

# EXTERNAL AND INTERNAL EGG QUALITY CHARACTERISTICS OF INDIGENOUS *SIRUVIDAI*, ASEEL AND WHITE LEGHORN CHICKENS

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## ABSTRACT

*A study was conducted to evaluate external and internal egg quality characters of three chicken breeds/ ecotypes namely, indigenous Siruvidai, TANUVAS Aseel and White Leghorn. A total of 180 eggs (120 eggs from Siruvidai chicken, 30 eggs from TANUVAS Aseel and 30 eggs from White Leghorn) were subjected to this study. The weight, length, width and surface area of White Leghorn eggs were significantly ( $P < 0.05$ ) higher than those of TANUVAS Aseel and indigenous Siruvidai chicken. Shape index was found to be significantly ( $P < 0.05$ ) higher in Siruvidai chicken eggs compared to that of TANUVAS Aseel and White Leghorn. Among the internal egg qualities, the height and width of albumen and albumen index were significantly ( $P < 0.05$ ) higher in White Leghorn chicken eggs compared to that of TANUVAS Aseel and Siruvidai chicken. Yolk height and yolk index of three breeds showed no significant difference among breeds. Yolk width was significantly ( $P < 0.05$ ) higher in TANUVAS Aseel compared to that of Siruvidai chicken. Yolk colour was significantly ( $P < 0.05$ ) higher in TANUVAS Aseel and Siruvidai chicken compared to that of White Leghorn. Shell thickness was significantly ( $P < 0.05$ ) higher in TANUVAS Aseel and White Leghorn as compared to Siruvidai chicken. Haugh unit was significantly ( $P < 0.05$ ) higher in White Leghorn compared to TANUVAS Aseel and Siruvidai chicken. The results revealed that the egg quality characters like egg weight, egg length, egg width, shape index, surface area, albumen height, albumen index, shell thickness and Haugh unit of indigenous Siruvidai chicken is different from other indigenous breed like Aseel and exotic breed like White Leghorn.*

**Key words:** Egg quality traits, Indigenous chicken, breeds, albumen index, yolk index, shape index, shell egg and Haugh unit score

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## INTRODUCTION

The indigenous breeds of chicken have large impact on rural economy in most of the developing and underdeveloped countries. They play major role in providing subsidiary income and nutritional security through egg and meat for the rural poor and marginalized sections of the people. The indigenous breeds of chicken are more popular for their adaptability and better productivity under low input system of management (Kumar *et al.*, 2013a). The total egg production in India is 138.38 billion, which is an increase by 6.77 % over the previous year and currently, the per capita availability is 101 eggs per annum (BAHS,2023). Egg is accepted worldwide as a staple food and is recognised as an important ingredient in a balanced human diet. It is one of the finest foods, offering almost complete balance of essential nutrients like vitamins, minerals, fatty acids and proteins of great biological value (Brugalli *et al.*, 1998). In addition to being one of the foods of lowest cost, its consumption enhances nutritional value for the low-income population. Egg quality is important for consumers by its characteristics (Stadelman, 1977). The egg size and its quality are the important attributes in poultry farming. Genotype has direct influence on egg weight and other quality characteristics. Among many quality characteristics, external factors including cleanliness, freshness, egg weight and shell weight are important from consumer's perspective (Dudusola, 2010). The interior of hen's egg consists of the yolk and white or albumen. Interior characteristics such as yolk index, Haugh unit and chemical

composition are also important in egg product industry as the demand for liquid egg, frozen egg, egg powder and yolk oil increases (Scott and Silversides, 2000). Although, the incubation characters like fertility and hatchability (Vasanthi *et al.*, 2022), embryonic mortality (Vasanthi *et al.*, 2023) and carcass characters (Jamima *et al.*, 2020; Vasanthi *et al.*, 2023) of indigenous *Siravidai* chicken have been studied, the information on the egg quality traits are very scanty. Therefore, the present study was carried out to assess the egg quality parameters of this indigenous ecotype in comparison with an Indian breed, Aseel and an exotic breed, White Leghorn.

## MATERIALS AND METHODS

A total of 180 eggs collected from *Siravidai* (120 eggs), TANUVAS Aseel (30 eggs) and White Leghorn (30 eggs) collected at 28 weeks of age were subjected to study the external and internal egg quality parameters. A total of 300 *Siravidai*, 30 TANUVAS Aseel and 30 White Leghorn hens were reared under deep litter system of management with 16 hours photoperiod and other standard management practices. The eggs were weighed using electronic balance to an accuracy of 0.01 g. The length and width of the eggs were measured using Vernier calliper. Shape index was calculated as the ratio of width to length  $\times$  100. Subsequently, the eggs were broken and internal quality traits like length and width of albumen and width of yolk were recorded using the Vernier calliper. The heights of albumen and yolk were measured with the help of spherometer. Shell thickness was

measured from four pieces of shells, one each from broad and narrow ends and two from the body of the eggs with the help of digital screw gauge and averaged. The Haugh unit (HU) score was calculated using the following formula.

$$HU=100 \log (H+7.57-1.7W^{37});$$

where,

‘H’ is albumen height in millimetres, measured by spherometer and ‘W’ is weight of the egg in gram.

