Indigenous chicken genetic resources in Bangladesh: current status and future outlook

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Summary

Livestock especially poultry is a promising sector for poverty reduction in Bangladesh. Approximately 140 million chickens are scattered throughout 68, 000 villages in the country mostly of indigenous non-descript type. The production system for indigenous chickens is smallholder backyard scavenging in nature with each family keeping an average of 6-7 chickens to meet family requirements and from which a cash income can also be derived when necessary. Indigenous chickens produce about 75% of the eggs and 78% of the meat consumed domestically. Among said indigenous chicken genetic resources non-descript Deshi Aseel and Naked Neck breeds are noteworthy

The non-descript Deshi chicken constitutes about 90% of the indigenous population. Also known as '*Murghi*' they have undergone unknown periods of natural selection and are a reservoir of excellent genetic diversity. They show high levels of morphological and phenotypic variability and increased fitness under natural settings. Studies reveal that they may be regarded as one breed or population because of the small genetic distances among them. Deshi chickens are characterized by black (75%) and red (25%) plumage colour; black (39%) yellow (32%) and white (29%) shank color; black (99%) eye color; bright red (59%) and pale (41%) comb colour; white (82%) and yellow (17%) skin colour; no definite (61%) and lacing (17%) feather pattern; medium (70%) and large (19%) body size; single comb (97%) and rudimentary spur (98%); medium egg size (80%); light brown (67%) and white (27%) egg shell colour. Regarding production traits Deshi chickens have average hatch weight of 29 g; body weight at 4 8 12 weeks; weekly weight gain (0-12 weeks) of respectively of 77 175 315 24 grams; age at first egg (175 days); weight of pullet (0.9 kg); mature body weight (1.3 kg); hatchability (52%); fertility (83%); annual egg production (45 -50 eggs); 9% mortality up to 500 days of age.

The indigenous chicken population of Bangladesh has been undergoing genetic erosion since the 1960s following the introduction of improved stock from developed countries. Efforts to sustain commercial hybrid broiler and layer chicken farming under intensive and semi-intensive production models have been tested but efficiency of systematic characterization screening breed improvement and conservation programmes with the indigenous Deshi chickens at the smallholder village levels (*in-situ*) of Bangladesh are yet to be tested. Such an initiative may help to save these creatures from the grip of the threat of extinction. This in turn may help to sustain

village chicken production system in Bangladesh and could be a useful micro-economic strategy in the on-going poverty alleviation process in the country.

Résumé

L'élevage et en particulier l'élevage de volailles est un secteur important pour la réduction de la pauvreté au Bangladesh. Environ 140 millions de poulets sont élevés dans 68.000 villages la plupart appartenant à des races indigènes sans description du type. Le système de production des poulets indigènes est constitué de petites unités au sol avec une moyenne par élevage fermier de 6-7 poulets pour couvrir les besoins de la famille avec possibilité si nécessaire d'un revenu. Les races indigènes produisent environ 75% des oeufs et 78% de la viande consommés par famille. Mises à part ces ressources génétiques indigènes il faut aussi souligner l'importance de races non décrites de Deshi Aseel et Naked Neck.

La race non décrite Deshi représente environ 90% de la population indigène. Bien connue aussi comme "*Murghi*" ces populations ont été soumises à des périodes de sélection naturelle et représentent un excellent réservoir de diversité génétique. Le niveau de variabilité morphologique et phénotypique est élevé et en conditions naturelles on observe une amélioration de l'état physique. Des études ont indiqué qu'on peut les considérer comme une seule race ou population étant donné la courte distance génétique entre elles. Les poulets Deshi possèdent un plumage noir (75%) et rouge (25%); des pattes noires (39%) jaunes (32%) et blanches (29%); des yeux noirs (99%); une crête rouge intense (59%) ou pâle (41%); une peau blanche (82%) et jaune (17%); forme du plumage non défini (61%) et défini (17%); taille corporelle moyenne (70%) et grande (19%); crête unique (97%) et ergot rudimentaire (98%); taille des oeufs moyenne (67%); couleur de la coquille des oeufs brune (67%) et blanche (27%). En ce qui concerne la production les poulets Deshi pèsent en moyenne à l'éclosion 29 gr.; le poids corporel à la semaine 4 8 et 12 avec un gain de poids par semaine (0-12 semaines) respectivement de 77 175 315 24 gr.; âge à la première ponte d'œufs (175 jours); poids de la poulette (0,90 kg); poids corporel à la maturité (1,3 kg); niveau d'éclosion (54%); fertilité (83%); production annuelle d'œufs (45-50 œufs); 9% de mortalité jusqu'à 500 jours d'âge.

