FUDMA Journal of Agriculture and Agricultural Technology
ISSN: 2504-9496
Vol. 11 No. 4, December 2025: Pp. 41-46

https://doi.org/10.33003/jaat.2025.1104.06

COMPARATIVE STUDY OF THE PHYSICAL EGG QUALITY CHARACTERISTICS FROM CHICKEN, QUAIL, AND TURKEY IN IBADAN NIGERIA

[1*]Adisa, A.A., [2]Oshibanjo, O.D., [3]Olusola, O.O., [3]Abu, O.A., [1]Olatunde, A. and [1]Onaolapo, A.O
[1*]Agricultural Technology Unit, Department of Animal Science, Federal Polytechnic Ayede, Oyo State, Nigeria
[2]Department of Animal Production, Faculty of Agriculture, University of Jos, Jos Plateau State, Nigeria
[3]Agricultural Biochemistry and Nutrition Unit, Department of Animal Science, University of Ibadan, Ibadan, Nigeria
*Corresponding author: adisabdul007@gmail.com, +234-8075278707

ABSTRACT

Egg quality is composed of those characteristics of an egg, such as cleanliness, Haugh unit, shape index, egg weight, shell quality, yolk index and chemical composition that affect its acceptability by consumers. External egg properties can provide forehand information on egg content, and their evaluation can predict product yield. The study was conducted in Ibadan, Oyo State, Nigeria. Eggs from three different poultry species, namely layer chickens, quail, and turkeys, were collected from five farms across the state for the research. Data were analysed using descriptive statistics and ANOVA at $\alpha = 0.05$. Egg length (EL), egg weight (EW) and shell weight (SW) for chicken egg showed no significant difference at ($P<0.05$) with values ranging from (5.27±0.06cm-5.45±0.09cm), (60.64±1.73cm-63.59±1.11cm) and (7.13±0.23g-7.53±0.34g) respectively. Quail egg showed no significant difference for parameters such as the shell weight and shell thickness, with a value range of (1.24±0.09-1.46±0.04g) for shell weight at ($P<0.05$). All the parameters for turkey eggs, except egg weight, showed significant differences across farms. Chicken Egg content (EC) (yolk and albumen weight) showed no significant difference at ($P<0.05$). Turkey egg showed no significant difference for the egg content, and the highest value was recorded for farm D (64.10±2.79g), and the lowest for farm A (57.40±1.48g) at ($P<0.05$). The obtained results averages for yolk colour are (3.20±0.25, 3.30±0.15, 3.50±0.22, 3.80±0.42 and 6.00±0.54%). These results are important for predicting product yield, with yolk colour indicating consumers' perceptions of the final processed product.

Keywords: Egg quality, Physical quality, Haugh units, Poultry, Birds

INTRODUCTION

In poultry, egg quality refers to all egg characteristics that determine acceptability, price, hatchability, and the weight of the chickens, both shell and internal (Abebe et al., 2023). It is commonly defined as two categories (external (shell-related) properties and internal (yolk and albumen) properties), with the first requiring no destruction of the egg and the second necessitating breaking the egg. These two sets of traits define market value, storage life, processing suitability and hatchability. In poultry, egg quality is a multidimensional concept encompassing shell, internal, functional, and biochemical characteristics, which are influenced by genetics, age, nutrition, environment, and storage (Wijedasa et al., 2020).

The exterior characteristics are egg weight, length, width, shape index, shell thickness, shell weight, shell ratio, colour, and cleanliness (Kumar et al., 2021). These affect grading, breakage rate and market value. These characteristics are highly dependent on species, breed, strain, and ecotype: turkeys and certain commercial lines lay heavier eggs and produce heavier shells than local chickens or quail (Atte et al., 2024). The quality of shell impacts breakage and transportation, as well as microbial safety, and is dependent on breed, age, housing system, and diet (Rodriguez-Hernandez et al., 2024). Colour and thickness of the shell also differ by breed and may be related to mineral composition and shell strength (Djokic et al., 2022).

