EXTERNAL AND INTERNAL QUALITY OF EGGS PRODUCED FROM AGED HENS

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Abstract

An experiment was conducted to evaluate the quality of eggs produced from two genotypes aged hens, in specific points in molting period. In this study quality of eggs produced from ISA brown 88 weeks aged hens was compared with eggs produced from Hisex Brown 91 weeks aged hens. The values of external quality characteristics significantly decreased during the stress period in egg weight for 8.6% ($p<0.05$) and 14.16% ($p<0.01$) and become a little higher in second laying cycle ($p>0.05$). The same trend was found in shell weight which was decreased for 70.36% and 69.36% ($p<0.01$) and slowly increased in the second laying cycle 1.00% and 1.08% ($p>0.05$) in the first (ISA Brown) and second (Hisex Brown) group. Shell thickness was decreased during stress period for 62.38% and 62.32% ($p<0.01$) and still lower in the second cycle for 13.86% and 13.30% ($p<0.01$) in first and second group. Internal characteristics in yolk weight were changed for 14.58% ($p<0.01$) and 1.15% in stress period equalized closely 4.81% and 2.31% which was insignificant ($p>0.05$). The yolk colour significantly decreased during stress period ($p<0.01$) and equalized during the second cycle ($p>0.05$). The yolk index between different specific points of molting in first group was improved in the second egg laying cycle for 6.5% and 6.3% ($p>0.05$), but in the second group there was not found difference between preparing and second laying period, but it was found significant difference between stress period and preparing and second laying period for 12.4% and 12.8% ($p<0.01$). Albumen height and Haugh units did not changed their quality during the stress period ($p>0.05$), but in second laying period it was improved for 10% and 11% ($p<0.01$) in first (ISA Brown) and second (Hisex Brown) group.

Key words: quality, eggs, aged hens

INTRODUCTION

The monitoring of egg quality characteristics of external and internal type is important mainly for interest of economy of production. The attention of our experiment was devoted especially to egg quality, because crack egg shell presents high loses for market egg producers especially if eggs are produced from aged hens in the second laying cycle. Therefore is very important to evaluate the quality characteristics of eggs and the age factor which can affect them. The genotype and the age factor could be the most important factors influencing not only egg weight, but also the other (external and internal) egg characteristics. Many studies have shown that aged hens molted even in higher age of hens lay eggs with higher weight and the strong egg shell then at the end of the first laying cycle. Several of them have shown heavier eggs production in the second laying cycle in comparison with the first laying cycle [3] [4] [5] [6] [13] [15]. Brown egg layers usually produced heavier eggs that white ones. This was the reason why the difference in egg weight in our experiment was not visible in ISA and Hisex Brown layers. Egg weight influences the weight of components of eggs especially egg albumen and yolk [1], [14]. The egg shell quality is given throw the weight and the percentage of shell, thickness and the strength. The differences in egg shell quality depend on the environmental conditions and the feed quality and also of strain of layers [15]. The egg weight is characteristic which directly affects egg shell thickness and egg size also. Brown egg layers produce higher shell weight in comparison with some other hybrids of white colour [11], but the egg shell deformation in brown eggs is usually higher [15]. Significant negative correlation on egg shell deformation and the strength as well as thickness was found in brown eggs [15] [12], non significant

differences in shell strength were found in variable brown strains as a strain of hens used in our experiment. The shell thickness is also characteristic of external quality which is important for shell strength. The age of hens influenced on egg shell quality [15], but the stress is influencing shell thickness very significantly especially during the period of fasting [8]. The egg yolk and albumen quality characteristics were observed in several investigations [15]. They found significant higher egg yolk in brown eggs produced by Hisex Brown. In contrast some authors showed significant higher egg yolk in white eggs breeds (Lohman LSL in comparison with Brown). From albumen quality characteristics only Haugh units are influenced from genotype [12]. They found significantly higher value for Hugh units in white eggs in relation with brown eggs. Many authors showed the heritability of albumen height and Haugh units [14] [15]. The correlations between egg yolk weight and percentage were also found by some authors [9]. Always was found dependence of higher albumen and larger eggs [15]. The objective of our study was to investigate the differences between some external and internal quality characteristics of eggs produced during the second egg laying cycle and compared with two genotypes, ISA and Hisex Brown, and the changes of quality of the same characteristics during the different specific points of preparing, stress period and second egg laying cycle.

MATERIAL AND METHOD

Changes of quality of the same external and internal characteristics during the different specific points of preparing, stress period and second egg laying cycle were investigate with layers of two genotypes: ISA Brown, 88 weeks old and Hisex Brown, 91 weeks old.. Hens were accommodate in standard industrial poultry houses for egg production and separated in 2 groups: group 1 hybrid ISA Brown (88 weeks) and group 2 hybrid Hisex Brown (91 weeks).

Artificial molting was induced with application of 10 days period of fasting.

Special nutrition program was performed during the experiment: molt 1 (during the molting period), molt 2 (for laying start) and pick 1 (for stabilized and reaching the pick and stability of laying). Programming of feed mixtures was done with simplex method of linear programming.

In Table 1 are presented the nutritive value of feed mixtures for experimental nutrition.

