è stata condotta una prova in un allevamento di ovini Valle del Belice. Da febbraio a luglio, ogni 15 d, il latte di tutte le pecore in lattazione è stato analizzato per il CCS in modo da ottenere due tipi di latte, a basso (<1.000.000) ed alto (da 1.000.000 a 3.000.000) tenore in cellule. Sul latte di massa sono state effettuate le analisi chimiche (grasso, frazioni azotate, urea, lattosio, calcio, fosforo), citologiche (carica batterica, CCS), fisiche (pH, acidità titolabile, punto crioscopico) e tecnologiche (r, $a_{30}$ e $K_{20}$). Il latte di massa è stato caseificato separatamente per tipo di latte. I risultati hanno evidenziato una marcata influenza del CCS sulla qualità del latte, in accordo con quanto riportato in letteratura; nessuna influenza è stata osservata sui formaggi freschi e stagionati.*

**Key words:** somatic cell count, milk quality, Pecorino cheese.

**INTRODUCTION** – Somatic cell count (SCC) is an important tool for monitoring intramammary infections in dairy cows. However, systematic generalization of this decision rule is not easy in small ruminants. Determination of SCC in sheep milk is important for the processors of milk (indicator of quality), for breeders (mastitis indicator) and could be useful for selection as well. SCC value can be affected by some non-infective factors such as breed, stage of lactation, parity, type of lambing, type of milking, etc. (Bergonier *et al.*, 1994), as well the health status of the udder (Fruganti *et al.*, 1985; Ranucci *et al.*, 1988). In addition, EC Directive 92/46, which regulates the production and commercialisation of milk and dairy products, imposes strict limits on SCC from dairy cattle but it does not dispel the uncertainty over recommended SCC levels in small ruminants. With the aim of knowing more about somatic cells count and their effects on milk quality and cheese-making properties an experimental trial was carried out.

**MATERIAL AND METHODS** – The individual milk samples of 88 Valle del Belice breed ewes were pooled at the morning milking with the aim to screen for SCC. On the basis of these results, at the evening milking and at the following morning milking the individual milk samples were collected in two kinds: low (<1,000,000 SCC/mL) and high (from 1,000,000 to 3,000,000 SCC/mL) level. Bulk milk samples were collected fortnightly, for each group, from 14 February to 04 July for eight trials altogether. Each milk sample was divided into three aliquots and sent to the laboratories taking part in the study. The pH and the titratable acidity (°SH/50 ml) of milk samples was checked at 20°C, 1 h after their arrival at the laboratory. Milk fat, protein, lactose and somatic cells were determined by Combyfoss (Foss Italia). The bacterial count was determined by Bacto-Scan 8000S (Foss Italia). Total protein, casein, whey protein and non protein nitrogen contents were assessed according to

the official methods (AOAC, 1990). The Urea content was determined by CL10 which uses the pH-differential, while the freezing point was determined by Cryoscopy Astor. The renneting parameters, clotting time (r), firming time ($K_{20}$) and curd firmness after 30 minutes ($a_{30}$), were determined by Formagraph (Foss Italia), using the method of Zannoni and Annibaldi (1981). Eight cheese-making for each milk group were made according to the traditional production of Sicilian Pecorino-cheese (Gattuso, 1994) and two cheeses (Tuma, after 24 h of ripening and Pecorino, after 3 months of ripening), from each group, were produced. The Tuma and Pecorino cheeses were analysed for DM, crude protein, ether extract and to determine total calcium and phosphorus content. The statistical analysis was conducted by a two factor ANOVA model, where the first factor was the data of cheese-making (1.8) and the second factor was the group of somatic cells (HIGH and LOW). In the tables are reported the LSM only for the group of somatic cells and not for data of cheese-making, that was added to the model which important source of variability.

**RESULTS AND CONCLUSION** – The results of the physical-chemical parameters of bulk milk concerning the two groups are showed in Table 1. During the experiment, the mean of bulk milk SCC (expressed as $log_{10}$) of the two groups was respectively 6.40 and 5.56 for high and low group. The percentage of the ewes present to the high and low group were 69% and 19% respectively. Milk fat percentages resulted higher in the low group in accordance with the literature (Duranti and Casoli, 1991; Pulina *et al.*, 1991; Todaro and Scatassa, 2001). The nitrogen fractions did not present significant differences by group with the exception of urea that resulted lower for milk with high SCC. The lactose percentage was influenced by SCC, in fact the milk of high group presented a significant lower lactose percentage in accordance with the recent literature (Pulina *et al.*, 1991; Kalantzopoulos, 1994; Pirisi *et al.*, 1994; Di Marco *et al.*, 1997).

