COMPARATIVE EGG QUALITY EVALUATION OF ISA BROWN AND FUNAAB ALPHA LAYERS REARED ON BATTERY-CAGE IN A ZAMFARA POULTRY FARM

Jimoh, A.A. and Namakka, A.
1Department of Theriogenology and Animal Production, Faculty of Veterinary Medicine, Usmanu Danfodiyo University, Sokoto,
Corresponding Author: Tel:+2347035166498, E-mail: aajimoh1@gmail.com

ABSTRACT
Quality of eggs determines the acceptability to consumers. Egg quality differs in meaning as consumers' assessments of quality are influenced by the intended use of the eggs. Thus, a study on comparative egg quality evaluation of Institut de Sélection Animale Brown (ISA Brown) and FUNAAB alpha layers reared on battery-cage was carried out. In this study, 300 table eggs, 150 each of the Institut de Sélection Animale, Brown (IB) and the FUNAAB Alpha (FA), were sourced from Magaji Memorial Farm in Gusau, Zamfara State, and transported to the Physical Laboratory of Faculty of Agriculture, Usmanu Danfodiyo University, Sokoto for quality evaluation within 24 hours of laying. On weekly basis for a period of five weeks, a total of 70 eggs (35 eggs from each strain) of uniform size were randomly selected and analysed for quality variations. Data were analysed statistically using student T-test. The results showed that among all indices only egg weight, eggshell surface, albumen index and Haugh unit were significantly ($P \leq 0.05$) different between both strains of layer chickens. The FA eggs were significantly heavier in weight (FA:59.50 ± 4.64g; IB:57.16 ± 5.17g) and better in shell surface area (FA:71.32 ± 3.65; IB:69.19 ± 4.16) than eggs of IB layers. However, the IB layer eggs had significantly ($P \leq 0.05$) better albumen index (IB:0.12 ± 0.11; FA:0.04 ± 0.01) and Haugh unit (IB:80.77 ± 13.29; FA:72.80 ± 14.57) than eggs of FA layers. It can be concluded that although IB eggs are better in term of internal qualities, eggs of FA layers are more likely to gain acceptability of consumers who care for better external qualities, like egg weight and shell quality.
Key words: Egg quality, ISA Brown, FUNNAB Alpha, poultry farm

INTRODUCTION

Poultry eggs are relatively cheap among staple human food, as they also serve as raw materials for food industry, therapeutic diets and supplements (Lesnierowski and Stangierski, 2018). They are highly nutritious, equated to breast milk in biological and nutritional values (FAO, 2003; Matt *et al.,* 2009). Eggs are described as complete and reference proteins as they supply balanced nutrients, including nine essential amino acids to consumers (Damaziak *et al.,* 2017). In order to bridge the demand-supply gaps in egg production and alleviate protein deficits caused by the increasing human population, poultry industry has been commercialized through (among other measures) development of excellent egg strains of layer chickens capable of producing up to 300 eggs per year (Oluyemi and Roberts, 2000). Today, commercial egg production in Nigeria relies majorly on rearing exotic hybrids or strains of layer chickens under intensive management system. The *Institut de Sélection Animale,* ISA Brown is an exotic strain of layer chicken that is widely kept for egg production in most poultry farms across Nigeria. In recent time however, a new strain of chicken called FUNAAB Alpha, which was developed at the Federal University of Agriculture, Abeokuta, has begun to gain acceptance among farmers across the country including the Northwestern States, like Zamfara State. Since egg quality composed of both external and internal characteristics of an egg that affect its acceptability by consumers (Hanusova *et al.,* 2015), it is possible to have quality variations in eggs laid by these two strains even when management is the same. Egg qualities are affected by many factors including, strain and age of hen, heat stress, management system, nutrition and diseases (Roberts, 2004). We therefore conducted a preliminary study aimed at comparing the quality of eggs of both ISA Brown and FUNAAB Alpha kept in a poultry farm in the Northwestern state of Zamfara, Nigeria.

MATERIALS AND METHODS

Experimental Location: The study was conducted in the Physical Laboratory of the Faculty of Agriculture, Usmanu Danfodiyo University, Sokoto Main Campus. Sokoto. State is located in the

Sudan savannah zone in the extreme north-western part of Nigeria. It is between latitude 12ºN and 13º 58ºN and longitude 4º8E and 6º54'E (Mamman *et al.,* 2000) and shares common borders with Niger Republic to the north, Kebbi state to the south-west and Zamfara state to the east. The State is about 32,000 sq.km and it is characterized by two extreme temperatures relative to its tropical position, hot and cold seasons. The rainy season is from June to early October with average annual rainfall of 500mm (Mamman *et al.,* 2000).

