PHYSICAL-CHEMICAL EVALUATION OF LIQUID PRODUCTS FROM PASTEURIZED EGGS

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Abstract

To increase shelf-life time of eggs, were introduced the so called derivates from eggs, foods which keep in a great rate the quality of natural products, but which have a much more better preservation than egg.

Importance of the research carried out in the current paper derives from realization of an evaluation for physical-chemical indicators specific to liquid products obtained from eggs (pasteurized melange, pasteurized albumen and pasteurized yolk), preserved and stored in different regimes of microclimate.

To achieve the proposed goal were constituted 6 research batches (3 control batches stored at temperature of +4°C and RM = 90% and 3 experimental batches stored at temperature of +22÷+32°C and RM = 50÷70%) each of them being kept for a period of 90 days, determinations being made at each 30 days.

Analysed parameters were pH value, content in water, dry matter and minerals.

*Regarding pH value, the higher increase was recorded for pasteurized yolk, difference at the end of storage period being higher with 2.74% at product kept in refrigeration regime and with 12.89% at the one stored at room temperature, difference being very significant (Lc-2 vs Lexp-2 = ***;* $\hat{F}(174{,}50) > F\alpha\ (25{,}41)$.

Experimental factors didn't affect water content, neither dry matter contents and at the level of analysed mineral components recorded differences were insignificant.

Key words: pasteurization, storage, quality

INTRODUCTION

Liquid pasteurized products from eggs take a great breadth on Romanian market, this thing being a step forward regarding food safety and quality, because through pasteurization process is obtained a product which guarantee neutralization of harmful organisms like *Salmonella*.

Utilisation of pasteurized eggs in HoReCa units or in patisseries/bakeries, help those units to be in according with European legislation which require elimination of shell eggs, due to the risks on food safety.

Also there are management and efficiency benefits, because under the pasteurized form bag-in-box eggs don't require a separate storage place (in according with HACCP requirements) and must not be broken, and separation of yolk from albumen didn't imply the inevitable losses from the process. It is important to mention that together with utilisation of egg pasteurized products could took place changes in the manner of processing the final products, thing enlightened in the recipes which use eggs under this form.

Research realised in domain of eggs' preservation shown that majority of chemical components keep their initial properties after pasteurization process [6], [5].

It must be mention the fact that after pasteurization, composition in amino acids isn't changed, thing which is not valid for egg powder (content in amino acids decreasing) [4].

Importance of the realised research from the current paper derives from realization of a qualitative evaluation of physical-chemical indicators specific for derived products obtained from eggs, preserved and stored in different regimes of microclimate.

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Eggs are appreciated for their high nutritive value, and also for the very vast gamma in which could be prepared and consumed [2]. The great problem of those food products is represented by the quite short period in which the shelf life time is kept, reason for why were elaborated different preservation methods [1].

Storage of products derived from eggs at refrigeration temperature as well in suitable packages assure maintaining of their initial quality on a longer period of time, but failure to comply of temperature and air relative moisture leads to their depreciation, in an accelerated way in comparison with egg [3].

From the above mentioned reasons we aimed to study the evolution of qualitative parameters for pasteurized egg melange, pasteurized yolk and pasteurized albumen during storage in different conditions of environment and to establish the storage time as well as the microclimate parameters utilised at storage.

MATERIAL AND METHOD

The utilised biological material was represented by pasteurized melange, pasteurized yolk and pasteurized albumen, from each product category being settled 6 research batches (3 control batches Lc and 3 experimental batches Lexp) control batches being stored at parameters indicated by producer (+4°C) and experimental batches at room temperature (+22+32°C) during 90 days. Determinations were made on fresh product (day 0) and after that at 30 days, 60 days and 90 days of storage.

The main targets of the current study were determination of the main chemical quality indicators, such as water content, dry matter content, and mineral substances (Fe, Zn), during storage in different microclimate conditions.

pH value was determined using an electronic pH-meter, by electrode immersion into an aqueous extract (10 g product and 100 ml distilled water, repose 20 minutes at room temperature, followed by filtration).

Water content (%): was established through oven drying method. Samples drying in oven was realised at a temperature of +103±2°C, for 24 hours.

For determination of **assess solids (dry matter)**, was used the AOAC method no. 925.30 (AOAC, 1990).

