APRECIATION OF SOME MORPHOLOGICAL AND PHYSICAL QUALITY INDICATORS FOR EGGS OBTAINED FROM LAYING HENS REARED IN GROWING SYSTEMS AGGRED BY EUROPEAN UNION

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Abstract

Specialists in aviculture focused on elaboration and implementation in practice of some alternative systems for rearing of laying hens, which must fulfil their biological necessities, but at the same time to assure high levels of production [1]. From alternative systems, improved cage batteries had many positive appreciations; another exploitation solution is the one on a permanent layer, in shelters with controlled environment, but the most appreciated technological variant is rearing in open shelters with exterior paddocks (free range)[2]. By the current paper we aimed to analyse the quality of eggs gathered form hens reared in different growing systems, through four parameters (incidence of eggs with morphological anomalies, weight, thickness of mineral shell and breaking up resistance of mineral shell). The highest rate of eggs with broken shell was obtained at batch L3 (0.67%), followed by L2 (0.64%) and L1 (0.52%). The rate of eggs with a bad formed shell differed function of growing system, being 0.42 for L1, 0.4 for L2 and 0.36 at L3. The biggest weight of eggs was recorded at batch L3, with a mean of 64.289±0.247g; eggs gathered from L2 had a mean weight of 63.676±0.287g and 62.677±0.347g the ones from L1. Thickness of mineral shell at batch L3 had a mean value of 0.424±0.002mm, at the ones from L2 was 0.394±0.001mm and at the ones gathered from laying hens housed in batteries was 0.374±0.002mm. Breaking up resistance of mineral shell (kgf/cm^2) was in a close correlation with its thickness so the highest mean value was obtained at batch L3, 0.335±0.001, followed by L2 (0.328±0.001), respectively L1 (0.328±0.001). The presented results are part of an ample study for enlargement the knowledge area regarding quality of eggs destined for human consumption.

Key words: eggs' quality, rearing systems, morphological anomalies, eggs weight, breaking up resistance

INTRODUCTION

By the current paper we aimed to evaluate a series of qualitative parameters which characterize eggs for human consumption. The studied biological material was represented by eggs gathered from different hens reared in different growing systems, agreed by European Union, and which make the price difference for those food products.

MATERIAL AND METHOD

Studied biological material was represented by eggs gathered from hen commercial hybrid "Lohmann Brown". In our research were utilised three rearing systems, respectively: rearing in batteries in shelters with a controlled environment (L1), rearing on a permanent layer in shelters with a controlled environment (L2), rearing in opened shelters to the exterior paddock – free range (L3).

The main aimed indicators were: *rate of eggs with morphological anomalies*, *eggs' weight*, *thickness of mineral shell* and *breaking up resistance of mineral shell*.

Rate of eggs with morphological anomalies was determined after identification of anomalies, by their rating to total production.

Eggs' weight was established by individual weighting using an analytical balance.

Thickness of mineral shell was determined using a calliper after removing of shell membranes and drying; shell fragments

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were gathered from three areas and the mean of those three measurements represented the thickness of mineral shell [4].

Breaking up resistance of mineral shell is direct subjected by thickness of mineral shell and it was determined by using a Schröder device [4].

RESULTS AND DISCUSSIONS

Rate of eggs with morphological anomalies

After identification of eggs with morphological anomalies we conclude that in this case, the most frequent anomalies were represented by: eggs with wrong formed shell, the ones without yolk, eggs with two yolks respectively eggs with broken shell.

From percent rating the most frequent anomaly was the one represented by eggs with broken shell. The highest rate was determined in the case of eggs gathered from hens reared in free range system, respectively 0.67%, followed by the ones obtained from hens reared on permanent layer (0.64%) and the ones gathered from hens reared in battery cages (0.52%) (tab. 1 and fig. 1).

Table 1 Rate of eggs with morphological anomalies (%)

Anomaly	Eggs gathered from hens reared in batteries (L1)	Eggs gathered from hens reared on permanent layer (L2)	Eggs gathered form hens reared in free range system (L3)
Eggs with wrong formed shell	0.42	0.40	0.36
Eggs without yolk	0.08	0.06	0.05
Eggs with two eggs	0.06	0.05	0.05
Eggs with broken shell	0.52	0.64	0.67
TOTAL	**1.08**	**1.15**	**1.14**

Percent of eggs with wrong formed shell was different function of utilised rearing system, being 0.42% for the ones gathered from birds reared in batteries, 0.4% for eggs gathered from hens reared on permanent layer and 0.36% in the case of hens reared in free range system (tab. 1 and fig. 1).

The highest percent of eggs without yolk was obtained at the ones gathered from hens reared in batteries (0.08%), followed by the ones obtained from hens reared on permanent layer (0.06%) and by the ones produced in free range system (0.05%) (tab. 1 and fig. 1).

Eggs with two yolks were founded in a rate of 0.06% at L1 and 0.05% at L2 and L3 (tab. 1 and fig. 1).

