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# Study of the goat production system and the quality of milk produced in the Sierra Norte of Seville (Spain)

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**SUMMARY** – The objective of this study is to determine the situation of semi-extensive goat farms in the Sierra Norte of Seville (Spain) related to the bacteriological and hygienic quality of the raw milk. Twenty percent of the farms in the district were characterized, covering aspects related mainly to the milking and hygienic management. The bacteria and somatic cell content of raw milk coming directly from the udder and from churns (first at the end of the milking and second few hours after milking), were monitored for a period of nine months in 14 farms. Besides all the farms hold general sanitary norms, most of them do not carry out the general dairy herd recommendations for milking routine. It is observed that most germ contamination in milk occurred in the hours after milking (from 46,000 up to 267,000 germ/ml), always below the maximum allowed. Somatic cells in all farms with more than 50 goats are above 1,500,000 somatic cells/ml.

**Key words:** Goat, characterization, milk, bacteriological and hygienic quality.

**RESUME** – "Etude du système de production caprine et de la qualité du lait produit dans la Sierra Norte de Séville (Espagne)". Le but de ce travail est de connaître la situation des exploitations caprines semi-extensives dans la contrée de la Sierra Norte de Séville (Espagne), concernant la qualité hygiénique et sanitaire du lait. La caractérisation a été faite sur 20% des exploitations en tenant compte des aspects de la production les plus liés à la qualité du lait. On a contrôlé la teneur en bactéries et en cellules somatiques du lait dans 14 exploitations pendant neuf mois ; on a pris des échantillons directement du pis ainsi que du bidon à deux moments : tout de suite après la traite et quand ceci arrivait au magasin communautaire, avant de mélanger le lait. Malgré le fait que toutes les exploitations sont aux normes hygiéniques et sanitaires, la plupart ne tiennent pas tout à fait compte des conseils qu'on leur donne pour réaliser correctement la traite. La contamination principale a lieu après la traite (on passe de 46 000 jusqu'à 267 000 germes/ml), en étant toujours en dessous du maximum permis. On trouve la principale concentration de cellules somatiques par ml, plus de 1 500 000, dans les fermes qui ont plus de 50 chèvres.

**Mots-clés :** Caprin, caractérisation, lait, qualité hygiénique et sanitaire.

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## Introduction

The goat sector is very important in the Autonomous Region of Andalusia (Spain), due both to the large number of goat farms and to their socio-economic repercussion, as they tend to be located in marginal areas. The goat production system has undergone little development, representing 1.5% (both meat and milk) of Spain's Final Cattle Production (MAPA, 1995), making it one of the least well-known sub-sectors of the livestock industry.

Guidelines now in force (RD 1679/94 and RD 402/96), to regulate the activity of farms producing goat's milk so as to ensure milk of suitable bacteriological and hygienic quality is obtained, have led to concern among all the agents involved, with action being taken to ensure these new regulations are adhered to. This situation forms the framework for the present study, which is the result of collaboration with the "Corsevilla" co-operative, operating in the Sierra Norte district of the province of Seville.

The general aim of this study is to determine the situation of the semi-extensive goat farms in the area with regard to the bacteriological and hygienic quality of the milk, as far as both the production system and the final quality of the milk itself are concerned.

## Materials and methods

### Farm characterization

In order to characterize the farms, 28 breeders (representing 20% of the total number of farms) from the district in question were interviewed. They were chosen by stratified sampling according to the size of the herd on each farm, of which four groups were established: less than 51 goats (4 farms); 51 to 99 (8); 100 to 199 (9); and 200 or more goats (7). The survey was conducted by carrying out personal interviews with the breeders between February and April 1998. It contained a total of 216 items related to different aspects of production (identification, territorial base, infrastructures, installations and machinery, herd composition, food and reproductive handling, health and hygiene, production and sale), although we have selected for this article only those that have a direct relation with the bacteriological and hygienic quality of the raw milk.