Depuis les années 60 la population indigène de poulet au Bangladesh a subi une érosion génétique à cause de l'introduction de races améliorées en provenance des pays développés. Des efforts ont été fait pour encouragé la commercialisation des hybrides de poulets d'engrais et de ponte en conditions de production intensives et semi-intensives mais l'efficacité de la caractérisation systématique la sélection l'amélioration de race et les programmes de conservation avec les poulets Deshi dans les conditions d'environnement au niveau des villages (in-situ) du Bangladesh doivent encore être testés. Ce genre d'initiative peut aider à sauver ces animaux de l'extinction. En même temps cela permettrait d'aider la production de poulets au niveau des villages du Bangladesh tout en étant utile pour la stratégie micro-économique du procès de réduction de la pauvreté dans le pays.

***Keywords**: Genetic resources Indigenous chicken Bangladesh.*

Introduction

The economy of Bangladesh heavily depends on its agricultural resources. Livestock is the most viable sector in the economy of the four sub-sectors of agriculture (crop livestock fisheries and forestry). At present livestock contributes 6.5% to GDP on the basis of value added through its production of milk eggs meat and hides and skins. Poultry production and poultry related industry contributes most significantly to the total livestock sector in Bangladesh some 21% of the total livestock contribution whereas the livestock sub-sector contributed 12 to 14% to total agricultural GDP in 1998 - 99 at current prices (Khan and Roy 2003).

It is estimated that there are about 140 million chickens and 13 million ducks in the total poultry population (DLS 2000).

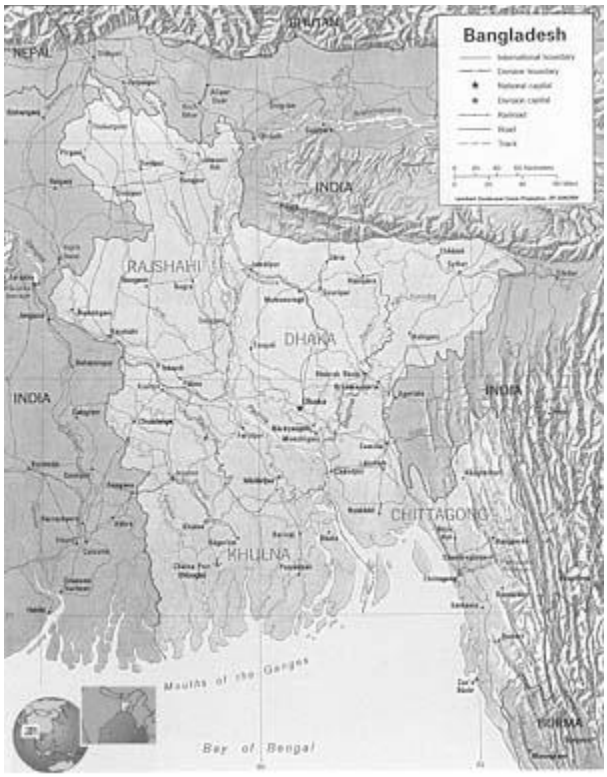

Figure 1. Geographic map of Bangladesh.

Poultry production in Bangladesh is dominated by indigenous chickens. Indigenous chickens constitute nearly 80% of the total chicken population of the country (DLS 1998). About 89% of the rural livestock-holders rear chickens and the average number per household is 6.8. Very little is known however about the indigenous chicken flocks their genetic makeup management bird performance disease resistance and adaptation to local conditions. Therefore the aim of this study is to summarize the current status of the indigenous chicken genetic resources of Bangladesh and thereafter to suggest how they could be improved under the existing village conditions of the country.

Location and Temperature

Bangladesh is located between 20.75°N and 25.75°N in latitude and between 88.30°E and 92.75°E in longitude. The mean annual temperature is about 26°C (Figure 1). Mean monthly temperature ranges between about 18°C in January and 30°C in April-May. Extreme temperatures range between about 4°C and 43°C except on the coast. Ground frost is occasionally experienced in exposed parts of the hill areas but not on the plains.

