

Quantitative and qualitative milk characteristics of Nebrodi goats

A. Zumbo[#], B. Chiofalo, L. Liotta, A. Rundo Sotera and V. Chiofalo

Dept. MO.BI.FI.P.A. - University of Messina, Polo Universitario dell'Annunziata, 98168 Messina, Italy

Abstract

Milk quantity and quality characteristics were investigated in 40 lactating Nebrodi goats of different ages and order of kidding. Every month from the start of the first lactation individual daily yields were recorded and individual milk samples were taken to determine the concentrations of fat, protein and lactose, the somatic cell count (SCC), pH, titration acidity (°SH) and clotting properties, using the parameters r (clotting time), k_{20} (curd firming time) and a_{30} (curd firmness). Results show that the daily milk yield was higher for the goats in the third and higher parity, while the protein and fat levels were higher in the primiparous goats. Goats with multiple kids showed significant higher daily milk yield (942 g vs. 761g), lactose percentage (4.63 vs. 4.73) and SCC (\log_{10} 5.86 vs. \log_{10} 5.63) than does with single kids. The elastometric parameters of the milk from primiparous goats showed higher " r " and " a_{30} " values than older goats. The clotting time and curd firmness of the milk from goats that had multiple kids were higher than from goats with single kids. Pearson's analysis showed a negative correlation between daily milk production and fat and protein percentages ($r = -0.235$ and $r = -0.179$, respectively). A negative correlation between curd firmness (a_{30}) and somatic cell content was observed, but the latter was correlated positively with clotting time, confirming the negative role of these cells on the milk clotting properties.

Keywords: Autochthonous populations, goat, milk quality

[#]Corresponding author. E-mail: alessandro.zumbo@unime.it

Introduction

In Sicily autochthonous breeds are protected by regional politics through local, national and European operative programmes under different Institutions. These are animals that could produce by utilizing marginal areas. From this point of view, autochthonous caprine breeds and populations are well-adapted to these areas. In this region interest in caprine breeding used to be minimal, but is improving. This is probably related both to the utilization of forage resources in the mountain and hilly areas that are not used for other purposes, and to the dietetic and nutritional characteristics of milk, cheese and meat of this ruminant.

In Sicily (Italy) over 200.000 goats are reared. The highest density is in the province of Messina where the animals are reared under extensive conditions in systems of transhumance. These goats possess a wide range of morphological characteristics, even within the same population, called the "Nebrodi goat". It is a rustic and thrifty goat without a well-defined colour. Some are black, but some also have grey and reddish colours. Feeding is on pasture, except during adverse climatic conditions, when the animals need a supplementation of hay and concentrate. The "Nebrodi" or "Messinese" goat, as they are also called, roam free in woody areas and during the winter season are enclosed in yards at night. Genetic improvement on prolificacy and resistance to weather conditions has been practised by breeders, to the detriment of milk production (Giaccone *et al.*, 2001).

Materials and Methods

Forty Nebrodi goats of different ages and order of kidding, belonging to a farm in the province of Messina were used. Feeding was on mixed pastures. Kids were raised in a small shelter and received only their mothers' milk twice daily, at 7:00 and 14:00. Every month from the start of the first lactation the quantity of milk produced was recorded individually at the two daily milkings at 7:00 and 16:00. At the same time individual milk samples were taken to determine fat, protein and lactose concentrations, and a somatic cell count (SCC) with a Combifoss 6200 (Foss Electric) instrument. On each sample the pH, titration acidity (°SH) and the clotting properties were determined according to the parameters r (clotting time), k_{20} (curd firming time) and a_{30} (curd firmness), using a Formagraph (Foss Electric) according to the A.S.P.A. method (1995).

Data were submitted for the statistical analysis using ANOVA (SAS, 2001). Factors considered were parity and type of kidding. Parity of kidding was divided in first, second and the third and over. Pearson's correlation was carried out to analyse for type of kidding (single and multiple).

Results and Discussion

Daily milk yield (Table 1) was higher in the milk of the goats in the third and higher parity of kidding ($P < 0.01$) than in earlier parities, which is in agreement with the results obtained by Giaccone *et al.* (1995) on Derivata di Siria goats in Sicily. The protein and fat percentages were higher in the primiparous goats, characterised by a lower milk production. The SCC was lower ($P < 0.05$) in the milk of the goats in the third and higher parity than for the younger ones.

Table 1 Milk yield and composition (mean values)

Factors		Milk yield	% Fat	% Protein	% Lactose	pH	°SH	Log ₁₀ SCC
Parity	1	681 A	4.75 A	3.87 A	4.70 a	6.72 A	7.35	5.83 A
	2	852 B	4.26 B	3.63 B	4.63 b	6.65 B	7.25	5.86 A
	≥3	1022 C	4.32 B	3.54 B	4.71 a	6.70 A	7.20	5.54 B
Type of kidding	Single	761 A	4.51	3.65	4.73 A	6.69	7.27	5.63 A
	Multiple	942 B	4.37	3.71	4.63 B	6.69	7.26	5.86 B

Means on the same column followed by different letters differ significantly (A, B, C, = $P < 0.01$; a, b, = $P < 0.05$)
 SH - titration acidity; SCC – somatic cell count

Goats with multiple kids compared to those with single kids showed differences ($P < 0.01$) in daily milk yield (942 g vs. 761 g), lactose percentage (4.63 vs. 4.73) and SCC (log₁₀ 5.86 vs. log₁₀ 5.63). The higher milk yield in multiple kidding goats could be explained by the effect of the greater quantity of placental hormones produced during pregnancy and by the suckling kids in multiple kidding goats (Bertoni *et al.*, 1998). As regards elastometric parameters reported in Table 2, milk from the primiparous goats showed higher ($P < 0.01$) values of "r" and "a₃₀" than those registered for the second and the third and higher parity goats.