Content in mineral substances (mg/100g): was determined through spectrophotometer atomic absorption method (AAS), using a GBC-AVANTA type spectrophotometer.

Collected data were subjected to statistical computation, using the ANOVA one-way algorithm included in MsExcel, to calculate the descriptive statistics (mean, standard error) and find out whether there were significant differences and upgraded with PostHoc Daniel's XL Toolbox version 4.01 (http://xltoolbox.sf.net), to identify the differences.

RESULTS AND DISCUSSIONS

pH value have direct influences on product quality, imposing its hygienic and technological features.

Analysis in dynamics of pH value for the studied melange show an increasing from one stage to another under the influence of assured storage conditions.

So, for fresh melange, pH value was of only 6.50±0.02 at batch Lc-1 (consequence of pasteurization process), and of 6.48±0.02 at batch Lexp-1. Studied character presented a very good homogeneity inside batches, a proof being the values of variation coefficient, of only 0.84% at first batch and of 0.69% at batch Lexp-1. From statistical point of view, at this first control weren't observed differences with statistical signification between those two compared batches.

First statistical differences regarding pH value of pasteurized egg melange, mainly influenced by microclimate conditions assured during storage were observed after the first 30 days of storage, in the moment in which the arithmetic mean for the product from control batch Lc-1 was 6.52±0.02 and at experimental batch Lexp-1 was of 6.80±0.03; recorded differences being very significant, a proof being calculus obtained at the end of ANOVA test (Lc-4 vs Lexp-4 = n.s.; $\hat{F}(0,4) < F\alpha\ (5,32)pt.1{:}8\ GL$) (tab. 1).

Table 1 Evolution of pH value at products from pasteurized eggs (pasteurized melange, yolk and albumen)

Period (days)	Batch	Statistical estimators			
		$\bar{X} \pm s_{\bar{X}}$	V%	Minimum	Maximum
0	Lc-1	6.50±0.020	0.84	6.40	6.50
	Lexp-1	6.48±0.020	0.69	6.40	6.50
	Lc-2	5.10±0.030	1.38	5.00	5.20
	Lexp-2	5.12±0.040	1.63	5.00	5.20
	Lc-3	5.01±0.005	0.22	5.00	5.03
	Lexp-3	5.02±0.010	0.41	5.00	5.05
Signification between means of analysed batches			Lc-4 vs Lexp-4 = n.s.; $\hat{F}(0,4) < F\alpha\ (5,32)pt.1:8\ GL$		
			Lc-5vs Lexp-5 = n.s.; $\hat{F}(0,16) < F\alpha\ (5,32)pt.1:8\ GL$		
			Lc-6 vs Lexp-6 = n.s.; $\hat{F}(0,89) < F\alpha\ (5,32)pt.1:8\ GL$		
30	Lc-1	6.52±0.020	0.68	5.50	6.60
	Lexp-1	6.80±0.030	1.04	6.70	6.90
	Lc-2	5.12±0.040	1.63	5.00	5.20
	Lexp-2	5.44±0.020	1.01	5.40	5.50
	Lc-3	5.04±0.009	0.41	5.02	5.07
	Lexp-3	5.30±0.050	1.85	5.19	5.44
Signification between means of analysed batches			Lc-4vsLexp-4 = ***; $\hat{F}(56,01) > F\alpha\ (25,41)pt.1:8\ GL$		
			Lc-5vs Lexp-5 = ***; $\hat{F}(51,2) > F\alpha\ (25,41)pt.1:8\ GL$		
			Lc-6vs Lexp-6= ***; $\hat{F}(31,56) > F\alpha\ (25,41)pt.1:8\ GL$		
60	Lc-1	6.54±0.02	0.83	6.50	6.60
	Lexp-1	6.94±0.02	0.83	6.90	7.01
	Lc-2	5.24±0.04	1.70	5.20	5.40
	Lexp-2	5.78±0.06	2.25	5.60	5.90
	Lc-3	5.09±0.01	0.51	5.06	5.12
	Lexp-3	5.56±0.05	2.01	5.41	5.71
Signification between means of analysed batches			Lc-4vsLexp-4=***; $\hat{F}(127,51) > F\alpha\ (25,41)pt.1:8\ GL$		
			Lc-5vsLexp-5 = ***; $\hat{F}(58,32) > F\alpha\ (25,41)pt.1:8\ GL$		
			Lc-6vs Lexp-6= ***; $\hat{F}(84,70) > F\alpha\ (25,41)pt.1:8\ GL$		
90	Lc-1	6.60±0.03	1.07	6.50	6.70
	Lexp-1	6.99±0.03	0.84	6.90	7.06
	Lc-2	5.28±0.04	1.58	5.20	5.40
	Lexp-2	5.98±0.04	1.41	5.90	6.10
	Lc-3	5.12±0.01	0.41	5.09	5.14
	Lexp-3	5.96±0.03	1.14	5.89	6.02
Signification between means of analysed batches			Lc-4vsLexp-4 =***; $\hat{F}(92,46) > F\alpha\ (25,41)pt.1:8\ GL$		
			Lc-5vsLexp-5=***; $\hat{F}(174,50) > F\alpha\ (25,41)pt.1:8\ GL$		
			Lc-6vsLexp-6=***; $\hat{F}(701,14) > F\alpha\ (25,41)pt.1:8\ GL$		

