**EVALUATION OF EGG QUALITY TRAITS OF INDIGENOUS GEESE OF ASSAM : AN UNEXPLORED BIODIVERSITY**

**ABSTRACT**

Assam, a state of north eastern India, treasures in its lap an indigenous germplasm of geese which are distributed throughout Assam. It can be regarded as a unique bio diversity of North Eastern India. Geese eggs are large in size and nutrient dense. It is a known fact that the egg quality traits are foremost selection standard in poultry breeding. Poor egg quality leads to economic losses at all production stages. A study was undertaken to observe the internal quality of eggs to assess the egg quality traits of indigenous geese egg. Data for egg quality traits were generated from a total of 32 numbers of geese eggs. Laboratory work pertaining to egg quality traits were carried out by following standard techniques. The mean and their standard errors for shape index, shell weight, shell thickness, specific gravity, albumen index, Haugh unit and yolk index were found to be 70.476 ± 1.120, 16.756 ± 0.282 g, 0.560 ± 0.009 mm, 1.285 ± 0.017, 0.075 ± 0.001, 64.662 ±1.201 and 0.362 ± 0.006 respectively. The range for shape index, shell weight, shell thickness, specific gravity, albumen index, Haugh unit and yolk index were recorded to be 61.45 to 93.56, 13.64 to 20.95 g, 0.490 to 0.700 mm, 1.150 to 1.570, 0.065 to 0.091, 48.990 to 77.740 and 0.298 to 0.417 respectively. The yolk colour was mostly observed to be yellow in colour and sometimes it looked to be orange in colour. Egg shell colour was mostly observed to be white in colour and sometimes it appeared as cloudy white. The baseline information on egg quality traits of indigenous geese of Assam can be used as breed descriptor and further improvement as well as conservation of the germplasm.

***Keywords:*** *Indigenous geese, Assam, egg quality traits*

1. **INTRODUCTION**

The state Assam which belongs to North East India, cradles in its lap an indigenous germplasm of geese. They are being reared since ancient times. They are locally called as ‘*Rajhanh’* meaning king of ducks for their long neck and majestic gait. They are distributed throughout Assam. They are generally reared by the rural people in backyard in traditional system of management with low input. Geese are let loose early in the morning for foraging and are housed during night hours in small houses made of locally available materials like wood, bamboo, trampolines etc. They are provided with kitchen wastes, whole grains, rice bran, rice grains etc. after coming back to their houses. Rural farmers find geese rearing quite profitable and it act as a supplementary income source. It provides much needed animal protein to the family. They are heavier birds and primarily reared for meat and eggs. Goose eggs are large sized and excellent source of many nutrients such as protein, iron, omega-3 fats and vitamins A, B and folate, good sources of vitamin D and fair sources of calcium. The local rearers hardly sell the goose egg as almost all the eggs are used for hatching to obtain goslings. The external and internal qualities of the eggs affect the hatchability and embryo development. It is a well known fact that the egg quality traits are the crucial for selection of birds for poultry breeding. It can be regarded as the foremost selection standard. Poor egg quality leads to economic losses at all production stages. Perusal of literature suggests that very few work has been carried out in indigenous geese of Assam and it should be explored scientifically. Considering the above fact, a study was undertaken to observe the internal quality of eggs to assess the egg quality traits of indigenous geese egg.

**2. MATERIALS AND METHODS:**

A total of 32 numbers of eggs procured from farmers belonging to four districts of Assam *viz.,* Udalguri, Nalbari, Darrang and Barpeta district (Fig.1).



 **Fig. 1. Map of Assam showing study area**

The duration of study was from September, 2020 to August, 2021. The laboratory work pertaining to egg quality traits were conducted in the Department of Livestock Products Technology, College of Veterinary Science, Assam Agricultural University, Khanapara, Guwahati, Assam, India. The statistical analysis was carried out in MS-EXCEL. The different traits under study were Shape index, Shell weight (g), Shell thickness (mm), Specific gravity, Albumen Index, Haugh Unit, Yolk Index, Yolk colour and Egg shell colour.

