

THE MODIFICATION OF SOME CHEMICAL PARAMETERS FOR DIFFERENT BRANDS OF MILK DURING REFRIGERATION

MODIFICAREA UNOR PARAMETRI CHIMICI PENTRU DIFERITE TIPURI DE LAPTE ÎN CONDIȚII DE PĂSTRARE LA RECE

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Abstract. Milk is one of the main foods especially in the diet of small children but not only theirs. In addition to consumption as pasteurized or high-temperature treated (UHT) milk, it is a raw material for making cheeses, yoghurts, other milk products, and many products in which it is used. It is an accessible source of calcium but also of fat, protein, lactose, other mineral substances, vitamins and enzymes. The fresh product being perishable is treated thermally to prolong the shelf life. The present paper analyzes the variation of different chemical parameters (pH, acidity, lactose content) under storage conditions at 4°C, and also the dry matter and nitrates contents for different types of milk marketed or distributed for consumption.

Key words: milk, chemical parameters, cold storage

Rezumat. Laptele face parte dintre alimentele de bază în special în alimentația copilor mici dar nu numai. Pe lângă consumul ca lapte pasteurizat sau tratat la temperaturi înalte (UHT), reprezintă materie primă în obținerea brânzeturilor, iaurturilor, altor derivate din lapte și a multor produse în a căror compoziție intră. Reprezintă o sursă accesibilă de calciu dar și de grăsimi, proteine, lactoză, alte substanțe minerale, vitamine și enzime. Produsul în stare proaspătă fiind perisabil, se tratează termic pentru a prelungi perioada de păstrare. Lucrarea de față analizează variația diferiților parametri chimici (pH, aciditate, conținut de lactoză) în condiții de păstrare la 4°C, alături de conținutul în substanță uscată și azoți pentru diferite tipuri de lapte comercializate sau distribuite către consum.

Cuvinte cheie: lapte, parametri chimici, păstrare la rece

INTRODUCTION

Milk is a natural emulsion containing proteins (casein and whey proteins), antibodies, enzymes, glycerides and complex lipids, lactose and carbohydrates, liposoluble and water-soluble vitamins, minerals (calcium, potassium, phosphorus, etc.). Lactose is the only source of galactose - a component of galacto-cerebrosides and is the substrate for microorganisms that produce

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fermentation, of technological importance in the production of acidic dairy products and in the maturing of cheeses (Usturoi, 2008).

Due to the complex composition, milk is a perishable product and must be stored under refrigeration for transportation and marketing. A study on the influence of storage conditions of raw milk in Italy in 2013 showed that there were significantly altered coagulation properties of milk induced by the addition of rennet after 12 hours at 4-6 and 8-10⁰C and also the cream forming capacity decreased when stored in all variants, especially at 13-15⁰C. The authors recommend keeping the raw milk at 8-10⁰C on farms for up to 24 hours (Malacarne *et al*, 2013).

Cold storage also influences the physico-chemical parameters of the milk powder, with very significant effects on titratable acidity, humidity and dry matter content (Semeniuc *et al*, 2012).

An extensive study on the influence of the storage conditions of some cheeses described the increase in proteolytic index, pH and salt content as well as the change in organoleptic properties (Todaro *et al*, 2017).

This paper aims to analyze changes in physicochemical parameters for seven types of drinking milk (UHT, pasteurized bottled and bulk) during storage at 4-6⁰C without boiling after opening the packs.

MATERIAL AND METHOD

The following milk brands were analyzed, with the characteristics offered by the producers:

P 1 – Zuzu (producer Albalact) Ingredients: standardized cow's milk 3.5% homogenised fat and pasteurized at high temperature. Nutritional information for 100 g of product: lipids 3.5 g, proteins 3.4 g, carbohydrates 4.5 g;

P 2 - Rarăul (producer Albalact) Ingredients: standardized cow's milk 3.5% homogenised fat and pasteurized at high temperature. Nutritional information for 100 g of product: energy value / 100 g: 62 kcal (259 kJ); protein 3.2 g, carbohydrate 4.5 g, lipids 3.5 g;

P 3 – La Dorna (producer Dorna Lactate) Ingredients: standardized cow's milk 3.5% homogenised fat and pasteurized at high temperature. Nutritional information for 100 ml of product: 62 kcal energy, 3.5 g fat, 3.2 g protein, 0.133 g sodium, carbohydrate 4.5 g;

P 4 – Milli (producer Milli) Ingredients: standardized cow's milk 3.5% homogenised fat and pasteurized at high temperature. Nutritional information for 100 ml of product: 62 kcal energy value; fat 3.5 g, protein 3.2 g, carbohydrate 4.5 g;

P 5 – Fulga (producer Albalact) Ingredients: standardized cow's milk 3.5% homogenised fat and pasteurized at high temperature. Nutritional information for 100 ml of product: 61 kcal energy value; fat 3.5 g, protein 3.2 g, carbohydrate 4.5 g;

P 6 – Fresh milk from the Rediu farm, pasteurized at 70⁰C;

P 7 – Vio (producer S.C. Ilvas, S.R.L) skimmed milk for consumer use, 1.8% fat.

