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Quality Characteristics of Broiler Breeder Eggs and their Hatching Performance

R. Ramaprakaash[1] and P. Selvan[2]*

[1]College of Poultry Production and Management, Hosur, Tamil Nadu – 635 110, India
[2]Department of Poultry Technology, College of Poultry Production and Management, Tamil Nadu Veterinary and Animal Sciences University, Hosur, Tamil Nadu – 635 110, India

**Corresponding author*

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A B S T R A C T

A study was carried out to assess the internal, external and microbial quality of hatching eggs from broiler breeders (Vencobb 430) and their hatching performance. For this purpose, a total of sixty eggs collected from a private farm located at Alampalayam, Tiruppur District were subjected for analysis. The internal quality were determined by measuring Haugh unit, Albumin index, yolk index, yolk colour and shell thickness whereas external quality by gauging egg weight, shape index, surface area and cleanliness. Similarly, the surface microbial load was determined by assessing for Total Viable Count (TVC), Coliform count (CC) and Staphylococcal count (SC). Further, a batch of the eggs was set in the incubator to determine the hatching performance. The results obtained were discussed.

Introduction

The quality of eggs is critical as eggs provide both physical protection and nutrition to the developing embryo (Ulmer-Franco *et al.*, 2010).

Shell quality (Wangensteen *et al.*, 1970), egg size (Ayeni *et al.*, 2018), hen age at laying (Roque and Soares, 1994), proportion of egg composition (Suarez *et al.*, 1997), all affect egg hatchability.

Narushin and Romanov (2002) also argued that egg structure and internal quality influence embryo growth and success of hatching.

Sekeroglu and Altuntas (2009) stated that internal quality factors such as albumin thickness and yolk integrity also affect egg hatchability.

These factors further influence chick quality, which in turn affects chick survival, growth and health.

With this in mind, the current pilot-scale study was proposed to assess both the internal, external and microbial quality of

broiler-breeding eggs produced in a private farm at Alampalayam, Tiruppur District and hatching performance.

Materials and Methods

Collection of eggs

The egg samples from broiler breeders (Vencobb 430) were collected from a private poultry farm located at Alampalayam, Tiruppur within few hours of laying and packed in clean egg trays.

Then, the trays were transported to the quality control laboratory at College of Poultry Production and Management, Hosur under hygienic conditions for further analysis.

Culture Media and supplements

All chemicals used in the study were of analytical grade, from reputed national firms. The culture media and supplement used were from Hi Media, Mumbai.

Internal Quality Assessment of eggs

Shell percent

The shell was dried with the membranes intact in a hot air oven at 105 ± 5°C overnight, cooled and weighed. The result is expressed as per cent of total egg weight.

Shell thickness

After broke out the shell, the shell membranes were peeled off. Took three pieces of shell, each piece was taken from three representative areas, namely from the narrow and broad ends and the third piece from the equatorial region of the egg.

The thickness was measured using a screw gauge and the average was calculated and represented as shell thickness in millimetre (mm).

Albumen index

After broke open the egg, the height of the thick albumen was measured using a Tripod stand micrometer or Spherometer, while the width and the diameter of the thick albumen is measured using the Vernier calliper. Then, the albumen index was calculated using the following formula.

$$\text{Albumen index} = \frac{\text{Height of albumen (mm)}}{\text{Average width of albumen (mm)}}$$

Haugh unit

Haugh unit is a modified version of albumen index, with the height of thick albumen adjusted to the standard egg weight. The Haugh unit was measured using following formula.

$$\text{Haugh unit} = 100 \log (H+7.57 - 1.7\ W0.37)$$

Where,

W = Weight of egg in grams

H = Height of thick albumen in mm

Yolk Index

The height of the yolk was measured by micrometer and diameter of yolk was measured at different locations using Vernier callipers. The yolk index was measured using following formula.

$$\text{Yolk index} = \frac{\text{Height of yolk in mm}}{\text{Average diameter of yolk in mm}}$$

Yolk colour

The intensity of yolk colour was measured using the Roche yolk colour fan as described by manufacturers instruction.