The data were analysed using SPSS 20.0 software. Significant differences between genetic groups of three breeds were tested by one-way analysis of variance (ANOVA) (Snedecor and Cochran 1994).

## RESULTS AND DISCUSSION

The values (mean  $\pm$  S.E) of external egg quality parameters of three different breeds of chicken are furnished in Table.1

The present study revealed that the egg weight was significantly ( $P<0.05$ ) higher in White Leghorn (51.36g) followed by TANUVAS Aseel (42.68 g) and *Siravidai* chicken (38.72 g). Veeramani *et al.* (2012) recorded similar values of 50.63 g in IWN strains of White Leghorn; whereas, Narayanankutty *et al.* (2009) and Churchill *et al.* (2019) recorded higher egg weights of 55.87 and 54.12 g in IWN strain of White Leghorn. The variation in egg weight reported in the above studies could be due to different generation of the same strain. The egg weight

of 41.70 g observed by Kumar *et al.* (2022) in Aseel was lower than egg weight of Aseel recorded in the present study. Kumar *et al.* (2013b) reported an egg weight of 41.81g in Tellicherry chicken; a native breed of Kerala, which is higher than the egg weight of indigenous *Siravidai* chicken.

The egg length was found to be significantly ( $P<0.05$ ) higher in White Leghorn (5.46 cm) followed by TANUVAS Aseel (5.12 cm) and *Siravidai* chicken (4.89 cm). Churchill *et al.* (2010) and Rath *et al.* (2015) reported similar length of 5.45 and 5.43 cm respectively in White Leghorn eggs. Islam *et al.* (2010) reported 4.83 cm egg length in indigenous chicken of Bangladesh similar to the value of *Siravidai* chicken of the present study. Kumar *et al.* (2022) observed lower values of 5.16 and 5.13 cm respectively in indigenous breeds like Aseel and Kadaknath reared under backyard system of management; whereas, Kumar *et al.* (2013b) recorded an egg length of 5.19 cm in Tellicherry chicken.

The egg width was found to be significantly ( $P<0.05$ ) higher in White Leghorn (3.89 cm) followed by TANUVAS Aseel (3.69 cm) and *Siravidai* chicken (3.60 cm). Churchill *et al.* (2010) and Rath *et al.* (2015) reported slightly higher values of 4.07 and 3.99 cm in White Leghorn eggs. Kumar *et al.* (2022) observed higher value of 3.85 cm in Aseel compared to that of present study. Although the egg width of 3.80 cm of Tellicherry breed of chicken recorded by Kumar *et al.* (2013b) slightly higher compared to that of indigenous *Siravidai* eggs, the value of 4.06 cm recorded

by Singh *et al.* (2018) in Uttara fowl was much higher.

The present study revealed that the shape index of eggs was significantly ( $P < 0.05$ ) higher in *Siravidai* chicken (73.53) followed by TANUVAS Aseel (72.11) and White Leghorn (71.25). Churchil *et al.* (2010) and Rath *et al.* (2015) reported shape index values of 75.88 and 73.53 in White Leghorn eggs which were slightly higher than that of same breed in the present study. A higher shape index values of 74.00 (Kumar *et al.*, 2022) and 77.07 (Rajkumar *et al.*, 2014) were recorded in Aseel chicken in earlier studies. Further, Haunshi *et al.* (2011) and Sohail *et al.* (2013) also recorded higher shape index values of 77.36 and 77.25 % respectively in Aseel eggs. A similar shape index of 75.23 comparable to that of indigenous *Siravidai* chicken of the present study was reported in indigenous Miri chicken by Haunshi *et al.* (2009).

The egg surface area was significantly ( $P < 0.05$ ) higher in White Leghorn chicken ( $69.05 \text{ cm}^2$ ) followed by TANUVAS Aseel ( $61.39 \text{ cm}^2$ ) and *Siravidai* chicken ( $57.00 \text{ cm}^2$ ). Rath *et al.* (2015) reported similar value of egg surface area of  $69.9 \text{ cm}^2$  in White Leghorn. In contrast to the findings of this study, several authors reported higher egg surface values compared to indigenous *Siravidai* chicken, including  $61.22 \text{ cm}^2$  reported by Sapkota *et al.* (2020) in Sakini chicken and  $69.17 \text{ cm}^2$  surface area reported by Rasali *et al.* (1993) in Philippine Native chicken.

The mean values of internal egg quality parameters of indigenous *Siravidai*,

TANUVAS Aseel and White Leghorn are furnished in Table.2.

