EFFECT OF STORAGE TIME AND TEMPERATURE ON HEN EGG QUALITY

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Abstract

Some results of a research, concerning the influence of the microclimate factors during eggs storage period on some specific physical and microbiological quality indices of the commercial consumption eggs, are presented within the paper. In order to achieve the study goal, were analyzed eggs from two known hybrids, respectively Lohmann Brown and Lohmann White, each divided into three different groups, but differentiated by microclimate factors insured during the storage (+4°C, RH 90%; +6°C, RH 65% and the last one was stored at +20 ± +25°C and a relative humidity of 40-50%.). The storage period counted 35 days and the quality assessments were done at the beginning of the period and then, at each 7 days. The microbiological indices were determinate on the start of the project and at the end. The comparative analysis of the studied physical quality factors indicated that the largest changes occurred in eggs belonged to Lohmann White hybrid stored at +20 ± 25°C / RH 40-50%. So regarding the weight of eggs, the losses were of -9.01%, while at the eggs of Lohmann Brown hybrid were recorded losses of -8.81%. Differences were the same for all the analysed physical indices. More important is the fact that keeping the eggs at high temperatures leads to a multiplication of existed germs on the mineral eggshell, finally favouring their passing through protection barriers and contaminating the egg content. For the eggs with brown shell stored in refrigeration regime (+4°C / RH 90%) contamination was only of 5.49% face to the initial charge, in comparison with 48.46% as it was the increase of the germs at the batch of eggs stored at high ambient temperatures (+20÷ +25°C / RH 40-50%).

Key words: eggs, quality, storage

INTRODUCTION

Chicken eggs are familiar, veritable nutrition economical and easy to prepare food, as they provide a well balance source of nutrients for man of all ages [7]. Moreover, their high quality protein, low caloric value and ease of digestibility make eggs valuable in many therapeutic diets for adults [3, 2].

All food has a limited shelf life, which will vary depending on the type of food and storage conditions. The egg is very perishable food product, which could lose its quality rapidly during the period between storage and consumption. Egg quality can be affected by the environmental conditions such as temperature and humidity of storage, as well the gaseous environment and storage time. Storage can modify some characteristics of the egg including loss of water, carbon dioxide and a subsenquently increase in the pH of the albumen [4].

Unlike external quality, the internal quality of eggs starts to decline as soon as they are laid by hens. Thus, although factor associated with the management and feeding of hens can play a role in internal egg quality, but egg handling and storage practices also have a significant impact on the quality of eggs reaching consumers [6].

This modification occurred because handling concern the increase in volume of the air cell, the liquefaction of the thick albumen portion, and the weakening of the vitelline membrane separating the yolk and the albumen. [8, 1].

Eggshell colour has always received more attention from the consumer than it deserves. There is little or no direct relation between shell colour and nutritional content of the egg, but eggshell colour does give an indication of the breeding history of the hen.

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White eggs are produced commercially by lines derived principally from the White Leghorn breed, whereas brown eggs are produced by hens derived from a number of dual-purpose breeds, including Barred Plymouth Rock, Rhode Island Red, Rhode Island White, Australorp, New Hampshire, and probably others. These dual-purpose breeds were the chickens kept in farm flocks in the last century, and brown eggs have been perceived by the consumer to be more natural or healthy than white eggs.

Washburn (1990) summarized research that described differences in the eggs produced by white and brown egg lines, but much of the research that he described is old. There is a paucity of recent literature describing quality or compositional differences between white and brown eggs. Albumen quality and the proportion of egg components are characteristics that respond to selection, and it could be expected that the old literature is no longer valid.

This research investigated differences in fresh and stored eggs of hens from two lines of commercial layers, one a brown egg line and one a white egg line.

MATERIAL AND METHODS

The studied material was represented by brown and white eggs, uniform from the initial weight point of view; which were divided into three equal batches (for each type of eggs examined), but differentiated through the value of microclimate factors assured during storage (tab. 1).

