RESEARCH REGARDING THE INFLUENCE OF THE PACKAGING TYPE ON THE QUALITY OF CONSUMPTION MILK

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Abstract

One of the main elements that has a major impact on consumers is the packaging of the product they are looking for. The packaging must mainly fulfill the functional role of covering a product and protecting it during the manipulations carried out both on the shelves of shops and in the consumers' house. Although major manufacturers invest large sums in order to assess the impact of packaging on consumers, many marketers do not pay much attention to how or not the packaging is functional for the product it serves, thus losing some of the consumers.

In order to achieve the proposed purpose, three packing units destined for consumer milk were purchased, namely milk packed in polyethylene bag, milk packaged in pet, milk packed in carton type tetra-pak and milk packed in glass bottle, all having a fat concentration of 3.5%.

The determinations made to establish the quality of the milk were: the fat content (%), the non-fat dry matter (%), the density (g/cm^3), the protein content (%), the acidity (°T), lactose (%), and added water (%).

Through this paper we set out to conduct a study on the qualitative parameters of consumer milk packaged in different forms and marketed.

Key words: milk, packaged, quality

INTRODUCTION

Both milk and milk products are important and indispensable foods for human life, so milk will always be a natural supplement, present in the diet, regardless of age [1], [12].

Regarding the chemical composition of milk, it is mentioned that "milk contains over 100 nutrients necessary for the human body (5 types of proteins, 20 amino acids, 10 fatty acids, 4 types of lactose, 45 mineral elements, 25 vitamins, enzymes, hormones etc.), high importance and having their percentage, 100% [2], [3], [4], [5].

The quality of food, especially milk, is a complex notion, quality being approached from the perspective of consumer safety. At present, quality is one of the disqualifying competitive elements for the food market, this being due to the consumer who seeks to satisfy his own needs, desires, preferences and demands, to the greatest extent [6], [8].

As a member country of the European Union, our country faces the challenges and restrictions imposed by the EU; that is why it is absolutely necessary to know and respect the European requirements both in the field of food production and marketing.

At European level, the milk sector ranks first in European agricultural production, representing about 14% of its total value.

The EU milk industry is renowned for the quality of the products obtained, not only for the famous assortments of cheeses, but also for the varied range of yoghurt, cream and ice cream.

Given the importance of drinking milk and ensuring the quality and safety of milk throughout the traceability chain, from producer to consumer, particular importance must also be given to the influence of the type of packaging on the quality of the milk [9], [11].

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According to STAS 5845 / 1-1986, the packaging constitutes "a means (assembly of means) meant to comprise or cover a product or a set of products, in order to provide temporary protection from several points of view (physical, chemical, mechanical, biological) in order to maintain both their quality and their integrity at delivery, handling, transport, storage and sale, until the final consumer or until the validity deadline is exceeded ".

Because of complex chemical composition, milk is considered an excellent environment for the development of microorganisms, which gives it a short shelf life, even if it is kept at low temperatures.

According to the specialized literature, milk preservation processes aim to stop the development of microorganisms and avoid the physical-chemical transformations of the finished product.

Both the choice of the appropriate packaging for the consumer milk and the selection of the materials necessary for their manufacture are made taking into account the interdependence of some factors, of which we list: requirements imposed by the conservation process, the interaction between the product and the packaging installation, the interaction between the packaging and the environment outside.

Raw milk is a perishable product, due to its composition. Exposure to light leads to loss of nutritional value, which is why it requires packing. Once the milk has been packed, it is recommended to protect the milk from light - both natural and artificial milk, as light has a destructive effect on some vitamins (especially vitamin B2).

For these reasons, in this paper we propose to analyze the influence of the type of packaging on the quality of milk during storage.

MATERIAL AND METHOD

In order to achieve the proposed purpose, three packing units destined for consumer milk were purchased, namely milk packed in polyethylene bag, milk packaged in pet, milk packed in carton type tetra-pak and milk packed in glass bottle, all having a fat concentration of 3.5%.

On the purchased milk, determinations were made with a view to establishing the qualitative parameters, after which the product was closed and kept at refrigeration temperatures for the period indicated by the manufacturer (7 days). At the end of the period it was considered necessary to repeat these analyzes in order to establish the type of packaging that manages to maintain the quality of the milk in optimal conditions.

