EFFECT OF REARING SYSTEM OF LAYING HENS ON SOME QUALITY PHISICAL INDICATORS FOR CONSUMPTION EGGS

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Abstract

Egg quality is a characteristic responsable for acceptability of a food by consumers. This paper aims to assess physical quality indicators for eggs obtained in two exploitation systems: (battery and free range), considering egg weight, format index, albumen index, yolk color and index. Physical measurements were performed by specific methods, on the 270 eggs in each system analyzed from hybrid Lohmann Brown hens, on three stages of productive life (beginning of laying, its peak lay and end of it). Statistical analysis of the data obtained indicated significant differences between mean values of white index (10.23 vs. 11.13), the yolk index (43.00 vs. 43.99) and format index (77.16 vs. 75.64), significant differences were recorded for egg weight (67.32 vs. 68.73g) and yolk color. The values obtained for weight of eggs from free range system were comparatively higher than ones gathered from batteries (68.61 vs. 69.18 g). Instead format index had higher values for eggs from battery face to the ones from free range (76.46 vs. 76.33).

Physical quality indicators were significantly better at eggs from free range system comparison with those specific for battery rearing, thanks to the beneficial influence of external atmospheric factors on reproductive functioning and metabolism of calcium.

Key words: egg, battery, free range, physical quality, consumer

INTRODUCTION

The eggs are the cheapest source of food at present. It is considered a complete food, for its rich content in essential amino acids, vitamins and minerals (1). Alternative rearing systems for laying hens' creates opportunity for expression of natural behavior, productivity and health of laying hens and egg quality derived from them. Alternative systems of rearing laying hens must be designed to balance the health and welfare of the birds with consumer preferences, needs of the industry and their impact on the environment and public health (3). Quality is an attribute, responsible for food acceptability by consumers (2). Making quality products is the desire of any manufacturer, but this can be achieved by creating the conditions for growth, providing ethological and physiological needs of laying hens (6). Internal quality of eggs is largely correlated to the quality of the white; its liquid faction is a sign of impairment egg quality. The quality of the yolk is influenced by two components, its color and periviteline and damaged membranes (5).

The color of the yolk is important for consumers (4), but depend largely administered diet of laying hens (3). Studies carried out by Leth et al., (2000) shows that the in eggs from alternative systems were found concentrations of lutein, 2-3 times higher, in contrast to those from conventional systems. Egg quality has a genetic basis and responsible for vary quality parameters was laying hybrids (7); also hens operating system (3), as well as the age of the chickens (7).

The objective of this study was to determine the physical quality indices of eggs from battery and free range system.

MATERIAL AND METHOD

To assess the physical quality of the eggs of the two systems, 270 eggs were collected from each unit as the age of 22 weeks, 34, and 70 weeks. They were divided into two

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batches 90 eggs for every age of hens, from free range growth Batch exp and the other 90 eggs at 22, 34 and 70 weeks, from hens battery operated batch c. These were analyzed by appropriate methods as follows: weight was determined by weighing them with the analytical balance, format index represents the percentage ratio between the diameter and the largest egg breakfast; measuring two dimensions of the egg was made with electronic calipers, then the eggs were broken on a glass plate and appreciated yolk color daylight using DSM yolk color. White and the yolk index were determined by a micrometer. The measurements were carried out in the vicinity of the yolk; diameter measurement is the average of four (two at the middle and two in the latch area of the fibers). The white index represented by the ratio between the height and the diameter thereof, and is calculated by the formula:

$$\mathbf{I_a} = \frac{h}{D},$$

where: $\mathbf{I_a}$ is the white index; ***h*** - albumen height; ***D*** - diameter albumen.

Yolk index, having working technique similar to computed with:

$$\mathbf{I_g} = \frac{h}{D},$$

where: $\mathbf{I_g}$ is the yolk index; ***h***- height of the yolk; ***D*** - yolk diameter.

Measurements were performed on three representative age of the laying hens studied their lifetime.

The statistical interpretation of the results was performed by calculating the position and variance estimators (arithmetic mean, standard deviation and coefficient of variation average and V%), establishing significance of differences.

RESULTS AND DISCUSSION

The analyzes performed on the 3 ages of productive life of the birds showed higher values of quality indicators of eggs free physical range, unlike those from the exploitation indices in batteries.

Eggs weight recorded significant values at 22 and 34 weeks and at the end of laying (70 week) results was insignificant.

Homogeneity of studied character was very good due to the variation coefficients below 10%.

Regarding the white and the yolk index values obtained from eggs analyzed showed very significant values at each age period analyzed.