Table 1 Organization of experience

Type of eggs	Batch	Egg number	Storage period (days)	Temperature (°C)	Relative humidity (%)
Brown eggs	Lc1	90	35	+4	90
	Lexp1			+6	65
	Lexp2			+20 ± +25	40-50
White eggs	Lc2			+4	90
	Lexp3			+6	65
	Lexp4			+20 ± +25	40-50

Physical quality indices of eggs were determine at each 7 days, starting with the first storage day till day 35, respectively, in according with the appreciation techniques used in aviculture:

- *weight* was established by individual weighting of each egg, using an analytical balance;
- *albumen index* was calculated based on the ration between height and diameter of the egg; albumen height was determined with a device with a comparative watch, and the diameter was measured with an electronic caliper;
- *yolk index* is provided by the ratio between diameter and height, these dimensions were measured with the same equipments as at albumen and using a same working method;
- *Haugh index* characterize the total value of egg quality and is based on the correlation between dense albumen height and egg weight; the concretion of this index was realised using some specific relations [5].
- *albumen pH* was determinate with a electronic pH-meter, model 330i, by immersing the electrode into the albumen.

The microbiological index (total number of germs of the shell and the total number of germs of the mixture of eggs), was determinate using the method of series dilution.

RESULTS AND DISCUSSIONS

Weight of eggs

The eggs from the current study, before storage was sorted after weight aspect proved by the lack of differences between batches at the first effectuated control. Concretely, the average values establish for their weight were of 68.142±0.103 g at batch Lc1, 68.115±0.688 g at batch Lexp1 respectively of 68.185±0.936 g at batch Lexp2 for the eggs with brown shell, while the mean values calculated for the eggs with white shell were of 70.223±0.075 g at batch Lc2, 70.351±0.076 at batch Lexp3 and of 70.298±0.076 at batch Lexp4.

Table 2 Weight of eggs

Storage period (days)	Type of eggs	Batch	n	$\overline{X} \pm s_{\overline{x}}$	V%	Differences as reported to the fresh eggs (%)
0	Brown eggs	Lc1	90	68.142 ± 0.103	0.151	-
		Lexp1		68.115 ± 0.688	1.011	
		Lexp2		68.185 ± 0.936	1.372	
	White eggs	Lc2	90	70.223 ± 0.075	1.015	-
		Lexp3		70.351 ± 0.076	1.038	
		Lexp4		70.298 ± 0.077	1.022	
7	Brown eggs	Lc1	90	67.932 ± 0.047	0.657	-0.41
		Lexp1		67.535 ± 0.137	1.919	-0.85
		Lexp2		66.991 ± 0.163	2.397	-1.75
	White eggs	Lc2	90	69.933 ± 0.080	1.089	-0.41
		Lexp3		69.711 ± 0.133	1.815	-0.91
		Lexp4		69.047 ± 0.164	2.254	-1.78
14	Brown eggs	Lc1	90	67.722 ± 0.068	0.952	-0.62
		Lexp1		66.955 ± 0.143	2.028	-1.70
		Lexp2		65.797 ± 0.237	3.422	-3.50
	White eggs	Lc2	90	69.643 ± 0.084	1.157	-0.82
		Lexp3		69.061 ± 0.171	2.354	-1.83
		Lexp4		67.796 ± 0.239	3.354	-3.59
21	Brown eggs	Lc1	90	67.512 ± 0.082	1.15	-0.92
		Lexp1		66.375 ± 0.171	2.437	-2.55
		Lexp2		64.592 ± 0.302	4.449	-5.27
	White eggs	Lc2	90	69.353 ± 0.089	1.221	-1.24
		Lexp3		68.411 ± 0.199	2.762	-2.76
		Lexp4		66.517 ± 0.374	5.338	-5.38
28	Brown eggs	Lc1	90	67.302 ± 0.097	1.373	-1.23
		Lexp1		65.795 ± 0.204	2.946	-3.40
		Lexp2		63.384 ± 0.332	4.976	-7.04
	White eggs	Lc2	90	69.063 ± 0.093	1.285	-1.65
		Lexp3		67.761 ± 0.244	3.421	-3.68
		Lexp4		65.238 ± 0.524	7.631	-7.20
35	Brown eggs	Lc1	90	67.092 ± 0.083	1.858	-1.54
		Lexp1		65.215 ± 0.210	3.055	-4.26
		Lexp2		62.176 ± 0.374	5.505	-8.81
	White eggs	Lc2	90	68.773 ± 0.689	1.331	-2.06
		Lexp3		67.111 ± 0.282	3.996	-4.60
		Lexp4		63.959 ± 0.689	10.221	-9.01

