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Evaluation of morphological features and performances of Aseel chicken of Bangladesh under intensive management condition

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ABSTRACT

The current study was aimed to evaluate morphometric features along with productive and reproductive performances of indigenous Aseel chicken of Bangladesh under intensive management condition. The experiment was conducted from day old to 40th week of age including a total of 54 Aseel chicken (25 male and 29 female). The results show that yellow shank and beak, small wattles in male, small-red earlobe, white skin, yellow eye and light brown eggs were dominant characters in Aseel chicken. Radius length, keel length, shank length and drumstick length were 8.44±0.09, 10.63±0.15, 9.59±0.11 and 7.59±0.05 cm, respectively, in females and corresponding values were 9.88±0.14, 12.73±0.15, 12.11±0.21 and 10.67±0.16 cm in male. Moreover, the body weight at day old, 1st, 2nd, 4th, 6th, 8th, 12th, 16th, 20th and 40th weeks of age were 22.69±0.74, 32.71±1.74, 58.84±4.35, 215.47±8.86, 364.82±15.43, 576.00±16.33, 807.19±19.07, 1059.61±22.24, 1630.29±34.92, 2150.49±42.27 and 2956.25±46.86 g, respectively in this experiment. Feed conversion ratio (FCR) were 1.76, 3.30, 4.41 and 4.93 at 1st, 4th, 8th and 12th weeks of age. The reproductive traits age at first lay (day), number of eggs per clutch, egg weight, fertility (%) on total egg, hatchability (%) on fertile egg and mortality (%) up to 40th week of age were 142±0.83, 18.67±1.17, 35.84±0.68, 58.81, 88.29 and 3.70%, respectively. This study provides some important baseline information of Aseel chicken that could be utilized in genetic improvement and conservation of this valuable genetic resource of Bangladesh.

Introduction

Indigenous chicken has attained great attention worldwide due to its better immunity and adaptability to the local climatic conditions (Khan, 2015). Of late, there is growing interest in native chickens among farmers because of their hardiness, ability to thrive under adverse conditions, and the desirable taste and flavor of their eggs and meat (Rajkumar *et al.,* 2017). The Aseel chicken, an indigenous breed native to South Asia, holds significant cultural and economic value in Bangladesh due to its unique morphological traits, behavioral characteristics, and resilience to adverse environmental conditions (Sarkar *et al.,* 2024). Aseel is recognized as one of the major indigenous poultry breeds found in Indo-Pak subcontinent and mainly used either in cock fighting or as backyard poultry in rural areas (Khan, 2004). Aseel has high carcass quality and is noted for large body size, long shanks, handsome, endurance, and aggressive nature (Sarkar *et al.*, 2024). Notwithstanding its distinctive attributes, the Aseel

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breed is notably underexploited in commercial poultry farming, mostly owing to its sluggish development and inferior egg production relative to commercial broilers and layers (Sarkar *et al.*, 2024). Poor egg production and greater broody behavior can be improved through proper housing, management, fulfilling nutritional requirements and selective breeding (Usman *et al.*, 2014).

In Bangladesh, though Aseel chicken is found in urban and peri-urban regions, its original breeding tract is Sarail upazila of Brahmanbaria district (Bhuiyan *et al.*, 2005). Historically, Aseel chickens were primarily bred for cockfighting due to their strength and bravery, although they are now also valued for their hardiness and meat quality (Chatterjee *et al.*, 2016). It is the heaviest chicken among the existing breeds and varieties of indigenous chicken in Bangladesh, the highest weight found 6 kg (Bhuiyan *et al.*, 2005; Yamamoto *et al.*, 2010). It is known for its ferocity and territorial attitude. This behavioral feature also makes them great foragers and capable of prospering in low input settings (Sarkar *et al.*, 2024). Until to date, much scientific intervention has not yet been given for this valuable genetic resource and limited information to us about their phenotypes and performances (Sarker *et al.,* 2012). More particularly, data regarding the actual genetic potentials of this valuable germplasm under intensive management is scarce. Qualitative and quantitative traits of native chickens can be used as primary data for the preservation of genetic resources. Therefore, the aims of the study were to investigate morphological features and productivity of Aseel chicken of Bangladesh under intensive management condition.

