

**Milk sheep quality variations during lactation in grazing and confined reared ewes**

Pistoia A., Poli P., Casarosa L., Balestri G., Ferruzzi G.

*in*

Priolo A. (ed.), Biondi L. (ed.), Ben Salem H. (ed.), Morand-Fehr P. (ed.).  
Advanced nutrition and feeding strategies to improve sheep and goat

Zaragoza : CIHEAM

Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 74

2007

pages 203-207

Article available on line / Article disponible en ligne à l'adresse :

<http://om.ciheam.org/article.php?IDPDF=800380>

To cite this article / Pour citer cet article

Pistoia A., Poli P., Casarosa L., Balestri G., Ferruzzi G. **Milk sheep quality variations during lactation in grazing and confined reared ewes.** In : Priolo A. (ed.), Biondi L. (ed.), Ben Salem H. (ed.), Morand-Fehr P. (ed.). *Advanced nutrition and feeding strategies to improve sheep and goat* . Zaragoza : CIHEAM, 2007. p. 203-207 (Options Méditerranéennes : Série A. Séminaires Méditerranéens; n. 74)



<http://www.ciheam.org/>  
<http://om.ciheam.org/>

# Milk sheep quality variations during lactation in grazing and confined reared ewes<sup>1</sup>

A. Pistoia, P. Poli, L. Casarosa, G. Balestri and G. Ferruzzi

DAGA, Sezione Scienze Zootecniche, Via del Borghetto 80, 56124, Università di Pisa, Italy

---

**SUMMARY** – The present study aims to investigate the effects of different sheep rearing techniques on the milk qualitative variation. The trial involved 2 groups of 10 ewes, half of them primiparous, reared by two different techniques: (i) grazing system group with concentrate integration 0.6 kg/kg of milk; and (ii) confined rearing group with hay "ad libitum" and the same quantity of concentrates. Milk yield and quality have been controlled monthly by collecting individual milk samples, which have been analysed in their physical, chemical and technological characteristics. The confined ewes produced a higher milk quantity during the whole lactation period (163 days). Chemical milk characteristics resulted better in the grazing group, because of the higher values of fat, protein and casein percentage, while the milk of confined ewes was more acid. The higher acidity values for milk of the confined group determined a better rennet clotting time "r", while the grazing group produced a harder curd firmness "a<sub>30</sub>", 30 min after rennet addition. The outlines of qualitative parameters during lactation were similar in the two groups: the chemical characteristics improved during lactation, while the curdling aptitude was better in the intermediate period.

**Keywords:** Sheep milk quality, breeding system.

**RESUME** – "Variations qualitatives du lait ovine pendant la lactation chez les brebis au pâturage ou confinées". Cette recherche étudie les effets de différentes techniques d'élevage sur les variations qualitatives du lait ovine pendant la lactation. Pour l'expérimentation on a utilisé deux groupes de dix brebis, dont la moitié primipares : (i) le premier groupe a été élevé au pâturage avec incorporation d'aliments concentrés (0,6 kg/kg de lait) ; et (ii) le deuxième groupe a été élevé dans la bergerie avec du foin ad libitum et avec la même quantité d'aliments concentrés. Tous les mois on a contrôlé les productions individuelles de lait et on a prélevé des échantillons pour les analyses chimiques et technologiques. Les brebis élevées dans la bergerie ont produit une plus grande quantité de lait pendant toute la lactation (163 jours). Les caractéristiques chimiques du lait se sont révélées meilleures dans le groupe élevé au pâturage car il y avait une plus grande quantité de lipides, de protéines et de caséine ; alors que le lait des brebis élevées dans la bergerie résultait plus acide. Cette plus grande acidité a déterminé une meilleure réactivité à la présure (r) alors que le lait des brebis élevées au pâturage a produit un caillé plus consistant (a<sub>30</sub>). Le profil des paramètres qualitatifs du lait pendant la lactation résultait semblable dans les deux groupes : les caractéristiques chimiques du lait s'améliorent progressivement alors que les paramètres technologiques se sont révélés meilleurs pendant la période centrale de la lactation.

**Mots-clés :** Qualité du lait ovine, techniques d'élevage.

---

## Introduction

The typical cheeses are more and more numerous and requested, therefore the sheep milk market developed and created the opportunity of a progressive passage from the traditional to the modern kinds of rearing in order to warrant a major uniformity of the milk quality. This is a necessary condition to obtain cheese products characterised by high and more constant qualitative standards. The ovine rearing is traditionally based on grazing because of the low feeding costs. The grazing permits to improve animal welfare and to obtain a natural feeding, but the quality of the grazing ewes milk is more changeable during lactation, because of either physiological or feeding causes, due to the quality and quantity of the pasture. On the contrary, the confined rearing permits to obtain an uniform and controlled animal feeding.

