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Phenotypic Characterization of Indigenous Non-Descript Tarai Fowl from the Eastern Himalayan Foothills of India

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Abstract

The present study was undertaken to phenotypically characterize and evaluate the production, reproduction, egg quality, carcass, and adaptive attributes of the indigenous Tarai fowl of the Eastern Himalayan foothills of West Bengal, India, with the objective of generating baseline information for its conservation and recognition as a distinct indigenous poultry genetic resource. The investigation was carried out during 2023–2025 under the Network Project on Animal Genetic Resources of West Bengal, funded by ICAR–National Bureau of Animal Genetic Resources (ICAR–NBAGR), Karnal 132001, Haryana, and implemented by the West Bengal University of Animal and Fishery Sciences (WBUAFS), Kolkata, in the Tarai region covering Jalpaiguri, Alipurduar, and Cooch Behar districts under traditional backyard production systems. A total of 1,300 adult birds were characterized for qualitative and quantitative traits, while production and reproductive performance were recorded from approximately 900 laying hens following FAO and ICAR–NBAGR characterization guidelines. Tarai fowl exhibited a relatively uniform phenotype characterized by predominantly red and black plumage in males and light brown plumage in females, yellow skin, whitish shanks, black eyes, red combs and earlobes, and predominantly single and pea combs. Birds were maintained under scavenging systems with an average flock size of 8.5 birds per household. Mean hatch weight was 31 g, while body weights at 52 weeks averaged 1,750 g in males and 1,455 g in females, indicating clear sexual dimorphism. The mean age at first egg was 205 days, and annual egg production averaged 87 eggs per hen under backyard conditions. Average egg weight was 41.75 g, with shell, albumen and yolk weights of 3.98 g, 15.37 g and 13.32 g, respectively. Eggshells were predominantly cream coloured, and the average Haugh unit was 67.0, indicating acceptable internal egg quality. The birds exhibited strong natural broodiness with mean fertility, hatchability on fertile egg basis, and hatchability on total egg set basis of 70.0%, 85.0% and 64.0%, respectively. Male birds recorded higher hot and cold carcass weights, dressing percentages, and meat-to-bone ratios than females, reflecting superior carcass yield. Mortality was highest during the first week after hatching and declined progressively with advancing age. Farmers reported excellent adaptability of Tarai fowl to low-input scavenging systems, efficient foraging ability, tolerance to humid subtropical climatic conditions, and apparent resistance to commonly encountered poultry diseases. Carcass quality assessment showed distinct sex-wise differences. Male Tarai fowl, slaughtered at an average age of 56 weeks (vs. 58 weeks in females), exhibited higher hot carcass weight (875 vs. 675 g), cold carcass weight (857 vs. 643 g), hot dressing percentage (57.56 vs. 55.78%), cold dressing percentage (56.38 vs. 53.14%), and meat-to-bone ratio (1.79 vs. 1.62), indicating superior carcass yield, meat recovery, and overall meat production potential. The study demonstrates that Tarai fowl possesses distinctive phenotypic characteristics, satisfactory productive and reproductive performance, desirable carcass traits, and valuable adaptive attributes suitable for sustainable backyard poultry production. The findings provide baseline scientific evidence for the conservation, genetic improvement, and formal recognition of Tarai fowl as a distinct indigenous poultry genetic resource of West Bengal under the ICAR–NBAGR breed registration programme.

Keywords: Indigenous poultry, Tarai fowl, phenotypic characterization, backyard poultry, genetic resources, Eastern Himalayan foothills

Introduction

Indigenous poultry genetic resources are vital components of livestock biodiversity, contributing significantly to food and nutritional security, rural livelihoods, and the sustainability of low-input farming systems, particularly in developing countries (FAO, 2015) [3]. Reared predominantly under backyard scavenging conditions, these birds are well adapted to local agro-climatic environments and are valued for their disease resistance, foraging ability, broodiness, and resilience under minimal management (Miao *et al.*, 2005;

Padhi, 2016) [13,14]. India possesses rich indigenous poultry diversity, including several registered breeds and numerous uncharacterized populations that have evolved through natural selection and traditional farmer selection over generations (NBAGR, 2021) [10]. However, indiscriminate crossbreeding and the increasing introduction of commercial poultry strains have accelerated genetic erosion, highlighting the need for systematic identification, characterization, and conservation of indigenous genetic resources (FAO, 2012) [4].

Phenotypic characterization is the first step in the documentation and conservation of animal genetic resources, providing baseline information on morphological, productive, reproductive, and adaptive traits essential for breed identification and genetic improvement (FAO, 2011) [5]. Indigenous chickens generally exhibit lower production than commercial breeds under intensive management but outperform them under backyard production systems due to their superior adaptability, survivability, reproductive fitness, and tolerance to local diseases (Padhi *et al.*, 2015; Rajkumar *et al.*, 2021) [15,16].

