KNOWLEDGE OF THE PASTEURIZED LIQUID EGG PRODUCTS QUALITY BY PHYSICO-CHEMICAL AND MICROBIOLOGICAL INDICATORS

Andreea Cătălina Nistor[1*], Aida Albu[1], M.G. Usturoi[1]

[1]*University of Agricultural Sciences and Veterinary Medicine Iaşi, Romania*

Abstract

An important and timely topic in the food industry, it is pasteurized liquid egg products, which have great utility in many industry and not only being sought ever more by consumers.

The purpose of this paper is to verify nutritional properties and microbiological quality throughout the shelf life recommended by the manufacturer and to highlight their degradation. The physicochemical and microbiological quality assessment was performed on liquid pasteurized white and yolk, packed in a 2 kg bag-in-box in refrigerator (0 ... + 4 °C), and consisted in determining the pH value, nitrogen slightly hydrolyzable and microbiological analyzes were carried out according to the standards in force.

The pH value increased during the shelf life from 8.29 (first day) to 8.98 (day 28), similar to pasteurized liquid yolk, the variation limits being between 5.93 and 6.04. Also, the slightly hydrolyzable nitrogen content was increased in the analyzed pasteurized liquid white (from 9.27 mg NH_3/100 g on the first day to 14.73 mg NH_3/100 g for the last day of storage), as well as in pasteurized liquid yolk to 6.57 mg NH_3/100 g in the fresh product to 10.82 mg NH_3/100 g in the stored product for 28 days). For the monitored microbiological indicators we also noticed an increase in their values during the storage period in the two types of analyzed egg products.

The conclusion of the study is the highlight of existence a positive correlation between physical and microbiological indicators for both pasteurized liquid white and yolk analyzed.

Key words: white, yolk, bag in box, quality

INTRODUCTION

Excellent product with food value for all categories of people, egg has always been one of the most commonly used food items in the world (annual increases of about 3%) [8].

Being a valuable food for man and an indispensable raw material for the food industry, at a rational consumption, the egg is a true stimulant for the metabolic functions of the body, increasing its resistance to disease and helping to strengthen the nervous system [1]. Regardless of the evolution of egg preservation or processing techniques, they must meet the strictest food safety conditions, while maintaining the native nutritional qualities of the eggs.

An important and up-to-date subject in the food industry is pasteurized egg products, which are of great utility in the food industry and beyond, being increasingly sought by consumers.

The production, processing and implicit consumption of eggs and derived products has steadily increased over the last decades; the gaining and industrialization of consumer eggs can be considered as some of the most dynamic activities on the agri-food chain [7].

Being safer from the point of view of food safety, pasteurized egg products have an increasing demand because they are easy to use throughout the food chain.

The assessment of the quality of these products could be quantified by applying conservation methods, refrigeration in our case.

Verification of nutritional properties and microbiological quality over the entire recommended shelf life is the purpose of the present work, at the intervals specified throughout the period recommended by the manufacturer and up to the impossibility of consumption due to their degradation.

[*]Corresponding author: andreea.nistor10@yahoo.com
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MATERIAL AND METHOD

Physical quality evaluation was performed on white and pasteurized liquid yolk packed in a 2 kg box. It was stored under refrigeration conditions (0…+4°C).

The analyzes were carried out on 2 samples, each packed unit opened every 7 days of the shelf life, totaling five storage periods of the analyzed product (1,7,14,21,28 days).

At the opening of the packing units, samples were taken to perform microbiological analyzes.

Determination of the pH was done with an InoLab laboratory pH meter before the hydrolyzable nitrogen and was determined by distillation with water vapor and capture in an acidic solution of ammonia by titration with a weak base.

Microbiological analyzes were carried out according to the standards in force as follows: determination of the total number of anaerobic mesophilic germs (NTGMA) was done by the decimal dilution method, subsequently degraded on bacterial species according to SR ISO 21528-2: 2007 for *Enterobacteriaceae spp*. [10].

Statistical interpretation of data obtained was performed by calculating the position and variance estimators and correlations was made by Analysys Data package included in MsExcel.

RESULTS AND DISCUSSIONS

PH value, a particularly important quality indicator because it can be correlated with implicitly microbiological sensory indicators. PH analyzes were performed on 2 samples from each open packet every 7 days of the shelf life, totaling five storage periods of the analyzed product.

Thus, the pH value of the liquid white has increased from one analysis step to the next. On the first day it was 8.29 ± 0.01, then at mid-life (day 14) it was 8.59 ± 0.01 and the end of the period, respectively, on day 28 analysis, this was 8.98 ± 0.01. From the point of view of the statistical analysis, we observe very significant results for the studied indicator.