Materials and methods

Establishment of nucleus flock

A total of 120 fertile eggs were collected from farmers' flocks of Brahmanbaria district, the breeding habitats of Aseel chicken in Bangladesh. Eggs were incubated at Poultry Production Research Division, Bangladesh Livestock Research Institute, Savar, Dhaka (hatchability = 57%). Chicks were brooded properly up to 5th weeks. Before brooding, all equipment and appliances were properly cleaned, washed and disinfected by fumigation. After 8th week of age, birds were screened based on their growth, body conformation and breed characteristics and finally, a small nucleus flock was developed including selected 54 birds among which 25 were male and 29 were female.

Management practices

Male and female birds were identified individually using leg bands and were kept in separate cage due to their aggressive behavior. Each cage was equipped with an individual feeder and drinker. Debeaking was done to all the experimental chickens at 10-12 days and 11-12 weeks of age using electric de-beaker. Vitamin K was supplied with drinking water for 3 days to prevent bleeding. The experimental birds were fed three types of rations according to the nutritional requirements determined as per NRC (1981) at different stages of rearing, starter (0-5 weeks), grower (6-19 weeks) and layer (20-40 weeks). *Ad-libitum* feeding was practiced during first five weeks where commercial layer starter feed was provided. Thereafter, restricted feeding was practiced during growing and laying period with hand mix compound feed. Refusals of the feed were measured every day in the morning. All the birds were reared in a natural-ventilated poultry house and allowed 16 hours lighting schedule of 12 hours (10-14 hrs.) sunlight and 4 hours (2-6 hrs.) artificial lights. Artificial insemination was practiced for all experimental birds. Each hen was inseminated twice a week and one ejaculate was directly inseminated to 4/5 hens. Vaccination and deworming were practiced as per schedule recommended for layer flock. Bio-security measures were followed properly in order to maintain healthy and hygienic environment.

Data recording

The general features of the chicks such as feather patterns, morphology and specific traits were recorded as qualitative or categorical traits. Qualitative traits such as plumage colors and patterns, shank color, comb type, skin color, eye color, beak color, ear lobes color was investigated according to the FAO (2012) guidelines only from adult chicken and were recorded accordingly. The morphometric traits like wing length (cm), shank length (cm), shank circumference (cm) and keel length (cm) were measured using tape at the 20th weeks of age. All measurements were taken by the same person to minimize human error. The productive and reproductive traits of the study included body weight (g), feed conversion ratio, age at sexual maturity, egg weight (g), fertility (%), hatchability (%) and survivability (%).

FCR was calculated by the following formula

$$\text{FCR} = \frac{Total\ amount\ of\ feed\ consumed}{Final\ live\ weight\ gain}$$

Statistical analysis

The collected data from the experimental record book was computed in excel sheet and the outliers were removed from the dataset in order to fit data into normal distribution. The Agricolae package in R was used to estimate descriptive statistics.

Qualitative traits

Qualitative traits are considered as parameters which have a direct link with production such as dimensions of different body parts and live weight (Silva *et al.*, 2015). Frequency of various qualitative traits of Aseel chicken were presented in the Table 1.

Results and Discussion

Table 1: Morphology of qualitative trait and it's frequency in Aseel chicken

Traits	Sex	n[1]	Characteristics features	Frequency (%)
Shank Color	M/F	44	Yellow White Black	91 7 2
Shank Feathering	M/F	44	Absent	100
Spur	M	19	Large Medium Small Rudimentary	20 16 48 16
No of toes	M/F	44	Four toes	100
Wattles	M	19	Medium Small	16 84
	F	25	Absent	100
Beak Color	M/F	44	Yellow White	91 9
Earlobe size	M/F	44	Small	100
Earlobe color	M/F	44	Red	100
Comb type	M/F	44	Rose comb Strawberry comb	50 50
Skin color	M/F	44	White	100
Eye color	M/F	44	Yellow White	80 20

[1]n= number of birds; M= male; F= female

In the current study, most of bird (91%) has yellow colored shank while small portion of chicken shank was white (7%) and black (2%). Churchill *et al.* (2019) reported only yellow color shank in Aseel cock. In alignment of the present study, Rajkumar *et al.* (2017) also stated yellow shank (65%) as dominant character. Almost half (48%) of the studied Aseel cock spur was small, followed by large (20%) and medium and rudimentary spur (16%). Majority (84%) of cock wattle size was small and female Aseel had no wattle. This result agrees with Rajkumar *et al.* (2017). Yellow (95%) and black beak was observed by Rajkumar *et al.* (2017) and Churchill *et al.* (2019) found brownish yellow and blackish yellow beak in Aseel male. All the experimental Aseel chicken had small sized red ear lobe. In agreement with our finding, Rajkumar *et al.* (2017) stated red (92%), white (6%) and black with others (2%) ear lobe for the same chicken breed. Half of the Aseel had Rose comb and half had Strawberry comb in our study but Churchill *et al.* (2019) reported Pea comb as dominant (80%) character followed by rose comb (20%). These differences may be due to variation in number of samples investigated, population and breed composition. All the Aseel chicken skin was white in color. Almost similar results were also observed by Rajkumar *et al.* (2017) who found 98% chicken skin was white and 2% yellow color. Though we observed 80% Aseel chicken had yellow color eye with 20% white. Totally different observation was reported by Rajkumar *et al.* (2017**)** who found black eye color in