Other abnormalities

The eggs were also examined for presence of blood spot, meat spot etc., through visual appeal by qualified veterinarian.

External Quality Assessment of eggs

Egg weight

The weights of the eggs were measured using standard analytical balance.

Shape index

Maximum length and also width of the eggs were measured using a vernier caliper. Then, shape index was arrived at by using the formula.

$$\text{Shape index} = \frac{\text{Average Width}}{\text{Average Length}} \times 100$$

Shell colour

Shell colour was measured by visual appeal under day light.

Cleanliness

The eggs were subjected to visual examination to assess for their cleanliness. Scoring system was adopted and the scores were given as follows. 5 - clean eggs; 4 – mildly soiled eggs, 3 – moderately soiled eggs; 2 – soiled eggs and 1- heavily soiled (dirty) eggs.

Surface area

Surface area of the eggs were calculated using the following formula.

$$\text{Surface area} = 12.6 \times \frac{\text{Length} + \text{Width}}{4} \times 2$$

Where, 12.6 is a constant.

Microbial quality

Surface samples of hatching eggs were obtained by Swabbing technique under aseptic condition. The microbial load in one square inch area was determined using sterile template. All microbial groups were determined with pour plate method following the procedures of American Public Health Association (APHA, 1984) with modifications, if necessary.

Total Viable Count

23. 5 g of Plate Count Agar (PCA) was suspended in one litre of distilled water, boiled to dissolve completely and sterilized by autoclaving at 121°C (15 lb Pressure) for 15 min. Final pH was adjusted to 7.0±0.2. Sterile petridishes in dublicate were inoculated with one ml aliquots of appropriate dilutions. About 10-15 ml of sterile PCA maintained at 44-46°C was poured and inoculums were mixed properly by rotating plates. After solidification, plates were incubated at 37°C for 48±1 hrs. Red to pink colonies of 0.5 mm in diameter were counted and expressed as $\log_{10}$cfu/in^2 surface area of egg.

Coliform count

41.5 g of Violet Red Bile Agar (VRBA) was suspended in one liter of sterilized distilled water and boiled to dissolve the medium

completely. Final pH was adjusted to 7.4±0.2. Duplicate one ml volumes of suitable dilutions were placed in sterile petridishes and 10-15 ml of boiled VRBA was added to each plate after cooling to 45°C.

Inoculums were mixed properly by rotating the plates. After solidification, the plates were incubated at 37±1°C for 24 hrs. Red to pink colonies of 0.5 mm in diameter were counted and expressed as log10cfu/in2 surface area of egg.

Stapylococcal count

63 g of Baird Parker Agar base (BPA) was suspended in 950 ml distilled water, boiled to dissolve completely and sterilized by autoclaving at 121°C (15 lbs pressure) for 15 min. Final pH was adjusted to 7.0±0.2. Prior to pouring the medium into the petridishes, 50 ml of egg yolk tellurite emulsion was added and mixed well.

Sterilepetridishes in duplicate were inoculated with one ml of aliquots of appropriate dilutions and 10-15 ml of sterile BPA (egg yolk tellurite added) was poured to each plate after cooling to 45C. Inoculums were mixed properly by rotating plates.

After solidification, the plates were incubated at 37±1°C for 24 hrs. Black, shiny and regular shaped colonies were counted and expressed as log 10 cfu/in2 surface area of egg.

Hatchability Performance

Of the sixty eggs, thirty eggs were set in the incubator under standard condition for determining the hatchability performance. After 21 days of incubation, the number of eggs hatched out was counted and thereby the hatchability percentage was arrived at. Further, the birth weights of the chicks were also measured.