Among the most well-known and used chemical reactions that indicate the state of freshness are the identification of easily hydrolyzable nitrogen. This gives us indications on the integrity of the protein molecule, and therefore on its degree of simplicity [3]. (tab. 1).

Table 1 Dynamics of physicochemical indicators of pasteurized liquid white

Day of storage	n	pH value		Easily hydrolysable nitrogen (mg NH_3/100 g)	
		$\overline{X} \pm s_{\overline{x}}$	V%	$\overline{X} \pm s_{\overline{x}}$	V%
1	10	8.29±0.01	0.36	9.27±0.16	5.70
7	10	8.54±0.01	0.61	10.78±0.22	6.57
14	10	8.59±0.01	0.40	11.99±0.24	6.20
21	10	8.73±0.01	0.52	12.95±0.16	3.89
28	10	8.98±0.01	0.55	14.73±0.32	6.81

Analyzing the dynamic this indicator showed a gradual increase over the whole period of storage values as the average value obtained by the first freshness was 9.27 ± 0.16 mg of NH_3/100g, it for the recommended period of validity middle value recorded for the readily hydrolyzable nitrogen was 11.99 ± 0.24 mg NH_3/100 g, subsequently on day 25 of analysis and the last recommended as its own consumption, the value obtained for nitrogen was 14.73 ± 0.32 mg NH_3/100 g.

Analyzing the dynamics of the total mesophilic anaerobic germs are observed in fresh raw egg white a value of 1.14 log cfu / mL, then increasing to 1.64 log cfu / ml on day 14, the final day of that period the 28 with an average value of 2.13 log cfu / ml.

The gradual evolution of NTGMA is a correlation between the initial microbial load of the white and its degree of multiplication during storage.

The results obtained statistically are very significant with a very good homogeneity, the values of the coefficient of variation being between 4.17-8.50% (tab. 2).

Table 2 Dynamics of microbiological indicators of pasteurized liquid white

Day of storage	n	NTGMA (log cfu/ml)		*Enterobacter spp* (log cfu/ml)	
		$\overline{X} \pm s_{\overline{x}}$	V%	$\overline{X} \pm s_{\overline{x}}$	V%
1	10	1.14±0.02	4.17	0.34±0.01	8.57
7	10	1.46±0.05	7.76	0.48±0.01	6.58
14	10	1.64±0.04	6.33	0.56±0.02	8.37
21	10	1.83±0.03	4.70	0.81±0.03	7.74
28	10	2.13±0.08	8.50	0.95±0.03	6.90

Not being one of spoilage microorganisms eggs *Enterobacter spp*. causes a secondary contamination. Thus, from the analyzes made on the fresh product, its presence was insignificant of 0.34 log cfu/ml, then increased to 0.56 log cfu/ml at the half-life of the storage and on the last day of determinations the value of 0.95 log cfu/ml

The data obtained by Polina de Sousa, etc. 2014 on the values of this indicator were 1.18 log cfu/ml for the fresh product [5].

Table 3 Correlation of physico-chemical and microbiological indicators of pasteurized liquid white

	pH value	NH_3	NTGMA	*Enterobacter spp.*
pH value	1			
NH_3	0.989	1		
NTGMA	0.992	0.998	1	
Enterobacter spp.	0.971	0.978	0.978	1

It can be seen that there is a strong positive correlation between the physico-chemical and microbiological indicators, the correlation coefficient having values close to +1.

PH value is a qualitatively important indicator because it is correlated with other quality indicators, such as sensory and microbiological ones.

The increase in pH during storage is mainly due to the concentration of ammonia formed during the decomposition of proteins [4].

Determination of free ammonia gives us indications about the integrity of the protein molecule, so its degree of simplicity [3].

Free ammonia can be quantitatively accounted for by making the readily hydrolyzable nitrogen.

Table 4 Dynamics of physicochemical indicators of pasteurized liquid yolk

Day of storage	n	pH value		Easily hydrolysable nitrogen (mg NH_3/100 g)	
		$\overline{X} \pm s_{\overline{x}}$	V%	$\overline{X} \pm s_{\overline{x}}$	V%
1	10	5.93±0.01	0.21	6.57±0.06	3.26
7	10	5.96±0.01	0.41	7.76±0.12	5.16
14	10	5.99±0.02	0.79	8.29±0.23	8.78
21	10	6.03±0.01	0.36	8.94±0.14	5.22
28	10	6.04±0.01	0.55	10.82±0.27	8.01

The dynamic analysis revealed a progressive increase during the storage period, so for first-time products the mean value obtained on the first day was 6.57 ± 0.06 mg NH_3/100g, thus reaching the 7- the average value obtained was 7.76 ± 0.12 mg NH_3/100 g. open products on day 14 showed nitrogen values of 8.29 ± 0.23 mg NH_3/100 g, and open packing units on day 28 had a readily hydrolyzable nitrogen value of 10.82 ± 0.27 mg NH_3/100 g.

