

CORRELATION BETWEEN BACTERIOLOGICAL QUALITY OF SHEEP MILK AND HYGIENE FACTORS ACTING ON DURING MILKING

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Abstract

Products obtained from sheep's milk benefit from a high demand on the European market and traditionally on the national Romanian market. Currently, the demand for sheep dairy is associated with the desire to consume organic products. The research took place from June 2012 until May 2013, in four farms from the north-west of Romania (Husasău Tincă - Bihor County, Carei - Satu Mare County, Nușfalău - Sălaj County and Oradea - Bihor County), including 432 lactating sheep (Țurcană breed). Taking into account the fact that there are different factors influencing the quality and quantity of milk products, the objective of this study was to evaluate the impact of sanitization method on the quality of milk production. Bacteriological control consisted in determining TNG/cm² in the samples taken from the hands of milker, from the animals' udder and from the vessels used for milking. Washing and specific disinfection determined the most drastic reduction of bacteria in milk. There are two important aspects: sanitizing milker's hands and animals' udder; even so, milking vessel should not be omitted. Proper sanitization can give milk qualitative properties framed within EU standards.

Keywords: sanitization, total number of germs, sheep milk

INTRODUCTION

Research on sheep milk quality and the influence of genetic and environmental factors on it began in France in 1962, when mechanical milking of sheep was initiated. This management of sheep exploitation was extended to most European countries (Purroy Unanua, 1986) causing an intense development of dairy industry from sheep milk. In this context, research regarding optimization of growth technologies and achieving a specific quality of milk, takes an important place in the scientific field of sheep exploitation (Pădeanu, 2000).

Approximately 25% of the world's land surface supports about 20 million pastoral households or about 180–200 million people (Degen, 2007). Given that the vast majority of milk production is converted to dairy, the quality of the milk is analyzed in terms of capability of being processed (Bencini and Pulina, 1997). In this context the quality and quantity of cheese depends on the particular gelling properties of the milk (Buttazzoni and Aleandri, 1990; Cavani et al, 1991).

The production of milk from sheep depends on a number of factors (Teușdea V., 2002). Factors determining milk production in terms of quantity and quality can be divided into: genetic factors, internal and external environmental factors (Iurcă, Răducu, 2005; Man, 2002; Silanikove et al, 2010). The quality of the milk for cheese making depends essentially on its physical and chemical composition and on hygienic and sanitary factors (bacterial count, somatic cells count, etc.) (Pirisi et al, 2007)

The objective of this study was to evaluate the impact of sanitization method (of the milker's hands, animals' udder, milking vessels) on the quality of milk production,

evaluated in terms of total number of germs/ ml milk (Ekici K. et al, 2004; Sabău., Rotaru, 2006).

MATERIAL AND METHODS

The study was conducted in the north-west of Romania, during June 2012- May 2013, in four sheep farms from the localities of: Husasău Tinca (Bihor County), Carei (Satu Mare County), Nuşfalău (Sălaj County) and Oradea (Bihor County). The animal biological material was formed of nine groups of twelve sheep (Țurcană breed), for each of the four farms. The groups of twelve animals were formed randomly from herds of some private farms that had at least 50 sheep.

Each sheep was marked so all subsequent operations could be executed on the same animals. Rehearsals necessary for the adopted experimental type resulted in two ways:

- by repeating a specific work/ operation of sanitizing or of control for its effectiveness three times in a row/ group of animals;
- by performing laboratory analyzes of TNG (total number of germs) in at least three repetitions of the average sample.

Since sanitation exams were conducted in four farms from different locations, there was used a total of 432 lactating sheep. (12x4x3x3). Bacteriological control consisted in determining TNG/cm² in the samples taken from the hands of milker, from the animals' udder and from the vessels used for milking.

Arrangements for sanitizing were done in three ways:

- V_m - assumed bacterial sampling from milker's hands, animals' udder, vessels and milk, under the usual conditions of the farm;
- V_{e1} - was achieved by washing milker's hands, animals' udder, milking vessels with warm water and toweling washed objectives or dry the vessels;
- V_{e2} - specific disinfection involved the use of Confidence solution 4% for udder disinfection, Laval solution and drying for milking vessels and antibacterial soap for washing hands and wiping them with disposable towel.

The statistical methods used in the calculation and interpretation of the results were based on Duncan test.

To valorize the experimental results, there was used the analysis of tri-factorial variance – model of subdivided lots – when sanitization effectiveness was evaluated as TNG /ml in milk. (Cucu et al., 2004, Ardelean et al, 2005).

For the tri-factorial experience, the results were presented in tables of bilateral analysis exclusively for experimental factors and for the interactions between the factors. In order to highlight links between simple combinations of experimental factors that were not revealed by tri-factorial experiments there were calculated simple correlation coefficients for all nine combinations between the sanitization variants and the three disinfected objective in terms of their effect on milk TNG. The significance of the results was given to P5% and P1%.

RESULTS AND DISCUSSION

Presenting results of the tri-factorial experience (sanitization method x disinfected objective x holding from the place of experimentation) will be made by two tables that will include all three experimental factors and two double interactions whose effects on TNG were significant.

Data from Table 1 show effects of sanitization method and of disinfected objective on the TNG in sheep milk (washing + specific disinfection).