Breeds/Types of Chicken

The indigenous chicken population is composed of a number of breeds/types such as non-descript Deshi Aseel Naked Neck and Hilly. Some dwarf chickens and Red Jungle Fowls can also be seen in the country. The non-descript Deshi chicken is more acceptable to rural people as an important source of meat and eggs (Barua and Howlider 1990) due to lower nutritional demand and higher resistance to diseases and heat stress. These rural Deshi chickens provide about 78% of poultry meat and 75% of eggs for domestic consumption. But these potential genetic resources are undergoing genetic erosion due to continuous introduction of exotic stock from developed country and their indiscriminate crossing with the indigenous chickens. No attempts have been made to improve and conserve these valued genetic resources.

Production and Management System

Chicken rearing is popular in the villages as a means of deriving food and extra income. Chicken rearing is culturally acceptable and technically and economically viable. Moreover the ownership of chickens is entirely in the hands of women. The common production method in the villages is backyard scavenging. The village chicken is a low producer because of poor genetic makeup and inadequate nutrition and management. In spite of this backyard chicken farming is a highly cost-effective enterprise because the inputs required to sustain the system are small. No cost is incurred by the farmers stocks and feeds are internally generated and health care is expected to be provided free by the government. Indigenous chickens have the advantage of being well adapted to the local environmental conditions (hot humid dry and rainy weather). Indigenous chickens are scavengers by nature and a system of supplementary feeding is not practical. The birds scavenge for their own feed from morning to evening around houses and fields. They depend on field grains insects earthworms green matters crop residues homestead pickings and kitchen wastes. No commercial diets are given to them. The eggs are naturally incubated under broody hens.

Distribution Housing and Diseases

The Deshi chickens and Naked Neck chickens are distributed throughout the country except in some hilly areas of the country. The Aseel indigenous game birds are found in Sarail Thana in the Brahmanbaria district and in the Chittagong region. Hilly birds are seen in hilly areas of the Chittagong region of the country.

Table 1. Morphological characteristics of indigenous Deshi chicken of Bangladesh.

Trait	Description
Plumage colour	Black (75 %) and red (25 %)
Shank colour	Black (39%) yellow (32%) and white (29%)
Eye colour	Black (99%)
Ear lobe colour	Red (80%) and white (20%)
Comb colour	Bright red (59%) and pale ((41%)
Skin colour	White (82%) and yellow (17%)
Egg shell colour	Light brown (67%) and white (27%)
Feather pattern	No definite (61%) and lacing (17%)
Body size	Medium (70%) large (19%) small (11%)
Comb type	Mainly single (97%)
Spur	Rudimentary (98%)
Egg size	Medium (80%)

Table 2. Morphological characteristics of Naked Neck Aseel and Hilly chicken of Bangladesh.

Trait	Naked neck	Aseel	Hilly
Plumage colour	Black or reddish	Deep purple	Grey or reddish
Skin colour	Yellow	white/yellow	Yellow
Shanks	Featherless	Featherless	Featherless
Egg shell colour	Brownish	Brownish	Brownish

Figure 2a. Deshi rooster.

Ninety nine per cent farmers keep their chickens in earthen houses. Out of 99% about 22% keep their chickens inside the owner's bed room. In most of the mud houses space and ventilation system are not adequate. Inside the houses some bedding materials (litter) such as ash and sand are used. These materials are easily available to the farmers and cost nothing. The owner does not or cannot clean the houses every day but about once in 15 days cleaning takes place and is normally done by women. The chickens sometime lay eggs outside the chicken houses e.g. in store room or similar quiet places.

In the scavenging village chicken production system disease is the main constraint. The common diseases are Newcastle disease coccidiosis fowl cholera and fowl pox. Government vaccination programmes often do not reach the rural villages mainly due to insufficient veterinary extension services and shortage of vaccines.

Morphological Characteristics

In Bangladesh non-descript Deshi (Figure 2a and 2b) Naked Neck (Figure 3) Aseel (Figure 4) Hilly (Figure 5a and 5b) and Red Jungle Fowls (Figure 6) chickens comprise the indigenous chicken population. They show high levels of morphological and phenotypic variability and increased fitness under natural settings. Studies reveal that they may be regarded as one breed or population because of the small genetic distances among them (Okada *et al.* 1987). The Aseel is divided into two types Sarail and Chittagong. The morphological descriptions of indigenous chickens of Bangladesh are shown in Table 1 and 2.

