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Phenotypic characterization of Aseel, Hilly and Indigenous chickens *in situ*

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Abstract

This study was done in Nagar of Baraigram Upazila of Natore district, Bandarban Sadar Upazila of Bandarban Hill district and in Sarail Upazila of Brahmanbaria district to know the present status of Indigenous and Aseel chicken and to characterize the term of their morphology, productivity and genotypes in situ.. Morphology and management were studied in foundation stock. Distinct morphological variation was observed for shank color, comb type and height between two genotypes of chickens. The body weight and growth rate of Aseel were significantly higher ($p<0.01$) than those of indigenous and Hilly chickens. All chickens were found to have normal plumage patterns. The shank of indigenous chicken was 90% white and 10 % black, while the shank color of Aseel chicken was observed to be 100% yellow. In the case of Hilly and Aseel chicken, 100% comb color was red, but for Indigenous, 99% was red and the rest was pale red color. The comb type of Indigenous was 99% single and 1% others; Aseel was 75% pea and 25% rose comb; Hilly was 88.9% single and 11.1% others. Among three genotypes, the average age of cocks was 1.39± 0.08, 2.01± 0.26, 1.16± 0.09 years and that of hens was 1.13±0.08, 1.69±0.23, 1.26±0.09 year for Indigenous chicken, Aseel and Hilly chickens, respectively. These differences affected meat yield. The results sugegests that Aseel is superior for body weight and meat yield; therefore, a genetic improvement program can be taken for Aseel to develop a meat type line in the future.

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Introduction

Poultry, a major source of animal protein in Bangladesh, play a significant role in the present economy as well as create opportunity for employment generation in rural and urban areas. Hence, the importance of poultry as a source of income for the landless and marginal farmers, particularly women, has become increasingly recognized (Ogunlade and Adebayo, 2009). Rural scavenging poultry has significantly been contributed to the livelihoods of poor households: economically as starter capital, as a means to recover from disasters, as an accessible protein source and for disposable income, and as the expense of children's education, socio-culturally for mystical functions, hospitality and exchange of gifts to strengthen social relationships (Aklilu *et al.*, 2008). Saleque and Mustafa (1996) studied possibilities for women's participation in poultry development and concluded that most of the rural and landless women (70%) are directly or indirectly involved in poultry rearing activities, but they have little experience. Despite the tremendous growth of the poultry industry using exotic species, indigenous chickens constitute nearly 80% of the total chicken population of the country (Sarker N. R., A., 2014). About 89% of the rural households have organic backyard poultry with an average of 6.8 birds per household (Haque *et al.,* 2003). Indigenous chicken constitutes an important source of meat and egg preferred by all classes of people. Because of their pigmentation, leanness (high protein and low-fat content), taste, firmness and suitability for special dishes, they fetch premium prices almost double those of exotic chickens (Horst, 1991; Mafeni 1995; Islam and Nishibori, 2009; 2010). Indigenous chickens are reared in a scavenging system with no extra feeds, housing, vaccines, medicine, or management. Scavenging chickens thrive on residual grains in the yard, kitchen wastes, insects, earthworms and so on (Islam and Nishibori, 2009). Ninety percent of the rural household in Bangladesh raise a few poultry under a scavenging or semi-scavenging system. During the daytime, these birds scavenge and eat household waste, crop residues, insects and other available feedstuffs, and sometimes a small amount of supplemented feeds offered by the flock owner (Das *et al.,* 2008). Poultry production in rural areas suffers from serious problems including issues with housing, feeding, diseases, and other facilities, as well as a lack of knowledge of rural farmers regarding different aspects of poultry production, such as quality of feed, disease prevention and control techniques (Bulbul, 1983; Ukil, 1992). Information regarding rural poultry production and consumption patterns, constrains and farmer's livelihood in Bangladesh is very scant.

Moreover, breeding for high productivity has caused the loss of many commercials, research and indigenous genetic resources (Fulton, 2006; Delany, 2006; Woelders *et al.,* 2006). Many breeds are getting extinct leaving us without having even the very basic information about their characteristics and potential benefits. In such a scenario, phenotypic characterization of available breeds is vital for the proper management of these resources.

This study is undertaken to survey the current status of Aseel and Indigenous chickens *in situ and t*o know the morphology and production characteristics of Aseel and Indigenous chickens *in situ*.

Materials and methods

The present study was conducted based on field survey data from farmers.