The interior consists of albumen (white) and yolk. The properties of albumin, such as height, viscosity, Haugh unit, and proportion, are highly associated with freshness and with functional properties, including foaming and gelling, used in the food industry (Ikusika et al., 2025). The Haugh index (HU) is an egg weight-to-albumen height ratio that is an important freshness index (Kumar et al., 2021). Yolk characteristics include weight, colour, index, lipid and cholesterol profile, which are significant for nutrition and hatchability (Salgado et al., 2020). Time and temperature decrease albumen and yolk height, decrease HU, raise pH, and distribute contents, all of which are signs of quality loss (Kop-Bozbay, 2024).

The quality of eggs is typically characterised by a set of conventionally accepted quantitative parameters, divided into external and internal characteristics. External traits that are usually determined include egg weight, length, width, shape index, volume, and surface area (Dinesh et al., 2025). Internal characteristics revolve around the albumen and yolk structure and composition (among them albumen index, Haugh unit, pH, yolk index, yolk weight, yolk colour) (Pardo et al., 2025). The correlation between internal and external characteristics enables the prediction of internal quality from measurements of shell and egg weight, thereby enabling non-destructive grading (Alkan, 2024).

The study aims to compare and contrast the physical quality characteristics of eggs across various poultry species, and to examine the impact of species-specific differences in external and internal characteristics on grading, suitability for processing, and market value.

MATERIALS AND METHODS

The research was carried out in Ibadan, Oyo State, Nigeria. The five commercial poultry farms in the Ibadan metropolis, and one of them was the University of Ibadan Teaching and Research Farm, obtained three poultry species, that is, Chicken (*Gallus gallus domesticus*), Turkey (*Meleagris gallopavo*), and Quail (*Coturnix coturnix japonica*) to establish the different physical qualities of the various eggs.

Sample Collection

Thirty (30) eggs of each species were collected from each farm within 24 hours of laying to ensure freshness. The eggs were keenly examined on their cleanliness and free of cracks and shell defects and then taken to the laboratory. The eggs were then left to stabilize to the room temperature before analysis. The samples were sorted by species, labelled and evaluated regarding physical quality within 24 hours of collection.

Data Collection

To determine the external traits, the weights of the eggs were determined using a high-precision weighing scale. Egg length and egg width were taken using vernier calliper. The eggshell was dried by air, and then the weight and thickness of the eggshell were recorded. The weigh of the shell was determined using an Amper High Precision Weighing Balance whereas the shell thickness was determined using a micrometre screw gauge.

For internal characteristics, every egg was cracked onto a plate. A Vernier calliper was used to measure the heights of the albumen and yolk. The albumen and yolk were measured with a vernier calliper, and the yolk height was measured. The yolks' weights were measured using a high-precision weighing balance. The Petri dish weight was measured, and the parameters of yolk weight were determined as a result of comparing the weight of the dish and the weight of the yolk. It was used to determine the yolk colour using a yolk chart. The height of albumen and the weight of the egg were used to obtain haugh units in the equation: $HU = 100 \times \log(H - 1.7W^{0.37} + 7.6)$

Where HU is the Haugh Unit, H is the Albumen height (mm), and W is the Egg weight (g).

Statistical analysis

Data obtained were subjected to descriptive statistics and Analysis of Variance (ANOVA) to compare means across the three species. Significant differences between means were separated using appropriate post hoc tests at the 5% level of significance ($p < 0.05$).

RESULTS

External Egg Quality Parameters

The results for external egg quality of the three poultry species across different farms are shown in Tables 1, 2, and 3. Table 1 shows the results for the external chicken egg parameters, including egg width, egg length, egg weight, shell thickness and shell weight. Egg length, egg weight and shell weight were not significant at (P<0.05) with values ranging from (5.27±0.06-5.45±0.09, 60.64±1.73-63.59±1.11 and 7.13±0.23-7.53±0.34) respectively, across the five farms used. However, egg width and shell thickness were significantly different (P<0.05) across the five farms. The highest egg width was recorded for farm A, followed by farm D, while the highest variation was recorded for shell thickness, with the highest value for farm C (0.35±0.03), and the lowest for farm B (0.28±0.02).