ANOVA within rows, between groups for different superscripts, one by one comparison: ns: not significant; significant = * (P <0.05); distinguished significant = ** (P <0.01).

At the end of determinations effectuated for water content, was observed the fact that during those 90 storage days, between the analysed batches weren't interfere differences with statistical signification (tab. 2).

So, at the first control realised for water content, for pasteurized egg melange were recorded mean values of 75.4±0.400% for product from batch Lc-1 and of 74.80±0.374% for the one from Lexp-1 batch.

During storage could be observed a small decreasing of water content for all those three assortments of studied products, but as it is shown in tab. 2 differences between batches weren't with a statistical signification.

Table 2 Water content (%) of pasteurized egg products (pasteurized melange, yolk and albumen)

Period (days)	Batch	Statistical estimators			
		$\bar{X} \pm s_{\bar{X}}$	V%	Minimum	Maximum
0	Lc-1	75.400±0.400	1.186	74	76
	Lexp-1	74.800±0.374	1.118	74	76
	Lc-2	57.720±0.159	0.617	57.12	58.01
	Lexp-2	57.754±0.167	0.647	57.15	58.14
	Lc-3	87.910±0.368	0.934	87	89
	Lexp-3	87.962±0.375	0.952	87.12	89.14
Signification between means of analysed batches			Lc-4 vs Lexp-4 = n.s.; $\hat{F}(1,2) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-5vs Lexp-5 = n.s.; $\hat{F}(0,98) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-6 vs Lexp-6 = n.s.; $\hat{F}(0,93) < F\alpha\ (5,32)pt.1{:}8\ GL$		
30	Lc-1	75.200±0.374	1.112	74	76
	Lexp-1	74.400±0.679	2.040	72	76.01
	Lc-2	57.110±0.160	0.620	57.11	58
	Lexp-2	57.746±0.170	0.657	57.13	58.13
	Lc-3	87.914±0.368	0.935	87.01	89.01
	Lexp-3	87.956±0.373	0.947	87.11	89.12
Signification between means of analysed batches			Lc-4 vs Lexp-4 = n.s.; $\hat{F}(1,06) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-5vs Lexp-5 = n.s.; $\hat{F}(1,02) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-6 vs Lexp-6 = n.s.; $\hat{F}(1,04) < F\alpha\ (5,32)pt.1{:}8\ GL$		
60	Lc-1	75.000±0.447	1.333	74	76
	Lexp-1	74.180±0.856	2.581	71	76.01
	Lc-2	57.714±0.161	0.625	57.1	57.99
	Lexp-2	57.738±0.172	0.656	57.12	58.12
	Lc-3	87.912±0.366	0.930	87.02	89
	Lexp-3	87.916±0.373	0.948	87.11	89.1
Signification between means of analysed batches			Lc-4 vs Lexp-4 = n.s.; $\hat{F}(0,71) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-5vs Lexp-5 = n.s.; $\hat{F}(1,12) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-6 vs Lexp-6 = n.s.; $\hat{F}(1,41) < F\alpha\ (5,32)pt.1{:}8\ GL$		
90	Lc-1	75.000±0.632	1.885	74	77
	Lexp-1	73.978±1.044	3.154	70	73
	Lc-2	75.532±0.205	0.796	56.99	57.96
	Lexp-2	57.724±0.170	0.657	57.1	58.1
	Lc-3	87.904±0.382	0.947	87.01	89.01
	Lexp-3	87.888±0.368	0.935	87.9	89.05
Signification between means of analysed batches			Lc-4 vs Lexp-4 = n.s.; $\hat{F}(0,70) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-5vs Lexp-5 = n.s.; $\hat{F}(1,12) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-6 vs Lexp-6 = n.s.; $\hat{F}(1,36) < F\alpha\ (5,32)pt.1{:}8\ GL$		