In a first stage, the packaging for the consumer milk was analyzed, focusing mainly on the manufacturer's indications, indications specified on the packaging.

Consumer milk packaged in the bag (fig. 1) was the most used milk packing method after 1989 [10], but in recent years it has been found increasingly difficult on the shelves of shops.

Fig. 1 Pasteurized milk packaged in bags

We mention that for the milk packed in the bag there was no possibility of closing the meter to protect the product from contact with oxygen. Also, in order to ensure that the bags are kept in storage during the storage period, they were introduced in berzelius glasses.

Consumer milk packaged in plastic (PET) (fig. 2).

For this category of milk was used a milk with a fat content of 3.5%. The bottles used are HDPE - High density polyethylene

Fig. 2 Pasteurized milk packaged in PET

Consumer milk packaged in TETRA-PAK (fig. 3). For this category of milk was used milk with a fat content of 3.5%. The heat treatment to which this milk was subjected was the pasteurization process (which requires heating the milk at 72°C for 15 seconds). The following objectives are achieved through this process: destruction of pathogenic bacteria (preserving the quality by destroying most microorganisms), providing a product that can be kept for a long time, without altering its qualities.

Fig. 3 Pasteurized milk packaged in Tetra pak

Consumer milk packaged in glass bottle (fig. 4). Consumer milk packaged in glass packaging can be found under two variants: pasteurized milk and sterilized milk.

Fig. 4 Pasteurized milk packaged in glass bottle

In the case of pasteurized milk, wide-necked bottles (36 - 40 mm) are used, being suitable for sealing with prefabricated crowns. There are also cases where the glass is sealed with an aluminum foil. The capacity of the bottles is usually one liter or half a liter.

The determinations made to establish the quality of the milk were: the fat content (%), the non-fat dry matter (%), the density (g / cm^3), the protein content (%), the acidity (°T), lactose (%) and added water (%).

The device used to determine the quality physico-chemical parameters whas EKOMILK SPECTRA (fig. 5), a milk analyzer that works on infrared and ultrasound, was able to quickly detect the main qualitative parameters of milk.

Fig. 5 Analizator EKOMILK-Spectra

RESULTS AND DISCUSSIONS

For the milk packed in the bag, the first difference observed was the fat content which registered an average value of 3.42 ± 0.015% on the first day of analysis, the values recorded on the label being 3.5%. The studied character presented a very good homogeneity, the value of the coefficient of variation being 0.74%. At the end of the experimental series, after the 7 days indicated by the manufacturer, the average calculated for the fat content was 3.42 ± 0.12% (tab. 1).

Table 1 The physical - chemical characteristics of the milk packed in the bag

SPECIFICATION	Fresh milk		Milk stored 7 days	
	$\bar{X} \pm s_{\bar{x}}$	V%	$\bar{X} \pm s_{\bar{x}}$	V%
Fat content (%)	3.42±0.015	0.74	3.42±0.12	0.61
Dry matter non-fat (%)	7.97±0.01	0.19	7.96±0.01	0.13
Density (g/cm^3)	1.026±0.001	0.01	1.0262±0.001	0.01
Protein (%)	3.01±0.01	0.19	3.01±0.01	0.19
Lactose (%)	4.39±0.01	0.60	4.39±0.01	0.57
Acidity (°T)	16.33±0.33	3.53	22.00±0.57	2.55
Added water (%)	3.12±0.01	0.81	3.12±0.01	0.81

Significant changes were found in the case of acidity, for example, for fresh milk, the average value of the acidity on fresh milk was 16.33 ± 0.33°T and at the end of the storage period it reached an average value of 22.00 ± 0.57°T.

The studied character presented a very good homogeneity for both groups, the values of the coefficients of variation being 3.53% respectively 2.55%.

The increase in acidity was due in particular to the type of packaging in which the milk was stored, as it was not possible to be closed during storage. We mention that after these 7 days of storage, the milk was unfit for consumption, it presented flakes, odor and sour taste.

A final parameter analyzed was the added water content of the product, which must be 0%, according to the standards in force. In the case of milk packed in the bag, the percentage of water determined on the fresh milk was 3.12 ± 0.01% percentage that did not change during storage, the average value recorded at the end being 3.12 ± 0.01%.