Table 1: External Egg Properties of Chicken Eggs

Parameter	AC	BC	CC	DC	EC
Egg Width (cm)	$4.22±0.03^{a}$	$4.07±0.05^{b}$	$4.06±0.02^{b}$	$4.12±0.04^{ab}$	$4.01±0.03^{b}$
Egg length (cm)	5.45±0.09	5.39±0.07	5.33±0.05	5.27±0.06	5.37±0.09
Egg Weight(g)	63.59±1.11	62.56±1.77	62.52±1.27	61.59±1.76	60.64±1.73
Shell Thickness(mm)	$0.31±0.01^{ab}$	$0.28±0.02^{b}$	$0.35±0.03^{a}$	$0.32±0.02^{ab}$	$0.31±0.02^{ab}$
Shell Weight(g)	7.53±0.34	7.2±0.32	7.38±0.21	7.13±0.23	7.44±0.26

a,b, Means with different superscripts in the same row differ significantly (P< 0.05). AC= Farm A for Chicken, BC=Farm B for Chicken, CC = Farm C for Chicken, DC = Farm D for Chicken, EC= Farm E for Chicken

Table 2 shows the results for the external properties of quail eggs from five different farms. Properties such as shell thickness and shell weight were not significantly different, but there were some numerical differences. The shell weight had a value range of (1.24±0.09-1.46±0.04) across the farms, while parameters such as egg width, egg length and egg weight showed significant differences at (P<0.05). The obtained results for egg weight were (9.40±0.32, 9.50±0.18, 9.71±0.22, 9.96±0.21 and10.22±0.23) in increasing order.

Table 2: External Egg Properties of Quail Eggs

Parameter	AQ	BQ	CQ	DQ	EQ
Egg Width(cm)	0.91±0.01^{a}	0.92±0.01^{a}	0.92±0.02^{a}	0.92±0.01^{a}	0.85±0.02^{b}
Egg Length(cm)	1.19±0.02^{b}	1.16±0.01^{b}	1.20±0.02^{b}	1.17±0.01^{b}	3.00±0.03^{a}
Egg Weight	9.96±0.21^{ab}	9.50±0.18^{b}	10.22±0.23^{a}	9.71±0.22^{ab}	9.40±0.32^{b}
Shell Thickness(g)	0.12±0.01	0.12±0.01	0.11±0.01	0.13±0.01	0.11±0.01
Shell(mm) Weight(g)	1.46±0.04	1.32±0.05	1.44±0.04	1.28±0.14	1.24±0.09

a,b, means that the different superscripts in the same row differ significantly (P< 0.05), AQ= Farm A for Quail, BQ=Farm B for Quail, CQ = Farm C for Quail, DQ = Farm D for Quail, EQ= Farm E for Quail

The results for the external properties of turkey eggs used in the research are shown in Table 3. The egg weight showed no significant difference at (P<0.05) across the five farms used, with the highest value for farm D (73.45±2.95) and the lowest for farm A (66.10±1.66). Properties such as egg width, egg length, shell thickness, and shell weight varied significantly across the farms used. A value of (4.24±0.05) was the lowest recorded for farm A for egg width, while there was no significant difference at (P<0.05) from the remaining four farms, with values ranging from (4.48±0.06-4.59±0.05). The results for egg length were highest for farm D (6.24±0.12) and lowest for farm A (5.93±0.09).

Table 3: External Egg Properties of Turkey Eggs

Parameter	AT	BT	CT	DT	ET
Egg Width(cm)	4.24±0.05^{b}	4.48±0.06^{a}	4.54±0.03^{a}	4.59±0.05^{a}	4.59±0.05^{a}
Egg Length(cm)	5.93±0.09^{b}	6.09±0.13^{ab}	6.22±0.64^{ab}	6.24±0.12^{a}	6.14±0.06^{ab}
Egg Weight(g)	66.10±1.66	70.36±2.99	72.02±1.61	73.45±2.95	73.08±2.29
Shell Thickness (mm)	0.30±0.01^{b}	0.39±0.17^{a}	0.32±0.01^{b}	0.30±0.01^{b}	0.29±0.01^{b}
Shell Weight(g)	8.76±0.31^{ab}	8.45±0.22^{b}	9.18±0.27^{ab}	9.24±0.27^{ab}	9.52±0.31^{a}