ANOVA within rows, between groups for different superscripts, one by one comparison: ns: not significant

Naturally, dry matter content of the studied products, recorded a parallel evolution with the decreasing of water content from them.

For pasteurized melange from batch Lc-1, dry matter had a level of 24.60±0.400% for the fresh one (day 0) and 25.00±0.632% after those 90 storage days. In case of batch Lexp-1, determination of dry matter substance enlightened values of 25.20±0.374% for fresh product and of 26.022±1.044% for the one stored for 90 days. Like in the case of water content weren't observed differences with statistical signification during those 90 days of storage (tab. 3).

Table 3 Dry matter content of pasteurized egg products (pasteurized melange, yolk and albumen)

Period (days)	Batch	Statistical estimators			
		$\bar{X} \pm s_{\bar{X}}$	V%	Minimum	Maximum
0	Lc-1	24.600±0.400	3.635	24	26
	Lexp-1	25.200±0.374	3.320	24	26
	Lc-2	42.278±0.159	0.842	41.99	42.88
	Lexp-2	42.246±0.167	0.884	41.86	42.85
	Lc-3	12.090±0.368	6.798	11	13
	Lexp-3	12.038±0.385	6.961	10.86	12.88
Signification between means of analysed batches			Lc-4 vs Lexp-4 = n.s.; $\hat{F}(1,12) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-5vs Lexp-5 = n.s.; $\hat{F}(1,31) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-6 vs Lexp-6 = n.s.; $\hat{F}(1,42) < F\alpha\ (5,32)pt.1{:}8\ GL$		
30	Lc-1	24.800±0.374	3.373	24	26
	Lexp-1	25.600±0.679	5.930	23.99	28
	Lc-2	42.282±0.160	0.847	42	42.89
	Lexp-2	42.254±0.170	0.898	41.87	42.87
	Lc-3	12.086±0.368	6.805	10.99	12.99
	Lexp-3	12.044±0.373	6.921	10.88	12.89
Signification between means of analysed batches			Lc-4 vs Lexp-4 = n.s.; $\hat{F}(1,23) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-5vs Lexp-5 = n.s.; $\hat{F}(3,04) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-6 vs Lexp-6 = n.s.; $\hat{F}(3,41) < F\alpha\ (5,32)pt.1{:}8\ GL$		
60	Lc-1	24.000±0.447	4	24	26
	Lexp-1	25.820±0.856	7.417	23.99	29
	Lc-2	42.286±0.161	0.853	42.01	42.9
	Lexp-2	42.262±0.170	0.897	41.88	42.88
	Lc-3	12.088±0.366	6.770	11	12.98
	Lexp-3	12.084±0.373	6.900	10.9	12.89
Signification between means of analysed batches			Lc-4 vs Lexp-4 = n.s.; $\hat{F}(1,41) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-5vs Lexp-5 = n.s.; $\hat{F}(3,04) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-6 vs Lexp-6 = n.s.; $\hat{F}(3,21) < F\alpha\ (5,32)pt.1{:}8\ GL$		
90	Lc-1	25.000±0.632	5.656	23	26
	Lexp-1	26.022±1.044	8.969	24	30
	Lc-2	42.468±0.205	1.078	42.04	43.01
	Lexp-2	42.276±0.170	0.897	41.9	42.9
	Lc-3	12.096±0.372	6.885	10.99	12.99
	Lexp-3	12.112±0.368	6.784	10.95	12.91
Signification between means of analysed batches			Lc-4 vs Lexp-4 = n.s.; $\hat{F}(2,15) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-5vs Lexp-5 = n.s.; $\hat{F}(2,18) < F\alpha\ (5,32)pt.1{:}8\ GL$		
			Lc-6 vs Lexp-6 = n.s.; $\hat{F}(3,51) < F\alpha\ (5,32)pt.1{:}8\ GL$		

ANOVA within rows, between groups for different superscripts, one by one comparison: ns: not significant

Decreasing of dry matter content is obvious also in the case of the two others products (pasteurized yolk and albumen) but the recorded differences from a control stage to another were insignificant.

