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Researches concerning variation of some phisico-chemical parameters of raw milk used to obtain semi-hard cheeses

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Abstract

The aim of the investigations was to study the variation of some physico-chemical parameters in the cheese processing. For milk analysis, the sampling was done in two steps from the processing flow: at the raw milk reception and after milk pasteurization. Several physical, chemical and microbiological factors interfere in cheese processing. These factors should be taken into account at the raw milk and the final product quality control.

Keywords: physico-chemical parameters, non-fat dry matter, proteins, freezing point

1. Introduction

Semi-hard cheeses are made from fresh raw milk, pressed and salted in brine; they don't have the surface micro flora. The quality of final product, the specific consumptions and the technico-economical indices of milk production largely depends on the milk quality. Obtaining of some quality products is conditioned by the raw milk quality used, respectively by its aptitudes to obtain cheeses (including sensorial, physico-chemical, hygienic and microbiological characteristics).

2. Materials and methods

For milk analysis, the sampling was done in two steps of the processing flow: at the raw milk reception and after the heat treatment (pasteurization). The samples were collected randomly, in sterile containers, after the milk homogenization (according to STAS 9535/1-87). The analyses were done during on two winter months (December and January), following the next methods:

- Determination of titrable acidity – titration method, according to STAS 2418/2008;
- Determination of fat content – butirometric method, according to SR ISO 6731/96;
- Determination of non-fat dry matter content – oven drying method, according to SR ISO 6731/96;
- Determination of protein content – Kjeldahl method, according to SR ISO 8968-1/2002;
- Determination of freezing point - Cryoscope method, according to SR EN ISO 5764/2003;
- Determination of milk density - by the thermolactodensimeter, according to STAS 143-2008;

3. Results and Discussion

In figure 1 are shown the results of physico-chemical analysis of raw milk, at the milk reception, during cold season.

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Table 1. Statistical analysis of physico-chemical parameters of raw milk at the milk reception (n = 16)

Parameter	Minimum value	Maximum value	Mean, $\overline{X}$	Standard deviation of the mean, $s_{\overline{X}}$	Standard error of the mean	Coefficient of variation, %
Non-fat dry matter content, %	8.07	9.14	8.556	0.3114	0.07786	3.64
Protein content, %	3.21	4.14	3.536	0.2322	0.05804	6.57
Fat content, %	3.34	5.18	4.259	0.4808	0.1202	11.29
Freezing point, ºC	-0.5421	-0.5250	-0.5328	0.005371	0.001343	-1.01
Titrable acidity, ºT	15.5	18.5	17.16	0.8509	0.2127	4.96

Table 2.Statistical analysis of physico-chemical parameters of pasteurized milk (n = 16)

Parameter	Minimum value	Maximum value	Mean, $\overline{X}$	Standard deviation of the mean, $s_{\overline{X}}$	Standard error of the mean	Coefficient of variation, %
Non-fat dry matter content, %	8.050	9.120	8.547	0.3114	0.07784	3.64
Protein content, %	3.200	4.120	3.523	0.2294	0.05735	6.51
Fat content, %	3.330	5.170	4.243	0.4804	0.1201	11.32

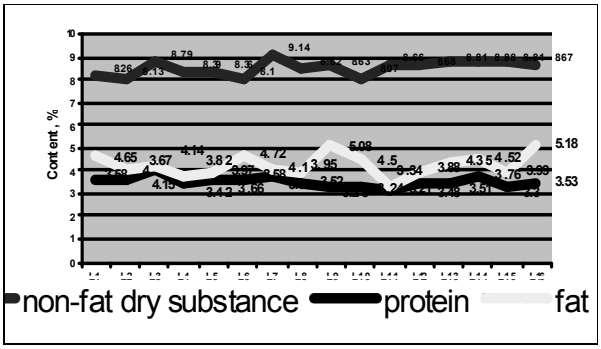

Figure 1. Physico-chemical parameters of raw milk at the milk reception during cold season

The statistical analysis was performed with two-way analysis of variance **(**ANOVA**)**.

The non-fat dry matter content of milk ranged between 8.07 and 9.14%. 43.75% from the samples were under the average value of 8.556 ± 0.3114.