Results and Discussion

Internal and External characteristics of eggs

The Mean±S.E values of shell percent, shell thickness, Albumen index, Haugh Unit, Yolk index and Yolk colour of the eggs examined are given in Table 1.

The mean shell weight, shell thickness and shell percent obtained in the present study is 5.43g, 38.78 mm and 8.43% respectively. The mean Albumen Height, Length and Width were 6.12, 11.64 and 9.88, respectively. Similarly, Haugh Unit and Albumen index obtained were 75.56 and 0.57, respectively. The mean yolk height and diameter were 16.83 and 4.54 whereas yolk index and yolk colour value were 3.72 and 8.10, respectively.

The Mean± S.E values of egg weight, shape index, surface area and cleanliness of the eggs examined are given in Table 2.

The mean egg weight, egg length, egg width and shape index obtained from the present study were 64.44, 5.84, 4.56 and 78.27, respectively. The mean surface area and cleanliness scores of eggswere 65.51 and 1.03, respectively. Joseph *et al.*, (1999) conducted similar study to compare the egg quality characteristics four strains of broiler breeders *viz.*, Cobb 500, Shaver Starbro, Avian 24K, and Hubbard Hi-Y. Similarly, Okur *et al.*, (2018) assessed the relationship between Egg weight (EW), egg length (EL), egg width (EWd) and shape index (SI) of hatching eggs which were obtained from middle-aged (39 week) broiler breeders (ROSS 308 genotype). The egg shape index is an important indicator of egg quality and is expected to be among 72 and 76 in good quality, also is considered as sharp if below 72 and round if above 76 (Sarica and Erensayin, 2014).

Table.1 Mean ± SE values for Internal Quality Characteristics of Hatching eggs from broiler breeders

Albumen			Haugh Unit	Albumen Index	Yolk		Yolk Index	Yolk colour	Shell thickness	Shell weight
Height	Length	Width			Height	Diameter				
6.12±0.16	11.64±0.21	9.88±0.21	75.56±1.17	0.57±0.02	16.83±0.16	4.54±0.04	3.72±0.05	8.10±0.14	38.78±0.36	5.43±0.09

Table.2 Mean ± SE values for External characteristics of hatching eggs from broiler breeder

Egg weight	Egg length	Egg width	Shape Index	Surface area	Cleanliness
64.44±0.69	5.84±0.05	4.56±0.03	78.27±0.83	65.51±0.32	1.03±0.03

Table.3 Hatchability performance for broiler breeder eggs

Egg weight (in grams)	**65.51±0.84**
Chick weight (in grams)	46.27±0.67
No. of eggs set	30
No of chicks hatched	27
Hatchability percentage	90%
No. of infertile eggs	1
No. of Dead in shell eggs	1
No. of dead in germ	1

Microbial Quality Assessment

The microbial quality of eggs was determined by enumerating total viable bacteria, Coliforms and Staphylococcal organisms. The mean Total Viable Count (TVC) and Coliforms count on surface of the eggs were 5.15 and 4.03 log_{10}cfu/sq.in., respectively. This might be attributed to the lack of sanitation of eggs prior to setting in the hatchery incubator. However, the petri dishes pertaining to Staphylococcal count did not have a statistically significant number of colonies.

Hatchability performance

The hatchability performance of broiler breeder eggs that were incubated and hatched out in Hatchery Unit at College of Poultry Production and Management, Hosur are given in Table 3.The results revealed that out of 30 eggs set 27 hatched out normally and hatchability percentage was 90%. Among the rest, each one was infertile, dead in shell and dead in germ, respectively. Mean weight of eggs that were set in incubator was 65.67 and of chick was 46.27 g. The results of several workers (Bohren *et al.*, 1961; Byng and Nash, 1962; Tandron *et al.*, 1983) have indicated that declines in hatchability start 2 to 3 d after lay. However, it is often suggested that hatchability starts to decline only after 7 d of storage (Mayes and Takeballi, 1984; Meijerhof, 1994a).

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