Selection of study area

Three districts of Bangladesh, Bandarban Sadar Upazila of Bandarban Hill district, Sarail Upazila of Brahmanbaria district and Baraigram Upazila of Natore district, were pre-selected for conducting the present study.

These three areas were selected based on the distribution of indigenous poultry genetic resources, good transportation access, and better cooperation from farmers. Indigenous Non-descriptive chickens were studied in Baraigram Upazila, Aseel chickens in Sarail Upazila and Hilly chickens were studied in Bandarban Sadar Upazila.

The Global Positioning System (GPS) coordinate values of Bandarban Sadar Upazila, Sarail Upazila and Baraigram were between 21°55' and 22°22' North latitudes to 92°08' and 92°20' East longitudes, 24°00' and24°11' north latitudes to 90°59' and 91°15' east longitudes and 24.3083°N latitudes to 89.1708°E longitudes respectively.

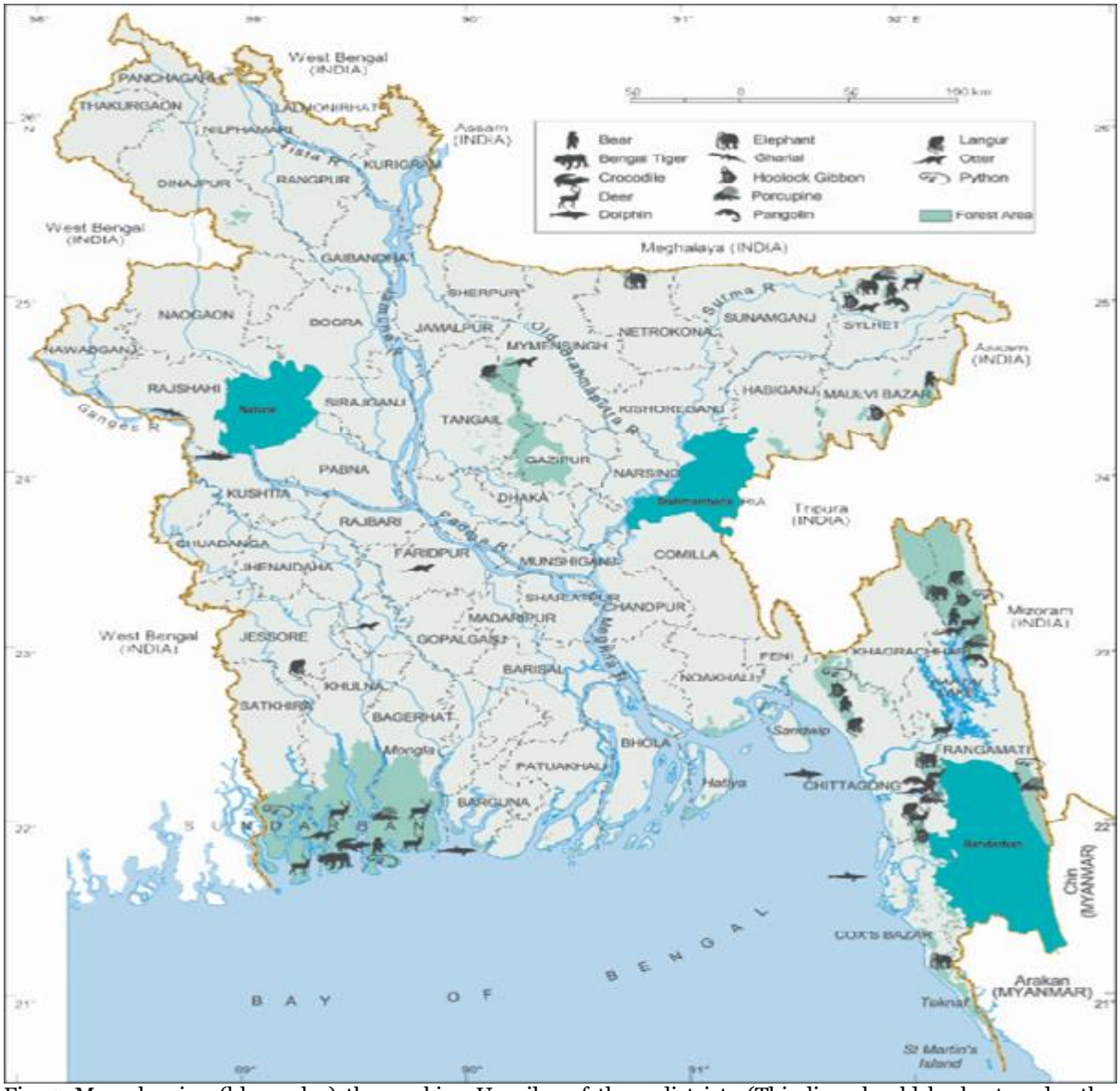

Fig. 1. Map showing (blue color) the working Upazilas of three districts (This line should be kept under the picture and the picture should be placed at right part of text or below the text.).