Table 1. Nutritive value of feed mixture

Nutritive value	Type of feed mixture		
	Molt 1	Molt 2	Peak
Dry matter, %	91.01	88.76	88.55
M. energy kcal/ kg	2770	2750	2750
Crude proteins, %	15.50	16.00	15.60
Crude fat, %	3.68	4.68	3.64
Crude fiber, %	3.68	3.47	3.13
Total ash, %	8.55	10.78	10.97
Lysine, %	0.80	0.84	0.76
Methionine, %	0.47	0.38	0.36
Calcium, %	2.80	3.60	3.80
Phosphorus, %	0.50	0.50	0.38
Sodium, %	0.25	0.22	0.20
Chlorine, %	0.15	0.14	0.14

Eggs for analysis were sampled in 3 specific points, preparing period (10 eggs), stress period (5 eggs) and second egg laying cycle (40 eggs).

Eggs were weighed and broken on a flat surface where the height of the albumen was measured with micrometer. The yolk was separated from the albumen and weighed. Also was measured the diameter and height of yolk. Yolk colour was determinate with a yolk colour fan of Roche company. Egg shell was dried on room temperature and weighed. After removing the inner membrane thickness was measured with micrometer on broad, middle and narrow side.

Haugh units were calculated from records of egg weight and albumen height as an indicator of interior egg quality [13].

Haugh unit = $100 * \log_{10} (H-1.7W^{0.37}+ 7.56)$

where H = height of the albumen and W = egg weight.

The yolk index was calculated according to the equation [7].

Yolk index = (Yolk height, mm/yolk diameter mm) * 100

The Variance analysis was used to find the significant differences in egg quality characteristics in the specific points. In case of differences between the groups and periods t test was applied.

RESULTS AND DISCUSSION

The value of feed consumption during the preparing and second laying cycle was ad libidum, but during the stress period in duration of 10 days the hens were fasting. The watering was ad libidum during the period of lighting program lasting 7 hours per day.

The egg weight during the fasting period until the stopping of laying was higher in ISA Brown hens (64.38g) and lower in Hisex Brown (59.46g) which is significantly different ($p<0.05$). During the preparing and second laying cycle there was not significant difference in egg weight.

The differences of the shell weight during the all specific periods of molting was nearly equal because there was not any statistic differences in the shell weight during the same specific periods.

The same situation was found in the shell thickness compared in the same periods of molting. In the both characteristics (shell weight and shell thickness) as well as egg weight there were found significant changes: in the egg weight, between the stress and the other periods, because they were significant different, preparing and fasting, second egg laying and fasting period ($p<0.01$). But there were not found differences between the genotype of layers, it means that their performances are nearly the same ($p>0.05$).

The results of external quality characteristics are presented in table 2.

The mentioned results were expected because many authors found the similar significances between the same characteristics of egg quality and the differences between the genotype of the brown egg layers [1] [15].

The internal quality characteristics of eggs produced from two genotypes of brown egg layers artificially molted during the age between 88 and 91 weeks are presented in Table 3.

The yolk weight during the preparing and second egg laying period in both hybrid strain were nearly the same between 18.20 g and 19.12 g, but during the fasting stress period yolk weight decreased between 16.40 g and 18.84 g. Yolk weight during the stress period in the eggs of ISA Brown strain was lower for 2.5 g in comparison with the weight of the same period in the eggs of Hisex Brown strain, but the albumen height and Haugh units are higher. In albumen height positive difference in ISA Brown albumen was 0.5 mm, but in the Haugh units was higher for 2.2 units. Those differences showed that the weight of the eggs of ISA Brown strain during the fasting period was as a result of a higher albumen content.

Yolk colour during the preparing and second egg laying period were not significantly changed, but during the fasting the colour decreased for nearly 50 %. The differences are high significant because during the fasting period the hens probably spent nearly the all reserve of colour pigments from the body. Those differences are highly significant ($p<0.01$).

The differences between external and internal quality characteristics of eggs laid during different specific points of molting by fasting of the hens were highly significant in comparison with the other methods of artificial molting, but the laying efficiency at the period of starting of laying, which was shorter, give the priority of this method because the other methods presented by authors [6] [10] were function slowly and give lower egg laying intensity in comparison to the method of fasting.

Table 2. External quality characteristics in eggs produced from aged hens

Characteristics	ISA Brown			Hisex Brown		
	Preparing period	Stress period	Second egg laying cycle	Preparing period	Stress period	Second egg laying cycle
1. Egg weight, g	70.43	64.38	73.38	69.27	59.46	73.65
2. Shell weight, g	7.76	5.46	7.88	7.18	4.98	7.56
3. Shell thickness, microns	404	252	348	406	253	352

Table 3. Internal quality characteristics in eggs produced from aged hens

Characteristics	ISA Brown			Hisex Brown		
	Preparing period	Stress period	Second egg laying cycle	Preparing period	Stress period	Second egg laying cycle
1. Yolk weight, g	19.12	16.40	18.20	19.06	18.84	18.62
2. Yolk colour	8.60	4.40	9.10	8.70	4.40	8.43
3. Yolk index, %	42.28	44.12	48.78	46.26	40.53	46.46
4. Albumen height, mm	7.26	6.60	8.38	7.15	6.10	8.61
5. Haugh unit	82.24	79.64	88.22	81.78	77.44	89.39

CONCLUSIONS

From the research made with the aim to see the differences of the quality characteristics of the eggs during the different specific points of molting of two strains of brown egg layers (ISA and Hisex) can be concluded that:

1. During the fasting stress period, where the egg laying is stopping for one week, the external egg quality rapidly was decreasing down and the differences was highly significant.

2.During the second egg laying cycle egg weight, shell weight and shell thickness as well as egg production are rising rapidly and they should be under control.

3.The internal quality characteristics also decreased during the stress period and rapidly increased during the next egg laying cycle. The differences of quality between the two mentioned points are highly significant. In the second laying cycle the laying hens of both hybrid strains are producing the eggs of high quality.

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