Table 1

The influence of the method of sanitization and of the disinfected objective on the NTG in sheep milk

Disinfected objective Method of sanitization	TNG (thousands/ml milk)							
	hands		udder		vessels		Total manner of sanitization	
No sanitization	2477*	b	1682	c	3178	a	2446	M
Washing with water	281	d	202	d	120	d	201	N
Washing + specific disinfection	94	d	91	d	85	d	90	N
Method average	951	AB	659	A	1128	B		

DS5% to compare two averages ways of sanitization: 783 – 799 TNG (thousands/ml)

to compare two average methods of sanitization: 296 – 311 TNG (thousands/ml)

to compare two average way x method of sanitization: 513 – 578 TNG (thousands/ml)

Note: difference between any two values followed by at least a commune letter; it's insignificant for P5%.

It is noted that both methods of sanitization and disinfected objective had significant effects on milk TNG. Washing + specific disinfection (Ve2) detaches itself because it obtained the most drastic reduction of TNG in milk. It is interesting to note that the method including washing with water and the one including washing + specific disinfection are not paying specific differentiation for TNG in milk. This would allow recommending using either sanitization method in sheep farms. But considering that washing + specific disinfection have TNG in milk, we recommend to use the third option as the most effective in reducing milk TNG.

It is important to keep in mind that regardless of statistical significance or insignificance between sanitization methods, considering TNG in milk after certain hygiene works should be made taking into account EU standards (Ștețca Gh. et al , 2006; Taftă V., 2001).

Influence of disinfected objective on TNG from milk highlights that far, the worst effect is represented by milking vessels. It is evident, therefore, that washing all objectives with water or with water + specific disinfection will provide milk that respects EU standards (Directive CE 91/180; Directive EEC/92/46 – 1992).

Data from Table 2 present the influence of the holding from the experimental location and of the sanitization method on milk TNG.

According to data presented in Table 2, it can be said that the best results regarding TNG from milk are obtained in holdings Carei and Oradea, and the worse results are registered in Nușfalău and Husasău Tinca (the difference between the TNG averages are not statistically significant).

If we consider the interaction: sanitization method x holdings, it is observed that in almost all the localities the best results are obtained by washing + specific disinfection (below 100000 TNG/ml milk). The exception is holding Nușfalău, where even with this combination of factors, TNG in milk passes 100000/ml, making it closer to the upper limits of the EU requirements.

Table 2

The influence of the type of disinfection and of the holding from the experimental location on the NTG in sheep milk

Method of sanitization Holding	TNG (thousands/ml milk)							
	V _m - no sanitization		V _{e1} – washing with water		V _{e2} – washing + specific disinfection		Holding average	
Husasău de Tinca	2604	b*	214	ef	95	fg	971	M
Carei	2343	c	193	efg	86	g	874	N
Nuşfalău	2753	a	225	e	105	efg	1027	M
Oradea	2083	d	171	efg	76	g	777	P
Average of sanitization method	2446	A	201	B	90	B		

DS5% to compare two averages methods of sanitization: 783 – 799 TNG (thousands/ml)

to compare two average holdings: 56 – 61 TNG (thousands/ml)

to compare two averages of interaction: sanitization method x holding > 112 – 130 TNG (thousands/ml)

Note: difference between any two values followed by at least a commune letter; it's insignificant for P5%.

* Romania Standard SR ISO 5541/2/1996

It is obvious from these data that sanitization by washing + specific disinfection applied to milker's hands, to milking vessels and to animals' udder provides in all localities the lowest TNG in milk, well below the EU standards. Based on these findings we recommend this type of sanitization for all sheep farms.

Since tri-factorial experience could not establish links between certain combinations of experimental factors (e.g.: without washing hands but udder and vessels washing), we tried highlighting those links with statistical correlations.

Table 3 presents the simple correlation coefficients between the different methods of sanitization and the disinfected objectives based on the decrease of TNG in milk.

Table 3

The simple correlation between NTG on hands, udder, vessels and NTG in the milk, in three methods of sanitization

Method of sanitization	Correlation coefficients		
	Hands	Udder	Vessels
V _m - no sanitization	0.55 ^(x)	0.63 ^x	0.50
V _{e1} – washing with water	0.75 ^{xx}	0.55 ^(x)	0.47
V _{e2} – washing + specific disinfection	0.86 ^{xx}	0.87 ^{xx}	0.25

r for P5% = 0.58

P1% = 0.71

Data from Table 3 clearly show that all methods of sanitization are significantly correlated and significantly distinct with two of the disinfected objectives (milker's hand and animal udder). This correlation is lacking when it comes to the method of sanitization and disinfected vessels.

The explanation of such results is quite logical taking into account the fact that in the practice of sheep farms even if there is no sanitization of animals' udder or milker's hands, vessels are still minimally disinfected (rinsing thereof with water after use). It is obvious that our recommendations will dwell mainly on sanitizing milker's hands and animals' udder, but not omitting milking vessel.

CONCLUSIONS

It is recommended for all sheep holdings the washing + disinfection of hands before the start of the milking operation, so the transfer of germs from hands to milk will be as low as possible.

All three methods of sanitization (no sanitization, washing with water, washing with water + specific disinfection) are significantly correlated or significantly distinct with two disinfected objectives (milker's hand and animals' udder).

The reason why there is no significant correlations between methods of sanitization and milking vessels is explained by the fact that vessel are still minimally cleaned, while this minimal sanitation is absent for the udder and hands. This is understandable, given the large number of sheep that need to be milked.

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