The following physical and chemical parameters were tested: moisture and dry matter (by oven drying method at 105⁰C), pH (potentiometric method), titratable acidity (volumetric method and Thörner degrees expression), lactose content

(polarimetry method), nitrites content (Griess reagent colorimetric method and Spekol 1100). Titrations for the acidity values and pH values were performed at four-day intervals until the organoleptic properties were changed below the acceptability limit.

RESULTS AND DISCUSSIONS

As regards the moisture and dry matter of the analyzed milk samples, the values are shown in figure 1.

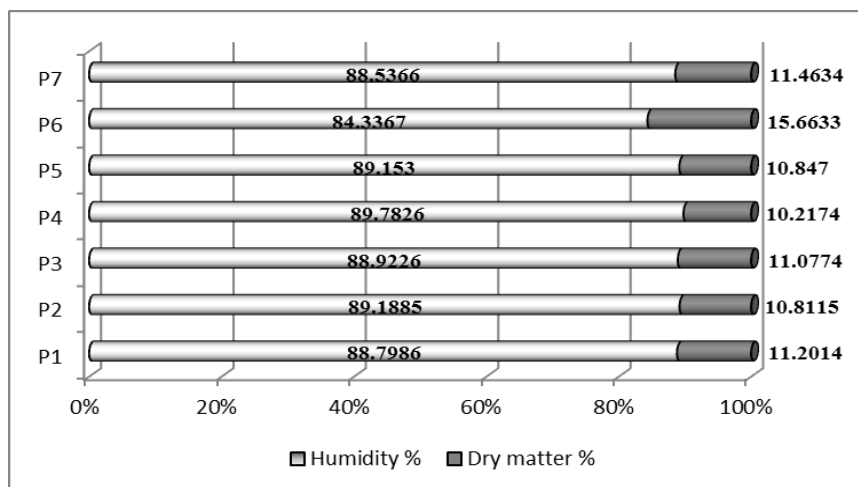


Fig. 1 Moisture and dry matter values for the analysed milk samples

The pH values were determined at the time of opening the pack and at four-day intervals, the samples being maintained at 4-6°C throughout the shelf life. Recorded data are shown in figure 2.

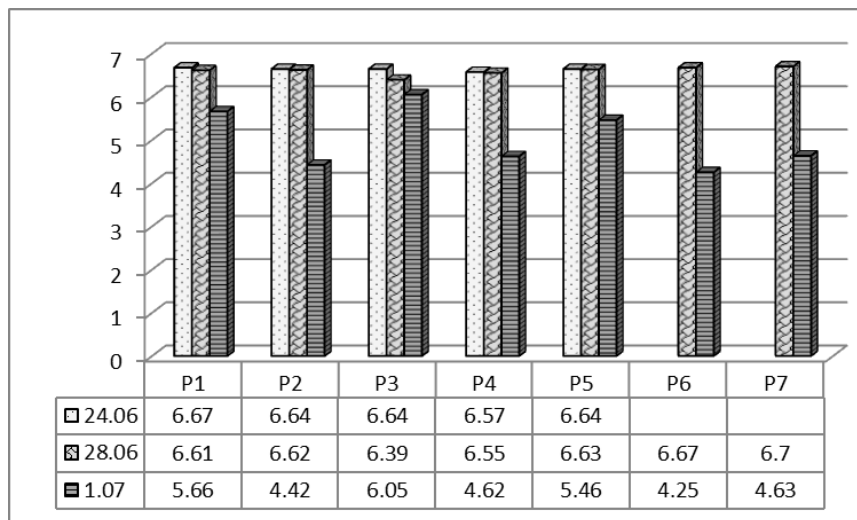


Fig. 2 Variation of pH-values during storage in refrigeration conditions

Acidity was expressed in degrees Thorner and the determinations were made at four and nine days after the opening of the packs. The values obtained are presented in figure 3.

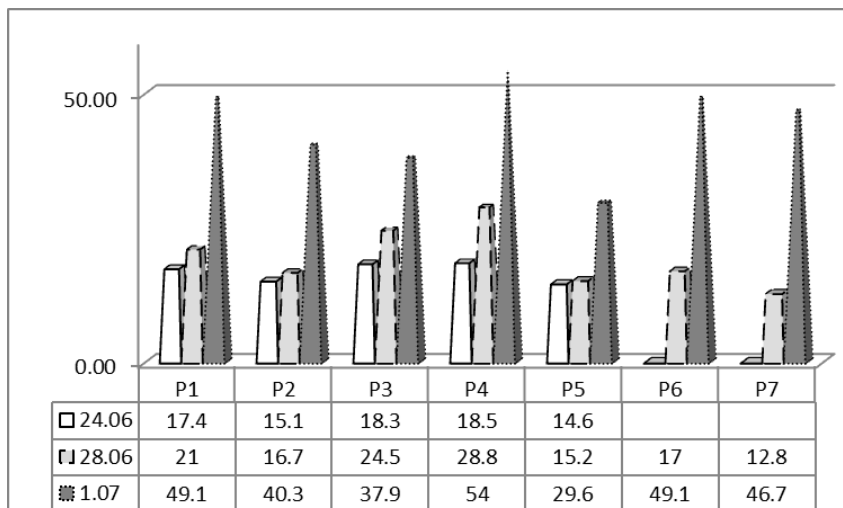


Fig. 3 Variation of acidity values ($^{\circ}T$) in time for the considered milk samples

The lactose content was determined from deproteinized milk with 10% trichloroacetic acid solution by polarimetric method. For drinking milk (P_6 and P_7), a single determination was made at the opening of the package, and for the milk treated at high temperatures, two determinations were made at four days. The values obtained are presented in figure 4.