Sampling technique and duration of data collection

An elaborate household survey (In-depth household survey) was conducted to collect data. For this purpose, 200 (Bandarban sadar 55, Sarail 80 and Baraigram 65) randomly selected households (HH) were surveyed. For proper identification and data collection, a chicken leg band was used. Simple and direct questions were used to obtain information. Information regarding the number of chickens per household, age and sex group (chick, pullet, cockerel, hen, or cock), the morphology of adult chickens (Comb type, ear lobe color, shank color, plumage pattern), housing pattern, length of lighting practiced for laying hens, available feeds and feeding system, disease prevention measures and treatment practiced by the farmers were investigated through interviewing the farmers. The chickens were categorized into cock (male chicken>8 months), hen

(female chicken>8 months), cockerels (male chick 2-8 months), pullet (female chick 2-8 months) and chicks (unsexed chick <2 months of age).

Measurement of dependent and independent variables

In this study, the dependent variables were chicken type; on the basis of availability Hilly, Aseel and Indigenous chicken were taken into consideration in the selected areas. The number of chickens according to age group; the number of cock, hen, cockerel, pullet and chicks were documented during the study. Age (year); male/female, body weight (kg), shank length (cm), height up to back (cm), and height up to head (cm) were also documented during the study.

The study was measurement the following independent parameters: plumage pattern; normal or others, and comb type; it is an important parameter for phenotypic characterization of chicken-single, rose, pea and others, comb color- red & pale red were recorded in this experiment. Ear lobe color; red & white, shank color-white, black & yellow, skin color-white & yellow and finally, egg shell color- white & light brown were recorded. Besides these, the management practices of these three genotypes in these areas were recorded. Management system-semi-intensive/intensive, housing- bamboo made, wooden or others, lighting for layers, proper ventilation, feed supplement, use of vaccine and marketing system were documented in this study.

Data analysis

The collected data were complied, tabulated and analyzed. The quantitative variables were analyzed to obtain descriptive statistics using General Linear Model (GLM) multivariate analyses procedure under Statistical Package for the Social Sciences (SPSS 17.0). The qualitative parameters were analyzed using descriptive statistics and compared as percentages using the same software package.

Results and discussion

After data analysis, it was observed that the average number of chickens per household was almost the same in Baraigram and Sarail (7.2 3±4.46 and 7.69± 2.75); however lower value was observed in the Bandarban Hill district (5.11± 1.78) (Table 1). The percentage of different sex and age group has been shown in Fig. 2a-c. The morphological characteristics of three types of chicken reared in three locations have been presented in Table 2. Phenotype is an important characteristic of any species. For the characterization of indigenous chicken, eight phenotypic characters were considered in this study. The characters were bird type, plumage pattern, shank color, comb type & color, earlobe color, skin color and eggshell color**.** Three genotypes were considered, namely Indigenous, Aseel and Hilly. All chickens were found to have a normal plumage pattern. In the case of shank color, 3 shank-colored chickens were found in the studied villages (Fig. 3). The shank of indigenous chicken was 90% white and 10 % black, while the shank color of Aseel chicken was observed to be 100% yellow. The shank color of Hilly chicken was 50% yellow, 39% white and 11% black. Tabassum (2012) described 4 shanks colored, 52% white, 2% white & red, 36% black and 10% yellow in indigenous chickens (Daikwo *et al.*, 2011) recorded 8.5% white, 13.75% black, 37.25% black/yellow and 40.5% yellow (Sarker *et al.*, 2014). reported the most predominant shank color was white in forest ecotype, but grey, black & yellow-colored shanks were also found and all the chickens had yellowish shank color in Aseel chicken in Bangladesh. In the case of Hilly and Aseel chicken, 100% comb color was red, but for indigenous, 99% was red and the rest was pale red color (Fig. 4). The comb type of Indigenous was 99% single and 1% others; Aseel was 75% pea and 25% rose comb; Hilly was 88.9% single and 11.1% others. The single comb was the commonest (96.45%), followed by rose (3.10%), while pea was the least (0.44%) reported by Apuno *et al.* (2011). Badubi *et al.* (2006) reported that the Indigenous chickens were mostly single combed, as was also observed by Sarker *et al.* (2011) in Asia among the Indigenous chickens of Bangladesh. Thus, the results of the present study and published reports from others research works suggest that the single comb is dominant over any type of combs elsewhere.