The assured microclimate factors during storage influenced the evaporation rhythm of water content from eggs, and were recorded losses for both eggs' categories. In day 35 of storage, the mean calculated values for eggs with white shell were of 68.773±0.689 g for Lc2, 67.111±0.282 g for batch Lexp3 and of 63.959±0.689g for eggs belonging to batch Lexp4. For the eggs with brown shell the mean calculated values were higher, fact which shows us that the losses were lower than in the case of eggs with white shell (tab. 2).

Albumen index

Dimensional appreciation of albumen could offer information regarding the freshness state of eggs. In the case of studied eggs, mean calculated values for albumen index at fresh eggs were between 0.1520±0.0012 and 0.1529±0.0011 for the ones provided from Lohmann Brown hybrid and for the ones from Lohmann White hybrid the vales were between 0.1520±0.0003 and 0.1524±0.0003.

Table 3 Albumen index

Storage period (days)	Type of eggs	Batch	n	$\overline{X} \pm s_{\overline{x}}$	V%	Differences as reported to the fresh eggs (%)
0	Brown eggs	Lc1	5	0.1523 ± 0.0011	1.825	-
		Lexp1		0.1529 ± 0.0011	1.873	
		Lexp2		0.1520 ± 0.0012	1.811	
	White eggs	Lc2	5	0.1520 ± 0.0003	1.845	-
		Lexp3		0.1524 ± 0.0003	1.885	
		Lexp4		0.1521 ± 0.0004	1.832	
7	Brown eggs	Lc1	5	0.1462 ± 0.0012	2.220	-4.0052
		Lexp1		0.1429 ± 0.0014	2.378	-6.5402
		Lexp2		0.1360 ± 0.0015	3.217	-10.9796
	White eggs	Lc2	5	0.1451 ± 0.0004	2.451	-4.5394
		Lexp3		0.1421 ± 0.0003	2.521	-6.7585
		Lexp4		0.1354 ± 0.0005	2.584	-10.9796
14	Brown eggs	Lc1	5	0.1401 ± 0.0013	2.562	-8.0105
		Lexp1		0.1329 ± 0.0015	3.639	-13.0804
		Lexp2		0.1200 ± 0.0018	5.112	-21.0526
	White eggs	Lc2	5	0.1382 ± 0.0004	2.833	-9.0789
		Lexp3		0.1327 ± 0.0005	3.418	-12.9265
		Lexp4		0.1198 ± 0.0007	5.218	-21.2360
21	Brown eggs	Lc1	5	0.1340 ± 0.0015	2.851	-12.0157
		Lexp1		0.1229 ± 0.0021	4.773	-19.6206
		Lexp2		0.1040 ± 0.0025	6.897	-31.5789
	White eggs	Lc2	5	0.1313 ± 0.0005	3.104	-13.6184
		Lexp3		0.1219 ± 0.0008	5.472	-20.0131
		Lexp4		0.1032 ± 0.0011	7.214	-32.1499
28	Brown eggs	Lc1	5	0.1279 ± 0.0019	3.133	-16.0216
		Lexp1		0.1129 ± 0.0025	5.796	-26.1608
		Lexp2		0.0860 ± 0.0029	8.311	-43.4210
	White eggs	Lc2	5	0.1244 ± 0.0006	3.617	-18.1578
		Lexp3		0.1116 ± 0.0009	5.674	-26.7716
		Lexp4		0.0849 ± 0.0012	8.211	-44.1814
35	Brown eggs	Lc1	5	0.1211 ± 0.0024	3.476	-20.4858
		Lexp1		0.1009 ± 0.0033	7.039	-34.0091
		Lexp2		0.0680 ± 0.0036	10.278	-55.2631
	White eggs	Lc2	5	0.1175 ± 0.0008	3.921	-22.6973
		Lexp3		0.1002 ± 0.0011	6.895	-34.2519
		Lexp4		0.0621 ± 0.0014	9.325	-59.1745