99% case with rest 1% white color. Variation in genetic proposition and population may be the possible causing factor of above-mentioned differences.

Feather color distribution

Table 2 presented feather color and frequency of both male and female Aseel chicken.

Table 2: Feather color and its frequency in Aseel chicken

Name of feathers	Feather color frequency (%)										
	Male (20)					Female (24)					
	Black	Light brown – white	Light red	Dark red	Dark-red black white	Black	Light red	Dark red	Black-red	White	Mixed
Neck/Hackle feather color	10.52	21.05	10.52	26.35	31.58	20	-	44	12	8	16
Sickle feather color	36.84	21.06	-	-	42.10	-	-	-	-	-	-
Saddle feather color	5.2	31.57	5.2	26.31	31.72	20	-	20	24	20	16
Breast feather color	17.87	11.67	5.81	23.51	41.14	20	20	-	24	20	16
Wing bow feather color	63.15	10.5	-	5.23	21.05	56	-	24	12	8	-
Wing bar feather color	42.10	21.05	5.23	21.05	10.52	20	-	20	40	20	-
Wing bay feather color	63.16	15.79	5.23	5.23	10.52	36	-	20	24	20	-

Various color like black, light brown-white, light red, dark red, and dark-red black and white, black red, white and mixed white were appeared in various frequencies at different parts Dark-red black and white (31.58%) and dark red (44%) was dominant neck feather color in male and female, respectively. Among the three-color appeared in sickle feather, dark-red black white (42%) was dominating. In case of male Aseel chicken, most of cases saddle feather was dark red black white (31.72%) while in female, it was black red (24%). Breast feather followed the same trend as saddle feather where predominant color was dark-red black white (41.14%) in male and black red (24%) in female. Interestingly, both male and female wing bow feather primary color was black (63.15% and 56%). Most of the male Aseel had black (42.10%) wing bar feather whereas black-red (40%) was seen in maximum female. Black color wing bay feather dominates both male (63.16%) and female (36%). In a previous study, Sarker *et al.* (2012) recorded feather color of Aseel chicken. They found dominant color as follows; red (male: 56.14% vs female: 54.16%) for neck feather, black (male: 71.93% vs female: 54.17%) for sickle feather, red (male: 40.35%) and pale brown (female: 58.33%) for saddle feather, black (male: 64.91%) and pale brown (female: 50%) for breast feather, black (male:68.91%) and pale brown (62.5%) for wing bow feather, red (male:63.16%) and pale brown (female: 50%) for wing bar feather and black (male:80.70%) and pale brown (female: 54.17%).

Morphometric features

Morphometric measurement of both male and female Aseel chicken had been shown in Table 3. Higher value was obtained for all the studied trait in male compared to female at 20th weeks of age. Mean keel length was 12.73±0.15 cm and 10.63±0.15 cm in male and female bird, respectively. Aseel cock shank length was 12.11±0.21 cm and in case of female, it was 9.59±0.11 cm. Cock drumstick length was 10.67±0.16 cm and was 7.59±0.05 cm in hen. Shank circumference was higher in male than female chicken (male: 6.83±0.13 cm vs 5.03±0.08 cm). Average drumstick circumference of male was 10.37±0.16 cm. Sarker *et al.* (2012) stated comparatively higher average radius length, keel length, shank length in male and female (11.04±0.07 vs 8.96±0.23 cm, 14.39±0.19 vs 10.79±0.23 cm and 12.79±0.13 vs 10.21±0.25 cm) in Aseel chicken. Mahmood *et al.* (2017) reported a little longer drumstick (male:12.4 cm vs female: 12.4-12.7 cm) for Aseel chicken in Pakistan. These variations may be because of difference in age, nature of study and management practices. Overall mean shank circumference in both sexes was lower

than the result of Sarker *et al.* (2012) and Mahmood *et al.* (2017).