Regarding the mineral content existed in pasteurized egg products, elements analysed by us (Fe and Zn) were founded in normal quantities, being in the limits described in consulted literature.

Regarding Fe content (mg/100g) for pasteurized melange and stored in refrigeration conditions calculated mean values oscillated between 1.348g/100g value obtained in day 0 and 1.345g/100g, value obtained in last storage day (day 90). Enlightened differences during storage weren't presented statistical signification (fig. 1).

For Zn content, like in the case of Fe content values oscillated from one control stage to another for each analysed product but the differences recorded at each control stage proved to be insignificant (fig. 2).

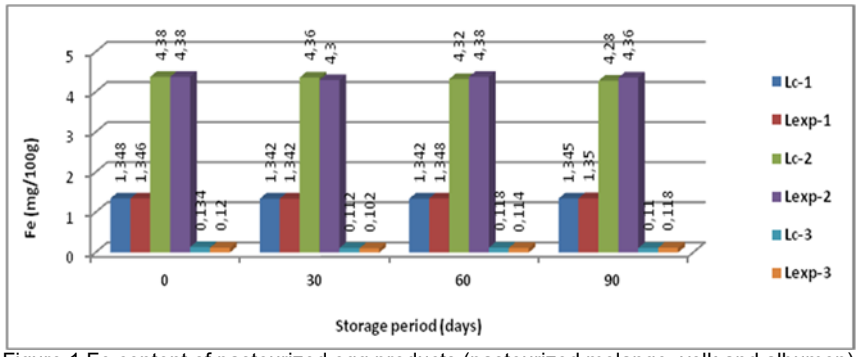

Figure 1 Fe content of pasteurized egg products (pasteurized melange, yolk and albumen)

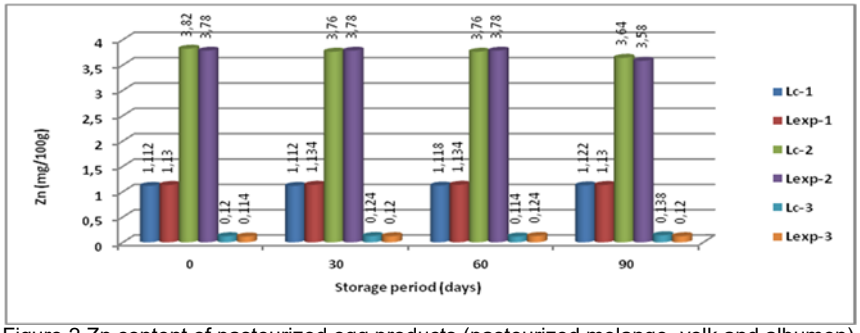

Figure 2 Zn content of pasteurized egg products (pasteurized melange, yolk and albumen)

CONCLUSIONS

Results obtained at the end of a three series of experiments which were at the base of the current paper, lead to conclusion that experimental factors (product type and assured microclimate factors during storage) had a lower or higher influence on quality of analysed products (pasteurized melange, pasteurized yolk and pasteurized albumen).

Very significant differences were recorded at pH value determination where at the end of determinations were obtained values higher with 1.53% for Lc-1 batch and with 7.87% for Lexp-1 batch. Also in case of pasteurized yolk were recorded increases of ph value during storage, for batch Lc-2 being recorded an increase of 3.52% and for batch Lexp-2 the increase was with 16.79% higher. For pasteurized albumen and stored in refrigeration conditions the obtained value for pH at the end of determinations was higher with 2.19% face to 18.72% as it was recorded for albumen from batch Lexp-3.

Regarding water and dry matter content in analysed products (pasteurized melange, pasteurized yolk and pasteurized albumen) the observed differences didn't present any statistical signification from one control stage to another.

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