Egg Source and Experimental Design: A total 70 eggs used for this study (out of ten crates i.e., three hundred (300) table eggs purchased) were sourced from the Magaji Farm located at Tashar Rawayya along Kaura Namoda Road, Zamfara State, Nigeria. The eggs were collected within five consecutive weeks between the months of October and November,2023. On weekly basis, two (2) crates of fresh eggs (one crate each from IB and FA strains of layer chickens) were purchased and only 7 eggs were randomly selected from each crate of IB and FA eggs. The eggs were analyzed and compared for their external and internal egg quality traits within 24 hours of laying as described in detail as follow.

Measurement of External Egg Quality Parameters: *(i) Egg Weight* (g): The eggs were weighed individually on a sensitive scale and each weight was inscribed on the eggshell. *(ii) Egg Length and Width* (cm), the length of each egg was measured between the pointed and the broad ends. While the width was measured from the widest point of each egg using the vernier calliper. *(iii) Eggshell Weight* (g): Egg shell weight was determined after emptying the egg contents. The shell interior was cleaned with a tissue paper and allowed to dry thereafter; the weight was taken using the sensitive scale. *(iv) Eggshell Thickness* (mm): This was measured using a micrometre screw gauge with anvil jaw calibrated in millimetres. Measurement was done after cleaning the internal part of the shell. This was measured by taking readings from the proximal, medial and the distal portion of the shell and the average was recorded as the shell thickness for each particular egg. The external egg quality parameters were measured according to procedures described by Coutts and Wilson, (2007), and the *eggshell Surface Area* was calculated from the value of the egg weight using the procedure described by Hughes (1984).

Shell Surface Area $=EW^{0.667}$ X K or K x $EW^{2/3}$ *Where* EW = egg weight, K = 4.67 for egg weight less than 60g, K = 4.68 for egg weight between 60 – 70g, and 4.69 for egg weight greater than 70g.

Measurement of Internal Egg Quality Parameters: *(i) Yolk Weight* (g): The egg was broken into an already weighed yolk separator, the albumen was removed. The yolk and the separator were weighed. The weight of the empty separator was deducted from the weight of separator and yolk to give the yolk weight. *(ii) Yolk height* (cm) and *(iii) Yolk colour*: Yolk height of the egg was measured using a Vernier calliper, while colour of the yolk was scored visually with the aid of Roche colour fan which is numbered from 1 to 15 and the colour intensity ranges from very light yellow to orange. The colour was placed near the yolk to determine the colour that matches the yolk. *(iv) Albumen weight* (g): This was obtained by subtracting both the yolk and the shell weights from the egg weight. *(v) Albumen Height* (cm): This was measured by using a vernier calliper. All internal egg quality parameters (*Yolk Weight, Yolk height, Yolk colour, Albumen Weight, Albumen Height*) were measured according to procedures described by Coutts and Wilson, (2007). Other parameters obtained by different mathematical expressions were presented as follow:

Yolk Index: This was calculated as the ratio of the height of the broken-out yolk to its width according to expression of Ukwu et al., (2017).

$$\text{Yolk index} = \frac{\text{Yolk height (cm)}}{\text{Yolk width (cm)}}$$

Yolk Percentage: This was calculated as the percentage weight of the yolk to the egg weight according to expression of Kul and Seker, (2004) as:

$$\text{Yolk percentage} = \frac{\text{Weight of yolk (g)}}{\text{Weight of egg (g)}} \times 100$$

Albumen Percentage: This was expressed according to expression of Kul and Seker, (2004) as:

$$\text{Albumen percentage} = \frac{\text{Weight of albumen (g)}}{\text{Weight of egg (g)}} \times 100$$

Haugh Unit: Haugh Unit was calculated using the expression of Haugh (1937).

HU=100 Log [H +7.57 -1.7W0.37] Where H = observed height of albumen, W = egg weight according to Kul and Seker, (2004).

Data Analysis: The data were presented in means together with their standard deviations (SD). The means were analyzed using T-test analysis and considered statistically significant at 5% (P≤0.05) probability using Statistical Package for the Social Sciences (SPSS) version 20 software.

