

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

P. Giaccone¹, M.L. Scatassa², M. Todaro¹

¹ Dipartimento Scienze Entomologiche, Fitopatologiche, Microbiologiche agrarie e Zootecniche, Università di Palermo, Italy

² Istituto Zooprofilattico Sperimentale della Sicilia "A. Mirri", Palermo, Italy

Corresponding author: Massimo Todaro. Dipartimento Scienze Entomologiche, Fitopatologiche, Microbiologiche agrarie e Zootecniche, Sezione di Produzioni Animali. Viale delle Scienze 13, 90128 Palermo, Italy – Tel: +39 091 7028861 – Fax: +39 091 7028873 – Email: zootmax@unipa.it

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 (K₂₀) and curd firmness after 30 minutes (a₃₀), 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 log₁₀) 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
a ₃₀ (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 $P \leq 0.05$; capital different letters are significant at $P \leq 0.01$.

ACKNOWLEDGEMENTS – Research funded by MIPAF (Prof. Portolano B.). Authors thanks Mr. Nicolò Lo Bue for his support.

REFERENCES – AOAC., 1990. Official Methods of Analysis. 15th Edn. AOAC. Arlington. **Bergonier**, D., Lagriffoul, G., Berthelot, X., Barillet, F., 1994. Facteurs de variation non infectieux des comptages de cellules somatiques chez les ovins et caprins laitiers. Proc. Int. Symp. Somatic cells and milk of Small Rum., 113-135. **Di Marco**, V., Portolano, B., Todaro, M., Giaccone, P., Caracappa, S., 1997. Le cellule somatiche del latte ovino in relazione ai fattori ambientali, alla produzione, al CMT e all'esame batteriologico. Arch. Vet. Italiano 48 (5-6):165-174. **Duranti**, E., Casoli, C., 1991. Variazione della composizione azotata e dei parametri lattodinamografici del latte di pecora in funzione del contenuto di cellule somatiche. Zoot. Nutr. Anim. 17 (2):99-105. **Fruganti**, G., Ranucci, S., Tesei, B., Valente, C., 1985. Variazioni di alcuni costituenti del secreto mammario di pecore in rapporto a momenti diversi della lattazione ed allo stato sanitario della mammella. Atti SIPAOC, 6:185-195. **Gattuso**, A.M., 1994. "Pecorino Siciliano", Sci. Tecn. Latt. Cas. 45:185-192. **Kalantzopoulos**, G., 1994. Influence de la présence de cellules somatiques on lait et la qualité des produits laitières. Proc Int. Symp. Somatic Cells and milk of Small Rum., 231-237. **Pirisi**, A., Piredda, G., Podda, F., Pintus, S., 1994. Effect of somatic cell count on sheep milk composition and cheese-making properties. Proc Int. Symp. Somatic Cells and milk of Small Rum., 245-251. **Pulina**, G., Cappio-Borlino, A., Papoff, C.M., Campus, R.L., Rassa, S.P.G., 1991. Influenza della conta cellulare nella valutazione del contenuto proteico del latte di pecore di razza Sarda. Atti ASPA, 9:1009-1017. **Ranucci**, S., Valente, C., Tesei, B., Fruganti, C., Mangili, V., Boni, M., 1988. Sanitary control of sheep udder: total and differential cell controls in milk. Atti S.I.P.A.O.C., 8:81-98. **Todaro**, M., Scatassa, M.L., 2001. La qualità del latte nella razza ovina "Valle del Belice". Ed. Tipografia Ausonia, Palermo. **Zannoni**, M., Annibaldi S., 1981. Standardization of the renneting ability of milk by Form graph. Sci. Tecn. Latt. Cas. 32: 79-94.