The index format is the only indicator whose values are superior to eggs from battery- operation compared to the free range.

Table 1 Evolution of egg weight

Hen age (weeks)	Statistical estimators (n=90)	Batches of experience	
		Lc (Approved batteries)	Lexp (Free range)
22	$\overline{X} \pm s_{\bar{x}}$ (g)	44.53±0.13	45.01±0.14
	V%	2.77	3.06
	Significance of differences	$\hat{F}$ =5.89; $F\alpha_{0.01}$=6.77; $\hat{F} < F_{0.01} \rightarrow$*	
34	$\overline{X} \pm s_{\bar{x}}$ (g)	67.32±0.42	68.73±0.47
	V%	5.97	6.78
	Significance of differences	$\hat{F}$ =6.28; $F\alpha_{0.01}$=6.77; $\hat{F} < F_{0.01} \rightarrow$*	
70	$\overline{X} \pm s_{\bar{x}}$ (g)	68.61±0.26	68.54±0.24
	V%	3.63	3.45
	Significance of differences	$\hat{F}$ =2.04; $F\alpha_{0.05}$=3.89; $\hat{F} < F_{0.05} \rightarrow$n.s.	

In the first table was presented weight of eggs from free range system, and from those increase in the battery. So at 34 weeks at battery eggs weight was 67.32 ± 0.42g compared with those from a range free operation were weight was 68.73 ± 0.47 g. Data from the literature indicate values between 57.6-62.7g (4.5) in eggs from alternative systems and 55.5-62.31g (1.5) in the rearing system from battery.

Table 2 shows the values found for the format index for eggs of the two systems analyzed. These early laying of 74.40 ± 0.12 were vs. 72.00 ± 0.08. Both values for beginning and peak of lay were very significant. The end of the productive brings significant values of this index 76.46 ± 0.20 vs.76.33±0.25. The literature indicates values of format index from 74.47 to 78.27 (1.5) for eggs from free range system vs.78.17-77.98 (1.5) for the batteries. Van den Brand et al. (2004) reported a more elongated eggs from battery while Petek et al. (2009) and Wang et al. (2009) argue that there is no correlation between the operating system and format index.

Table 2 Format index

Hen age (weeks)	Statistical estimators (n=90)	Batches of experience	
		Lc (Approved batteries)	Lexp (Free range)
22	$\overline{X} \pm s_{\bar{x}}$ (%)	74.40±0.12	72.00±0.08
	V%	1.62	1.08
	Significance of differences	$\hat{F}$ =25.29; $F\alpha_{0.001}$=11.19; $\hat{F} > F_{0.001} \rightarrow$***	
34	$\overline{X} \pm s_{\bar{x}}$ (%)	77.16±0.07	75.64±0.15
	V%	0.88	1.96
	Significance of differences	$\hat{F}$ =13.09; $F\alpha_{0.001}$=11.19; $\hat{F} > F_{0.001} \rightarrow$***	
70	$\overline{X} \pm s_{\bar{x}}$ (%)	76.46±0.20	76.33±0.25
	V%	2.56	3.17
	Significance of differences	$\hat{F}$ =7.00; $F\alpha_{0.001}$=11.19; $\hat{F} < F_{0.001} \rightarrow$**	

Table 3 presents the average values of the white index, which is an important characteristic in determining the quality of the eggs. Determinations on eggs from two systems analysis indicated high values for the white index at 22 weeks 10.51±0.05 eggs from batteries and 10.92±0.04 on eggs from free range system.

The second stage of the analyzed age, 34 weeks bring higher levels in sample free range being 11.13±0.04 and lower for the batch increased in batteries with values 10.23±0.05.

A decrease of the white index was manifested in last week of exploitation from 9.44±0.03 which is the values from lot of battery system and 9.85±0.04 in the batch operated alternately.

The statistical differences were very significant for albumen index throughout the productive, very good homogeneity of the values with the coefficient of variation was less than 10%.The values found in the literature for the white index is between 7.23-9.50 [3, 4] to eggs from increase free range and 7.30-9.73 [3, 4] to those from the laying hens exploited in batteries.