The present study aims to investigate the effects of the two different techniques of sheep rearing on milk quality variations during lactation.

---

<sup>1</sup>Research supported by MIUR (PRIN, 2003).

## Materials and methods

The trial was carried out in a farm located in a hilly area of Pisa district. In this farm over 1000 Sarda ewes were allowed to graze on pasture and each evening they were returned to the barn. The ewes are milked twice a day in a modern milking parlour, where concentrates are supplied. The trial involved 2 groups of 10 ewes each, the half of which primiparous. The two groups were homogenous in terms of age, parity, body weight, daily production and days in milk, but reared by two different techniques: (i) grazing system group: ewes grazed on a natural pasture together with the flock for every day and received a concentrate integration of 0.6 kg/kg of milk; and (ii) confined rearing group: ewes were fed with polyphite hay "ad libitum" and the same concentrate (0.6 kg/kg of milk). The trial began on April 2003, at the end of the sucking phase, and it went on along the whole lactation period until September (163 days). Hay and concentrates intake (chemical composition: CP 13.02%, CF 31.15%, and CP 19.46%, CF 7.05% respectively) have been controlled in each groups. Pasture production (tDM/ha) was evaluated weekly by sample cuts on the grazing areas. Individual milk samples have been monthly collected and analysed for their physical-chemical (pH, density, titratable acidity, fat, protein, casein, total solids, ash) and technological ( $r$ ,  $k_{20}$ ,  $a_{30}$ ) characteristics according to ASPA methods (1995).

Data were analysed by ANOVA using JMP software, taking into consideration rearing system.

## Results and discussion

The confined ewes produced a higher milk quantity during the whole lactation period (Fig. 1) (Braghieri *et al.*, 2001; Fois *et al.*, 1997). On average, milk production was 1.347 kg/d and 1.141 kg/d per ewe, respectively in confined group and in grazing group ( $p < 0.05$ ).

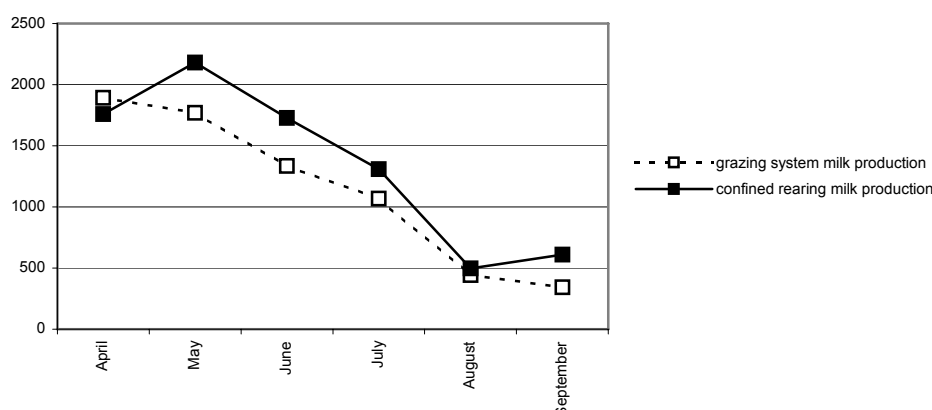


Fig. 1. Outline of milk yield during lactation (g/head/d).

The confined primiparous and pluriparous ewes produced a higher milk quantity than those on pasture (1.239 vs 0.979 kg/head/d and 1.455 vs 1.304 kg/head/d respectively) (Table 1). The higher milk production of confined ewes is probably due to the balanced feeding (Cannas, 1999). On Spring and Summer 2003 the climate was very dry for a long period (from May to the end of August); this fact limited the fodder production (on Spring the average fodder production was 2.55 tDM/ha and chemical composition CP 15.30%, CF 26.05%; on Summer 0.81 tDM/ha and chemical composition CP 8.82%, CF 31.45%). The average feed intake resulted: hay 1.630 kg/head/d and concentrates 0.805 kg/head/d for the confined group; concentrates 0.650 kg/head/d for the grazing group. The average values of milk (fat, protein and ash) resulted higher ( $P \leq 0.05$ ) in the grazing group, both in the primiparous and pluriparous. The casein content resulted higher in the grazing group too but presented statistical differences only for the primiparous ewes. Total solids content was higher ( $P \leq 0.05$ ) in the pluriparous of grazing group. Concerning to technological parameters, it has been observed a better ( $P \leq 0.05$ ) rennet clotting time ( $r$ ) in the confined group, both for the primiparous and pluriparous. No differences have been obtained in the rate of curd formation ( $k_{20}$ ), while the curd

firmness ( $a_{30}$ ) 30' after rennet addition resulted higher ( $P \leq 0.05$ ) for the primiparous ewes of the grazing groups (Table 2).