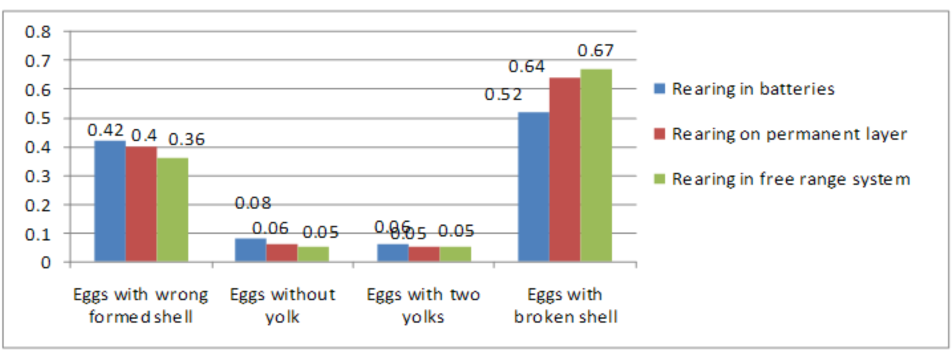

Fig. 1 Rate of eggs with morphological anomalies

Eggs' weight

After eggs weighting, the greatest weight was recorded for batch L3, those one being in a mean of 64.289±0.247g, with oscillation limits between a minimum of 62.14g and a maximum of 66.14g. Eggs collected form hens reared on a permanent layer had a mean weight of 63.676±0.287g and the ones obtained from hens reared in batteries had a mean weight of 62.677±0.347g.

Calculation of variation coefficients show the homogeneity of studied character for all three batches (tab. 2 and fig. 2).

Table 2 Eggs' weight (g)

Eggs' weight (g)	Eggs gathered from hens reared in batteries (L1)	Eggs gathered from hens reared on permanent layer (L2)	Eggs gathered from hens reared in free range system (L3)
$\bar{X} \pm s_{\bar{x}}$	62.677±0.347	63.676±0.287	64.289±0.247
Min.	59.36	61.15	62.14
Max.	65.13	66.12	66.14
V%	2.482	2.020	1.772
Significance of differences between batches' mean	L1 vs. L2 = **; $\hat{F}$ (4.895) > Fα (4.098) for 1:38 GL L1 vs. L3 = ***; $\hat{F}$ (14.256) > Fα (12.714) for 1:38 GL L2 vs. L3 = n.s.; $\hat{F}$ (2.614) < Fα (4.098) for 1:38 GL		

Analysis of differences between batches' means show the existence of very significant differences between batches L1 and L3, significant between L1 and L2, respectively the absence of statistical significance between batches L2 and L3.

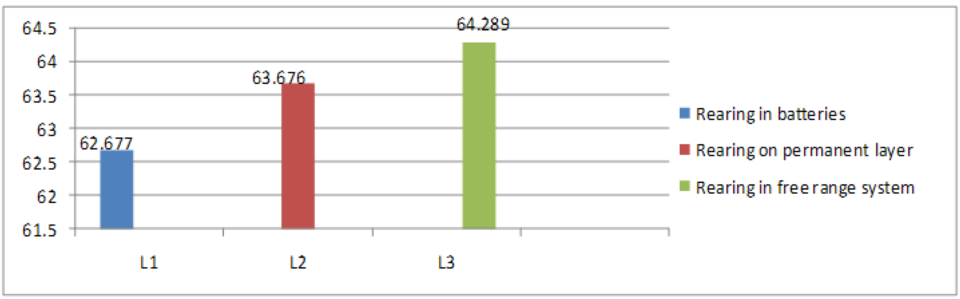

Fig. 2 Eggs' weight

Thickness of mineral shell

Thickness of mineral shell in case of batch L3 placed at an average level of 0.424±0.002mm, in conditions of minimum value determination of 0.399mm and a maximum one of 0.437mm. Variation coefficient enlightened a very good homogeneity of studied character (tab. 3 and fig. 3).

Table 3 Thickness of mineral shell (mm)

Thickness of mineral shell (mm)	Eggs gathered from hens reared in batteries (L1)	Eggs gathered from hens reared on permanent layer (L2)	Eggs gathered from hens reared in free range system (L3)
$\bar{X} \pm s_{\bar{x}}$	0.374±0.002	0.394±0.001	0.424±0.002
Min.	0.356	0.383	0.399
Max.	0.398	0.408	0.437
V%	3.086	1.863	2.356
Significance of differences between batches' mean	L1 vs. L2 = ***; $\hat{F}$ (44.323) > Fα (12.714) for 1:38 GL L1 vs. L3 = ***; $\hat{F}$ (214.307) > Fα (12.714) for 1:38 GL L2 vs. L3 = ***; $\hat{F}$ (113.747) > Fα (12.714) for 1:38 GL		

At eggs gathered from hens reared on permanent layer the mean thickness 0.394±0.001mm and at the ones reared in batteries was 0.374±0.002mm; also in this case character was homogenous.

