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# EVALUATION OF THE MICROBIOLOGICAL QUALITY OF FRESH AND PASTEURIZED MILK

Corbu Alexandru Radu[1], Tuțulescu Felicia[1]*
[1*]University of Craiova, Horticulture Faculty
* *Correspondence author. E-mail*: felixdragomir@yahoo.com

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## ABSTRACT

*Milk, due to its chemical composition and the high degree of digestibility of the components, holds an important place in the rational diet of man, being one of the most accessible sources of protein of animal origin, with a superior biological value. At the same time, milk is an ideal medium for the growth and multiplication of microorganisms, which can lead to changes in taste and smell, color, texture and even its sanitary value. The present study makes a comparison between fresh (raw) milk and pasteurized milk, in terms of the total number of germs, which an important microbiological indicator in determining the quality of milk.*

## INTRODUCTION

Milk is a food that plays a major role in ensuring food security for humans, representing the raw material used in the production of over 1000 dairy products (Sarkar S. 2015). The consumption of raw milk should be discouraged, as numerous outbreaks and even deaths have been recorded (Vahedi M. et al., 2013). In addition to testing for microbial quality, milk is subjected to tests for drug residues and other tests for the identification of contaminants at the species level. Appropriate sanitary measures should be taken at all stages, from production to consumption, to provide healthy dairy products (Solomon M., et al., 2013). Pasteurization is the most commonly used method for reducing the number of microorganisms present in milk so that it is a safe food for human consumption. It destroys most of the vegetative bacterial cells, but the thermophilic and some of the G(-) bacteria can survive, subsequently disrupting the safety and quality of dairy products (Angulo et al., 2009). The microbiological quality of pasteurized milk is directly influenced by the quality of raw milk, the thermal treatment used, storage conditions, and the degree of post-pasteurization contamination (Rysstad et al., 2006). Ahmed K. (2013) indicated a poor microbiological quality of raw milk due to bacterial contamination. Singh et al. (2012) found that inadequate packaging systems for milk can lead to its contamination, while Moussa et al. (2013) studied the effect of storage temperature on the quality of raw milk. By analyzing the different pasteurization methods in terms of time and temperature, it has been proven that the HTST (High Temperature Short Time) method is better, compared to the LTLT (Low Temperature Long Time) method in reducing the number of bacterial colonies in cow's milk.

## MATERIAL AND METHODS

Six samples of milk were taken for study: 4 samples were represented by raw, unpasteurized milk, 2 samples originated from cattle farms and were distributed through milk vending machines, and another 2 samples came from local producers (individual households), while pasteurized milk was purchased from the store. All the samples were acquired and tested at the same time for the total number of germs. The determinations were made in three stages: initially, after 24, and respectively 48 hours of storage at three temperature thresholds (0-40 °C; 12 °C; 25 °C) to establish the multiplication rate of the microorganisms initially present in the milk.

*Determination of the total number of germs*

Determination of the total number of germs in milk can provide quantitative information regarding the contamination status, but at the same time also initial data on the quality of the milk. Although not many methods have been attempted for determining the total germ count (TGC), currently, the applicable STAS standards require the use of the pour plate method (Koch method). Measured sample volumes (0.1 ml, 1 ml) from the control sample or from dilutions $10^{-1}$, $10^{-2}$ are inoculated. The culture media used were: tryptone - yeast extract - glucose - agar and agar - meat broth - peptone - lactose. For each dilution, two Petri dishes are inoculated. After determining the number of colonies on the two plates, the arithmetic mean of the colonies is calculated and multiplied by the dilution factor. This will establish the number of germs for each dilution. After inoculation, the plates are incubated at 32 °C for 72 hours, with the first readings taken after 24 hours. Only the plates that developed between 30 – 300 colonies will be considered. To obtain the result, the arithmetic value of the Petri dishes inoculated with the same dilution is calculated. However, there should be no differences greater than ± 10 % between them.

## RESULTS AND DISCUSSIONS

The sampling was done in sterile containers, with the microbiological analysis being carried out immediately after the samples were collected. Figure 1 presents the results obtained regarding the total number of germs (NTG).