$^{a,b,\ ab}$ means that the different superscripts in the same row differ significantly (P< 0.05), AT= Farm A for Turkey, BT=Farm B for Turkey, CT = Farm C for Turkey, DT = Farm D for Turkey, ET= Farm E for Turkey

Table 4 shows the analysis of variance for the internal chicken egg parameters across five farms. The parameters include albumen weight, egg content, yolk colour, albumen height, haugh unit, yolk height, yolk weight and albumen %. Albumen weight, albumen % and egg content were not significantly different across the farms. However, they all showed some numerical difference with a value range of (53.12±1.56-56.61±1.90, 36.04±1.44-39.37±1.17 and 65.74±1.31-69.08±2.10) for egg content, albumen weight and albumen %, respectively. Yolk height showed differences among farms; farm D had the highest value (1.67±0.07), and farms A, B, and C were not significantly different, with farm E recording the lowest value (1.49±0.041).

Table 4: Internal Egg Properties of Chicken Eggs

Parameter	AC	BC	CC	DC	EC
Albumen Weight(g)	39.37±1.17	37.37±1.30	36.16±1.34	36.63±1.50	36.04±1.44
Albumen%	69.08±2.10	66.30±1.02	65.74±1.31	67.17±1.41	67.70±0.99
Albumen Height(cm)	0.53±0.05^{ab}	0.42±0.05^{b}	0.53±0.06^{ab}	0.59±0.02^{a}	0.60±0.04^{a}
Egg Content(g)	56.36±1.28	56.61±1.90	54.89±1.25	54.43±1.61	53.12±1.56
Yolk Height(cm)	1.43±0.07^{b}	1.31±0.06^{b}	1.34±0.09^{b}	1.67±0.07^{a}	1.49±0.04^{ab}
Yolk Weight(g)	16.14±0.55^{b}	20.26±2.38^{a}	18.91±0.61^{ab}	18.30±0.30^{ab}	17.07±0.45^{ab}
Yolk Colour	3.10±0.28^{b}	3.40±0.16^{b}	3.50±0.17^{b}	3.20±0.13^{b}	4.20±0.29^{a}
Haugh Unit	65.39±5.53^{ab}	56.14±5.31^{b}	66.59±6.50^{ab}	75.12±2.04^{a}	76.12±2.26^{a}

$^{a,b,\ and\ ab\ mean}$ that the different superscripts in the same row differ significantly (P< 0.05). AC= Farm A for Chicken, BC=Farm B for Chicken, CC = Farm C for Chicken, DC = Farm D for Chicken, EC= Farm E for Chicken

The results of the analysis of variance for the internal quail egg parameters across five farms are shown in Table 5. All the internal properties showed a significant difference at (P<0.05) across the five farms. The recorded results for egg content are (7.10±0.14, 7.54±0.29, 8.17±0.19, 8.30±0.24 and 8.64±0.21) in increasing order across the farms. The obtained result for the yolk colour ranged from (3.60±0.30-6.40±0.43), with the highest and lowest value for farm D and C, respectively.

Table 5: Internal Egg Properties of Quail Eggs

Parameter	AQ	BQ	CQ	DQ	EQ
Albumen Weight(g)	3.83±0.18^{ab}	3.89±0.22^{ab}	3.62±0.31^{ab}	3.47±0.42^{b}	4.52±0.31^{a}
Albumen %	46.13±1.58^{b}	47.70±2.58^{b}	41.49±2.77^{b}	42.09±3.03^{b}	57.69±3.42^{a}
Albumen Height(cm)	0.23±0.01^{b}	0.24±0.02^{b}	0.21±0.01^{b}	0.20±0.03^{b}	0.30±0.21^{a}
Egg Content(g)	8.30±0.24^{ab}	8.17±0.19^{ab}	8.64±0.21^{a}	7.10±0.14^{b}	7.54±0.29^{ab}
Yolk Height(cm)	0.65±0.05^{ab}	0.64±0.04^{ab}	0.70±0.05^{a}	0.58±0.34^{ab}	0.5±0.06^{b}
Yolk Weight(g)	4.47±0.19^{ab}	4.28±0.24^{b}	5.02±0.19^{a}	4.60±0.14^{ab}	3.60±0.25^{b}
Yolk Colour	3.80±0.29^{b}	3.70±0.26^{b}	3.60±0.30^{b}	4.50±0.34^{b}	6.40±0.43^{a}
Haugh Unit	76.93±1.11^{b}	78.21±1.56^{b}	75.45±0.79^{b}	75.28±0.26^{b}	82.52±1.21^{a}