Genetic Characterization

The volume of work pertaining to the genetic constitution of the indigenous chickens of Bangladesh is very thin. In the 1980s collaboration between Japan and Bangladesh Agricultural University attempted to clarify the gene constitution at the morphological and blood group loci of the Deshi chicken in Bangladesh (Okada *et al.* 1988 Zaman *et al.*, 1991). Genetic distance was estimated from gene frequencies at 4 blood groups and plasma polymorphic proteins (the AKP AKP-2 ES-1 Amy-1 Amy-3 Alb Pas and Tf loci). The gene frequencies at morphological loci were also used to compare chickens of different districts (geographical areas of the country). The morphological characteristics observed were: a) comb shape; b) ear lobe colour; c) feather colour; and d) shank colour. Concerning the gene frequency at each locus some variations were observed among the districts. Good variation in the frequencies of the E and I alleles controlling feather colour was noticed. The genetic distances among indigenous Deshi populations were very small but the distance between the Deshi and Aseel was relatively large which almost corresponded to the differences between the breeds. These studies further revealed that no systematic selection had been carried out on those morphological characteristics of the indigenous chickens of Bangladesh.

Figure 2b. Deshi chickens.

Table 3. Performance of indigenous chickens of Bangladesh.

	Type of indigenous chicken			
Trait	Deshi	Naked Neck	Aseel	Source
Hatch weight (g)	29			Hoque *et al.* 1975
Body weight (g) at 4 weeks	77[1]			Hoque *et al.* 1975
at 8 weeks	175*			Hoque *et al.* 1975
at 12 weeks	315*			Hoque *et al.* 1975
Weekly weight gain (0 - 12 wks), (g)	24*			Hoque *et al.* 1975
Age at first egg (d)	175	234	240-300*	Barua 1992; Huque and Ebadul 1990; Sazzad 1986; BLRI 1999; Huque 1999
Mature body weight (kg)	1 - 1.3	1.171	1.7-4.50*	Okada *et al.* 1988; Huque and Assaduzzaman 1990; BLRI 1999
Egg production/hen/year (no.)	45-50	50-55	33*	Yoshimura *et al.* 1997; Sazzad *et al.* 1990; Hoque *et al.* 1975; Ahmed and Islam 1985; Huque *et al.* 1990; BLRI 1999
No. of eggs/clutch	10 - 16			Sazzad 1986
No. of clutch/year	3-4			Huque *et al.* 1990
Egg weight (g)	35-39	42		Sazzad 1986; Ahmed and Islam 1985; Hoque *et al.* 1975
Fertility (%)	83 %			Hoque *et al.* 1975

Hatchability of all eggs set (%)	75 - 87		Barua 1992; Sazzad 1986; Hoque *et al.* 1975
Feed efficiency (kg per kg body wt.)	4-5		Sazzad *et al.* 1990
Feed efficiency (kg per kg egg mass)	8.6 - 8.8		Yeasmin and Howlider, 1998
Mortality (%) (up to 500 days)	9.0	8.33*	Hoque *et al*. 2003; Azizul, 1983

*Performance under intensive management system.

Figure 3. Naked neck chicken.

Performance of Indigenous Chicken

Table 3 shows the performance of the Deshi chickens of Bangladesh summarized from various published scientific papers and research reports. Among the indigenous population egg production is higher in Naked Neck chicken. The annual egg production per hen was 50-55 in Naked Neck and was 45-50 in Deshi chickens under scavenging conditions. But the Aseel produced only 33 eggs per year under an intensive management system. In general the eggs of indigenous chicken are much sm

aller than those of exotic breeds/strains. Egg weight varied from 35-39 g in Deshi to 42 g in Naked Neck chickens. Deshi chickens attain puberty early relative to other indigenous types. The highest age at sexual maturity was 240-300 days in Aseel birds followed by 234 and 175 days respectively in Naked Neck and Deshi chickens. The mature body weight of Deshi and Naked Neck chickens was very similar and it varied from 1.0 to 1.3 kg. But the Aseel bird was heavier than other indigenous chickens. The feed conversion efficiency for per kilo body weight and per kilo egg mass production was 4.5 and 8.6 - 8.8 respectively in Deshi chickens. However data for feed efficiency in Naked Neck and Aseel chickens is not available.

Figure 4. Assel chicken.

Figure 5a. Hilly roosters.

Figure 5b. Hilly chicken.

Figure 6. Red Jungle fowl of Bangladesh.