**Table 1 : Different methods utilized for data collection**

|  |  |  |
| --- | --- | --- |
| **Sl. No.** | **Trait** | **Method** |
| 1. | Albumen index | The albumen index was measured as per the method of Heiman and Carver (1936). The height of thick albumen (mm) was measured by a Spherometer and the width by Vernier Callipers (mm) and estimated by dividing the height of thick albumen with the width of thick albumen. |
| 2. | Yolk index | The yolk index was estimated as per the method of Funk (1948). The height of the yolk(mm) was measured at the centre by using a Spherometer and the width of the yolk(mm) was measured at two places by using the Vernier Calliper and the mean width was calculated. The yolk index was calculated by using following formulaYolk Index= Height of the yolk (mm)/ Mean width of the yolk (mm)  |
| 3. | Haugh unit  | Haugh unit = 100 log (H +7.57– 1.7 W0.37) [Raymond Haugh,1937] where, H=height of the thick albumen(mm),W=weight of the egg (g) |
| 4. | Shell weight (g)  | Removing the shell membrane from the shell and drying and weighing it with the help of an electronic balance. |
| 5. | Shell thickness(mm) | The average thickness of the shell measured at three places *viz.* equatorial region, narrow end and broad end with the help of a Vernier Callipers.  |
| 6. | Shape index  | The shape index was calculated as per the method described by Shultz (1953), by measuring length and width of each egg in mm with the help of a Vernier Callipers and estimated as follows:Shape index = (Egg width (mm)/ Egg length (mm)×100  |
| 7. | Specific gravity  | Specific gravity=Weight of egg (g)/Volume of egg (ml) [Harms *et al*. (1990] |
| 8. | Yolk Colour  | The yolk colour of the egg was observed directly during the time of measuring the other egg quality traits. |
| 9. | Egg shell colour | The colour of the shell of the egg was observed directly at the time of collection of the egg and recorded. |

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|  **Fig 2: Recording of different egg quality traits** |

**3. RESULTS AND DISCUSSION**

The means and their standard errors along with the range and co-efficient of variation (%) for different egg quality traits, *viz.,* shape index, shell weight, shell thickness, specific gravity, albumen index, Haugh unit and yolk index are depicted in the Table 2.

**Table 2. Mean and standard error along with range of various egg quality traits of indigenous geese of Assam**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Sl. No. | Egg quality traits | Average | Range | CV% | N |
|  | Shape index | 70.476 ± 1.120 | 61.45 to 93.56 | 8.990 | 32 |
|  | Shell weight (g) | 16.756 ± 0.282 | 13.64 to 20.95 | 9.510 | 32 |
|  | Shell thickness(mm) | 0.560± 0.009 | 0.490 to 0.700 | 8.850 | 32 |
|  | Specific gravity | 1.285 ± 0.017 | 1.150 to 1.570 | 7.470 | 32 |
|  | Albumin index | 0.075 ± 0.001 | 0.065 to 0.091 | 10.070 | 32 |
|  | Haugh unit | 64.662 ± 1.201 | 48.990 to 77.740 | 10.510 | 32 |
|  | Yolk Index | 0.362 ± 0.006 | 0.298 to 0.417 | 9.070 | 32 |

 N= no. of observations.

The overall mean value for shape index was reported as 70.476 ± 1.120 with a range of 61.45 to 93.56 in the present study on indigenous geese of Assam. Shape index observed in the present study was similar to the reported values of Hamadani and Khan (2016) and Gogoi *et al.* (2021) in indigenous geese of Kashmir (71.05 ± 0.70) and indigenous geese of upper Assam (69.60 ± 5.20) respectively. Whereas, Tilki and Inal (2004) reported lower average shape index of eggs from 1, 2 and 3years old geese as 68.0, 68.6 and 68.0 % respectively. Also, lower values were found by Mustafa *et al.* (2005) in Turkish geese (66.80 ± 0.16 %).

The overall least squares mean for shell weight in indigenous geese of Assam was found to be 16.756 ± 0.282 g within a range between 13.64 to 20.95 g. A similar value of shell weight was observed by Gogoi *et al.* (2021) and recorded as 15.2 ± 1.92 g in indigenous geese of upper Assam. However, higher shell weight of 19.8 g in Italian geese; 18.7, 18.4 and 20.1 gm in 1, 2 and 3 years old Turkish geese; and 26.60 ± 1.52 g in 3rd year of breeding and 20.40 ± 1.14 g during first year of breeding in Lithuanian Vishtines geese were observed by Pakulska *et al.* (1995); Tilki and Inal (2004) and Razmaite *et al.* (2014) respectively. Boga Kuru and Kirmizibayrak (2024) reported the shell weight (g) of light, medium and heavy Turkish geese as 11.32 ± 0.23, 14.28 ± 0.25 and 17.46 ± 0.59 respectively.