Table 1. Population dynamics of three genotypes.

Parameter	Location		
	Natore	Brahmanbaria	Bandarban
Genotypes	Indigenous	Aseel	Hilly
Total house-holds	65	80	55
Total number of chickens	238	100	92
Chicken/house-hold	7.23+4.46	7.69 + 2.75	5.11 + 1.78
Cock/house-hold	0.57± 0.14	1.69 ± 0.31	2.00±0.13
Hen/house-hold	2.27± 0.25	3.31± 0.27	0.16± 0.10
Cockerel /house-hold	1.33 ± 0.19	00.00	0.07± 0.04
Pullet /house-hold	0.53± 0.26	0.08 ± 0.04	1.96± 0.06
Chick/house-hold	3.23 ± 0.54	2.62 ± 0.65	0.95± 0.65

The earlobe color of Indigenous was 53.33% red and 46.66% was white; for Aseel 100% was red and for Hilly 83.3% was red and 16.9% was white (Fig. 5) which are similar to the findings of Biswas (2005) reported that the red earlobe color of Indigenous chicken was predominantly red (58%) followed by white earlobe (45.8%) but Ahmed and Ali (2007) however found 80.55% white earlobe color of indigenous chicken. The result shows that indigenous chicken mainly laid white (93.33%) colored eggs and light brown (6.66%) (Fig. 6) which is similar findings of Tabassum (2012).

Biswas (2005) reported that the indigenous chickens laid light brown (62.42%) to the cream of off white (30.28%) colored eggs, but Aseel laid about 20% white & 80% light brown color egg and Hilly laid 8303% white & 11.7% light brown color eggs.

Table 2. Phenotypic characteristics of adult Indigenous, Aseel and Hilly chicken.

Parameter		Genotype		
		Indigenous	Aseel	Hilly
Number of observation (n)		65	80	55
Plumage pattern	Normal (%)	100	100	100
Shank color	White (%)	90	-	39
	Black (%)	10	-	11
	Yellow (%)	-	100	50
Comb color	Red (%)	99	100	100
	Pale red (%)	1	-	-
Comb type	Single (%)	99	-	88.9
	Rose (%)	-	25	-
	Pea (%)	-	75	-
	Others (%)	1	-	11.1
Ear lobe color	Red (%)	53.33	100	83.3
	White (%)	46.66	-	16.9
Egg shell color	White (%)	93.33	20	83.3
	Light brown (%)	6.66	80	11.7

The average age, weight and body measurements of adult chickens in three genotypes have been presented in Table 3. Among three genotypes, average age of cocks was 1.39± 0.08, 2.01± 0.26, 1.16± 0.09 years and that of hens was1.13±0.08, 1.69±0.23, 1.26±0.09 year for Indigenous chicken, Aseel and Hilly chickens, respectively. Differences for age among the genotypes of both sexes were statistically

significant (p<0.05). Average body weight of cocks was 2.29±0.05, 3.38±0.08, 2.11±0.11 kg and that of hens was0.89±0.03, 2.61±0.05, 1.38±0.04kg in Indigenous chicken, Aseel and Hilly chickens, respectively. Differences for weight among the genotypes of both sexes were statistically significant (p<0.05). Shank lengths for indigenous chickens were found to be 9.29± 0.04and 6.87± 0.15cm in cocks and hens, respectively; that was 13.07 ± 0.09 and 12.87± 0.06cm in cocks and hens, respectively in Aseel, and in Hilly chicken that was 11.40±0.26cm for cocks and 8.57±0.08cm for hens. These differences were statistically significant (p<0.05) among the three genotypes. Height up to back and height up to head also varied among the three genotypes, as shown in Table 3. There were significant differences (p<0.05) for those two parameters among Indigenous chickens, Aseel Hilly chickens.

Table 3. Age, weight and body measurements of adult chickens in three genotypes.