$^{a,b, \text{ and } ab \text{ mean}}$ that the different superscripts in the same row differ significantly (P< 0.05). AQ= Farm A for Quail, BQ=Farm B for Quail, CQ = Farm C for Quail, DQ = Farm D for Quail, EQ= Farm E for Quail

Table 6 shows the analysis of variance for the internal turkey eggs used during the research. Means along columns with different superscripts are significantly different. Parameters such as albumen weight, albumen %, egg content and yolk weight were not significantly different across the farms at (P<0.05). The albumen height was significantly different across the farms with values of (0.50±0.08, 0.26±0.12, 0.70±0.04, 0.81±0.05 and 0.68±0.03) for farms A, B, C, D and E, respectively.

Table 6: Internal Egg Properties of Turkey Eggs

Parameter	AT	BT	CT	DT	ET
Albumen Weight(g)	36.26±1.91	37.22±1.56	38.23±1.12	39.75±2.00	37.66±1.68
Albumen %	62.92±2.12	60.58±1.04	60.84±1.11	62.00±1.64	59.73±2.89
Albumen Height(cm)	0.50±0.08^{b}	0.26±0.12^{c}	0.70±0.04^{a}	0.81±0.05^{a}	0.68±0.03^{a}
Egg Content(g)	57.40±1.48	61.58±2.78	62.83±1.39	64.10±2.79	63.56±2.00
Yolk Height(cm)	1.26±0.07^{a}	0.32±0.03^{b}	1.48±0.07^{a}	1.39±0.97^{a}	1.37±0.10^{a}
Yolk Weight(cm)	21.18±0.97	24.57±1.37	24.45±0.94	24.36±1.51	25.89±2.57
Yolk Colour	6.00±0.54^{a}	3.80±0.42^{b}	3.20±0.25^{b}	3.30±0.15^{b}	3.50±0.22^{b}
Haugh Unit	58.49±9.28^{b}	26.39±4.27^{c}	79.69±2.09^{a}	86.01±2.87^{a}	77.73±2.77^{a}

^{a,b,c} Means with different superscripts in the same row differ significantly (P< 0.05), AT= Farm A for Turkey, BT=Farm B for Turkey, CT = Farm C for Turkey, DT = Farm D for Turkey, ET= Farm E for Turkey

DISCUSSION

The study evaluated and compared the physical and quality properties of eggs of three poultry species, including chicken, turkey and quail, in order to establish how changes in external and internal characteristics determine the quality or grading, processing and the overall market value.

The measurement of external egg traits indicates that although certain physical traits are genetically determined, others depend on the practices used in farm management. The weight of chicken eggs used in the experiment (60.64 to 63.59 g) is much heavier in comparison to the 36.51 g mean weight of Nigerian native domestic fowl, as recorded by Odafe-Shalom and Owen (2020). Such a significant difference indicates that the farms in this study raised better commercial breeds, including Noiler, rather than unimproved local chickens. This observation is consistent with that of Yahaya et al. (2025), who also reported similar weight profiles in better strains of chicken. The shells were considerably different in the farms. Farm B had a thinner shell (0.28 mm) than Farm C (0.35 mm). Although Oleforuh-Okoleh et al. (2020) attribute shell thickness to genetic strain, high shell thickness in naked-neck genotypes, the low value of shell thickness in Farm B could be due to dietary calcium deficiency or environmental stress. The weights of the quail eggs (9.40-10.22 g) were in line with the 9.75 g standard in the Songhai Delta region, as revealed by Odafe-Shalom and Owen (2020). This implies that the mass of quail eggs is not affected by the various farming conditions. However, it was significantly different in egg length. The length of Farm E eggs was 3.00 cm, which corresponds to the length of 2.95 cm (Odafe-Shalom & Owen, 2020). On the contrary, Farms A-D produced eggs that were significantly shorter (1.16-1.20 cm). This comparison suggests that Farm E is breeding a phenotype within the typical range for Japanese Quail, whereas the other farms are recording exceptionally low values for the species. Tests of turkey eggs showed definite breed characteristics. The weights (66.10-73.45 g) are within the range reported by Yahaya et al. (2021) for black and white strains in Nigeria, that is, local strains. Farm B produced eggs with the thickest shells (0.39 mm). It is greater than the 0.27 mm average of earlier studies in Zaria (Yahaya et al., 2021). This finding implies that the turkeys in Farm B were fed enough calcium, which enabled them to build up their shells, although there were other management problems.