In the present study on indigenous geese of Assam, the overall mean value for shell thickness was recorded as 0.560 ± 0.009 mm with a range of 0.490 to 0.700 mm. The present findings of shell thickness is in harmony with the findings of Tilki and Inal (2004); Hamadani and Khan (2016); Karabulut (2020); and Gogoi *et al.* (2021) in Turkish geese (0.55 mm, 0.51 mm and 0.51 mm in 1, 2 and 3 years old geese); indigenous geese of Kashmir (0.53 ± 0.31mm); native, Chinese and Linda geese (0.510, 0.504 and 0.555 mm) and indigenous geese of upper Assam (0.54 ± 0.09 mm) respectively. Boga Kuru and Kirmizibayrak (2024) also reported the shell thickness (mm) of light, medium and heavy Turkish geese as 0.53 ± 0.003, 0.50 ± 0.003 and 0.46 ± 0.006 which corroborated with the present report. However, lower shell thickness compared to present findings were observed by Sari *et al.* (2019) as 0.48 ± 0.01, 0.48 ± 0.01 and 0.48 ± 0.06 mm on 45th ± 5 day, 60th ± 5 day and 75th ± 5 days of the laying period in Lindovskaya (Linda) geese of Turkey respectively.

The overall mean value for specific gravity was found as 1.285 ± 0.017 g/dl within a range of 1.150 to 1.570 g/dl. Hamadani and Khan (2016); Kokoszynski (2017) and Karabulut (2020) reported specific gravity of eggs from indigenous Kashmiri geese; Rypinska, Kartuska and Suwalska geese of Poland and Linda geese as 1.09 ± 0.01 g / dl; 1.088 to 1.090 g/ cm3 and 1.173 to 1.288 g/dl respectively which were in accordance with the present result. These findings are in harmony with the present result.

The overall value for albumen index in the present investigation was recorded as 0.075 ± 0.001 within a range between 0.065 to 0.091. A comparable value with the present findings were recorded by Hamadani and Khan (2016) in indigenous Kashmir geese eggs (0.09 ± 0.01%). Whereas, Gogoi *et al.* (2021) reported a lower albumen index in indigenous geese of upper Assam (of 0.058 ± 0.009 %) and a higher value of albumen index was recorded by Tilki and Inal (2004) in Turkish geese (as 6.76 ± 0.05 % ) and Sari *et al.* (2019) in Linda geese of Turkey (5.10 ± 0.19 %, 5.24 ± 0.15 % and 4.71 ± 0.11 % on 45th ± 5 day, 60th ± 5 day and 75th ± 5 days of the laying period).

In the present study on indigenous geese of Assam, the overall average value for Haugh Unit was recorded as 64.662±1.201 with a range of 48.990 to 77.740. Gogoi *et al.* (2021) also found a similar value of 60.00 ± 9.54 in indigenous geese of upper Assam. On the other hand, a higher value for Haugh Unit were reported by Hamadani and Khan (2016) as 71.31 ± 1.84 in indigenous geese of Kashmir and Sari *et al.* (2019) as 82.57 ± 2.00, 83.03 ± 1.93 and 79.95 ± 1.18 on 45th ± 5 day, 60th ± 5 day and 75th ± 5 days of the laying period of Lindovskaya (Linda) geese. Contrastingly, lower Haugh Unit was reported by Tilki and Inal (2004) in Turkish geese as58.9 ± 0.45.

The overall least squares mean for Yolk Index in indigenous geese of Assam was found to be 0.362 ± 0.006 within a range between 0.298 to 0.417.The present finding for yolk index corroborates well with the findings of Tilki and Inal (2004); Razmaite *et al.* (2014); Hamadani and Khan (2016); Bhuiyan *et al.* (2017) and Gogoi *et al.*(2021) in eggs of Turkish geese (34.5 ± 0.11%); Lithuanian Vishtines geese (37.14 ± 1.96 % during 3rd year of breeding); indigenous geese of Kashmir (0.38 ± 0.01); Nageswari ducks of Bangladesh (34.36 ± 0.61%) and indigenous geese of upper Assam (35.15 ± 6.08%) respectively.

The yolk colour was mostly yellow in colour and sometime it was orange in colour in the eggs of indigenous geese of Assam.

Egg shell colour was observed to be mostly white and sometime it appeared as cloudy white. A similar yolk colour of orange to yellow was also reported by Hamadani and Khan (2016) in indigenous geese of Kashmir. However, Banerjee (2013) and Hamadani and Khan (2016) reported white colour egg shell in cotton Pygmy geese of Assam, indigenous geese of West Bengal and in indigenous geese of Kashmir. These observations corroborated with the present finding.

**4. CONCLUSION**

 The baseline information generated on egg quality traits of the indigenous geese of Assam through the study can be of help in documentation and development of breed descriptors for registration of this non-descript germplasm. The external and internal qualities of the eggs affect the hatchability and embryo development. It is a well known fact that the egg quality traits are the crucial for selection of birds for poultry breeding. It can be regarded as the foremost selection standard. Results obtained would contribute in further research as well as various breeding activities for improvement and conservation of the indigenous geese. There is immense need of popularization of geese farming of Assam which is having huge potentiality for uplifting the economy of farmers.