In the last day of storage (day 35), were obtained inferior values, especially at batches Lexp2 and Lexp4 face to the values founded at previous controls. So, the mean of albumen index was for batch Lc1 of 0.1211±0.0024 with a variation coefficient of 3.476%, while at batch Lc2 the obtained mean was of media 0.1175±0.0008 (V% = 3.921). For eggs stored at temperatures from +20 to +25°C, both at brown shell eggs and also at white shell ones the mean calculated values were net inferior in comparison with the eggs stored in refrigeration conditions (tab. 3).

Yolk index

This indicator allow to appreciate the eggs' quality through the state of vitelline membrane, which assure the integrity and shape of yolk; at the same time with eggs' aging vitelline membrane is weak and gets a winkled appearance, determine the flattening of yolk, so a decrease of the vales for yolk index. Yolk index evolved differently for all six batches during storage period, so the mean calculated values for it, at fresh eggs provided from Lohmann Brown hybrid were between 0.0450±0.0013 and 0.0452±0.0012 while the calculated values for eggs provided from

Lohmann White hybrid were between 0.0449±0.0002 and 0.0451±0.0001. At the end of storage period the calculated differences for this index were of -68,374% for Lexp4, -40% for Lexp3, -24,390% for Lc2.

Table 4 Yolk index

Storage period (days)	Type of eggs	Batch	n	$\bar{X} \pm s_{\bar{X}}$	V%	Differences as reported to the fresh eggs (%)
0	Brown eggs	Lc1	5	0.0452 ± 0.0012	1.74	-
		Lexp1		0.0451 ± 0.0012	2.31	
		Lexp2		0.0450 ± 0.0013	1.96	
	White eggs	Lc2	5	0.0451 ± 0.0001	1.91	-
		Lexp3		0.0450 ± 0.0002	2.47	
		Lexp4		0.0449 ± 0.0002	2.12	
7	Brown eggs	Lc1	5	0.0432 ± 0.0013	2.53	-4.424
		Lexp1		0.0421 ± 0.0015	3.55	-6.651
		Lexp2		0.0390 ± 0.0016	3.41	-13.333
	White eggs	Lc2	5	0.0421 ± 0.0001	2.73	-6.651
		Lexp3		0.0416 ± 0.0002	3.56	-7.555
		Lexp4		0.0382 ± 0.0002	4.52	-14.922
14	Brown eggs	Lc1	5	0.0412 ± 0.0014	3.49	-8.849
		Lexp1		0.0391 ± 0.0016	4.48	-13.303
		Lexp2		0.0330 ± 0.0017	5.22	-26.666
	White eggs	Lc2	5	0.0411 ± 0.0002	3.65	-8.869
		Lexp3		0.0388 ± 0.0002	4.69	-13.777
		Lexp4		0.0326 ± 0.0001	5.83	-27.394
21	Brown eggs	Lc1	5	0.0392 ± 0.0015	4.39	-13.274
		Lexp1		0.0361 ± 0.0017	5.53	-19.955
		Lexp2		0.0271 ± 0.0020	7.11	-39.777
	White eggs	Lc2	5	0.0406 ± 0.0002	4.79	-9.977
		Lexp3		0.0353 ± 0.0002	5.82	-21.555
		Lexp4		0.0265 ± 0.0012	7.83	-40.973
28	Brown eggs	Lc1	5	0.0352 ± 0.0015	4.98	-22.123
		Lexp1		0.0331 ± 0.0022	6.56	-26.607
		Lexp2		0.0213 ± 0.0026	9.05	-52.666
	White eggs	Lc2	5	0.0389 ± 0.0001	5.21	-13.747
		Lexp3		0.0327 ± 0.0002	6.72	-27.333
		Lexp4		0.0208 ± 0.0003	10.11	-53.674
35	Brown eggs	Lc1	5	0.0312 ± 0.0020	5.56	-30.973
		Lexp1		0.0281 ± 0.0027	7.61	-37.697
		Lexp2		0.0150 ± 0.0031	10.98	-66.666
	White eggs	Lc2	5	0.0341 ± 0.0001	5.88	-24.390
		Lexp3		0.0270 ± 0.0002	7.73	-40.000
		Lexp4		0.0142 ± 0.0002	11.59	-68.374

Haugh index

Determination of this index is used, especially, for appreciation of eggs for incubation, but it is suitable also for consumption eggs, because define the total value of quality, on the basis of dens albumen height and egg weight.