Table 2 Elastometric parameters (mean values)

Factors		r (min)	k ₂₀ (min)	a ₃₀ (mm)
Parity	1	10.06 A	1.84	41A
	2	8.83 B	1.85	35B
	≥3	9.25 B	1.99	33 B
Type of kidding	1	8.88 A	1.85	35 a
	2	9.88 B	1.93	38 b

r - clotting time; k₂₀ - curd firming time; a₃₀ - curd firmness

Means on the same column followed by different letters differ significantly
 (A, B, = $P < 0.01$; a, b, = $P < 0.05$)

Higher values for clotting time and curd firmness were registered for multiple kid goats. Neither of the two factors influenced the curd firming time. From correlation analysis (Table 3) negative correlations were observed between daily milk production and the fat and protein percentages ($r = -0.235$ and $r = -0.179$, respectively). This agrees with reports by Riggert (1980) and Costantinou (1984). A positive correlation ($r = 0.245$) was obtained between whole milk yield and lactose percentage, in agreement with Riggert (1980) and Kala & Prakash (1990).

The correlation between curd firmness (a₃₀) and somatic cell content was negative, but the latter was correlated positively with clotting time, confirming the negative role played by these cells on milk clotting

properties. The correlations among protein percentage and r and a_{30} parameters ($r = 0.354$ and $r = 0.478$, respectively) were positive. All elastometric parameters were positively correlated with pH.

Table 3 Matrix of correlation coefficients (%)

	Milk yield	Fat	Protein	Lactose	pH	SH	SCC	r	a_{30}	k_{20}
Milk yield	1	-0.235**	-0.179**	0.245**	0,072	0.036	-0.121*	0.151*	0.123*	0,136
Fat		1	0.079	-0.106	0,075	-0.273**	0.235**	0.164**	0.013	0.039
Protein			1	0.304**	0,069	0.496**	-0.146**	0.354**	0.478**	0.040
Lactose				1	0.354**	0.332**	-0.448**	0.209**	0.399**	0.003
PH					1	-0.112*	-0.117*	0.434**	0.216**	0.171**
SH						1	-0.328**	-0.126*	0.318**	-0.103
SCC							1	0,163*	-0.204**	0,106
r								1	0.263**	0.276**
a_{30}									1	-0.081
k_{20}										1

SH - titration acidity; SCC – somatic cell count; r - clotting time; k_{20} - curd firming time; a_{30} - curd firmness
 *P < 0.05; **P < 0.01

Conclusions

Information obtained by this research contributed to the knowledge of the significance of the Nebrodi goat population in Sicily. In fact, milk produced by these goats has unique quality and clotting characteristics, making it better than the milk of specialised dairy goats. All this underlines the role that the goat race and population could play in the utilizing the marginal regions of Sicily.

Acknowledgements

Research financed by P.R.A. - 2002 (Prof. Vincenzo Chiofalo).

References

- A.S.P.A., 1995. Metodi di analisi del latte delle principali specie di interesse zootecnico. Scientific Association of Animal Production, University of Perugia Press, Perugia, Italy. pp. 152-155.
- Bertoni, G., Bernabucci, U. & Rosatini, U., 1988. Rapporto fra indice di gemellarità e produzione lattea in pecore di razza Comisana. Atti VIII Convegno SIPAOC. pp.69-75.
- Costantinou, A., 1984. Studies on the lactation of Damascus goat and growth of their kids. Anim. Breed. Abstr. 52, 336 (Abstr).
- Giaccone, P., Portolano, B., Bonanno, A., Alicata, M.L. & Todaro, M., 1995. Aspetti quanti-qualitativi della produzione lattea nella popolazione caprina Derivata di Siria. Zoot. Nutr. Anim., 21, 97-109.
- Giaccone, P., Todaro, M., Portolano, B., 2001. La capra dei Nebrodi, Eds. Ist. Zootec. Gen., Facoltà di Agraria- Università di Palermo.
- Kala, S.N. & Prakash, B., 1990. Genetic and Phenotypic parameters of milk yield and milk composition in two Indian goat breed. Small Rumin. Res. 3, 475-484.
- Riggert, E.H., 1980. Milk yield of German improved fown goats in lactations, 1-8 Anim. Breed. Abstr., 48, 360 (Abstr).
- SAS, 2001. Statistical Analysis Systems user's guide (Version 8.2). SAS Institute Inc., Cary, North Carolina, USA.
- Zumbo, A., Chiofalo, L. & Liotta, L., 2000. La Capra Argentata dell'Etna. L'allevatore di ovini e caprini. 1, 1-2.