### Bacteriological and hygienic quality of the raw milk

To determine milk quality a sample of 14 farms were chosen, all of which carried out hand milking, being this system the most used in the district. Three milk samples were taken at each farm. The first one at the beginning of milking, straight from the udder (eliminating the first squirts) from 15% of the goats on the farm. The second one from the churn at the end of milking; and the third one from the churn, when it arrived at the common reception area (co-operative tank). Samples were taken once a month for nine months (December to August). Azidiol was added to each sample, and the samples were then refrigerated and sent to laboratory in order to count the number of somatic cells (Fossomatic) and to determine the number of germs per millilitre (Bactoscan). On the day the samples were taken a survey was conducted concentrating mainly on the changes made to each farm's health and hygiene practices that might affect analysis results.

Statistical analysis was performed using the SPSS programme (1994) for Windows.

## Results and discussion

### Farm characterization (28 farms, hand and machine milking)

The main characterization results in relation with the milking and hygienic management are listed in Table 1 and complete the results published by Mena *et al.* (1999).

Farms have herds size ranging from 36 to 450 goats (average of 142), have a low or medium degree of intensification (the criterion used was mainly the dependence of animal of grazing, and others like breed of goats and use the of technology) (Castel *et al.*, 1996) and most of them carry out hand milking once or twice a day. Goats make up the main activity in only 10.7% of the cases, and are normally combined with farming of another kind of livestock. The lack of electricity and running water makes installing machine-milking methods somewhat complicated, but this should be implemented if herd size is increased or the production system intensified, which on the other hand would clearly be undesirable if the farms aim to operate an environmentally-friendly animal production system.

As can be seen in Table 1, the majority of the farms take general sanitary measures, such as disinfecting premises and rodent clearance, animal delousing and vaccination, or installations cleaning. However, for milking routine, the majority of the farms do not carry out general dairy herd recommendations, such as washing and drying udders before milking, eliminating the first squirts, post-milking sealing-off, or drying-off and antibiotic therapy. In relation with the six farms with machine milking, all of them clean their equipment on a daily basis, less than half use alkalis for weekly equipment cleaning, and only 60% use hot water.

### Bacteriological and hygienic quality of the raw milk (14 farms, hand milking)

The results obtained show considerable variability in the data, particularly in the number of germs/ml, which led to logarithmic transformation (log 10) being chosen for this variable, to ensure a valid application of the variance analysis.

Table 1. Discrete variable frequency results (percentage respect of total)<sup>†</sup>

Variable	%	Variable	%	Variable	%
<i>Main activity</i>		<i>Other species</i>		<i>Type of farm</i>	
Goats	10.7	Sheep	82.1	Family-owned	35.7
Others	46.4	Dairy cattle	92.9	Ltd company	10.7
Equal share	42.9	Beef cattle	75.0	Self-employed	53.6
<i>Goat house</i>		Extensive pigs	53.6	<i>Running water</i>	
Yes	85.7	<i>Truck access</i>		Yes	13.0
No	14.3	Yes	85.7	No	87.0
<i>Electricity supply</i>		No	14.3	<i>Diseases</i>	
Yes	10.7	<i>Exchange of males</i>		Mastitis	50.0
No	89.3	Yes	17.9	Agalactica	32.1
<i>Causes of culling</i>		No	82.1	Others	46.4
Old age	60.7	<i>Delousing</i>		<i>Vaccination</i>	
Low production	89.3	Yes	96.4	Yes	92.9
Mastitis	18.9	No	3.6	No	7.1
Other diseases	85.7	<i>Disinfects premises</i>		<i>Rodent clearance</i>	
Death	39.3	Yes	81.5	Yes	70.4
<i>Vaccinated against</i>		No	18.5	No	29.6
Braxy	64.3	<i>No. of milkings per day</i>		<i>Drying-off method</i>	
Brucellosis	25.0	Once a day	53.6	None	14.3
Agalactica	46.4	Twice a day	35.7	Sudden	7.1
<i>Milking method</i>		No milking	10.7	Gradual	64.3
Hand	78.6	<i>After milking</i>		Other	7.1
Machine	21.4	Sealing-off	8.0	<i>Machine milking</i>	
<i>Before milking</i>		Drying-off therapy	8.0	Cleaned daily	100.0
Washes hands	87.5	<i>Artificial suckling</i>		Uses acid	40.0
Cleans udders	29.2	Yes	3.6	Uses hot water	60.0
Eliminates 1 <sup>st</sup> squirts	24.0	No	96.4	Uses detergent	80.0

<sup>†</sup>All data are related to 28 farms, excepts the *cleaning of machine milking* which is related only to 6 farms.