Indigenous chickens are more resistant to prevalent diseases under a free range system. The mortality rate of Deshi birds was 9.0% up to the age of 500 days. But the mortality rate was slightly lower in the Naked Neck chicken. The hatchability of all eggs varied from 75% to 87%. This wide rage of hatchability may be due to differences in incubation systems and other environmental factors.

Breeding Programme

Breeding efforts were undertaken to improve the chicken genetic resource of Bangladesh mainly through an upgrading and/or crossbreeding programme. The main vision of all efforts was to establish a suitable type of chicken adaptable to the environmental conditions of Bangladesh. Hoque *et al*. (1975) in the early 1970s crossed indigenous Deshi chickens with White Leghorn New Hampshire and White Cornish birds and found that the Deshi chicken can be improved in a

sustainable way by upgrading with exotic breeds and that the New Hampshire upgrade was most economic for egg production under farm conditions (intensive system).

A Backyard Poultry Development Project was in operation during 1970s (Ahmed and Islam 1985) with the intention of upgrading the Deshi chicken through the production and distribution of breeding cocks and pullets in the rural project villages. This programme was initiated by the Bangladesh Agricultural University (BAU) through the financial assistance of UNICEF in 100 villages. During the project's life firstly the indigenous Deshi birds were vaccinated farmers motivated to dispose of their Deshi cocks and to rear crossbred chicken. This programme was also supplemented with feeds farmer cooperative formation (Backyard Poultry Raisers Society BPR) regular vaccinations training and marketing channel development. The society members disposed of all their indigenous cocks from the project area. The germplasm introduced was Rhode Island Red (RIR) or White Leghorn (WLH) x RIR or Australorp cocks of 18-20 weeks of age. The aim was to maintain rigidly a 50% exotic and 50% indigenous blood level under village conditions. A total of 5264 cocks 3500 pullets 1500 growing chicks and 74,100 hatching eggs were distributed among the BPRs of the project area. Implementation of said programme in the villages resulted in a significant increase in average egg production per hen per year an increase in average annual egg consumption per person and a lowering of bird mortality (growing and adult) during the project's life. However it was noticed that after withdrawal of project activity the crossbred birds failed to be sustained in the villages.

Following the BAU Backyard Poultry Development Project the government of Bangladesh took up the Cockerel Exchange Programme in the country for the development of indigenous village chickens. Improved exotic breeds (WLH RIR Fayoumi) were mainly being used for the improvement of local chickens via a crossbreeding programme through the distribution of egg chick and pullets and cockerel exchange activities. In support of this up until the 1990s the Government Central Poultry Farm and its multiplication units maintained exotic pure breeds (WLH RIR New Hampshire Plymouth Rock) and hatched day old pure-bred chicks these being sold to interested farmers and private smallholder entrepreneurs to encourage them to take up commercial chicken farming. However again no positive growth could be shown using exotic pure-breds in village conditions mainly because of problems arising of adaptability high mortality and significant genotype-environment interaction.

Experiments at the Government Central Poultry Farm Dhaka during the period from 1987 to 1989 encompassed 22 genetic groups of which 5 were pure-breds (Australorp Barred Plymouth Rock White Leghorn Rhode Island Red Fayoumi and indigenous Deshi) and the remainder were crossbreds (F_1) made up of the aforementioned pure breeds (Ambar *et al.* 1999). These studies inferred that Fayoumi may best be used for crossbreeding with WLH or RIR (Fayoumi x WLH - called Rupali and RIR x Fayoumi called Sonali). Further the resultant layers would be suitable for those farmers who wished to farm on small scale eggeries in semi-intensive conditions in Bangladesh. With the Government Central Poultry Farm producing Sonali/Rupali commercial chicken production in semi-intensive conditions in Bangladesh continued until the mid 1990s.

Another trial was commenced in 1993 (Rahman *et al.* 1996) where different exotic hens were tested in semi-scavenging conditions. One of the breed combinations was a cross between a commercial hybrid as the female line and an improved breed (Fayoumi RIR or WLH) as the

male line. Another breed combination was Sonali. The hypothesis was that the use of commercial hybrids as parent hens would satisfy the multiplication links with respect to high egg production while using another breed as males would satisfy the end users with respect to good scavenging and survival traits. Their study inferred that for the government semi-scavenging smallholder model of chicken production the breeding strategy should be based on the production of Sonali birds.

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