During the lactation the values of the observed physical-chemical parameters showed the same trend in both groups. Fat, protein and casein milk contents showed always higher values for grazing group and an increasing trend during lactation in both groups (Fig. 2) in according to Boros *et al.* (1986), Daghash *et al.* (1993) and Hassan (1995). The differences between the two groups increased in the final milking phase, especially in order to fodder availability decrease. Milk acidity (pH and titratable acidity) shows a different trend: in the first period milk became more and more acid up to the intermediate phase of lactation (103 days in milk), then it reached values next to neutrality, as showed in Fig. 2. This variability is very important in cheese making, because of the influence on the technological parameters related to the dynamism, time and quickness of milk curdling ( $r$  and  $k_{20}$ ). These parameters have an opposite trend in comparison with titratable acidity: in the first part of lactation, till 103 days in milk, they progressively decrease and subsequently they begin to increase up to the end. The curd firmness 30' after rennet addition has an increasing trend because it is related to the casein content (Duranti and Casoli, 1991; Martini, *et al.*, 1999).

Table 1. Daily milk yield and physical-chemical characteristics (mean values)

		Grazing system	Confined rearing
Milk yield (kg/head/day)	Primiparous	0.979 a	1.239 b
	Pluriparous	1.304 a	1.455 b
pH	Primiparous	6.82	6.74
	Pluriparous	6.84	6.79
Density	Primiparous	1.037 a	1.036 b
	Pluriparous	1.035	1.035
Fat (%)	Primiparous	7.36 a	6.60 b
	Pluriparous	7.24 a	5.47 b
Protein (%)	Primiparous	6.66 a	6.01 b
	Pluriparous	6.28 a	5.71 b
Casein (%)	Primiparous	5.28 a	4.64 b
	Pluriparous	4.86	4.56
Titratable acidity °SH	Primiparous	9.64 a	10.33 b
	Pluriparous	10.04 a	9.38 b
Total solids (%)	Primiparous	24.35	23.56
	Pluriparous	24.69 a	22.89 b
Ash (%)	Primiparous	1.27 a	1.16 b
	Pluriparous	1.22 a	1.06 b

<sup>a,b</sup> Results are different  $P \leq 0.05$

Table 2. Cheese making characteristics

		Grazing system	Confined rearing
r (min)	Primiparous	11'38" a	9'12" b
	Pluriparous	12'36" a	10'28" b
$k_{20}$ (min)	Primiparous	1'46"	1'43"
	Pluriparous	1'54"	2'09"
$a_{30}$ (mm)	Primiparous	39.32 a	29.17 b
	Pluriparous	37.19	33.70