A check of internal quality helps identify problems with storage and nutrition that could be overlooked in external measurements. For chicken eggs, the Haugh Unit (HU) was greater than 75 in Farms D and E. This is in line with the 78.1 HU average for fresh indigenous eggs reported by Odafe-Shalom and Owen (2020). Farm B, on the other hand, showed a significantly lower HU (56.14) and a lower height of albumen (0.42 cm). According to Yahaya et al. (2025), the internal quality of improved strains declines within 7 days of storage. Farm B also had the heaviest yolks (20.26 g). A low freshness index and a large yolk are normally evidence of water transfer between the egg white and the yolk, which is a sure indication of ageing eggs (Yahaya et al., 2025). Also, the high albumen content of these commercial strains is consistent with the results of Atte et al. (2024), who found that, in most cases, exotic chickens have higher albumen percentages than local strains. There were high differences in nutrition and high consistency in quality in quail eggs.

The yolk colour score of farm E eggs was 6.40. This is much darker than the 3.60-4.50 range characterised in other farms. Given that paler yolks are common in poultry research in Nigeria, which has a general deficiency of forage, birds at Farm E (Kabir et al., 2024) were considered to have paler yolks, suggesting that the deep colour was due to pigments or carotenoids added to the feed. The percentage of albumin present in Farm E was also higher than in the other farms (57.69%). This is unlike the results of Odafe-Shalom and Owen (2020), who documented that the quail egg yolk-to-white ratio is usually higher than that of chicken eggs. Farm E may be breeding a certain genetic strain chosen to produce more protein. The turkey egg test revealed a contradiction between shell strength and internal freshness. Farm B produced the thickest shells, but of very poor internal quality. The Haugh Unit was 26.39 only, and the albumen was milk-like (0.26 cm). These values fall short of the acceptable USDA standards discussed by Atte et al. (2024). This indicates protein degradation, most likely due to heat stress or prolonged storage. Farm D, on the other hand, had a high Haugh Unit of 86.01, which is superior to the Haugh Units reported for Nigerian local turkeys (79-81) by Yahaya et al. (2021). Farm A was characterised by deep yolk pigmentation (6.00), indicating that the birds were able to feed on green plants or maize.

REFERENCES

Abebe, F., Metaferiya, H., & Kelemework, S. (2023). Review of Factors Affecting Egg Quality and Its Effect. *Journal of Animal Health*. https://doi.org/10.47604/jah.2224

Alkan, S. (2024). Prediction of Internal Quality Characteristics by Regression Equations Using External Quality Characteristics of Egg in Cream Coloured Laying Hens. *Akademik Ziraat Dergisi*. https://doi.org/10.29278/azd.1587892

Atte, P., Isaac, M., Isyaku, O., Olaiya, S., Lawal, A., & Olaniyan, O. (2024). Effect of species on egg qualities of poultry birds. Nigerian Journal of Animal Production. https://doi.org/10.51791/njap.vi.5374

Dinesh, K., Sankhyan, V., Thakur, D., Kumar, R., & Suman, M. (2025). Effect of Age on Egg Quality Traits in Native Chicken at Different Ages of Measurements under Intensive System in Himachal Pradesh. *International Journal of Bioresource and Stress Management*. https://doi.org/10.23910/1.2025.6229