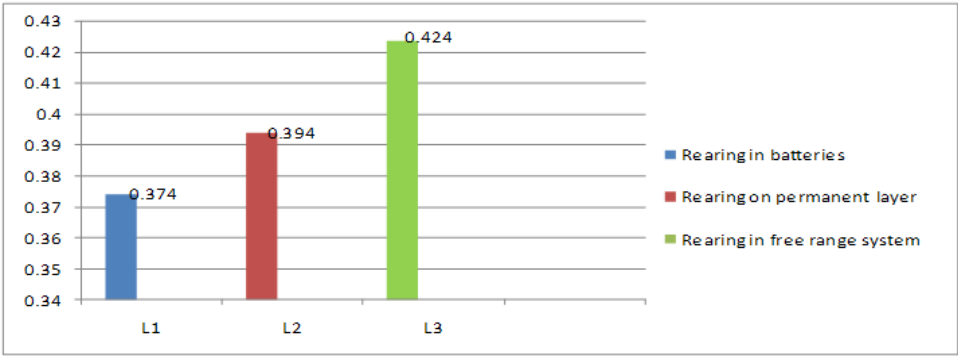

Fig. 3 Thickness of mineral shell

After making the statistical interpretation we observe that between batches were recorded very significant differences.

Breaking up resistance of mineral shell

Breaking up resistance of mineral shell is in close correlation with its thickness [3] so the greatest mean value was recorded in case of batch L3, 0.335±0.001 kgf/cm^2, followed by L2 (0.328±0.001kgf/cm^2), respectively by L1 (0.325±0.001 kgf/cm^2). Inside batches the character was very uniform, V% oscillating in interval 1.486-1.873 kgf/cm^2 (tab. 4 and fig. 4).

Table 4 Breaking up resistance of mineral shell

Breaking up resistance (kgf/cm^2)	Eggs gathered from hens reared in batteries (L1)	Eggs gathered from hens reared on permanent layer (L2)	Eggs gathered from hens reared in free range system (L3)
$\overline{X} \pm s_{\overline{x}}$	0.325±0.001	0.328±0.001	0.335±0.001
Min.	0.315	0.319	0.323
Max.	0.338	0.335	0.345
V%	1.873	1.486	1.745
Significance of differences between batches' mean	L1 vs. L2 = n.s.; $\hat{F}$ (2.661) < Fα (4.098) for 1:38 GL L1 vs. L3 = ***; $\hat{F}$ (25.008) > Fα (12.714) for 1:38 GL L2 vs. L3 = ***; $\hat{F}$ (15.009) > Fα (12.714) for 1:38 GL		

From statistical point of view between L1 and L2 weren't observed differences but, comparing L2 and L3, respectively L1 and L3 were observed very significant differences.

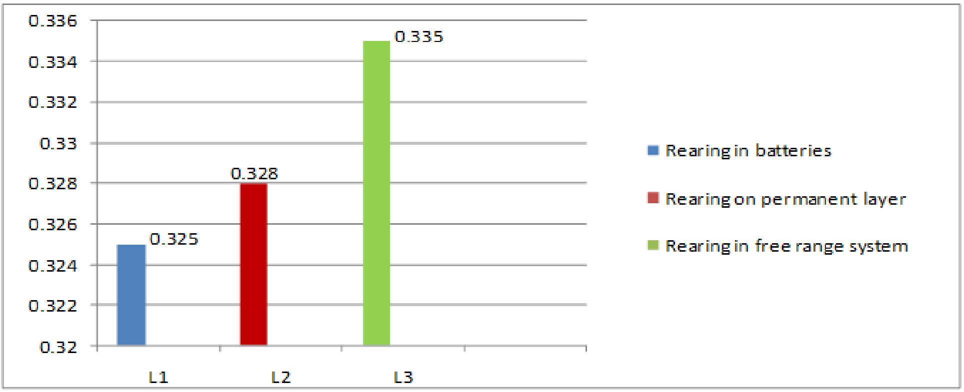

Fig. 4 Breaking up resistance of mineral shell

CONCLUSIONS

After identification of eggs with morphological anomalies was observed the fact that the highest percent was recorded in the case of experimental batch L2 (1.15%), followed by L3 (1.13%) and L1 (1.08%). Differences weren't high, being in the limits imposed by literature; however was noticed an increased rate of eggs with broken shell in case of batches L2 and L3, fact which generate apparition of the above mentioned differences.

Eggs' weight was uniform inside those three batches; the lowest mean values being recorded at L1 (62.677g), followed by L2 at which weight was higher with 1.59% and L3 with a superiority of 2.57%.

Thickness of mineral shell rated at L1 (0.374mm), was with 5.34% higher in case of batch L2 (0.394mm) and with 13.36% for L3 (0.424mm).

Breaking up resistance of mineral shell was in a direct correlation with its thickness being 0.325 kgf/cm^2 for L1, 0.328 kgf/cm^2 at L2 (with 0.92% higher comparatively with L1) and 0.335 kgf/cm^2 in case of eggs obtained at batch L3 (with 3.07% higher face to L1).

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