As in the case of milk packed in the bag and for milk packed in plastic glass, deviations in fat content were encountered. For example, for fresh milk the average fat content was 3.27 ± 0.01% and 3.26 ± 0.11% at the end of the determinations. The studied character presented a very good homogeneity (tab. 2).

Table 2 The physical - chemical characteristics of the milk packed in PET

SPECIFICATION	Fresh milk		Milk stored 7 days	
	$\bar{X} \pm s_{\bar{x}}$	V%	$\bar{X} \pm s_{\bar{x}}$	V%
Fat content (%)	3.27±0.01	0.70	3.26±0.11	0.61
Dry matter non-fat (%)	7.95±0.01	0.20	7.94±0.01	0.13
Density (g/cm^3)	1.0263±0.001	0.01	1.0263±0.001	0.04
Protein (%)	3.03±0.01	0.16	3.03±0.01	0.22
Lactose (%)	4.35±0.01	0.55	4.35±0.01	0.57
Acidity (°T)	16.40±0.33	2.90	18.12±0.50	1.30
Added water (%)	5.84±0.01	0.70	5.83±0.01	0.77

Regarding the content of dry matter, the average value for fresh milk was 7.95 ± 0.01%, the character studied being very homogeneous, the value of the coefficient of variation reaching 0.20%.

For stored milk, the average value was relatively constant, the average being 7.94±0.01%. The studied character also presented a very good homogeneity, the value of the coefficient of variation being 0.13%.

Regarding the acidity, where the maximum value indicated by the standard is 19˚T, at the end of the average experience we calculated was 18.12 ± 0.50°T compared to 16.40±0.33°T as much as was at the beginning of storage. Regarding the studied character, it presented a very good homogeneity for both groups, the values of the coefficients of variation being 2.90% and 1.30% respectively.

The last parameter analyzed by us was the water added from the product, where the average value was 5.84±0.01% at the beginning of the determinations and 5.83±0.01% at the end of the determinations. The studied character presented for this parameter a very good homogeneity, the values of the coefficients of variation being of 0.77% respectively 0.77%.

With regard to milk packaged in a tetra-pak type box, the fat content was 3.40±0.01% before storage, being less than 0.10% compared to the value written on the label. presented a very good homogeneity, the value of the coefficient of variation being 0.65%. At the end of the determinations, after the 7 days of storage, there were no reported changes in the fat content, the average value of the fat content being 3.40±0.09% (tab. 3).

Table 3 The physical - chemical characteristics of the milk packed in TETRA-PAK

SPECIFICATION	Fresh milk		Milk stored 7 days	
	$\bar{X} \pm s_{\bar{x}}$	V%	$\bar{X} \pm s_{\bar{x}}$	V%
Fat content (%)	3.40±0.01	0.65	3.40±0.09	0.51
Dry matter non-fat (%)	8.01±0.01	0.25	7.99±0.01	0.16
Density (g/cm^3)	1.0264±0.001	0.01	1.0263±0.001	0.02
Protein (%)	3.05±0.01	0.19	3.04±0.01	0.12
Lactose (%)	4.40±0.01	0.41	4.38±0.01	0.33
Acidity (˚T)	16.12±0.19	1.90	19.60±0.50	3.33
Added water (%)	3.18±0.01	0.42	3.16±0.01	0.22

Regarding the protein content, for fresh milk the level was 3.05 ± 0.01% on the first day of storage and 3.04 ± 0.01% on the seventh day of storage. The studied character presented a very good homogeneity, the value of the coefficients of variation being 0.19% and 0.12%.

The lactose content was 4.40 ± 0.01% with a coefficient of variation of 0.41%. For milk stored the average was 4.38 ± 0.01% and the value of the coefficient of variation was 0.33%. In this case, too, water was added to the product, therefore, the milk packaged in a tetra-pak box the percentage of added water was 3.18 ± 0.01%.

Glass is the packaging that takes the consumer with the thought of a healthy product, an organic product. For the milk we analyzed, the fat content indicated on the label was 3.5%, the average obtained by us being lower by 0.63%, ie 2.87 ± 0.01%. The studied character presented a very good homogeneity, the value of the coefficient of variation being 0.70%. After the 7 days of storage, the average value in the ones regarding the fat content was 2.86 ± 0.12% and the value of the coefficient of variation of 0.55% (tab. 4).