The Tarai region of northern West Bengal, located in the foothills of the Eastern Himalayas, is characterized by a humid subtropical climate, high rainfall, and extensive backyard poultry farming. Rural households have traditionally maintained a distinct indigenous non-descript chicken population that is well adapted to the local environment and contributes to household nutrition, income generation, and livelihood security. Despite its apparent uniqueness and socio-economic importance, this population has not been scientifically characterized, and baseline information on its phenotypic and productive attributes remains scarce. Therefore, the present study was undertaken under the Network Project on Animal Genetic Resources of West Bengal, funded by ICAR–National Bureau of Animal Genetic Resources (ICAR–NBAGR), Karnal, Haryana, and implemented by the West Bengal University of Animal and Fishery Sciences during 2023–2025, to comprehensively characterize the phenotypic, morphometric, production, reproductive, and adaptive attributes of this indigenous chicken population, herein designated as Tarai Fowl. The findings are expected to support its conservation, genetic improvement, and formal recognition as a distinct indigenous poultry genetic resource.

Materials and Methods

Study Area

The study was carried out in the native breeding tract of the indigenous Tarai Fowl in the Tarai region of the Eastern Himalayan foothills of northern West Bengal, covering representative villages of Jalpaiguri, Alipurduar, and Cooch Behar districts. The surveyed blocks included Maynaguri, Jalpaiguri Sadar, Cranti, and Malbazar in Jalpaiguri; Alipurduar, Falakata, Kalchini, and Kumargram in Alipurduar; and Sitai, Sitalkuchi, and Mathabhanga in Cooch Behar. The study area lies between 26.3°–26.6° N latitude and 88.7°–89.5° E longitude and is characterized by a humid subtropical climate, annual rainfall of 2,500–3,500 mm, and an integrated crop–livestock production system. Indigenous chickens are traditionally reared under backyard scavenging conditions with minimal external inputs. Owing to their long-term adaptation to this unique agro-ecological region, this indigenous non-descript chicken population is locally recognized as the Tarai Fowl of West Bengal.

Sampling Strategy and Data Collection

A multistage stratified sampling design was employed between 2023 and 2025 to obtain representative coverage of the indigenous non-descript chicken population of the Tarai region. Initially, villages with a predominance of backyard poultry production were identified in consultation with local veterinary personnel and extension functionaries.

Subsequently, households maintaining indigenous chickens continuously for at least five years and practicing traditional backyard management were selected for inclusion in the study.

A total of 1,300 adult birds representing both sexes were phenotypically evaluated, while production and reproductive performance data were collected from approximately 900 laying hens maintained under backyard production systems. Information on flock structure, management practices, feeding regime, housing, health care, breeding practices, and production performance was collected through direct field observations, individual animal measurements, and structured interviews using a pre-tested questionnaire developed in accordance with the characterization guidelines of the FAO (2011) and ICAR–NBAGR (2021) [5,10].

Phenotypic and Morphometric Characterization

Phenotypic characterization was carried out following the standard descriptors for poultry genetic resources prescribed by FAO (2011) and ICAR–NBAGR (2021) [4,10]. Both qualitative and quantitative traits were recorded.

Qualitative traits included plumage colour and pattern, skin colour, shank colour, comb type, comb colour, earlobe colour, eye colour, beak colour, feather distribution, and other externally visible breed-specific characteristics. Quantitative traits included body weight at hatch, 8 weeks, 12 weeks, 24 weeks and 52 weeks (adult age), together with other morphometric measurements wherever applicable.

Body weight was recorded using a calibrated digital weighing balance with an accuracy of ± 1 g. Linear body measurements and comb dimensions were recorded using a calibrated digital vernier caliper and measuring tape as appropriate. All measurements were obtained following standardized procedures to minimize observer bias and measurement error.

Growth and Production Performance

Growth performance was assessed by recording body weight at predetermined age intervals from hatch to adulthood. Production performance was evaluated using records maintained by farmers together with periodic field monitoring. Parameters recorded included age at first egg, annual egg production per hen, clutch size, clutch length, clutch interval, brooding behaviour, and laying cycle. Annual egg production was calculated as the average number of eggs produced per hen per year under backyard production conditions.

Egg Quality Assessment

Egg quality characteristics were evaluated using freshly laid eggs collected randomly from representative households across the study area. Egg weight was measured using a calibrated digital balance with an accuracy of 0.01 g. Eggshell colour was recorded through visual assessment and classified into cream and brown categories. Owing to the extensive backyard production system and field conditions, internal egg quality parameters, including albumen and yolk characteristics, were assessed only where feasible following standard poultry egg quality evaluation procedures (Sreenivasiah *et al.*, 2018) [19].

Reproductive Performance

Reproductive performance was evaluated under the prevailing backyard production system using natural mating and natural incubation. Parameters recorded included broodiness behaviour, fertility, hatchability on total egg set basis, and hatchability on fertile egg basis. Fertility percentage was calculated as the proportion of fertile eggs to the total number of eggs set for incubation, while hatchability percentages were calculated according to standard poultry breeding procedures.