<sup>a,b</sup> Results are different  $P \leq 0.05$

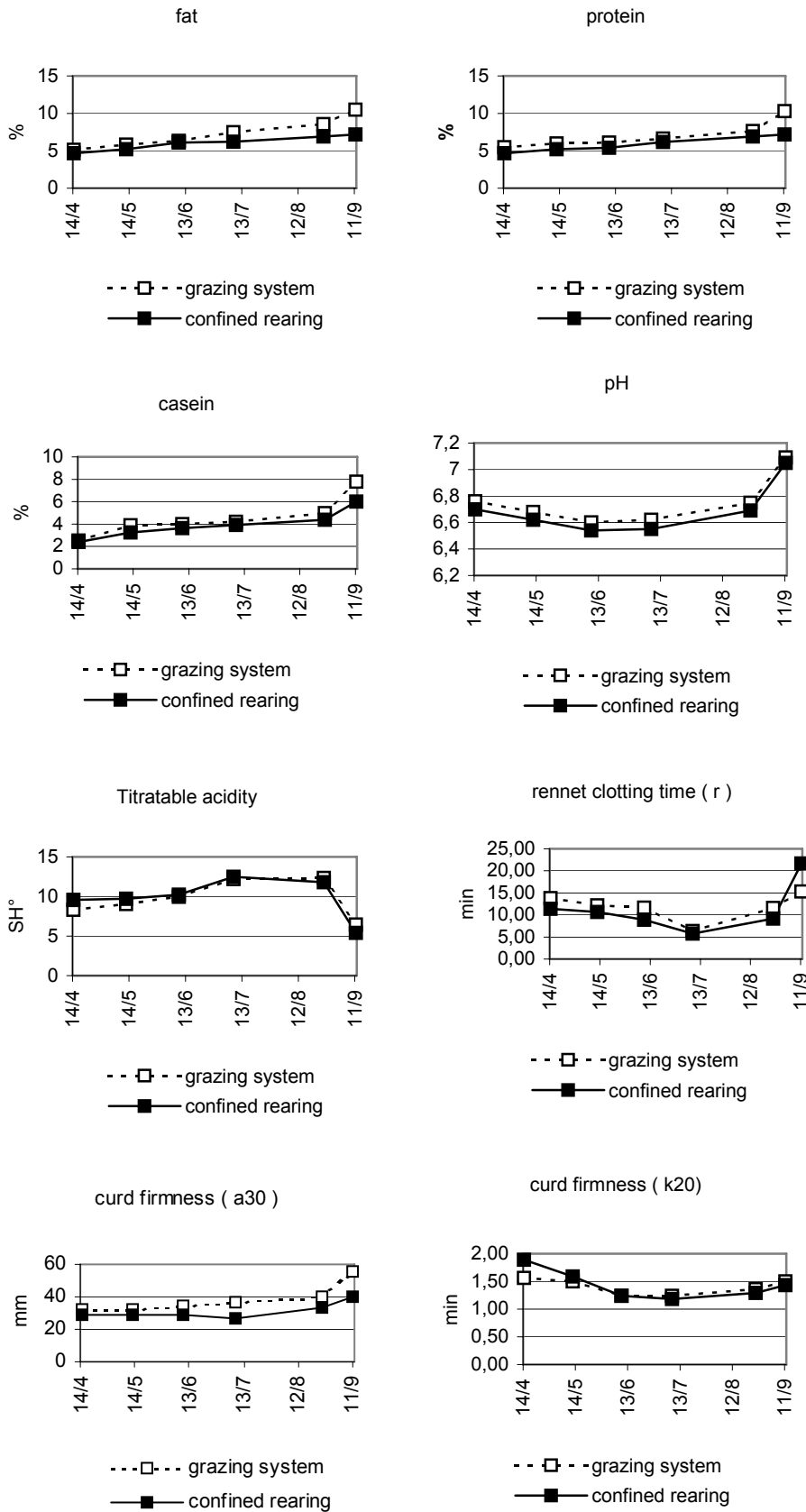


Fig. 2. Outlines of the milk physical-chemical and technological parameters.

## Conclusion

The different rearing system influenced milk yield and qualitative characteristics without changing the trend of the principal parameters during the lactation period (Pirisi *et al.*, 1995).

In the confined rearing group the milk yield was higher, but the nutritional characteristics of milk were lower. The milk chemical parameters of both groups improved during lactation, when milk yield decreases.

The grazing group milk showed a lower rennet clotting time; but a higher curd firmness. The curdling aptitude of the milk of both the groups is better in the central part of lactation, showing a better rennet clotting time and final curd firmness. The aspects of the curdling dynamism are very important for an effective whey discharging and a balanced drying which influence curd and cheese reological characteristics.

## References

- ASPA (1995). *Metodi di analisi del latte delle principali specie di interesse zootecnico*. Università di Perugia, pp. 1-224.
- Boros, V., Kracl, Z. and Stevonkova, E. (1986). Effect of lactation stage on composition of goat and ewe milk. *Zbornik-Prac-Vyskumneho-Ustavu-Mliekarskeho-v-Ziline*, 9: 29-37.
- Braghieri, A., Pacelli, C., Girolami, A., Montemurro, N., Quaranta, V. and Napolitano, F. (2001). Effect of confinement on welfare and milk quality of Sarda ewes. In: *Proceedings of the ASPA XIV Congress*, Firenze (Italy), 12-15 June 2001, pp. 589-591.
- Cannas, A. (1999). Piatto unico anche per le pecore. *Informatore Zootecnico*, 6: 56-58.
- Daghash, H.A., Shetaawi, M.M. and Saad, N.M. (1993). Changes in certain blood and milk constituents during the first 5 weeks post-lambing in coarse-wool ewes of Upper Egypt. *Assiut Vet. Med. J.*, 29, 58: 40-48.
- Duranti, E. and 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: 99-105.
- Fois, N., Molle, G., Sitzia, M., Pani, R., Moniello, G. and Pinna, W. (1997). Alimentazione con unifeed ed unifeed+pascolo in pecore di razza Sarda: aspetti quanti-qualitativi della produzione latte. In: *Proceedings of the ASPA XII Congress*, Pisa (Italy), 23-26 June 1997, pp. 255-256.
- Hassan, S.H. (1995). Effects of crossing and environmental factors on production and some constituents of milk in Ossimi and Saidi sheep and their crosses with Chios. *Small Rum. Res.* 18, 2: 165-172.
- Martini, M., Verità, P. and Cianci, D. (1999). *La qualità del latte ovino. Rassegna delle conoscenze scientifiche*. ARSIA, pp. 1-161.
- Pirisi, A., Piredda, G., Fois, N., Scintu, M.F. and Ligios, S. (1995). Influenza della tecnica di alimentazione sulle caratteristiche qualitative del latte di pecora. In: *Proceedings of the SISVET Congress*, Salsomaggiore (Italy), 27-29 September 1995, pp. 895-896.