Determination of the total number of anaerobic mesophilic germs in first freshness yolk (day 1) indicated the value of 1.65 ± 0.06 log cfu/ml; subsequently the total number of anaerobic mesophilic germs increased, so at the middle of the storage period it was 2.09 ± 0.08 log cfu/ml; and on the 28th day 2.38 ± 0.04 log cfu/ml.

The progressive increase in the total number of anaerobic mesophilic germs is the consequence of the correlation between the storage period and the initial microbiological load of the products.

Taking into account the limits found in the literature regarding this indicator (2 - 3.89 log cfu/ml after [6], [2]), it may be appreciated that the analyzed yolk corresponded from the point of view of the existing microbiological load .

With regard to *Enterobacter spp*., it can be stated that from the determinations made on the fresh product its presence was almost insignificant of 0.80 ± 0.03 log cfu/ml and during storage the values increased to 1.94 ± 0.05 log cfu/ml on the last day of analysis.

Although the degree of contamination with *Enterobacter spp.* was very low, it should not be forgotten that some species of this genus have an important pathogenicity regarding the digestive tract of the consumer.

Table 5 Dynamics of microbiological indicators of pasteurized liquid yolk

Day of storage	n	NTGMA (log ufc/ml)		*Enterobacter spp* (log ufc/ml)	
		$\overline{X} \pm s_{\overline{X}}$	V%	$\overline{X} \pm s_{\overline{X}}$	V%
1	10	1.65±0.06	8.79	0.80±0.03	8.92
7	10	1.89±0.06	7.75	1.25±0.04	7.69
14	10	2.09±0.08	8.87	1.29±0.05	9.02
21	10	2.29±0.09	9.72	1.37±0.04	6.64
28	10	2.38±0.04	4.63	1.94±0.05	5.97

Although not one of the egg alteration microorganisms, its presence in the yolk analyzed indicated secondary contamination of the eggs from which it was obtained, contamination which is not relevant to endanger the health of the consumer.

According to Regulation 2073/2005, which provides for microbiological criteria for food, we note that the maximum admissible limit for Enterobacter spp. Is 2 log cfu/ml, the microbiological analysis of the pasteurized liquid yolk produced in our country places the product below this limit [9].

Table 6 Correlation of physico-chemical and microbiological indicators of pasteurized liquid yolk

	pH value	NH_3	NTGMA	*Enterobacter spp.*
pH value	1			
NH_3	0.931	1		
NTGMA	0.996	0.938	1	
Enterobacter spp.	0.878	0.985	0.897	1

In this case it is also noticed that the values of the correlation coefficients have values close to +1 which indicate the existence of strong positive correlations between the analyzed indicators.

CONCLUSIONS

Data on pH evolution indicates values ranging from 8.25-8.35 on the first day, then on the 7th day of storage, between 8.46-8.60, mid-life (day a 14-a) between 8.53-8.64 and for the last analysis period, respectively 28th day (8.90-9.05). The gradual deterioration of the product by pH was expressed.

Evolution of easily hydrolysable nitrogen pasteurized liquid egg white showed a rise during the five periods of the validity is correlated with sensory evaluation and expressing significant differences throughout the period.

The results on microbiological indicators indicate an increase in the total number of anaerobic mesophilic germs from one stage to the next, with very significant results on the character being analyzed.

The presence of *Enterobacter spp*. in the pasteurized liquid white indicates secondary contamination. The data obtained are statistically significant but are below the maximum prescribed by the legislation.

Thus, for products opened on storage day 1, mean pH values ranging from 5.93-6.04, with variation coefficients below 5%, are shown to indicate the homogeneity of the products analyzed.

On day 7, the product under analysis recorded pH values ranging from 5.93 to 5.99; packs opened on day 14 had values ranging from 5.94-6.05. For packs opened on day 21, the average value of the recorded pH was 6.03, and for the last day of day 28 the values ranged from 5.99-6.08.

The amount of easily hydrolyzable nitrogen recovered during the storage for the products under study differ statistically significant, indicating a degree of degradation and accelerated in connection with the sensory analysis.

The progressive increase in the total number of anaerobic mesophilic germs is the consequence of the correlation between the storage period and the exchanges between the lipids and the initial water of the products. Values obtained with NTGMA showed very good homogeneity, the coefficient of variation being between 4.63-9.72%.

Being one of the egg alteration microorganisms, the presence of *Enterobacter spp.* in the yolk analyzed indicated secondary contamination, which is not relevant to consumer health.

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