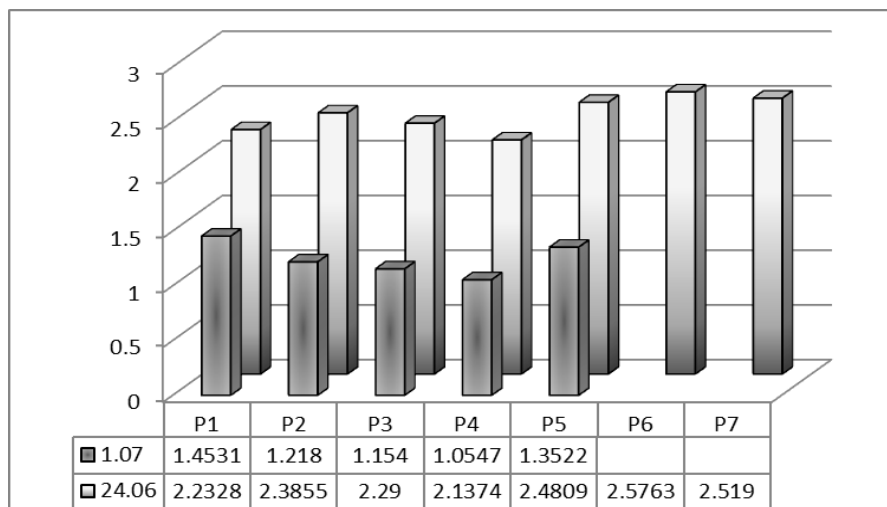


Fig. 4 The lactose contents of the milk brands

The daily dose accepted for the ingestion of nitrates is 0 – 0.07 mg/kg (Yeh *et. al.*, 2013), therefore the nitrite content for the milk samples was determined, the values obtained being presented in figure 5.

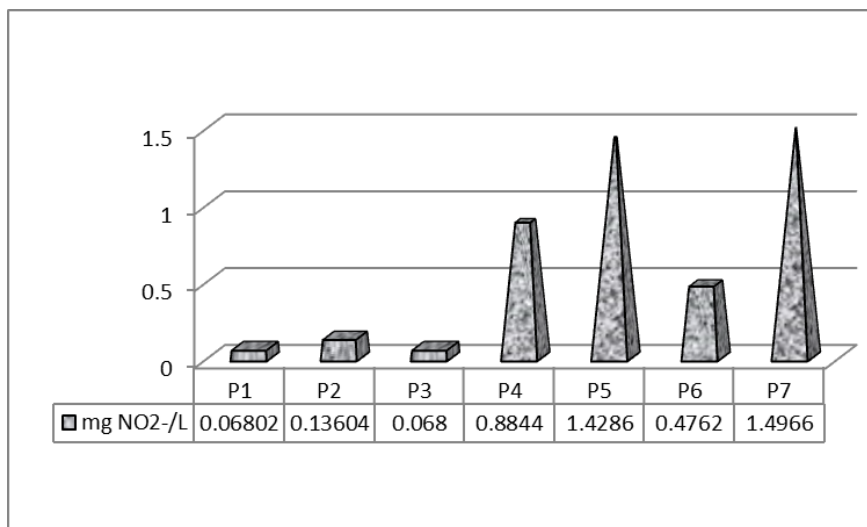


Fig. 5 Nitrites contents for the considered milk samples

CONCLUSIONS

1. Milk is a daily food used in adults and, most important, children's diet, therefore it's essential to insure its quality;

2. Dry matter content of the considered seven brands of milk varied between 10.21 – 15.66%, more or less in accordance with the average 13% accepted for cow milk;

3. Most of the UHT milk brands dropped one or two units of pH in approximately ten days, except P₃, where pH decreased only with 0.59 units, while fresh milk decreased 2.5 units in average after only four days;

4. Free acids content increased in four days of storage for the fresh milk three times or more, while the UHT samples resisted longer, with small changes after four days and significant ones after ten days; the sample which had the lowest acidity was P₅;

5. The lactose content ranged from 2.12 – 2.57%, with a decrease to a half for all the UHT samples where this parameter was determined twice;

6. Only three brands of milk - P₁, P₃ and P₆ – had smaller amounts of nitrites, therefore being appropriate for small children's diet. The highest nitrites contents were registered for P₅ and P₇ samples.

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