

# THE MICROBIOLOGICAL QUALITY OF RAW MILK DETERMINED ACCORDING TO THE MILKING SYSTEMS USED

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**Abstract.** This study examined the microbiological parameters of raw milk according to milking systems. The raw material milk was collected from 10 holdings with different forms of ownership, with different technical equipment and different milking systems. The microbiological parameters of milk from the period April 2021-March 2022 were analyzed, respectively the determination of NTG/ml in milk at 30°C and NCS by the electronic fluoro-opto method. According to EC Regulation 853/2004 for raw milk NTG at 30°C (per ml)  $\leq$  100,000, it follows that of the 10 holdings included in the research, 14 values of the geometric mean over a period of two months do not fall within the limit allowed according to the CE standard, and for NCS (per ml)  $\leq$  400,000, it follows that out of the 10 holdings included in the research, 7 values of the geometric mean for a period of three months do not fall within the limit allowed according to the CE standard.

**Keywords:** raw material milk, milking systems, the total number of germs, the number of somatic cells

## INTRODUCTION

The composition and properties of raw milk are crucial in controlling the quality of dairy products, and variation in the quality attributes of raw milk affects the properties of the finished product differently. Understanding the factors that lead to the presence of these important bacterial groups in raw milk is key to reducing their influence on the quality of processed dairy products.

Raw milk from a healthy cow usually has little bacterial contamination but as it leaves the udder it can become contaminated through a variety of routes with bacteria coming into contact with contaminated equipment from environmental sources.

The regulatory authority established the maximum allowed NTG level of 100,000 cfu/ml, the basis for the calculation being the use of the variable geometric mean observed over a period of two months, with at least two samples per month, and the NCS value as 400,000 cells/ml with a single sampling per month. Somatic cell counting is considered a basic method in milk quality control programs because it is a major indicator in assessing its quality, especially hygienic quality.

The maximum allowable limit for cow's milk considered adequate is around 400,000 cells/ml. The presence of somatic cells is quantified as the number of cells/millilitre of milk. If this limit is exceeded, regardless of whether or not the

milk shows sensory or biochemical changes, the milk is included in the suspect category and is not given for consumption.

***The number of germs in milk.*** The presence of microorganisms in milk is of particular importance for the quality, sanitation and freshness of this product. These microorganisms can increase or decrease the quality of milk products, or make them inedible, either through their pathogenic action, or through degradation and the production of toxic metabolites.

One of the necessary requirements for the production of a quality milk from a hygienic point of view is to obtain acceptable levels of the number of bacteria in the milk. A much more common problem is milk bacteria, which by their type and number can influence the quality of the milk product, reducing its suitability for processing and consumption.

Some of the concerns related to the presence of bacteria relate to the possibility that a germ potentially pathogenic to the human consumer could appear in raw milk, leading to food poisoning.

## MATERIAL AND METHOD

The study was carried out in 10 cattle farms within Bistrița-Năsăud county, farms with different forms of ownership, with different technical and material equipment, applying different exploitation technologies and different milking systems.

The research was carried out between April 2021 and March 2022, all farms included in the research were asked about their willingness to participate in this work, this thesis being a research study and not a control activity.

The codification of animal holdings was resorted to without referring to their direct origin, so that the manual milking system includes the codified holdings: A, B, C, D and the mechanized milking system includes the following holdings: E, G, H, I, J. The monitoring was carried out on two categories of samples:

- samples collected from four animal holdings using manual milking coded A, B, C, D;

- the samples collected from six animal holdings that use mechanized milking coded- E- use a milking system in a drum; E, G- use a milking system through the milking room; H, I, J- use milking system by means of milking robot- Lely Armstrong.

Milk samples were collected according to EU Regulation 853/2004 transcribed into national legislation by Order 35/2016 with two samples per month for the determination of NTG and one sample for the determination of NCS.

Raw milk for samples is collected from a representative sample of the entire amount of milk after homogenizing it inside the tank or can, in a sterile 250 ml container, being transported to the Bistrița-Năsăud Veterinary Sanitary Laboratory within a maximum of 4 hours from collection with keeping the temperature regime as close as possible to the original storage stage.