Also like in the case of other studied indexes, Haugh index suffered modifications during storage for both types of eggs; so at the eggs provided from Lohmann Brown hybrid the value of this index was between 91.210±0.89 and 91.219±0.79 and at eggs from hybrid Lohmann White were recorded, at first control, values between 91.212±0.070 and 91.225±0.78 (tab. 5).

Modifications in eggs' weight and in dens albumen consistency leads to a gradual decrease of Haugh index values, especially for batch Lexp2 and for batch Lexp4 (eggs from this batches were kept at room temperature) where were calculated differences of -34,534% and -35,877% (tab. 5).

Table 5 Haugh index

Storage period (days)	Type of eggs	Batch	n	$\overline{X} \pm s_{\overline{x}}$	V%	Differences as reported to the fresh eggs (%)
0	Brown eggs	Lc1	5	91.219 ± 0.79	8.21	-
		Lexp1		91.210 ± 0.89	9.31	
		Lexp2		91.213 ± 0.82	8.54	
	White eggs	Lc2	5	91.312 ± 0.70	7.32	-
		Lexp3		91.225 ± 0.78	8.12	
		Lexp4		91.214 ± 0.70	7.26	
7	Brown eggs	Lc1	5	89.212 ± 0.81	8.64	-2.299
		Lexp1		87.025 ± 0.86	9.32	-4.604
		Lexp2		84.914 ± 0.69	7.76	-6.906
	White eggs	Lc2	5	89.191 ± 0.88	9.37	-2.223
		Lexp3		86.930 ± 0.97	10.54	-4.692
		Lexp4		83.876 ± 0.83	9.28	-8.043
14	Brown eggs	Lc1	5	87.112 ± 0.84	8.64	-2.299
		Lexp1		85.025 ± 0.86	9.32	-4.604
		Lexp2		84.914 ± 0.69	7.76	-6.906
	White eggs	Lc2	5	87.106 ± 0.87	10.54	-4.508
		Lexp3		84.893 ± 1.01	11.23	-6.925
		Lexp4		77.925 ± 0.84	10.21	-14.568
21	Brown eggs	Lc1	5	85.012 ± 1.01	11.22	-6.899
		Lexp1		82.825 ± 0.91	10.82	-9.208
		Lexp2		78.614 ± 0.69	8.81	-20.720
	White eggs	Lc2	5	85.007 ± 1.04	11.67	-6.809
		Lexp3		81.998 ± 1.03	11.73	-10.099
		Lexp4		71.336 ± 0.87	10.73	-21.791
28	Brown eggs	Lc1	5	82.912 ± 1.09	12.52	-9.199
		Lexp1		78.625 ± 0.99	11.95	-13.812
		Lexp2		66.014 ± 0.65	9.35	-27.627
	White eggs	Lc2	5	82.890 ± 1.20	13.73	-9.130
		Lexp3		77.876 ± 1.11	13.57	-14.619
		Lexp4		65.217 ± 0.91	11.24	-28.500
35	Brown eggs	Lc1	5	80.812 ± 1.18	13.82	-11.499
		Lexp1		74.425 ± 1.03	13.08	-18.416
		Lexp2		59.714 ± 0.62	9.88	-34.534
	White eggs	Lc2	5	80.788 ±1.34	15.72	-11.435
		Lexp3		73.729 ± 1.13	14.59	-19.168
		Lexp4		58.488 ± 0.93	11.46	-35.877

Albumen pH

A number of chemical changes take place in shelled eggs during storage, the first of which is the increase of albumen pH, from 7,6 to maximum of 9,7, caused by a loss of carbon dioxide through the pres in the eggshell.