For the dry matter content, an average value of 8.09 ± 0.01% was recorded on the first day of storage and 8.09 ± 0.05% on the 7th day of storage. The studied character was also very homogeneous this time, the values of the coefficients of variation being 0.20% and 0.15% respectively.

In terms of density, it registered an average of 1.0272 ± 0.001g / cm3 having the same value as in the determinations made in the last day. The protein content was 3.06 ± 0.01% on fresh milk and 3.05 ± 0.01% on milk stored under refrigeration conditions (tab. 4).

Regarding lactose in milk, the average value calculated by us on the fresh product registered an average of 4.43 ± 0.01% with a coefficient of variation of 0.30%, a value that did not undergo major changes, reaching the end of storage at an average of 4.42 ± 0.01%.

Table 4 The physical - chemical characteristics of the milk packed in glass bottle

SPECIFICATION	Fresh milk		Milk stored 7 days	
	$\overline{X} \pm s_{\bar{x}}$	V%	$\overline{X} \pm s_{\bar{x}}$	V%
Fat content (%)	2.87±0.01	0.70	2.86±0.12	0.55
Dry matter non-fat (%)	8.09±0.01	0.20	8.09±0.05	0.15
Density (g/cm^3)	1.0272±0.001	0.01	1.0272±0.001	0.10
Protein (%)	3.06±0.01	0.12	3.05±0.01	0.15
Lactose (%)	4.43±0.01	0.30	4.42±0.01	0.44
Acidity (°T)	16.20±0.21	1.16	18.01±0.22	0.17
Added water (%)	4.22±0.01	0.55	4.21±0.01	0.61

CONCLUSIONS

One of the main elements that has a major impact on consumers is the packaging of the product they are looking for. The packaging must mainly fulfill the functional role of covering a product and protecting it during the manipulations carried out both on the shelves of shops and in the consumers' house.

All milk samples analyzed by us had a 3.5% fat content, content that is labeled.

Following the determinations made it was observed that none of the four assortments had the fat content written on the label. So for example for the milk packed in the bag, the value we determined was less than 0.08%, for the milk packed in plastic glass the difference was 0.23%, for the one in the tetra-pak box a difference of 0.10% and for milk packaged in glass bottle a difference of 0.63% was obtained.

The storage period, as mentioned above, did not affect the fat content of milk, the differences between the values obtained at the beginning of the determinations and those calculated at the end of them are insignificant.

Regarding the protein level inscribed on labels, it had a value of 3%, the average values obtained by us being slightly higher. Therefore, for milk packaged in the average bag we calculated was 0.01% higher, for milk packaged in the average plastic glass it was 0.03% higher. Regarding the milk packaged in tetra-pak type, the average value calculated by us for the protein level was 0.05% higher than that indicated by the label and for the milk packed in glass by the glass, the average calculated by us was was 0.06% higher than the minimum indicated by the manufacturer.

For the milk packaged in the bag, the average value of the acidity at the opening of the packing units was 16.33°T, which at the end registered an average of 22°T. According to the data obtained the milk packed in the bag could not be consumed in the last day. The cause of the increase in acidity was due in particular to the fact that the milk packed in this form could not be closed during storage.

It should also be mentioned that the packaging unit did not specify that its non-consumption at the time of dispatch can lead to its alteration. For milk packaged in plastic glass, a container that is provided with a lid, the average acidity value was 16.4°T, reaching 18.12°T, which allows its consumption even on the last day of storage recommended by the manufacturer.

As for the milk packaged in the tetra-pak type box, the average acidity value on the fresh product was 16.12°T and in the end it exceeded the maximum allowed limit by 0.06°T, which also makes us believe that this type of packaging does not ensure the hermetic closure of the box. For milk packaged in glass, at the beginning of the storage period, the average value for acidity was 16.2°T, and at the end of the research, the average determined after the determinations was 18.01°T with 0.99°T lower than the maximum value indicated. standards.

Following the determined results, we can recommend the consumption of consumed milk packaged in the glass bottle, as it has proven to be the most efficient method of storing milk, followed by milk packaged in a tetra-pak box.

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