Effect of Time Intervals of Egg Formation on Some Quality Characteristics of Oravka Chicken Eggs

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Abstract
In this study, we studied the influence of time intervals of egg formation on some egg quality parameters in descending part of laying curve in pure Oravka chicken breed. We studied the daily dynamics of egg production from 6 a.m. to 8 p.m. for 30 days on 66 hens. Experiment was realised in deep litter system in pens with automatic egg nest. Feeding of hens was providing by feed mixture for laying hens (crude protein 158.06 g/kg, metabolic energy 11.32 MJ/kg). Feeding and watering were ad libitum. Birds were exposed to natural light as a practiced in rural areas of South-West Slovakia. The results showed that prolonging the time intervals of egg formation increased of egg weight, eggshell weight and eggshell proportion. At the same time, albumen weight and albumen proportion decreased during period.

Key words: egg formation, egg quality, hen, Oravka, time interval.

1. Introduction

The chicken breed Oravka was created by crossbreeding of the hens from Orava region in Slovakia with Rhode Island Red, Wyandotte White and New Hampshire. It was a dual-purpose breed, raised both for meat and for eggs [1-3].
Body weight of cockerels is between 2.8 and 3.3 kg, body weight of hens is between 2.2 and 2.7 kg, laying ranges from 180 to 200 eggs per year; eggs are of a brownish eggshell, with average weight about 55 g [4,5]
Egg production varies within a flock indicating individual bird differences in laying performance. Though overall flock performance may be high, not all hens in the flock lay at the same rate. Furthermore, while some hens may be laying at a very high rate, some others may not be laying at all [6,7] or laying at sub economic levels [8].
The evaluation of the egg characteristics is important factor for consumer preferences for better egg quality. The overall quality of the chicken egg is determined by the egg external and internal qualities. The appearance of the egg is important for consumer appeal. The external quality characteristics are evaluated on the basis of egg size and eggshell characteristics. The internal quality is based on the albumen and yolk quality characteristics. All egg quality characteristics are affected by several factors, including hen's age, genotype, nutrition and time of oviposition [9-11].
The aim of this study was to evaluate effect of time intervals of egg formation on some external and internal quality characteristics of Oravka chicken eggs.

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2. Materials and methods

Birds were placed in breeding pen with deep litter. Feeding and watering were *ad libitum*. Feeding of poultry was providing by commercial feed mixture for laying hens. Nutritional value of diet is shown in Table 1. Birds were exposed to natural light as a practiced in rural areas of South-West Slovakia.

We analysed daily the time intervals of egg formation in pure chicken breed Oravka in the second half of egg production on 66 hens for 30 days, from 6 a.m. to 8 p.m.

Analyse of basic external and internal egg quality parameters we realised in laboratory at Institute of Animal Husbandry, SUA in Nitra.

Due to the rarity of the occurrence of extreme lengths of egg formation, we statistically evaluated the interval from 23 to 29 hours by method of [12].

Egg, eggshell (with membrane) and yolk weights were individually determined to 0.01g accuracy using a laboratory scale Owa Labor (VEB Wägetechnik Rapido, Germany). The albumen weight was calculated from the difference between the egg weight, and the yolk and eggshell weight. The percentage proportion of the eggshell, albumen and yolk in the egg were determined.

Data were analyzed using analysis of variance by JASP 0.8.6 software [13], Significant difference was used at 0.05 probability level and differences between groups were tested by the Duncan‘s Multiple Range Test [14] at the levels of significance.

3. Results and discussion

Table 2 shows that the egg weight increased as the length of formation prolonged. Eggs formed after 23 and 24 hours were statistically significantly lighter ($P<0.05$) than eggs formed after 25 hours.

As can be seen from Table 2, the albumen weight of the with the length of egg formation showed an irregular decrease in 23 and 24 hours, a rise up in 26 hours and a significant decrease in eggs formed more than 29 hours. These are statistically no significant differences ($P>0.05$). By extending the length of egg formation, its weight increased, which can be explained by the increased passage of water into the egg albumen during the formation of the inner and outer eggshell membranes and the eggshell.