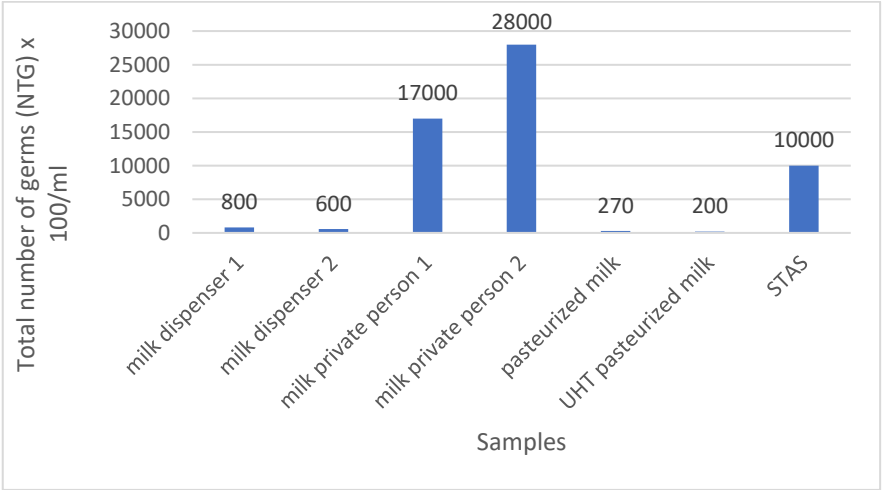


Figure 1. Total number of bacteria present in the analyzed milk samples

The presence of a large number of germs in pasteurized milk can be explained by a very high load before pasteurization, with spore-forming germs predominating for which pasteurization is ineffective. In fact, pasteurization is a incomplete sterilization method that only destroys vegetative forms; the remaining viable spores germinate and give rise to other vegetative forms. The raw milk was subsequently kept for 24 and 48 hours at three temperature thresholds to establish the influence of storage temperature on the microorganisms that are present in these samples.

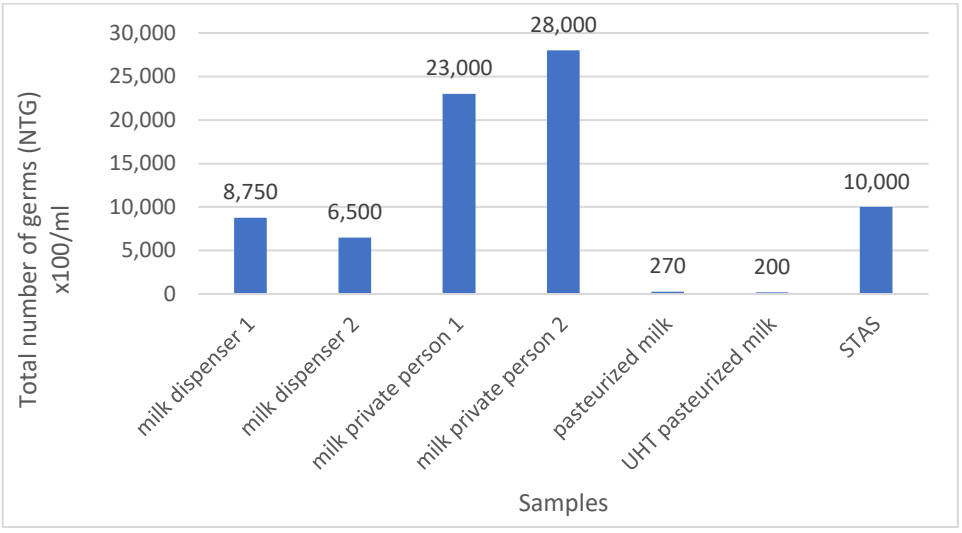


Figure 2. Total number of germs present in milk samples analyzed after storage for 24 hours at 0-4 °C

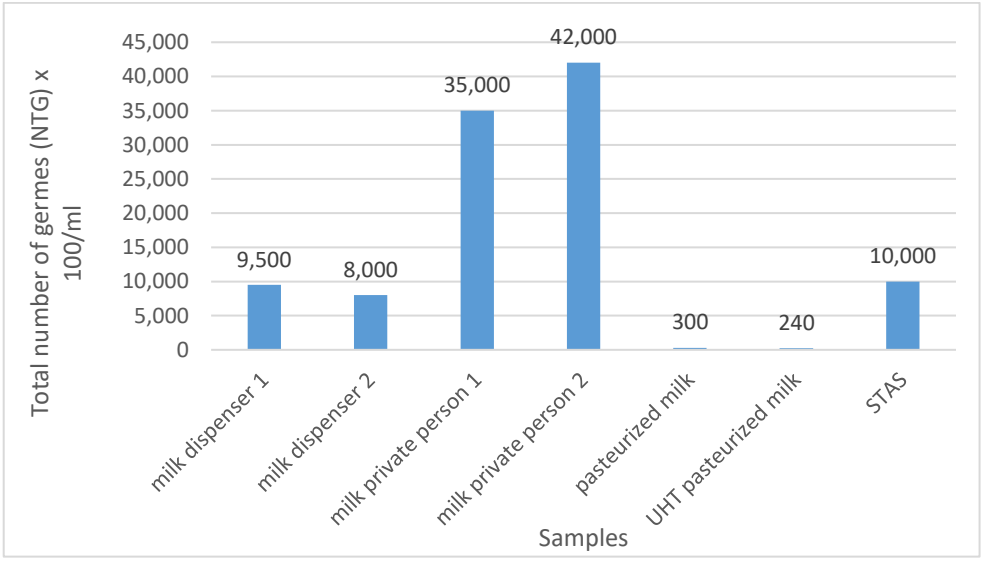


Figure 3. Total number of germs present in milk samples analyzed after storage for 24 hours at 12°C