Table 3: Morphometric measurements of Aseel chicken under intensive management

Trait	Male				Female			
	n[1]	Min	Max	Mean	n[1]	Min	Max	Mean±SE
Radius length (cm)	20	9	12	9.88±0.14	24	7.8	9.4	8.44±0.09
Keel length (cm)	20	11	14	12.73±0.15	24	9.7	12.4	10.63±0.15
Shank length (cm)	20	10.5	13.5	12.11±0.21	24	8.5	10.5	9.59±0.11
Drumstick length (cm)	20	9.3	12.2	10.67±0.16	24	7.42	8	7.59±0.05
Shank circumference (cm)	20	6	8.1	6.83±0.13	24	4.4	5.8	5.03±0.08
Drumstick circumference (cm)	20	9	11.5	10.37±0.16	24	7.42	8	7.59±0.05

[1]n= number of birds

Table 4: Body weight (g) of Aseel chicken up to 40th week of age

Age in weeks	n	Min	Max	Mean±SE
DOW	54	16	30	22.69±0.74
1st	53	26	38	32.71±1.74
2nd	53	40	103	58.84±4.35
4th	52	110	308	215.47±8.86
6th	52	173	574	364.82±15.43
8th	52	362	750	576.00±16.33
10th	50	516	984	807.19±19.07
12th	50	742	1290	1059.61±22.24
16th	49	1105	2086	1630.29±34.92
20th	48	1503	2565	2150.49±42.27
40th	46	2298	3469	2956.25±46.86

Growth performance

Body weight of Aseel chicken were summarized in the Table 4. Average body weight of day old Aseel chick was 22.69±0.74 g. Day old Aseel chicken average body weight presented in this study was lower than the findings of 31.69 g and 33.19±0.20 g reported by Miazi *et al.* (2020) and Haunsi *et al.* (2011). Body weight at 1, 2, 4, 6, 8, 10, 12, 16, 20 and 40 weeks were 32.71±1.74, 58.84±4.35, 215.47±8.86, 364.82±15.43, 576.00±16.33, 807.19±19.07, 1059.61±22.24, 1630.29±34.92, 2150.49±42.27 and 2956.25±46.86 g, respectively. In a previous study, Sarker *et al.* (2012) observed body weight 31.14±0.55, 48.63±3.99, 138.40±5.91 and 212.88±4.82 g at 1st, 2nd, 4th and 6th weeks of age which lower than the same age group of the present study. In another study, Sarker *et al.* (2016) stated the average body weight of Aseel chicken 1st, 2nd, 4th and 6th weeks were 49.33±1.58 g, 107.66±3.73 g, 218.00±4.51 g, 347.33±11.17 g respectively that was comparatively higher than the present findings. Average body weight of Aseel chicken at 8th, 12th, 16th, 20th and 40th weeks of estimate in the current study was much lower than the findings of Dalal *et al.* (2022) who reported 461.41±10.09, 683.64±15.10, 886.01±20.24, 1117.30±22.68 and 1772.02±18.86 g, respectively. The daily feed intake, nutrient content of the feed and management system might be the associated factors for the deviations between present and previous studies.

Table 5: Feed intake and FCR of Aseel chicken up to12th week of age under intensive management

Age in week	1st	4th	8th	12th
Feed intake (g)	8.24±0.04	31.33±0.09	56.19±0.19	65.85±0.10
FCR	1.76	3.30	4.41	4.93

Feed intake and feed conversion ratio

Average daily feed intake/bird were recorded and presented in the Table 5. Feed intake at 1st, 4th, 8th and 12th weeks of age were 8.24±0.04, 31.33±0.09, 56.19±0.19 and 65.85±0.10 g, respectively. In contrast to our results, Jatoi *et al.* (2014) stated that the average feed intake of Lakha varieties of Aseel chicken at 1st, 4th, 8th and 12th weeks were 14.14 g,

41.68 g, 66.56 g, 85.53 g, respectively. Flock size, stocking rate, temperature, noise, lighting, feed and water factors, physical form of feed, feed flavor, anti-nutritional factors, physical condition of chicken etc. may affect the average daily feed intake of chicken (Ismail, 2023). Table 5 presented feed conversion ratio (FCR) from 1st to 12th weeks of age. Best FCR was obtained at 4th week while the worst was found at 12th week of age. Jatoi *et al.* (2014) reported 4.74±0.3, 3.73±0.25, 4.95±0.3 and 6.2±0.43 at 4th, 8th, 12th and 15th week in Mianwali varieties of Aseel. At the same experiment, for Peshwari varieties of Aseel chicken, FCR were recorded as 4.90±0.3, 5.15±0.3, 5.00±0.28 and 6.55±0.31 at the same age categories. In another experiment, Sarker *et al.* (2016) observed FCR of 3.18 for 0-8 weeks and 3.62 for 8-18 weeks of age of Aseel chicken. Age of birds, quality of feed and farm management practices may affect FCR of Aseel chicken.