Results AND Discussion

The results of external egg qualities of both ISA Brown and FUNAAB Alpha layer chickens is presented in Table 1. The results showed that among all indices egg external quality, egg weight and egg shell surface area were significantly (P≤0.05) different between both strains of layer chickens. The FA eggs were significantly heavier in weight (59.50 ± 4.64g) and better in shell surface area (71.32 ± 3.65) than eggs of IB layers which had weight and surface area equal to (57.16 ± 5.17g) and (69.19 ± 4.16) respectively. It has been reported that, among other qualities of egg, farmers share interest in egg weight and egg shell quality with the consumers (Tolimir *et al.,* 2016). Good egg weight and shell quality may attract consumers and ensure good prices for farmers. Therefore, eggs of FA layer chickens may be more attractive and acceptable to consumers than the eggs of IB layer chickens due to their heavier weight and better shell quality.

Table 1. Mean ±SD Comparative external egg quality of ISA Brown and FUNAAB Alpha layer chickens (n=35)

	Data on indices of external egg quality of two strains of layers		
Parameter	**ISA Brown**	**FUNAAB Alpha**	**Sig.(2-tailed)**
Egg Weight (g)	57.16 ± 5.17^{b}	59.50 ± 4.64^{a}	0.050
Egg Length (mm)	56.60 ± 3.23	56.60 ± 3.23	0.418
Eggshell Surface Area	69.19 ± 4.16^{b}	71.32 ± 3.65^{a}	0.026
Egg Shape Index (%)	78.47 ± 4.59	77.96 ± 4.16	0.628
Eggshell Weight(g)	6.09 ± 1.22	6.27 ± 0 .68	0.450
Eggshell Thickness (mm)	0.44 ± 0.07	0.44 ± 0.02	0.776
Eggshell Percentage (%)	10.99 ± 1.01	10.57±1.12	0.110
Egg Width (mm)	44.31 ± 1.84	44.72±1.68	0.314

Means with different superscripts $^{(a, b)}$ are significantly different at 5% probability

Table 2. below presents results of internal egg qualities of both ISA Brown and FUNAAB Alpha layer chickens. The results showed that only albumen index and Haugh unit differ significant between both strains of layer chickens. The IB layer eggs had significantly (P≤0.05) better albumen index (0.12 ± 0.12) and Haugh unit (80.77±13.29) than eggs of FA layers which had (0.04±0.01).and (72.80±14.57)

Table 2. Mean ± SD Comparative internal egg quality of ISA Brown and FUNAAB Alpha layer chickens (n=35)

	Data on indices of internal egg quality of two strains of layers		
Parameter	**ISA Brown**	**FUNAAB Alpha**	**Sig. (2-tailed)**
Albumen Weight (g)	36.16 ± 4.60	37.10 ± 7.66	0.538
Albumen Height (mm)	6.74 ± 1.96	6.85 ± 1.69	0.373
Albumen Index	0.12 ± 0.11^{b}	0.05 ± 0.01^{a}	0.001
Albumen Percentage (%)	62.82 ± 3.43	63.79 ± 3.60	0.258
Albumen Width (mm)	111.74 ± 3.07	112.09 ± 3.60	0.670
Yolk Width (mm)	41.22 ± 2.07	41.82 ± 2.21	0.246
Yolk Height (mm)	14.94 ± 2.49	15.60 ± 3.63	0.810
Yolk Weight (mm)	14.73 ± 1.59	15.14 ± 1.69	0.294
Yolk Colour	9.88 ± 3.20	10.14 ± 2.86	0.724
Yolk Index	0.36 ± 0.06	0.37 ± 0.09	0.497
Yolk Percentage (%)	25.87 ± 2.98	25.60 ± 2.94	0.701
Haugh Unit	80.77 ± 13.29^{a}	72.80 ± 14.57^{b}	0.020

Means with different superscripts $^{(a, b)}$ are significantly different at 5% probability respectively. Albumen index and Haugh unit are important indicators of internal egg quality. Although, internal egg qualities diminish as egg ages due to weakening of egg membranes (Oluyemi and Roberts, 2000), strain differences have also been reported to have effects on internal egg quality (Roberts, 2004). The significant low albumen and Haugh unit obtained in eggs of FUNAAB Alpha layer chickens may therefore be attributed to its genetic function.

CONCLUSION AND RECOMMENDATION

As evident from the study, eggs of ISA Brown layers are better in term of two internal qualities, albumen index and Haugh unit while eggs of FUNAAB Alpha layers are better in two external qualities (egg weight and egg shell surface area). It could therefore be concluded that eggs of FUNAAB Alpha are more likely to gain acceptability of consumers who care for better external qualities, like egg weight and shell quality. More on-farm studies are recommended on FUNAAB Alpha layer chickens in the Northern states of Nigeria especially during hot season when egg qualities are usually affected.

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