## RESULTS AND DISCUSSIONS

## Expression of NTG results in studied farms:

Table 1

Period April 2021- March 2022	Manual milking farm				Mechanized milking farm					
	A	B	C	D	E – milking in a drum	Farm with milking room		Farm with milking by means of the robot		
						F	G	H	I	J
April - May 2021	8,9x10 <sup>4</sup>	7,0x10 <sup>4</sup>	1,4x10 <sup>6</sup>	2,6x10 <sup>5</sup>	7,1x10 <sup>4</sup>	6,7x10 <sup>4</sup>	5,7x10 <sup>4</sup>	9,3x10 <sup>40</sup>	5,3x10 <sup>4</sup>	6,5x10 <sup>4</sup>
June - July 2021	8,6x10 <sup>4</sup>	8,7x10 <sup>4</sup>	2,3x10 <sup>6</sup>	1,3x10 <sup>6</sup>	6,9x10 <sup>4</sup>	8,2x10 <sup>4</sup>	5,6x10 <sup>4</sup>	6,7x10 <sup>4</sup>	6,0x10 <sup>4</sup>	6,8x10 <sup>4</sup>
August - September 2021	1,1x10 <sup>5</sup>	7,5 x10 <sup>4</sup>	1,8x10 <sup>6</sup>	1,9 x10 <sup>6</sup>	6,9 x10 <sup>4</sup>	7,9 x10 <sup>4</sup>	6,0 x10 <sup>4</sup>	7,7 x10 <sup>4</sup>	7,3 x10 <sup>4</sup>	7,7 x10 <sup>4</sup>
October - November 2021	8,0x10 <sup>4</sup>	8,0x10 <sup>4</sup>	1,2x10 <sup>5</sup>	3,4x10 <sup>5</sup>	5,7x10 <sup>4</sup>	6,3x10 <sup>4</sup>	6,4x10 <sup>4</sup>	8,2x10 <sup>4</sup>	6,6x10 <sup>4</sup>	6,7x10 <sup>4</sup>
December 2021 - January 2022	7,2 x10 <sup>4</sup>	7,8 x10 <sup>4</sup>	2,6 x10 <sup>5</sup>	2,9 x10 <sup>5</sup>	6,6 x10 <sup>4</sup>	7,1 x10 <sup>4</sup>	6,4 x10 <sup>4</sup>	7,3x10 <sup>4</sup>	5,4 x10 <sup>4</sup>	5,3 x10 <sup>4</sup>
February - March 2022	1,1 x10 <sup>5</sup>	7,8 x10 <sup>4</sup>	1,8 x10 <sup>5</sup>	4,4 x10 <sup>5</sup>	6,0 x10 <sup>4</sup>	7,3x10 <sup>4</sup>	6,3 x10 <sup>4</sup>	6,9 x10 <sup>4</sup>	5,2 x10 <sup>4</sup>	5,6 x10 <sup>4</sup>

Expression of NTG results in the studied farms:- Variable geometric mean observed over a period of two months, with at least two samplings per month

According to EC Regulation 853/2004 for raw milk the germ content at 300C (per ml)  $\leq 100,000$ , it follows that of the 10 holdings included in the research, 14 values of the geometric mean over a period of two months do not fall within the allowed limit according to the CE standard and 46 values of the geometric mean are according to the CE standard, all non-compliant samples come from the hand milking farm, the values with the highest germ load are obtained in the farm C.

The highest value of the geometric average for NTG in manually milked milk was obtained in farm C-230,000 cfu/ml, in the period June-July 2021 compared to the same period at farm B for the same milking system used, a mean geometric value for NTG of 86000 cfu/ml.

This result is only a confirmation of the fact that even if the same milking system is used in optimal hygienic conditions, with the observance of good work practices regarding the preparation of teats, the hygiene of the staff and the equipment with milk storage at a controlled temperature regime can obtain raw milk with values conforming to the EU standard.

The geometric mean value for NTG in the period April 2021- March 2022 from farms with mechanized milking

Although all 6 holdings use mechanized milking systems for milking, a variation of NTG between them is highlighted.

Exemplifying only for the period April-May 2021 and the following values are obtained:

- Farm E- milking in a drum - NTG-7,1 x10<sup>4</sup> ufc/ml
- Farm F- milking room - NTG-6,7 x10<sup>4</sup> ufc/ml

- Farm G- milking room - NTG-5,7 x104 ufc/ml
- Farm H- milking with the robot -NTG-9,3 x104 ufc/ml
- Farm I- milking with the robot -NTG-5,3 x104 ufc/ml
- Farm J- milking with the robot -NTG-6,5 x104 ufc/ml

It is a finding of the fact that the milking system influences the hygienic quality of the milk, it being correlated with the frequency of cleaning the bedding and droppings, with the type of bedding used with the ventilation system and with the way the cattle are housed.