The egg albumen height was significantly ( $P < 0.05$ ) higher in White Leghorn (8.64 mm) as compared to TANUVAS Aseel (6.66 mm) and *Siravidai* chicken (6.16 mm). In contrast to the present findings, Rath *et al.* (2015) reported slightly lower mean value of 8.41 mm in White Leghorn chicken. Kumar *et al.* (2022) also reported lower albumen heights in indigenous breeds of Aseel (6.02 mm) and Kadaknath (5.52 mm).

The egg albumen width in the present study was significantly ( $P < 0.05$ ) higher in White Leghorn (75.17 mm) followed by *Siravidai* chicken (70.92 mm) and TANUVAS Aseel chicken (69.91 mm). A slightly higher value of 76.91 mm albumen width was observed in White Leghorn eggs earlier by Rath *et al.* (2015). On the other hand, a lower value of 65.40 mm the albumen width was observed in Aseel by Kumar *et al.* (2022) compared to that of present study in the same breed.

The albumen index was significantly ( $P < 0.05$ ) higher in the eggs of White Leghorn (0.11) followed by that of TANUVAS Aseel (0.09) and *Siravidai* chicken (0.08). Sreenivas *et al.* (2013) reported a lower value of albumen index of 0.072 in White Leghorn chicken as compared to present study. In contrast to albumen index value of *Siravidai* chicken, lower albumen index values were reported in indigenous chickens like Tellicherry (0.05) by Kumar *et al.* (2013b) and 0.06 in indigenous Miri (Haunshi *et al.*, 2009) breeds.

**Table 1. Effect of different breeds on external egg quality**

Breeds	Egg Weight ** (g)	Egg Length ** (cm)	Egg Width ** (cm)	Shape index **	Surface area ** (cm <sup>2</sup> )
<i>Siravidai</i> (n-120)	38.72 <sup>c</sup> ± 0.36	4.89 <sup>c</sup> ± 0.01	3.60 <sup>c</sup> ± 0.01	73.53 <sup>a</sup> ± 0.25	57.00 <sup>c</sup> ± 0.45
TANUVAS Aseel (n-30)	42.68 <sup>b</sup> ± 0.68	5.12 <sup>b</sup> ± 0.02	3.69 <sup>b</sup> ± 0.02	72.11 <sup>b</sup> ± 0.20	61.39 <sup>b</sup> ± 0.60
White Leghorn (n-30)	51.36 <sup>a</sup> ± 0.58	5.46 <sup>a</sup> ± 0.02	3.89 <sup>a</sup> ± 0.01	71.25 <sup>b</sup> ± 0.20	69.05 <sup>a</sup> ± 0.56
F value	131.60	110.28	37.78	12.69	89.01
P Value	.000	.000	.000	.000	.000

**Table 2. Effect of different breeds on internal egg quality**

Breeds	Albumin Height (mm)	Albumen Width (mm)	Albumin Index	Yolk Height <sup>NS</sup> (mm)	Yolk* Width (mm)	Yolk Index <sup>NS</sup>	Yolk Colour	Shell thickness (mm)	Haugh Unit
<i>Siravidai</i> (n-120)	6.16 <sup>c</sup> ± 0.06	70.92 ± 0.45	0.08 <sup>c</sup> ± 0.001	16.24 ± 0.08	35.99 <sup>b</sup> ± 0.17	0.45 ± 0.002	6.02 ± 0.07	0.30 ± 0.003	85.24 ± 0.45
TANUVAS Aseel (n-30)	6.66 ± 0.10	69.91 ± 0.58	0.09 ± 0.007	16.35 ± 0.06	36.96 <sup>a</sup> ± 0.25	0.44 ± 0.003	6.16 ± 0.09	0.32 ± 0.004	86.99 ± 0.47
White Leghorn (n-30)	8.64 ± 0.02	75.17 ± 0.45	0.11 ± 0.005	16.52 ± 0.13	36.67 ± 0.27	0.45 ± 0.005	4.50 ± 0.005	0.32 ± 0.002	94.98 ± 0.17
F Value	166.96	13.35	76.08	1.55	4.39	1.14	45.37	6.14	63.74
P Value	.000	.000	.000	.214	.014	.322	.000	.000	.000

Significant (P<0.01); \*\* -Significant (P<0.05); <sup>NS</sup> - Not Significant

The present study revealed that the yolk height was not significantly different among the three genetic groups. The values were observed in this study in White Leghorn, TANUVAS Aseel and *Siruvidai* chicken were 16.52, 16.35 and 16.24 mm respectively. Rath *et al.* (2015) reported a higher value of yolk height (18.22 mm) in White Leghorn eggs as compared to present study. On the other hand, a lower value of 15.30 and 14.26 mm were observed in indigenous breeds like Aseel and Kadaknath by Kumar *et al.* (2022) compared to that of present study.