Parameter / Genotype		Indigenous (n=62)	Aseel (n=42)	Hilly (n=36)	Significance level
Age (year)	Male	1.39± 0.08^{b}	2.30± 0.26^{a}	1.16± 0.09^{c}	**
	Female	1.13 ± 0.08^{c}	1.69 ± 0.23^{a}	1.26 ± 0.09^{b}	**
Body weight (kg)	Male	2.29 ± 0.05^{b}	3.31 ± 0.08^{a}	2.11 ± 0.11^{c}	**
	Female	0.89 ± 0.03^{c}	2.61 ± 0.05^{a}	1.38 ± 0.04^{b}	**
Shank length (cm)	Male	9.29 ± 0.04^{c}	13.08 ± 0.09^{a}	11.42 ± 0.26^{b}	**
	Female	6.87 ± 0.15^{c}	12.85 ± 0.06^{a}	8.57 ± 0.08^{b}	**
Height up to back (cm)	Male	28.69 ± 0.48^{c}	41.53 ± 0.44^{a}	30.47 ± 0.67^{b}	**
	Female	24.21 ± 0.46^{c}	33.81 ± 0.64^{a}	26.57 ± 0.48^{b}	**
Height up to head (cm)	Male	33.72 ± 0.79^{c}	67.69 ± 0.40^{a}	35.58 ± 0.91^{b}	**
	Female	27.32 ± 0.42^{c}	58.96 ± 0.53^{a}	29.83 ± 0.48^{b}	**

Significant level ** p<0.05; a,b.c: Means within rows with different superscripts differ significantly.

Table 4. Least square mean of laying parameters of Aseel, Indigenous and Hilly chicken.

Parameter	Indigenous	Aseel	Hilly	Level of significance
Puberty age (day)	190.94± 0.51	205.92± 3.29	188± 0.71	*
Puberty weight (g)	986.89± 15.17	2329.63± 17.82	2136± 87.20	**
Clutch no./ laying year	3.86± 0.07	3.86± 0.44	3.80± 0.41	NS
Total no. of egg/ laying year (no.)	36.65± 0.09	40.00± 0.28	44.56± 0.25	*
Egg weight (g)	39.12± 0.09	49.23± 0.11	41.15± 0.19	**
Egg volume (cm3)	36.07± 0.25	37.70± 0.23	35.70± 0.21	NS

* = 5% (p<0.05),

** = 1% (p<0.01), NS= Not-significant; n = number of observations.

The estimated average number of clutches per hen in indigenous, Aseel & Hilly chicken were 3.86±0.07 and the number of eggs per hen per year was 36.65±0.09; 3.80± 0.41 and 44.56± 0.25, respectively. Faruque *et al.* (2010) found that the numbers of eggs/hen from starting to ten months of laying period were 108 in Indigenous chicken which was higher than the present finding. Islam *et al.* (2011) reported the number of eggs per clutch: as 15.7±1.24 and the number of clutches per year at 3.4±0.25, which was similar to the findings of the present study. On the other hand, Das *et al.* (2008) observed 45-50 eggs/year; these findings were also similar to the present findings.

So, it can be stated that such variations might be due to sampling size, feeding or management system, as well as the studied location of Bangladesh.

Table 5. Management practices for chicken in three locations.

Parameter		Genotype		
		Indigenous	Aseel	Hilly
Management system on the basis of input supply		Semi-intensive	Semi-intensive*	Semi-intensive
Feeding system	Only scavenging (%)	60	60	80
	Scavenging + one time supplement (%)	35	35	20
	Scavenging + two times supplement (%)	5	5	-
Feed used as supplement	Cooked rice (%)	50	20	60
	Rice granule (%)	40	80	40
	Paddy (%)		10	-
	Rice bran	10	-	-
Lighting system	Artificial lighting (%)	-	-	-
	Natural lighting (%)	100	100	100
House	Readymade small house (%)	13	-	-
	Homemade earthen house (%)	50	-	-
	Wooden house (%)	37	50	-
	Bamboo house (%)	-	50	40
	Kept in case in night time in bed room/store room/kitchen (%)	30	-	60
Housing materials	Mud	40	-	-
	Wood	20	40	10
	Tin	20		
	Bamboo	-	60	90
Treatment	Regular vaccination (%)	26.34	26.34	-
	Partial vaccination (%)	20.00	20.00	-
	No vaccination (%)	53.66	53.66	100
	Regular de-worming (%)	26.34	26.34	-
	Partial de-worming (%)	20.00	20.00	
	No de-worming (%)	53.66	53.66	
	Treatment done by Veterinary expert (%)	20	20	-
	Non- veterinary expert (%)	80	80	-

Table 6. Utilization and marketing information of three genotypes.