A simple comparison between farm H with a NTG value of 9.3 x104 cfu/ml, which uses the Lely Armstrong robot as a milking system, but the type of bedding is a straw one, the removal of waste is done with the blade tractor in parallel with farm I with a NTG value of 5.3 x104 cfu/ml which also uses the Lely Armstrong robot for milking, but in the cattle accommodation the floor is made of concrete drained with manure drains and covered with rubber and in the rest beds there are mattresses specially made of sponge and the cleaning frequency of the floor is made by the Lely Discovery robot, operated by the main computer every hour.

### Expression of NCS results in studied farms:

Table 2

Period	Manual milking farm				Mechanized milking farm					
	A	B	C	D	E – milking in a drum	Farm with milking room		Farm with milking by means of the robot		
						F	G	H	I	J
April 2021- March 2022										
April/May/ June	58.000	282.000	633.000	539.000	124.000	116.000	129.000	163.000	163.000	220.000
July/August/ September	58.000	179.000	2113.000	635.000	152.000	161.000	144.000	188.000	114.000	209.000
October/ November/ December	286.000	207.000	425.000	743.000	127.000	168.000	169.000	192.000	204.000	180.000
January/ February/ March	219.000	183.000	1056.000	257.000	127.000	194.000	163.000	220.000	60.000	146.000

Expression of NCS results in the studied farms:- Variable geometric mean observed over a period of three months, with at least one sampling per month.

According to EC Regulation 853/2004 for raw milk the content of somatic cells (per ml)  $\leq 400\ 000$ , it follows that of the 10 holdings included in the research, 7 values of the geometric average for a period of three months, with at least one sampling per month does not fall within the allowed limit according to the CE standard and 33 values of the geometric mean comply with the CE standard, all non-compliant samples come from the hand milking farm, the values with the highest somatic cell count are obtained in the farm C. Geometric average of NCS for the period April 2021- March 2022 from farms with manual milking

Average milk somatic cell count increased from April onwards with the largest increases observed between October and December when most cattle herds enter late lactation. For the four farms with manual milking included in the research, the lowest NCS value was in farm A 58.000 cells/ml - the period July-August-September compared with the highest value obtained in farm C with 2113.000 cells/ml, also the samples from holding C did not obtain values compliant with the EU standards, being

removed from the market and destroyed. For the other three holdings, respectively A, B, C, the geometric average fell below the maximum allowed value of 400.000. This improvement was possible due to effective monitoring of mammary gland health.

Geometric average of NCS for the period April 2021- March 2022 from farms with mechanized milking. Although all 6 holdings use mechanized milking systems, there is a small variation of NCS between them, all samples complying with EU standards, obtaining values well below the maximum allowed limit. Exemplifying only for the period April-May 2021 and the following values are obtained:

- Farm E- milking in a drum -NCS -124.000 cell/ml
- Farm F- milking room- NCS-116.000 cell/ml
- Farm G- milking room - NCS -129.000 cell/ml
- Farm H- milking with a robot - NCS -163.000 cell/ml
- Farm I- milking with a robot - NCS -163 cell/ml
- Farm J- milking with a robot - NCS -220 cell/ml

It can be seen how the degree of technology within the farm influences the hygienic quality of milk for NCS, investments in technologies to obtain hygienic milk are more feasible for larger herds and bring safety to the producer as well as stability of the herd through careful monitoring of the health of the mammary gland.

## CONCLUSIONS

The hygienic quality of milk is closely related to the size of the herd, the degree of technology of the farm, the observance of good hygiene practices regarding the preparation of udders, the hygiene of the milking equipment, the type of shelter, the type of bedding used and the milking system;

Educating farmers and successfully implementing on-farm mastitis control programs could prevent the spread of contagious mastitis and reduce late lactation;

The research shows that the most influential factor in the hygienic quality of milk is determined by the observance of good hygiene practices regarding the preparation of teats, milking equipment and ensuring a controlled temperature regime until it reaches the processing unit;

It is a challenge to control the microbial community in raw milk but changing milking routines associated with teat preparation, equipment cleaning, ensuring the temperature regime for milk storage regardless of the type of milking system used can provide a degree of control and guarantee us obtaining raw milk according to EU standards.

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