The egg yolk width was significantly ( $P<0.05$ ) higher in TANUVAS Aseel (36.96 mm) and White Leghorn (36.67 mm) followed by *Siruvidai* chicken (35.99 mm). In contrast, Rath *et al.* (2015) reported yolk width of 44.72 mm in White Leghorn chicken which is higher than that of present study. Hrnčár *et al.* (2016) also observed higher values of yolk width in other exotic breeds like New Hampshire (41.26 mm), Oravka (40.98 mm), Plymouth Rock (41.22 mm), Rhode Island Red (41.14 mm) and Sussex (40.96 mm). In Aseel eggs, Kumar *et al.* (2022) reported higher values of yolk width (40.10) compared to that of present study.

The yolk index of eggs of indigenous *Siruvidai*, TANUVAS Aseel and White Leghorn was not found to be significantly different in this study. The values observed in White Leghorn, TANUVAS Aseel and *Siruvidai* chicken were 0.45, 0.44 and 0.45 respectively. Lower values of 0.34 and 0.40 were reported by Sreenivas *et al.* (2013) and

Rath *et al.* (2015) in White Leghorn chicken in earlier studies. In contrast to the findings of this study, several authors reported lower yolk index values compared to indigenous *Siruvidai* chicken, including 0.31 in Tellicherry chicken (Kumar *et al.*, 2013b), 0.38 and 0.36 in Aseel and Kadaknath respectively (Kumar *et al.*, 2022) and 0.36 in Miri (Haunshi *et al.*, 2009).

The egg yolk colour was significantly ( $P<0.052$ ) higher in TANUVAS Aseel (6.16) followed by *Siruvidai* (6.02) and White Leghorn (4.50) chickens. In contrary to the findings of this study, Rajkumar *et al.* (2014) reported higher value of 7.35 in Aseel compared to that of present study in the same breed. However, earlier studies revealed that lower mean yolk colour ranging from 3 to 5 in White Leghorn. The yolk colour of *Siruvidai* hens of this study falls within the range of 3 to 10 in indigenous Naked Neck chicken reported by Kostaman and Sopiyan (2016). Hrnčár *et al.* (2016) reported higher values of yolk colour in exotic chicken breeds like New Hampshire (9.65), Oravka (9.74), Plymouth Rock Buff (9.49), Rhode Island Red (9.57) and Sussex (9.51) as compared to the present study. The high variability in yolk colour reported in earlier studies compared to that of present study could be attributed to the variations in the content of carotenoids in feed rather than genetic effect.

The shell thickness was significantly ( $P<0.052$ ) higher in TANUVAS Aseel (0.32 mm) and White Leghorn (0.32 mm) followed by *Siruvidai* chicken (0.30 mm). Similar value of 0.32 was reported by Rath *et al.* (2015) in

White Leghorn; while, higher value of 0.35 in Aseel by Kumar *et al.* (2022). The egg shell thickness value of 0.38 mm recorded in Tellicherry breed of chicken by Kumar *et al.* (2013b) and 0.39 in Miri by Haunshi *et al.* (2009) are higher than the value observed in *Siruvidai* chicken in the present study.

The Haugh unit score was significantly ( $P < 0.05$ ) higher in White Leghorn (94.98) followed by TANUVAS Aseel (86.99) and *Siruvidai* chicken (85.24). Rath *et al.* (2015) also reported slightly lower value of Haugh unit score in White Leghorn chicken (92.00) and Hrnčár *et al.* (2016) also reported lower values of Haugh unit in exotic chicken breeds like New Hampshire (74.26), Oravka (73.69), Plymouth Rock Buff (73.54), Rhode Island Red (73.80) and Sussex (73.82) as compared to the present study. Kumar *et al.* (2022) reported lower value of Haugh unit score in Aseel (82.88) compared to that of current study. The value of 64.41 observed in Tellicherry breed of chicken by Kumar *et al.* (2013b) and 69.94 in Miri by Haunshi *et al.* (2009) which was lower than the value recorded in *Siruvidai* chicken. Haugh Unit score is highly affected by storage conditions like temperature and duration. This parameter was evaluated in this study uniformly from one day old eggs. The wide variations reported in the earlier studies could be attributed to the variations in storage conditions.

## CONCLUSION

This study presents insights into the egg quality parameters, which is newer for

indigenous *Siruvidai* chicken. The results highlight distinct characteristics in *Siruvidai* chicken eggs, setting them apart from other indigenous breeds such as Aseel and exotic breeds like White Leghorn across various egg quality parameters. This study contributes foundational information for the potential use of indigenous *Siruvidai* chicken in breeding programs aimed at developing pure and crossbred strains suitable for backyard farming; wherein, the breeds and varieties laying small to moderate sized eggs are preferred.

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