The non-fat dry matter represents approximately 70% from milk total dry matter and conditions nutritive and energetic value of milk, biological value, technological value, milk and dairy preservation and milk integrity.

The content of non-fat dry matter is an more stabile indicator comparing with the fat content [1].

The protein content ranged between 3.21 and 4.14%. 56.25% from the samples were under the average value of 3.536 ± 0.2322. The average value of protein content is of 3.4% for caw milk [3-5].

The fat content of milk samples ranged between 3.34 and 5.18% (not even one sample had the fat content under the minimum value, according to SR 2418-2008). 56.25% from the milk samples were under the average value of 4.259 ± 0.4808. The average value of the fat content for caw milk is of 3.5% [2-6].

The titrable acidity is an indicator for milk freshness. At the samples taken in study, the titrable acidity ranged between 15.5 and 18.5°T. 43.75% from the milk samples were under the average value of 17.16 ± 0.8509.

The freezing point ranged between –0.532 and –0.580°C. 43.75% from the analyzed samples were under the average value ($\overline{X} \pm s_{\overline{X}}$) of –0.5328 ±

0.005371. The value of freezing point is determined by the concentration of solutes from the milk (lactose, minerals and non protein nitrogen). By adding of some substances (sodium bicarbonates, salt) the freezing point decreases and the shelf-life increases. Adulteration of milk with water increases the milk freezing point to zero.

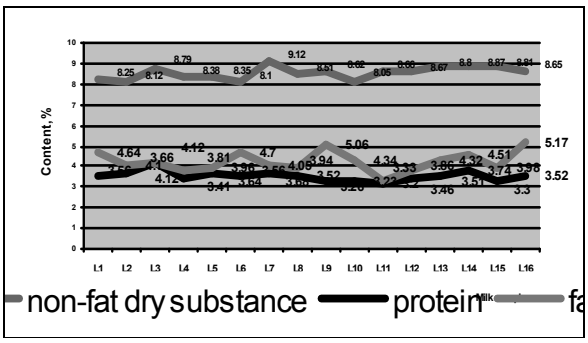

Figure 2. Physico-chemical parameters of pasteurized milk

The statistical analysis was performed with two-way analysis of variance **(**ANOVA**)**.

The values for milk non-fat dry matter ranged between 8.05 and 9.12%, slightly lower compared to unpasteurized milk, 43.75% from the samples being under the mean value ($\overline{X} \pm s_{\overline{X}}$) of 8.547 ± 0.3114. Also, 37.5% from the milk samples (as well as before pasteurizing) had the total dry matter content under the minimum limit of 8.5% (according to SR 143-2008).

The protein content ranged between 3.2 and 4.12% and the fat content between 3.33 and 5.17%, the parameters values being in all cases smaller than before pasteurization but in the Romanian standard limits. 18.75% from te milk samples were under the average value of 3.523 ± 0.2294 in terms of protein content and 56.25% from the milk samples were under the average value of 4.243 ± 0.4804 in terms of fat content.

During low temperature pasteurization, most of the CO_2 is removed, which leads to a decrease of titrable acidity with approximately 0.01% [1]. A side effect of pasteurization, increasing the cheese processing efficiency, is determined by the denaturation of soluble proteins that otherwise will go in the whey, by the fat retention in the curd and by the partial insolubilization of the minerals.

4. Conclusion

Based on the results of the experimental investigations, the following conclusions were drawn:

- The milk used for cheese processing must be pasteurized in order to achieve a uniform quality of cheese. After the heat treatment, the values of mentioned parameters were smaller. In summary, the pasteurization has been shown to affect the main components of the milk, which are theoretically negligible;
- During milk samples analysis, the values obtained for physico-chemical parameters were in accordance with the regulations for raw milk;
- To explain the variation of chemical composition after pasteurization, was taken into account the action of high temperature on the main components of the milk: the fat, under high heat treatment doesn't undergo significant changes (there are some variations in the fat membrane globules that determines the behavior of this parameter in the subsequent processing of milk); proteins under high heat treatment undergo profound changes, irreversible, which lead to a decrease of their solubility and looses of some biological properties.

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