Parameters		Genotype		
		Indigenous	Aseel	Hilly
Number of house-hold (n)		65	80	55
Egg used	Consumed by farmer (%)	40	25	50
	Used for hatching (%)	60	75	50
Egg sold	At home (%)	20	-	5
	To the middle men (%)	60	-	60
	In the market (%)	20	-	35
Live bird consumed	Consumed by farmer (%)	30	20	50
	Used for hatching (%)	70	80	50
Live bird sold	At home (%)	10	60	-
	To the middle men (%)	30	30	50
	In the market (%)	60	10	50

The estimated average number of clutches per hen was 3.86±0.44 and the number of eggs per hen per year was 40.00±0.28 in Aseel chicken. Sarker et el., (2011) reported the number of egg production/hen/year was 33 and those findings support the present findings. Haque *et al.* (2003) reported that total egg production/per year in Aseel ranged from 21 to 74, which also agreed to present findings. The estimated average egg weight of Indigenous chicken was 39.12±0.09g in the present study. Islam *et al.* (1985) observed that the average egg weight of 35.5g in Indigenous chicken is lower than in the present study. Haque (2000) found egg weight to range from 37 to 40g, which was similar to the present findings. Khatun *et al.* (2005) recorded the average egg weight of Indigenous chicken at BLRI 42.08g, which is higher than the present findings. Faruque *et al.* (2007) stated that egg weight at 36 weeks of age was 42.6g which was also higher than the present finding.

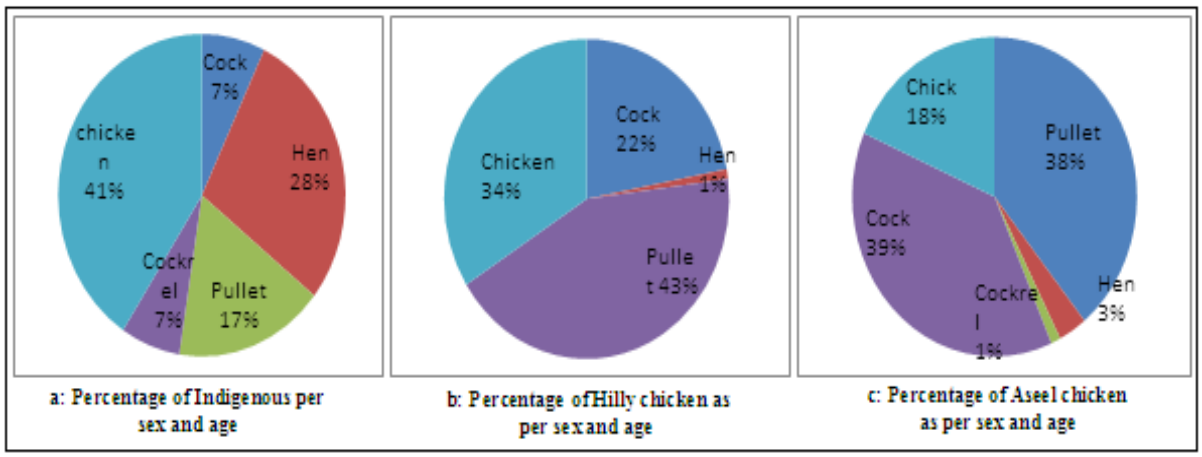

Fig. 2. Percentage of chickens as per sex and age.

The estimated average egg volume was 36.07±0.25 in the present study. Limited published information on egg volume of Indigenous chicken is available. Salah Uddin and Howlider (1998), Islam *et al.* (2001), Khatun *et al.* (2005), and Yeasmin and Howlider (1998) found a significant difference in egg volume in Indigenous full feathered layers compared to Indigenous autosomal dwarf chickens. The results of the present study revealed that the average egg weight was 49.23±0.11g and egg volume was 37.70±0.23cm3 in Aseel chicken which was higher than (Islam and Dutta 2010), who reported egg volume of Aseel as 34.99 cm3. Haque *et al.* (2013) reported egg weight ranged from 38 to 56g which agreed with the present finding. The variations in egg parameters between genotypes, as well as the findings of different authors, might be due to differences in breed, environment, and sample size or maybe methods of estimation and model used (Table 4). The estimated average puberty age and weight of Indigenous chicken were 237.94± 0.51 days, 986.89± 15.17g; 205.92± 3.29 d, 2329.63± 17.82g and 188± 0.71d, 2136± 87.20g respectively.

