

Egg Traits, Fertility and Hatchability of Brahma, Cochin and Orpington Chicken Breeds

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Abstract

This study aimed at evaluating egg traits, fertility and hatchability of Brahma, Cochin and Orpington breeds. The hens were feeding *ad libitum* with commercial layer diet. A total of 300 eggs (100 eggs from each breed) were collected to study for egg weight, egg shape index, percentage of yolk, albumen and shell. Fertility and hatchability were assessed in 392 eggs from Brahma, 388 egg from Cochin and 416 eggs from Orpington. There was no significant difference ($P < 0.05$) in egg weight and shape egg index. Orpington hens had significantly higher average egg number (138.41 egg) than Brahma (121.62 eggs) and Cochin (119.94 eggs) hens. Differences in percentage of yolk, albumen and shell in eggs of tested heavy breeds were statistically no significant ($P > 0.05$). The average fertility was 59.81%, 57.36% and 58.81% for Brahma, Cochin and Orpington respectively. Average hatchability varied significantly at $P < 0.05$ (80.08% in Brahma, 82.54% in Cochin and 89.86% in Orpington).

Keywords: Brahma, Cochin, Orpington, egg, hatching

1. Introduction

It is generally reported that egg production vary among breed and strain of hens [1-4].

Genetic variation in egg quality between breeds, strains and lines has been reported by [5].

Many researchers have reported significant genotype differences related to egg weight [6,7].

Egg weight influences on weight of egg parts or components. Correlation between egg weight and weight of albumen, yolk and shell are high are ranged from 0.67 to 0.97 [8].

However, egg quality is also influenced by the housing regimen under which the hens are kept [9] as well as the age of the laying hens [5].

Higher fertility has been recorded for light (White Leghorn) when compared with heavy breeds (Barred Plymouth Rock, Rhode Island Red, White Rock and New Hampshire) [10].

The optimum cock; hen ratio to ensure production of fertilized eggs should be maintained for the class of poultry under consideration. This ratio ranges from 1 cock for 5-10 hens, depending on the system (intensive or extensive) of production and size (light or heavy) of the breed [11].

Hatchability is a function of number of chicks hatched and is affected by numerous factors such as fertility, egg quality, handling of eggs and management conditions during incubation and hatching [12].

Heritability estimates for fertility and hatchability in chickens range from 0.06 to 0.13 [13].

Egg production, as well as fertility and hatchability are reproductive traits, lowly heritable, and are affected by several factors such as strain of chicken, nutrition, mortality, health, management practices, age at point of lay and persistency of lay [14].

Nowadays, there are not many scientific publications concerning production traits of meat breeds of hens. Thus, it seems to be justified to

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conduct experiments in this field. The purpose of this research is to evaluate the quality of eggs and hatch results of Brahma, Cochin and Orpington hens.

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 HYD-10. Nutritional value of diet is shown in Table 1. Fresh clean water was supplied daily.

Birds were exposed to natural light as a practiced in rural areas of South-West Slovakia.

A total of 300 eggs (100 eggs from each breed) were collected to study for egg weight, egg shape index, percentage of yolk, albumen and shell. Eggs were individually weighed to the nearest 0.01 gram on a laboratory scale Owa labor (VEB Wägetechnik Rapido, Germany). The lengths and widths were obtained using an electronic sliding calliper (precision 0.01mm), so that an egg shape index, defined as the ratio between length and width multiplied by 100 [15], could be calculated.

Using the individual weight of each egg percent yolk, percent albumen and percent shell were determined.

Fertility and hatchability were assessed in 392 eggs from Brahma, 388 egg from Cochin and 416 eggs from Orpington. Hatching eggs were incubated in an incubator F500S (PL Maschine Kft, Hungary) with capacity of 500 chicken eggs with automatic regulation with temperature and relative humidity. Eggs were automatically turned in interval of two hours.

Hatching eggs were fumigated with formalin gas. Formalin gas was generated by mixing 40ml formaldehyde of 40 % concentration and 20g potassium permanganate on 1m³ room capacity.

We compared percentage fertility, percentage hatchability of fertile and total eggs set. Fertility was determined as 100[number of fertile eggs]/number of total eggs set; hatchability from fertile eggs was determined from the formula 100[number of chicks hatched]/number of fertile eggs and hatchability from totally eggs set calculated as the number of chicks hatched/number of total eggs set.

Data were analyzed using analysis of variance (SAS, 2001) [16]. Significant difference was used at 0.05 probability level and differences between groups were tested by the Duncan's test at the levels of significance.

3. Results and discussion

The egg production, egg weight and egg shape were presented in Table 2. We found that Orpington hens had significantly higher ($P < 0.05$) average egg number per hen (138.41 egg) than Brahma (121.62 eggs) and Cochin (119.94 eggs) hens.

In egg weight and egg shape index were no significant difference ($P > 0.05$) in these egg traits among hens of Brahma, Cochin and Orpington. In comparison, for Aseel breed [17-19] reported an average egg weight from 41 to 52 g. This variation in egg weight might be due to variation in the age of the hens from which the eggs were collected under field conditions. [20] published egg weight for local light Italian breeds Modenese and Romagnolo (53.7g and 54.0g). For light breed Czech Golden Spotted Hen egg weight was balanced from 57.0 to 58.0 g [21], for dual breed Oravka 52.4 to 55.7 g [22] and 60.96 g [23] respectively.