Table 1. Effect of somatic cell count on milk quality.

| | High level | Low level | SE |
|---|---|---|---|
| Somatic Cell Count ($Log_{10}$) | 6.40 A | 5.56 B | 0.142 |
| Fat (%) | 6.29 B | 6.92 A | 0.142 |
| Protein (%) | 5.27 | 5.32 | 0.140 |
| Casein (%) | 4.25 | 4.39 | 0.072 |
| Whey Protein (%) | 1.08 | 1.03 | 0.086 |
| Non Protein Nitrogen (%) | 0.06 | 0.06 | 0.003 |
| Urea (mg/dl) | 31.69 B | 33.07 A | 0.303 |
| Lactose (%) | 4.38 b | 4.71 a | 0.085 |
| Total Bacterial Count ( $Log_{10}$) | 5.89 | 6.04 | 0.067 |
| pH | 6.79 A | 6.68 B | 0.006 |
| Titratable acidity (°SH/50 ml) | 3.66 | 4.38 | 0.263 |
| Calcium (g/l) | 1.89 | 1.93 | 0.028 |
| Phosphorus (g/l) | 1.42 | 1.35 | 0.030 |
| Freezing point (°C) | -0.553 | -0.557 | 0.001 |
| r (min) | 24.11 a | 18.96 b | 1.181 |
| $K_{20}$ (min) | 2.38 | 1.45 | 0.095 |
| a30 (mm) | 35.50 | 51.54 | 5.325 |
| Non reactive milk samples (%) | 62.50 | 12.50 | - |

On the row different letters are significant at P≤0.05; capital different letters are significant at P≤0.01.

The milk SCC increase is accompanied by a significant increment of the pH value (P<0.01) and a decrease of titratable acidity, even if the differences between groups did not result statistically different. Calcium and phosphorus content did not result statistically significant between groups, in partial accordance with results obtained by Pirisi *et al.* (1994) that showed statistic differences only for milk phosphorus content. The somatic cells influenced markedly the lactodynamographic parameters of the milk, the milk of high group presents a very significant (P<0.05) increase for clotting time (r) and a marked decrease of curd firmness (a30); another, the no-reactive milk samples resulted higher for high SCC group (62.50 *vs.* 12.50%). The effects of milk SCC on

lactodynamographic parameters are in full accordance with the literature (Duranti and Casoli, 1991; Pellegrini *et al.*, 1994; Pirisi *et al.*, 1994; Caracappa *et al.*, 2000; Todaro and Scatassa, 2001).
Results of chemical analysis of Tuma and Pecorino cheeses are reported in table 2. No statistical differences were found for cheeses of the two groups, in accordance with Pirisi *et al.* (1994). The results of this preliminary study confirmed that exist a remarkable influence of SCC on bulk ewe milk composition and lactodynamographic parameters. On the contrary, in accordance with results reported by other authors (Pirisi *et al.*, 1994), no significant differences were found on cheeses chemical composition.

Table 2. Effect of somatic cell count on Tuma cheese yielded and on Tuma and Pecorino chemical composition

| | High level | Low level | SE |
|---|---|---|---|
| **Tuma cheese** | | | |
| Milk destined to cheese making (kg) | 9.05 | 9.12 | 0.094 |
| Weight of cheeses after 24 h (kg) | 1.56 | 1.55 | 0.020 |
| Yield in cheese (%) | 17.26 | 17.11 | 0.259 |
| Dry matter (%) | 55.18 | 58.97 | 1.377 |
| Ether extract (% DM) | 47.94 | 47.80 | 0.735 |
| Crude protein (% DM) | 44.20 | 43.70 | 0.632 |
| Ash (% DM) | 5.63 | 6.46 | 0.357 |
| Calcium (mg/100g) | 1625 | 1595 | 34.026 |
| Phosphorus (mg/100g) | 1022 | 1019 | 11.961 |
| **Pecorino cheese** | | | |
| Dry matter (%) | 68.66 | 69.12 | 0.492 |
| Ether extract (% DM) | 48.00 | 47.86 | 0.679 |
| Crude protein (% DM) | 43.14 | 43.37 | 0.694 |
| Ash (% DM) | 6.46 | 6.28 | 0.127 |
| Calcium (mg/100g) | 1496 | 1479 | 19.877 |
| Phosphorus (mg/100g) | 981 b | 1031 a | 12.435 |

On the row different letters are significant at P≤0.05; capital different letters are significant at P£0.01.

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