**Disclaimer (Artificial intelligence)** : Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

**6. REFERENCES**

Banerjee, S. (2013). Morphological traits of duck and geese breed of West Bengal India. *Animal Genetic Resources*., 52: 1–16.

Bednarczyk, M. and Rosinski, A. (1999). Comparison of egg hatchability and in vitro survival of goose embryos of various origins. *Poultry Science Journal,* 78 (4) : 579-585.

Bhuiyan, M. S. A.; Mostary, D. S.; Ali, M. S.; Hussain, M. M. and Ferdaus, A. J. M. (2017). Performances of Nageswari duck of Bangladesh under intensive management condition. *Bang. J. Anim. Sci.,* 46(3) : 198-205.

B. BOĞA KURU and T. KIRMIZIBAYRAK, “The Impact of Different Egg Weights on External Egg Quality Characteristics in Turkish Native Geese of the Kars Region,” *Egyptian Journal of Veterinary Sciences*, vol. 55, no. 1, pp. 125–133, Jan. 2024.

Funk, E. M. (1948). The relation of the yolk index determined in natural position to the yolk index as determined after separating the yolk from the albumen. *Poult. Sci.,* 27(3): 367-367.

Gogoi, A.; Das, B.; Phookan, A.; Chabukdhara, P.; Pathak, S.S.; Pame, K. and Hoque, H. (2021). Evaluation of Physical Egg Quality Traits in Indigenous Geese of Upper Assam. *International Journal of Genetics*, ISSN: 0975-2862 & E- ISSN : 0975 – 9158, 13 : 804 – 806.

Hamadani, H. and Khan, A. A. (2016). “Morphological Characterization with Special Reference to Colour Variations in Domestic Geese (*Anser Anser domesticus*) ” *Indian Journal of Animal Science*, 86 (4) : 78.

Harms, R. H.; Rossi, A. F.; Sloan, D. R.; Miles, R. D. and Christmas, R. B. (1990). A method for estimating shell weight and correcting specific gravity for egg weight in egg shell quality studies. *Poult. Sci.,* 69(1): 48-52.

Heiman, V. and Carver, J. S. (1936). The albumen index as a physical measurement of observed egg quality. *Poult. Sci.,* 15(2): 141-148.

Karabulut, O. (2020). Estimation of the external quality characteristics of goose eggs of known breadth and length. *Vet Med-Czech,*66: 440-447.

Kokoszynski, D. (2017) Chapter 4 - Guinea Fowl, Goose, Turkey, Ostrich, and Emu Eggs. *Egg Innovations and Strategies for Improvements*. 33–43.

Mustafa, S.; Turgut, K.; Ali, R. A. and Muammer, T.L.K. (2005). Egg Weight, Shape Index and Hatching Weight and Interrelationships among these Traits in Native Turkish Geese with Different Coloured Feathers. *Turk. J. Vet. Anim. Sci*., 29: 353-357.

Pakulska, E.; Bednarczyk, M.; Badowski, J. and Siwek, M (1995). Influence of level and source of protein in diet quality on goose hatching eggs. 10th European Symposium on Waterfowl, Halle, Germany, 112–115.

Rabsztyn, A.; Andres, K. and Dudek, M. (2010). Variability, Heritability and Correlations of egg shape in the Zatorska goose. *J. Cent. Eur. Agric*., 11(4): 433-436.

Razmaite, V.; Sveistiene, R. and Svirmickas, G. J. (2014). Effect of Laying Stage on egg characteristics and yolk fatty acid profile from different aged geese. *Journal of Applied Animal Research,*42(2): 127-132.

Saatci, M.; Kirmizibayrak, T.; Aksoy, A. R. and Tilki, M. (2005). Egg weight, shape index and hatching weight and interrelationships among these traits in native Turkish geese with different coloured feathers. *Turkish Journal of Veterinary and Animal Sciences*, 29 (2): 353-357.

Sari, M.; Bugdayci, K. E.; Akbas, A.A.; Saatci, M. and Oguz, M. N. (2019). The effect of laying period on egg quality traits and chemical composition of Lindovskaya (Linda) geese reared under breeder conditions. *Turk J. Vet Anim Sci*., 43 : 662- 669.

Scripnic, E. and Modvala, S. (2010). Process of Increasing the Incubation Indices of Geese Eggs. Bulletin UASVM *Animal Science and Biotechnologies*, 67(1-2): 334-338.

Shultz, F. T. (1953) Analysis of egg shape of chickens. *Biometrics,* 9(3): 336-353.

Tilki, M. and Inal, S (2004). Quality traits of goose eggs: effects of goose age and storage time of egg. *Arch. Geflu¨gelk*., 68 (4): 182 – 186.