We recorded average egg shape index from 76.19 for Orpington to 76.48 for Cochin. A similar egg shape index (75.46) was reported for Aseel [17] and Oravka (75.71) [23].

The percentage of shell, albumen and yolk were presented in Table 3. There were no significant difference ($P > 0.05$) in these egg traits among hens of Brahma, Cochin and Orpington. Zanon et al. [20] reported higher eggshell proportion for both local Italian breeds (12.88 and 13.29%). The proportion of eggshell from the egg weight in Czech Golden Spotted hens ranged from 9.0 to 9.5 % [21].

Anderle et al. [21] reported yolk proportion for Czech Golden Spotted hens from 31.2 to 32.9% and [20] found similar yolk proportion in one of the local Italian breeds; 34.69% in Modenese and lower proportion 32.35% in Romagnolo.

Anderle et al. [21] reported albumen proportion for Czech Golden Spotted hens from 58.4 to 60.1%.

Mean fertility was 59.81%, 57.36% and 58.82% for Brahma, Cochin and Orpington respectively

(Table 4). There was no significant difference ($P>0.05$) in fertility among the different chicken breeds.

Mean hatchability from fertilized eggs was 80.08%, 82.54% and 89.86% for Brahma, Cochin and Orpington respectively (Table 4). Comparisons between heavy breeds revealed significant differences ($P<0.05$) in hatchability among the breeds. Our results are lower with other researchers who reported high fertility levels of 95.5% in scavenging chicken [24] and 96.11% in commercial layer chicken [25, 26]. Jayarajan [27] found significant variation in hatchability among genotypes. In his study the mean hatchability of White Rock, Rhode Island Red and White Leghorn were 68.89, 63.69 and 57.93% respectively. The findings of our study did not agree with that of [28] who found no significant difference in hatchability of fertile eggs between Rhode Island Red and New Hampshire ($P>0.05$). However, [29] found higher hatchability of eggs

from White Leghorn (66.80%) than those of Rhode Island Red (59.60%) and White Rock (44.10%) on total set eggs. Significant effect of genotypes on hatchability was also observed by [25]. They found that hatchability of total eggs set as 91.28, 86.08, 79.57 and 84.95% for Barred Plymouth Rock, White Leghorn, Rhode Island Red and White Rock, respectively.

These studies and several others have shown that fertility can highly vary even within the same breed mainly due to poor management and improper proportion of males or poor ability of males in the flock to produce viable sperms. The results of the present study alludes that the 1:10 cock to hen proportion.

Variations in hatchability can be accounted for by various factors. Several other researchers have reported that hatchability decreases with increasing egg storage period as percentage early and late embryonic mortality increases [30-32].

Table 1. Nutritional value of complete feed mixture

Nutrient	Unit	Feed mixture
Crude protein	g/kg	min. 153.00
ME	MJ/kg	min. 11.50
Ash matter	g/kg	max. 160.00
Fibre	g/kg	max. 60.00
Lysine	g/kg	min. 7.00
Methionine and cistine	g/kg	min. 6.00
– from that methionine	g/kg	min. 3.50
Linoleic acid	g/kg	min. 16.00
Calcium	g/kg	28.00-45.00
Phosphorus	g/kg	min. 5.00
Sodium	g/kg	1.20-2.50
Manganese	mg/kg	min. 40.00
Iron	mg/kg	min. 40.00
Copper	mg/kg	min. 4.00
Zinc	mg/kg	min. 60.00
Vitamin A	i.u./kg	min. 8000
Vitamin B ₂	mg/kg	min. 4.00
Vitamin B ₁₂	µg/kg	min. 10.00
Vitamin D ₃	i.u./kg	min. 1600
Vitamin E (α-tokoferol)	mg/kg	min. 10.00

Table 2. Effect of genotype on egg production, egg weight and egg shape index

Breed	Egg production per hen (pcs)	Egg weight (g)	Egg shape index (%)
Brahma	121.62±18.11	51.89±3.84	76.24±3.21
Cochin	119.94±17.24	51.56±4.05	76.48±3.18
Orpington	138.41±17.59 ^a	52.24±4.21	76.19±3.23

Values shown are mean ± SD (standard deviation)

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

Table 3. Effect of genotype on percentage of shell, albumen and yolk

Breed	Percentage of shell (%)	Percentage of albumen (%)	Percentage of yolk (%)
Brahma	10.36±1.15	59.44±2.98	30.20±2.05
Cochin	10.24±1.08	59.81±2.81	29.95±2.99
Orpington	10.28±1.11	59.19±2.88	30.53±2.08

Values shown are mean ± SD (standard deviation)

Table 4. Effect of genotype on fertility and hatchability

Breed	Fertility (%)	Hatchability from setting eggs (%)	Hatchability from fertilised eggs (%)
Brahma	59.81±4.24	45.48±3.21	80.08±5.19
Cochin	57.36±3.78	46.17±3.55	82.54±6.12
Orpington	58.82±3.81	47.35±3.47	89.86±4.88 ^a

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 irrelevant differences among Brahma, Cochin and Orpington for egg weight, egg shape index, percentage of shell, albumen and yolk from over egg, fertility and hatchability from setting eggs. There were found significant differences among breeds in egg production per hen and hatchability from fertilised eggs.

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