In the case of studied eggs the value of albumen pH at first control was between 8.52±0.042 and 8.59±0.013 at eggs with brown shell and at eggs with white shell the value of this index was between 8.53±0.071 and 8.59±0.034. The value of this index suffered modification since day 7 of storage where the pH albumen value increased with 7.35% for the eggs from batch Lexp3 and with 9.31% for the ones from batch Lexp4 (differences being related at the value obtained for fresh eggs). After 35 days of keeping the eggs at refrigeration temperatures the pH reached the value of 9.27±0.024 for brown eggs and 9.28±0.016 for white eggs (tab. 6).

Table 6 Albumen pH.

Storage period (days)	Type of eggs	Batch	n	$\overline{X} \pm s_{\overline{x}}$	V%	Differences as reported to the fresh eggs (%)
0	Brown eggs	Lc1	5	8.52 ± 0.042	1.106	-
		Lexp1		8.55 ± 0.083	2.183	
		Lexp2		8.59 ± 0.013	0.353	
	White eggs	Lc2	5	8.53 ± 0.071	1.857	-
		Lexp3		8.57 ± 0.013	0.355	
		Lexp4		8.59 ± 0.034	0.791	
7	Brown eggs	Lc1	5	8.85 ± 0.060	1.520	3.87
		Lexp1		9.18 ± 0.018	0.446	7.36
		Lexp2		9.34 ± 0.025	0.612	7.35
	White eggs	Lc2	5	9.00 ± 0.066	1.630	5.51
		Lexp3		9.21 ± 0.013	0.313	7.47
		Lexp4		9.39 ± 0.012	0.288	9.31
14	Brown eggs	Lc1	5	9.20 ± 0.026	0.636	7.98
		Lexp1		9.32 ± 0.011	0.277	9.00
		Lexp2		9.47 ± 0.030	0.727	8.85
	White eggs	Lc2	5	9.21 ± 0.033	0.805	7.97
		Lexp3		9.28 ± 0.014	0.346	8.28
		Lexp4		9.51 ± 0.014	0.323	10.59
21	Brown eggs	Lc1	5	9.21 ± 0.054	1.314	8.09
		Lexp1		9.27 ± 0.010	0.248	8.42
		Lexp2		9.50 ± 0.016	0.386	9.19
	White eggs	Lc2	5	9.22 ± 0.018	0.437	8.09
		Lexp3		9.31 ± 0.009	0.223	9.63
		Lexp4		9.51 ± 0.014	0.323	10.71
28	Brown eggs	Lc1	5	9.23 ± 0.025	0.606	8.33
		Lexp1		9.31 ± 0.006	0.159	8.88
		Lexp2		9.50 ± 0.020	0.478	9.20
	White eggs	Lc2	5	9.24 ± 0.019	0.455	8.32
		Lexp3		9.33 ± 0.010	0.244	8.87
		Lexp4		9.54 ± 0.010	0.227	11.06
35	Brown eggs	Lc1	5	9.27 ± 0.024	0.591	8.80
		Lexp1		9.37 ± 0.010	0.257	9.59
		Lexp2		9.52 ± 0.020	0.478	9.42
	White eggs	Lc2	5	9.28 ± 0.016	0.386	8.79
		Lexp3		9.36 ± 0.012	0.277	9.22
		Lexp4		9.56 ± 0.013	0.305	11.29

Total number of germs on mineral shell and in mix

Microorganisms which contaminate the mineral shell of eggs are usually developed under the shape of microbial associations and the effect of their activity depends on the interaction of several factors such as: initial infection and environment conditions or extrinsic factors (temperature and air moisture in the storage space).

This situation was confirmed by our investigations, the eggshell microbial payload being high enough: 91.98±0.49 germs/cm^2 of shell in Lc1, 91.85±0.47 germs/cm^2 of shell in Lexp1 batch and of 91.90±0.57 germs/cm^2 of shell in Lexp2 batch. For the white eggs the eggshell microbial was 93.87±0.38 germs/cm^2 of shell in Lc2, 94.21±0.51 germs/cm^2 of shell in Lexp3 and 93.95±0.44 germs/cm^2 of shell in Lexp4.