Yolk weight was not significantly affected by the length of egg production. For eggs formed at 23 hours, the yolk weight was 15.52±1.89 g, and the weight of eggs formed at 29 hours was 15.96±1.87 g. The yolk after ovulation did not significantly change ($P>0.05$) in weight during egg formation.

The eggshell weight increased as the length of egg formation prolonged ($P<0.05$). The eggshell weight of eggs formed at 23 hours was 4.32±0.76 g and the eggshell weight formed at 29 hours was 4.88±0.64 g. These differences were statistically significant.

Similarly, [15] recorded that longer intervals of egg formation result in an increase in egg weight, albumen weight and a decrease in yolk percentage. Also, [16] reported that egg weight variation with laying order and sequence length is typical of wild and domestic birds.

It follows from Table 3 that the albumen proportion decreased by prolonging egg formation at 23 hours from 62.14% to 59.81% at 29 hours and this decrease was significant in the end of observed period. There was a rapid decrease in the albumen percentage created at 29 hours, which was statistically significant ($P<0.05$).

The yolk proportion during its formation values from 29.11±1.86% in eggs formed in 27 hours to 29.98±1.77% in eggs formed in 29 hours. These are statistically no significant differences ($P>0.05$).

The eggshell proportion increased as the length of egg formation increased from 8.24±0.32% for eggs formed in 23 hours to 9.18±0.33% for eggs formed in 29 hours. The differences of the eggshell proportion were statistically significant ($P<0.05$). Our findings are consistent with previous studies of various authors [17-20].

Table 1. Nutritional value of complete feed mixture

Nutrient	Unit	Feed mixture
Crude protein	g/kg	158,06
ME	MJ/kg	11.32
Lysine	g/kg	8.07
Methionine and cisteine	g/kg	7.02
– from that methionine	g/kg	3.87
Threonine	g/kg	5,99
Calcium	g/kg	35.13
Phosphorus	g/kg	5.48
Sodium	g/kg	2.17
Manganese	mg/kg	148.79
Copper	mg/kg	18.74
Zinc	mg/kg	102.27
Selenium	mg/kg	0.38
Vitamin A	i.u./kg	10,000.00
Vitamin D_3	i.u./kg	2,500.00
Vitamin K	mg/kg	21.27

Table 2. Effect of the length of egg formation on the egg weight and its components

Breed	Egg weight (g)	Eggshell weight (g)	Albumen weight (g)	Yolk weight (g)
23	52.41±3.87^{b}	4.32±0.76^{b}	32.57±2.32	15.52±1.89
24	52.60±4.07^{b}	4.42±0.69	32.45±2.11	15.69±1.76
25	53.36±3.86^{a}	4.53±0.71	33.09±2.24	15.74±1.84
26	53.69±4.02^{a}	4.70±0.66	33.42±2.16^{a}	15.88±1.82
27	53.88±4.11^{a}	4.72±0.73	32.54±2.22	15.68±1.77
28	54.09±3.87^{a}	4.85±0.77^{a}	32.47±2.34	15.92±1.72
29	53.16±4.35^{a}	4.88±0.64^{a}	31.86±2.29^{b}	15.94±1.87

Values shown are mean ± SD (standard deviation)

^{a} means in a row with different superscript differ significantly (P<0.05)

Table 3. Effect of the length of egg formation on proportion of eggshell, albumen and yolk

Breed	Eggshell proportion (%)	Albumen proportion (%)	Yolk proportion (%)
23	8.24±0.32^{b}	62.15±2.09^{a}	29.61±1.87
24	8.40±0.29	61.69±2.31	29.83±1.82
25	8.49±0.31	62.01±2.22	29.49±1.79
26	8.75±0.39	62.24±2.14	29.57±1.83
27	8.76±0.24	60,39±2.21^{b}	29.11±1.86
28	8.97±0.29	60.03±2.36^{b}	29.43±1.82
29	9.18±0.33^{a}	59.93±2.07^{b}	29.98±1.77

Values shown are mean ± SD (standard deviation)

^{a} means in a row with different superscript differ significantly (P<0.05)

4. Conclusions

In conclusion, we observed that prolonging the time intervals of egg formation increased of egg weight, eggshell weight and eggshell proportion. At the same time, albumen weight and albumen proportion decreased during period.

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