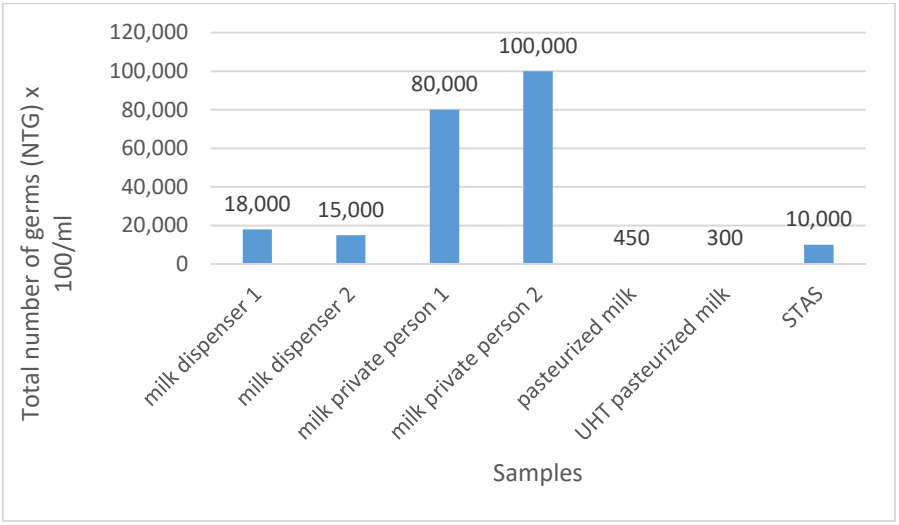


Figure 4. Total number of germs present in milk samples analyzed after storage for 24 hours at 25 °C

The thresholds mentioned earlier had been maintained for 47 hours at the same temperature and this led to an even greater increase in the total number of mesophilic germs and implicitly of pathogenic ones. It can be observed that the multiplication of germs presented a similar development to the one recorder after 24 hours of maintaining at the same temperatures. It is noteworthy that the evolution of microorganisms is much slower compared to raw milk, which can be explained by the fact that pasteurization destroys a large part of the absolutely essential vitamins for the development of certain microorganisms. Lactic bacteria are very particular about the presence of vitamins in milk, with some of them requiring at least 6 vitamins in the medium.

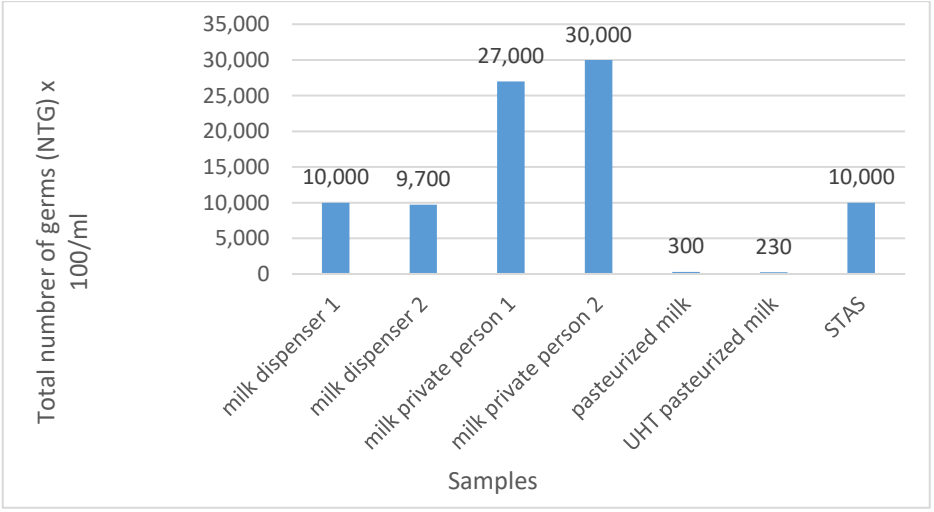


Figure 5. Total number of germs present in milk samples analyzed after storage for 48 hours at 0-4 °C