At the end of the storage period (day 35), the microbial payload for the white eggs was of: 99.85 germs/cm^2 in the Lc2 batch; 111.69±1.15 germs/cm^2 in Lexp3 batch and 151.21±1.74 germs/cm^2 in Lexp4 batch.

The increasing of total number of germs could be observed also in the mix from the studied eggs. If at the beginning of storage in the obtained mix from the brown eggs were identified a number of 2.21±0.009 germs/g in Lc1, 2.40±0.011 germs/g in Lexp1 and 2.35±0.010 germs/g in Lexp2, after 35 days of storage, the total number of germs in the eggs' mix reached at 5.17±0.033 germs/g in Lc1, 6.32±0.047 germs/g in Lexp2 and 9.55±0.091 germs/g in Lexp4 (tab. 7).

Table 7 Microbial payload of the eggshell and mix

NTG mineral shell					
Storage period days	Type of eggs	Batch	n	$\overline{X} \pm s_{\overline{x}}$ (germs/cm²)	V%
0	Brown eggs	Lc1	5	91.98 ± 0.49	5.12
		Lexp1		91.85 ± 0.47	4.95
		Lexp2		91.90 ± 0.57	5.93
	White eggs	Lc2	5	93.87 ± 0.38	4.89
		Lexp3		94.21 ± 0.51	4.79
		Lexp4		93.95 ± 0.44	5.02
35	Brown eggs	Lc1	5	97.03 ± 0.95	9.36
		Lexp1		109.73 ± 1.14	9.87
		Lexp2		136.44 ± 1.51	10.53
	White eggs	Lc2	5	99.85 ± 0.63	8.59
		Lexp3		111.69 ± 1.15	10.15
		Lexp4		151.21 ± 1.74	10.53
NTG mix (germs/g)					
0	Brown eggs	Lc1	5	2.21 ± 0.009	4.22
		Lexp1		2.40 ± 0.011	4.56
		Lexp2		2.35 ± 0.010	4.32
	White eggs	Lc2	5	2.76 ± 0.008	3.98
		Lexp3		2.82 ± 0.013	4.12
		Lexp4		2.79 ± 0.011	4.08
35	Brown eggs	Lc1	5	5.17 ± 0.033	6.19
		Lexp1		6.32 ± 0.047	7.11
		Lexp2		9.55 ± 0.091	9.12
	White eggs	Lc2	5	5.77 ± 0.041	5.71
		Lexp3		6.79 ± 0.052	8.19
		Lexp4		10.03 ± 0.050	10.21

CONCLUSIONS

Eggs' weight (g) had a descendant evolution for all six batches, the obtained values at the end of storage period for brown eggs being of 65.412±0.288 g for batch Lc1, 60.575±0.921 g for batch Lexp1 and of 52.422±0.991 g for batch Lexp2.

At the end of storage period the main significant differences face to the values established for fresh eggs were founded for albumen index (lowest with -22.6973% at batch L2 and with 59.1745% at batch Lexp4) and respectively, for yolk index (lowest with -24.390% at batch L2 and with -68.374% for Lexp4).

Decreasing of eggs' weight (due to the lost of water content), but also the albumen fluidization in time, leads to a diminishing of the Haugh index values, with only -11.435% in the case of eggs from batch L2, -19.168% for the eggs from batch Lexp3 and with -35.877% at the ones from batch Lexp4.

Microbiological quality indices which were determinate both on the surface of mineral shell and also on the obtained mix (albumen + yolk), modified the initial number of germs due to the temperature and air moisture in the storage spaces.

Total number of germs identified on the mineral shell of eggs at the beginning of storage (fresh eggs) had a value of 91.98±0.49ufc/cm^2 at batch Lc1, 91.85±0.47ufc/cm^2 at batch Lexp1 and of 91.90±0.57ufc/cm^2 at batch Lexp2, reaching at the end of determinations values between 107.16-258.77ufc/cm^2.

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