Reproductive performance

Under intensive management system reproductive performance of Aseel chicken were recorded and presented in the Table 6.

Table 6: Reproductive performances of Aseel chicken under intensive management

Traits	n	Mean±SE
Age at first lay (day)	24	142±0.83
Number of eggs per clutch	24	18.67±1.17
Egg weight	24	35.84±0.68
Fertility (%) on total egg	24	58.81
Hatchability (%) on fertile egg	24	88.29
Mortality (%) up to 40th week of age	2	3.70

The age at first egg is an important indicator of reproduction traits of hens (Tan *et al.*, 2021). The average age at first lay was 142±0.83 days which is much lower than the findings of Miazi *et al.* (2020) and Thomas *et al.* (2023) who stated 210 days and 165 days, respectively. Pramanik *et al.* (2022) stated hens managed by natural mating laid first egg at 215±15.05 days and those which were managed by AI with fresh and diluted semen laid eggs at 213±13.07 and 216±13.98 days of age. Genotype and management system might be attributing factors for these variations across the studies. Egg weight along with color and shape are external characteristics that influence grading, price, consumer preference and hatchability (King'ori, 2012). Mean egg weight was 35.84±0.68 g. This result was lower than the previous report of Kaleri *et al.* (2024), Thomas *et al.* (2023) and Dalal *et al.* (2022). This variation may be due to age of hen, oviposition time, feed availability and nutritional specification, body weight at sexual maturity and health of chicken. Fertility of Aseel hen egg was estimated 58.81%. However, better fertility rate was stated by Miazi *et al.* (2020) and Rehman *et al.* (2020). High temperature, poor management practices, mating behavior and nutrients deficiency may adversely affect the fertility (Hocking *et al.*, 2007). In the current study we detected hatchability of fertile egg 88.29%. Our findings were much higher compared to Rehman *et al.* (2020) who found 74.86±0.94 in intensive management system. On the other hand, Miazi *et al.* (2020) reported 94.74% hatchability for Aseel chicken. Egg storage time, quality and quantity of feed, age of hen (Ogbu *et al.*, 2018), egg shell thickness and porosity (Gonzalex *et al.*, 1999), incubation environment (Shafey *et al.*, 2006) etc. may be the contributing factors for variation in hatchability of fertile eggs.

The clutch length, indicating the number of consecutive days with eggs, is an important trait describing the individual laying pattern (Shi *et al.*, 2023). In this study number of eggs per clutch were recorded 18.67±1.17 which was much higher than the report of 2.8±1.0 by Iqbal *et al.* (2012) and 12.01±1.1 by Kamal *et al.* (2024). In the current study, intensive management practices, proper amount of feed with balanced nutrition may be the causing factor for higher number of egg production. The average mortality of Aseel chicken up to 40th weeks of age was 3.70%. Much higher mortality (11.11%) was observed by Miazi *et al.* (2020) up to first age of lay. Sarker *et al.* (2016) also reported the mortality of Aseel chicken at different ages and found the mortality 1.0%, 5.67% and 0% at 0-7 weeks, 8-18 weeks and 19-32 weeks of age. Chick gender, season, transportation, hunger and thirst, nutrition, diseases, flock management, and the experience and education level of managers are responsible factors for variation in chick mortality (Yenilmez, 2025). In the present experiment, birds were intensively reared which helps to reduce mortality rate compared to others.

Conclusion

This study provided information on the morphological characteristics, morphometric measures and performance of Aseel chicken. Aseel chicken reared in intensive production system showed improved

performance in terms of age at first lay, number of eggs per clutch and hatchability. This baseline information could be employed for their conservation initiative and the formulation of breeding strategies for the future development of this genetic resource.

Conflicts of Interest: The authors declare no conflict of interest.

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Author's contribution

Conceptualization and writing the original draft: FT and MSAB; Data curing and analysis and reviewing: FT and MM; Fund acquisition and methodology: MSKS and SF, and final editing of the manuscript: MSAB

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