For the germs/ml variable, variance analysis showed significant differences for the following factors: the month the sample was obtained, farm size and sample type (straight from udder, from the churn at the end of milking and from the churn when it arrived to the collective tank). Table 2 lists the mean and standard error for each of these factors.

The sample type is observed as a main factor in data variability ( $P < 0.001$ ), being observed that contamination occurs after the milk is taken out from the udder till it reaches the collective tank (46,000 vs 267,000 germs/ml). Significant differences were also obtained all through the different months of study ( $P < 0.001$ ), being the months at the beginning of the sample-taking period (Dec-Feb) together with August, those which show a greater number of germs/ml, and June and July those with less germs/ml. This may be due to the improvement of general sanitary norms observed in the majority of farms since February. Contrary to expectations, the number of germs/ml was lower during the months of hottest weather, which suggests that bacteriological quality can be maintained during the hotter summer months if the farm is run properly.

Herd size was also observed to have a significant effect ( $P < 0.01$ ); farms with a few number of animals have a lower germ/ml recount (less than 100,000 germs/ml for farms with 50 to 100 animals; and 160,000 to 210,000 germs/ml for herds over 100 animals). If milk from the tank is examined on its own, the values are 80,000 to 135,000 germs/ml for the smaller farms and 343,000 to 477,000 for farms with larger herds. Despite the differences, both data are below the limits set out in the relevant legislation (500,000 germs/ml, for untreated milk). The differences between these farms were due to different sanitary and hygienic management used. The greater

attention paid to matters of hygiene (of the farm in general and of the animals in particular) and the existence of a place only for milking explains the better results for farms with lower bacteriology.

Table 2. Mean values and standard error (SE) of germs/ml and cells/ml according to months, farm size and sample type

		Germs/ml (x 1000)		Somatic cells/ml (x 1000)	
		Mean	SE	Mean	SE
Grouped months	Lowest number	101	43.5	1626	70.2
	Intermediate value	132	30.9	-	-
	Highest number	151	30.4	2518	173.4
Farm size	<50 animals	93	37.9	1072	115.3
	50-100	56	6.8	1531	102.7
	150-200	164	42.1	1905	127.9
	>200	211	53.5	2209	140.7
Sample type	From udder	46	6.6	1644	127.5
	Churn	85	16.1	1889	122.2
	Collective tank	267	54.5	1856	103.8

Related to somatic cells/ml, significant differences were found according to herd size ( $P<0.001$ ) (1,072,000 for farms with few number of animals and 2,209,000 for larger herds) (Table 2). In the farms with worse results the somatic cell count (SCC) exceeded the limit that the EU hopes to establish (1,500,000 somatic cells/ml, Barbosa *et al.*, 1994) and limits established in countries as Norway (1,200,000) and USA (1,000,000) (Contreras *et al.*, 1997). In the some way described for bacteriology study, greater attention to health and hygiene conditions on farms with a lower SCC would explain the more favourable results for this parameter.

No important differences in the somatic cell/ml variable were found according to sample type (udder, churn and collective tank), but there was an influence in the month the sample was taken ( $P<0.001$ ), with July and August presenting the highest cell counts (2,518,000) and lower values for the other months (1,626,000). This factor would be influenced by the effect of the evolution of the number of cells during lactation (Rota *et al.*, 1993), with an increase in cells all through the end of the lactation period (Sierra *et al.*, 1993). A relation thus exists between the season and the grouped months according to the number of cells ( $r^2$ ,  $P<0.001$ ), so that the highest cell counts occurs during the summer months, when the lactation period comes to the end in the district in question (Mena *et al.*, 1999), due to the concentration effect because of milk production decreasing.

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