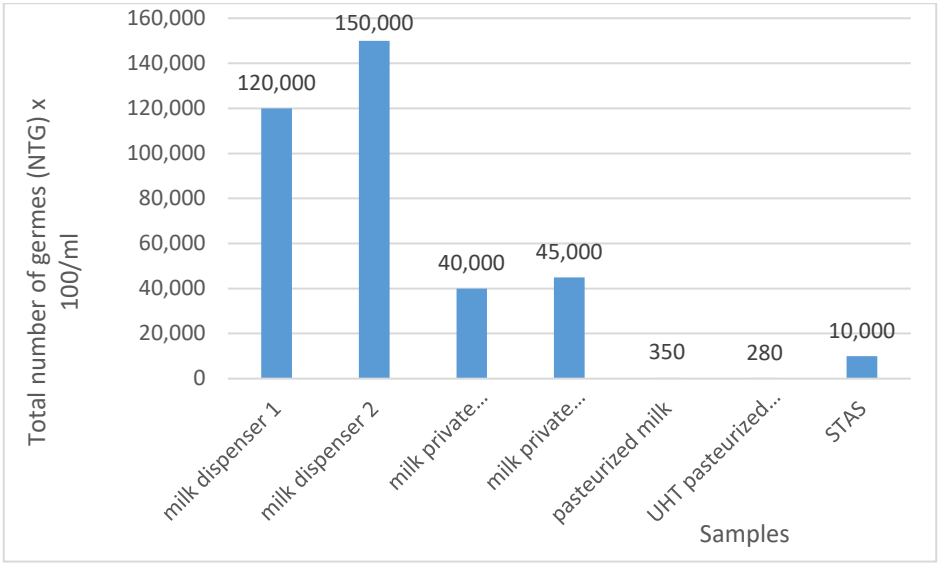


Figure 6. Total number of germs present in milk samples analyzed after storage for 24 hours at 12 °C

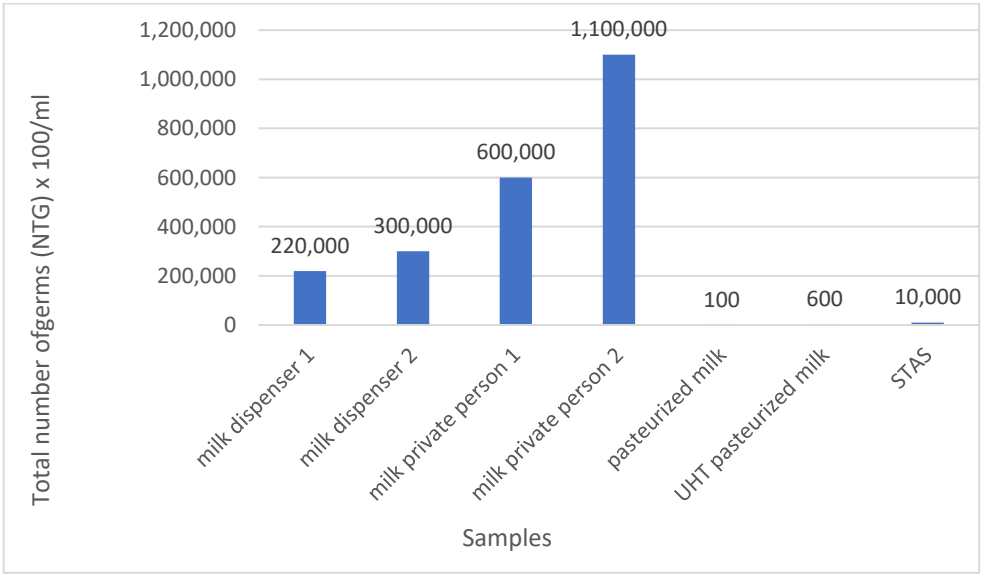


Figure 7. Total number of germs present in milk samples analyzed after storage for 24 hours at 25 °C

From the graphical representations, it can be observed that the lowest multiplication rate occurs at refrigeration temperature, while storage at 25°C leads to a doubling of the number of germs in 24 hours. This can be explained by the fact that 25°C corresponds to the optimal multiplication temperature for many genera and species of mesophilic microorganisms present in milk. The increase in the number

of germs even at 12 °C can also be explained by the presence of cryophilic germs in milk, in numbers lower than those of mesophilic germs.

## CONCLUSIONS

Among food products, milk is the most complete and easily assimilable food for the human body, being one of the basic foods and among the few animal-based foods that contains easily digestible dietary fats. Milk is well assimilated by the body, having an easy digestion process and a very short retention time in the stomach.

Although milk is a food that contributes to increasing resistance to diseases, under certain conditions, its consumption can create risks to consumers. Thus, milk can be considered a vector for pathogens of tuberculosis, salmonellosis, and brucellosis, as well as for toxic substances such as herbicides, toxic substances from feed, and even antibiotics. The hygienic value of a product can be compromised either because the technological processing process that has not been fully adhered to, or because the raw material has been contaminated with microorganisms or the chemical composition has undergone changes that render it unsuitable for consumption.

Keeping raw milk at refrigeration temperature allowed it to maintain compliance parameters only in the case of milk coming from automatic dispensing equipment, while milk from private producers lost this quality in less than 24 hours, a fact explained by the hygiene of the collection process which in this case can be poor.

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