Table 3 White index

Hen age (weeks)	Statistical estimators (n=90)	Batches of experience	
		Lc (Approved batteries)	Lexp (Free range)
22	$\overline{X} \pm s_{\bar{x}}$	10.51±0.05	10.92±0.04
	V%	5.07	4.09
	Significance of differences	$\hat{F}$ =30.43; $F\alpha_{0.001}$=11.19; $\hat{F} > F_{0.001} \rightarrow$***	
34	$\overline{X} \pm s_{\bar{x}}$	10.23±0.05	11.13±0.04
	V%	5.31	4.23
	Significance of differences	$\hat{F}$ =141.80; $F\alpha_{0.001}$=11.19; $\hat{F} > F_{0.001} \rightarrow$***	
70	$\overline{X} \pm s_{\bar{x}}$	9.44±0.03	9.85±0.04
	V%	3.67	4.21
	Significance of differences r	$\hat{F}$ =50.40; $F\alpha_{0.001}$=11.19; $\hat{F} > F_{0.001} \rightarrow$***	

Table 4 is representative of the yolk index. Its values throughout the period of laying eggs in the systems analyzed showed a significant decrease at 22 weeks was 42.98±0.00 vs. 44.01±0.01, 43.00±0.01 vs. 43.99±0.01 at week 34 and 43.51±0.80 vs. 43.63±0.03 in the last period of operation; the higher values recorded increase in free range eggs. The literature indicates values ranging from 43.3 to 43.29 [3, 4] for free range eggs and 42.72 to 43 [3, 4] for eggs provided from battery.

Table 4 Yolk index

Hen age (weeks)	Statistical estimators (n=90)	Batches of experience	
		Lc (Approved batteries)	Lexp (Free range)
22	$\overline{X} \pm s_{\bar{x}}$	42.98±0.05	44.01±0.07
	V%	0.11	0.16
	Significance of differences	$\hat{F}$ =86.32; $F\alpha_{0.001}$=11.19; $\hat{F} > F_{0.001} \rightarrow$***	
34	$\overline{X} \pm s_{\bar{x}}$	43.08±0.06	43.99±0.06
	V%	0.13	0.50
	Significance of differences	$\hat{F}$ =55.64; $F\alpha_{0.001}$=11.19; $\hat{F} > F_{0.001} \rightarrow$***	
70	$\overline{X} \pm s_{\bar{x}}$	43.51±0.80	43.63±0.03
	V%	6.79	0.69
	Significance of differences	$\hat{F}$ =5.43; $F\alpha_{0.01}$=6.77; $\hat{F} < F_{0.01} \rightarrow$*	

The last figure shows the values given to the DSM yolk color scale (La Roche) for eggs in both systems compared. For free range system the number of eggs were placed at 9 color sample was 31.11% of the eggs analyzed, compared with 20% that were in the batteries. Studies in the literature indicates values from 10.13 to 11.20 [1, 3] for free range eggs and 9.89 to 11.85 [1, 3] to the battery. It can be said that a decisive indicator for consumers in terms of quality of hen eggs is internal yolk color. This is a feature that is in constant relation with expectations and consumer preferences.

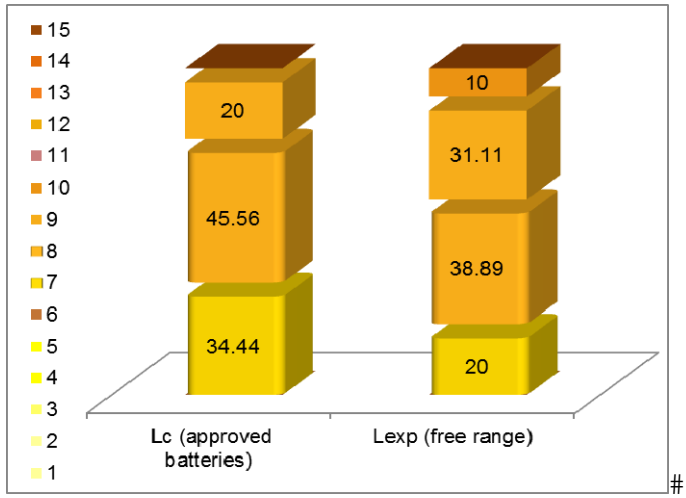

Figure 1 Yolk color

CONCLUSIONS

Research on the eggs obtained from studied hens showed higher weights to those from free range system because of the advantages conferred by nutrient order of this growth option.

Eggs deviated from the normal form (too elongated or too rounded, curved or pointed at both ends, with the throttle or deformity) are usually rejected by consumers. The values for this indicator were higher in the increase in battery than free range breeding.

Determinations on eggs from two systems analysis indicated high values for the index albumen for eggs from exploitation by outside paddock access, to those of conventional systems.

The yolk index depends on the quality of the yolk membrane surrounding egg yolk, and from research done this is more increased in free range eggs, than values registered at eggs from battery.

Knowing that the color of the yolk is a factor dependent strict on diet, it can be said that eggs from hens exploited systems with outdoor access (additional sources of food) have a color of yolk significantly enhanced, regardless of age, compared to those operated in batteries.

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