Fig. 3. Shank color of chicken.

It can be seen that the average puberty age of Aseel chicken was 205.92± 3.29 days and puberty weight was 2329.63± 17.82g. Sarker *et al.*, (2011) reported that puberty age was 230-240 day in Aseel hen, which was similar to the present findings. Sarker (2011) reported that the average adult live weight in Aseel females was 2062.50±105.26g which was less than the present findings. Umesh *et al.* (2000) reported that the age of the first egg of Aseel birds was 29 weeks which was also lower than the present findings. Chattergee *et al.* (2007) reported mature body weight of Aseel chicken was 2.43-3.81 kg which was similar to the finding of this study. Assaduzzaman (1990) reported that the mature body weight (kg) of Aseel was 1.7-4.50 kg which agreed with the present study. (Roberts, 1997) reported that the body weight of adult Aseel chicken ranged from 1.35-2.25 kg in females. Islam *et al.* (2005) also observed that the average body weight of Aseel hen was 2.43 kg which was similar to the present finding.

Fig. 4. Comb types of chicken.

The similarity of different studies for puberty age and weight of Aseel is due to the fact that Aseel is a breed and so common characteristics in all locations. Table 5 shows the chicken rearing and management practices in the studied areas.

Fig. 5. Earlobe types of chicken.

The chicken rearing and management practices in the selected areas were not satisfactory. 100% management system was semi-intensive. Approximately 30% of farmers kept chickens in their living houses. 50% of houses are made of earthen, 37% of wooden houses and 13% of houses were made of tin for indigenous chickens. In the case of Aseel, 50% of houses were made of bamboo and 50% were made of wooden (Fig. 7). 100% of farmers did not use lighting & ventilation system. Generally, chickens picked up grains such as rice, vegetables, green grass, insect, earthworm etc. from the yard, as chickens were reared under a semi-intensive system. Farmers supplied feed 2 times daily and maximum supplied only a carbohydrate source: that is broken rice, wheat, rice polish etc. Chickens in the study area mostly depended on scavenging feed that was insufficient for their requirement and contained low nutrients. Huque *et al.* (1992) reported that native chickens consumed 9-27 g/bird/day scavengeable feedstuffs, which is lower than the standard requirement and contained low nutrients and may be one of the

important factors that cause low productivity of local chickens (Das *et al.*, 2008). 73.33% of the farmers in selected areas did not vaccinate their chickens, whereas the remainder vaccinated once or twice per year. The vaccination programs are mainly provided by local livestock personnel and other experts. 100 by indirect% farmers were selling their chickens by indirect marketing systems.

Fig. 6. Egg shell color of chicken.

Fig. 7. Different types of the chicken house used in the selected sites.

About 40%, 25% and 50% of eggs of Indigenous chickens, Aseel and Hilly chicken, respectively, were consumed by farmers. The utilization and marketing system of the three genotypes is shown in Table 6.

Conclusion

Aseel, Hilly and Indigenous chickens were studied under a semi-intensive system in the home tract, i.e., in Sarail, Bandarban sadar and Baraigram upazila, respectively. The management system was found to be the same in three locations except for the rearing and mating system of Aseel cock. Breeding Aseel cock and fighting Aseel cock was reared in an intensive system and control mating was practiced for Aseel. Variation in shank color and comb type was observed in Indigenous chickens. Aseel had only a pea comb and a yellow color shank. The body weight of Aseel was significantly more from hatch to maturity than Indigenous & Hilly chickens. These differences affected their meat yield of them. The findings of the present study indicate that Aseel had better growth and laying performance than Indigenous chickens. Better performances of Aseel compared to Indigenous chicken, as well as homozygosity in some morphological characteristics, indicates that genetic improvement of Aseel for growth might be more logical using the principles of animal breeding and genetics.

Ethical approval

All animal procedures followed the protocol approved by the Animal Experimental Ethics Committee of Bangladesh Livestock Research Institute, Savar, Dhaka-1341 (BLRI: 2020/2/2).

Consent to participate

Not applicable.

Consent to publish

Not applicable.

Availability of data and materials

Not applicable.

Conflicts of interest

No potential conflict of interest relevant to this article was reported.

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