Djokić, N., Čobanović, N., Karabasil, N., Grković, N., Vićić, I., & Suvajdžić, B. (2022). Quality of table eggs in relation to shell colour. *Veterinarska stanica*. https://doi.org/10.46419/vs.54.2.5

Ikusika, O., Dwakasa, H., Luphuzi, S., Akinmoladun, O., & Mpendulo, C. (2025). Assessment of Egg Quality Across Seasons, Storage Durations, and Temperatures in Commercial Laying Hens. *Applied Sciences*. https://doi.org/10.3390/app151910344

Kabir, M., Ukeonye, U., Adamu, H., Umar, U., & Badmus, K. (2024). Comparison of proximate composition, internal and external qualities of eggs from four species of poultry marketed in Samaru Zaria, Nigeria. Nigerian Journal of Animal Production. https://doi.org/10.51791/njap.vi.6797

Kop-Bozbay, C. (2024). Quality traits of table eggs as affected by management practices and storage periods. *South African Journal of Animal Science*. https://doi.org/10.4314/sajas.v54i2.02

Kumar, M., Dahiya, S., Ratwan, P., Sheoran, N., Kumar, S., & Kumar, N. (2021). Assessment of egg quality and biochemical parameters of Aseel and Kadaknath indigenous chicken breeds of India under backyard poultry farming. *Poultry Science*, 101. https://doi.org/10.1016/j.psj.2021.101589

Nosike, R., Ebuzor, C., Onunkwo, D., Obasi, E., Ezea, J., Nwakpu, O., Ibe, S., & Oke, U. (2020). Effect of phenotype on egg quality characteristics of F1 locally-adapted Turkey of Nigeria. Nigerian Journal of Animal Production, 44(1). https://doi.org/10.51791/njap.v44i1.461

Odafe-Shalom, G., & Owen, E. (2020). Chemical analysis and quality assessment of Nigerian indigenous domestic fowl and quail eggs produced at Songhai Delta Farms. Nigerian Journal of Animal Production, 47(5). https://doi.org/10.51791/njap.v47i5.1325

Oleforuh-Okoleh, V., Chukwuemeka, U., & Adeoye, G. (2020). Influence of strain and production cycle on egg quality traits of two Nigerian indigenous chicken strains. Nigerian Journal of Animal Production, 45(2). https://doi.org/10.51791/njap.v45i2.475

Pardo, J., Ariza, A., Jurado, J., Bermejo, J., & Vallejo, M. (2025). Characterisation of the internal quality of turkey eggs according to their commercial grading. *Veterinary and Animal Science*, 29. https://doi.org/10.1016/j.vas.2025.100470

Rodríguez-Hernández, R., Rondón-Barragán, I., & Oviedo-Rondón, E. (2024). Egg Quality, Yolk Fatty Acid Profiles from Laying Hens Housed in Conventional Cage and Cage-Free Production Systems in the Andean Tropics. *Animals: an Open Access Journal from MDPI*, 14. https://doi.org/10.3390/ani14010168

Salgado, R., Sesma, B., Nazar, P., Haro, J., Ortega, J., & Vázquez, F. (2020). Analysis of quality and prediction of external and internal egg traits in Mexican native turkey hens. *Emirates Journal of Food and Agriculture*, 647. https://doi.org/10.9755/ejfa.2020.v32.i9.2143

Wijedasa, W., Wickramasinghe, Y., Vidanarachchi, J., & Himali, S. (2020). Comparison of Egg Quality Characteristics of Different Poultry Species. *Journal of Agricultural Science*. https://doi.org/10.5539/jas.v12n11p331

Yahaya, B., Iliyasu, M., & Abdu, I. (2025). Egg quality traits of Nigerian unimproved (Indigenous) and improved (Noiler) chickens as influenced by storage periods. Journal of Animal Science and Veterinary Medicine. https://doi.org/10.31248/jasvm2025.541

Yahaya, H., Olutunmogun, A., Mohammad, Y., Shettima, M., & Kabir, M. (2021). Evaluation of egg quality characteristics of two strains of local turkey (Meleagris gallopavo) in Zaria, Kaduna State. Nigerian Journal of Animal Production, 48(1), 1–11. https://doi.org/10.51791/njap.v48i1.2891