Mortality Assessment

Mortality data were collected for three age groups, namely 0–1 week, 1–8 weeks, and 8–20 weeks, through farmer records, recall information, and periodic field verification. Mortality percentage for each age group was calculated as the ratio of the number of birds that died during the specified period to the total number of birds present at the beginning of that age interval, expressed as a percentage.

Statistical Analysis

The collected data were compiled, coded, and validated prior to statistical analysis. Descriptive statistical parameters including mean, standard deviation (SD), standard error (SE), minimum, maximum, frequency, and percentage were computed as appropriate. Continuous variables are presented as mean $\pm$ standard error (SE), whereas qualitative traits are expressed as frequencies and percentages. Statistical analyses were performed using IBM SPSS Statistics Version 26.0 (IBM Corp., Armonk, NY, USA) and Microsoft Excel. Graphical representations were generated using Microsoft Excel.

Results

Phenotypic Characteristics

The indigenous Tarai fowl population exhibited a high degree of phenotypic uniformity across the surveyed districts, indicating the existence of a relatively stable indigenous population. Adult males were predominantly characterized by a combination of red and black plumage, whereas females generally possessed light brown plumage. A solid plumage pattern was the most frequently observed phenotype in both sexes. The birds exhibited predominantly yellow skin, whitish shanks, black eyes, and uniformly red combs and earlobes. Among the different comb types observed, the single and pea comb was the predominant type. The average comb size was recorded as 1.05 cm. Chick plumage colour closely resembled that of the dam, suggesting consistency in the inheritance of plumage characteristics.

Flock Structure and Management Practices

The indigenous Tarai fowl were reared predominantly under traditional backyard scavenging systems with minimal external inputs. The average flock size maintained by rural households was 8.5 birds, comprising approximately 15% cocks, 65% hens, and 20% chicks. Birds depended primarily on scavenging for feed, supplemented occasionally with household kitchen waste and locally available grains. Housing facilities were generally rudimentary, with birds being sheltered only during the night in simple kutcha structures to protect them from predators and adverse weather conditions.

Growth Performance

The growth performance of Tarai fowl under backyard production conditions is presented in Table 1. The mean hatch weight of chick was 31 ± 0.08 g. At eight weeks of age, male chicks attained an average body weight of 285.0 ± 2.6 g, whereas female chicks weighed 257.0 ± 2.3 g. By 12 weeks of age, body weight increased to 425.0 ± 3.1 g in males and 397.0 ± 2.9 g in females. The average adult body weight at 24 weeks reached 775.0 ± 2.4 g in males and 765.0 ± 2.1 g in females. The average adult body weight at 52 weeks reached 1750.0 ± 5.6 g in males and 1455.0 ± 4.8 g in females. Sexual dimorphism in body weight became evident from eight weeks of age onward, with males consistently exhibiting higher body weights than females throughout the subsequent growth period.

Egg Production Performance

The egg production characteristics of Tarai fowl are presented in Table 2. The mean age at first egg was 205 ± 1.3 days, with individual birds commencing laying between 180 and 214 days. Average annual egg production was 87 ± 1.1 eggs per hen, ranging from 60 to 98 eggs. The birds exhibited a distinct clutch-type laying pattern, with an average clutch size of 8.5 ± 0.4 eggs followed by a clutch interval of 18.0 ± 0.6 days. The average laying period extended for 12.0 ± 0.5 months, while the average age at disposal of hens under backyard production conditions was 22.0 ± 0.7 months.

Egg Quality Traits

The egg quality traits of indigenous Tarai fowl are presented in Table 3. The average egg weight was 41.75 g, ranging from 36 to 52 g. The average shell, albumen and yolk weights were 3.98 g, 15.37 g and 13.32 g, with ranges of 3.07–5.00 g, 10.12–19.60 g and 11.20–16.30 g, respectively. The average shell thickness was 0.59 mm, ranging from 0.38 to 0.82 mm. The average specific gravity, albumen index, yolk index and Haugh unit were 1.07, 65.70, 0.28 and 67.00, respectively. Eggshell colour was predominantly cream in 80% of the eggs, while 20% had brown shells. Albumen quality was predominantly thin in 93% of the eggs, with only 7% exhibiting thick albumen. Egg inclusion bodies were observed in a small proportion of eggs, with blood spots occurring in 3.33% and meat spots in 13.33% of the samples.

Reproductive Performance

The reproductive performance of Tarai fowl is presented in Table 4. Hens exhibited pronounced natural broodiness, a characteristic consistently observed under traditional backyard management. Mean fertility was $70.0 \pm 2.1\%$, ranging from 55 to 89%. Hatchability on a fertile egg basis averaged $85.0 \pm 1.9\%$, while hatchability on a total egg set basis was $64.0 \pm 2.3\%$, demonstrating satisfactory reproductive efficiency under natural incubation.

Carcass Characteristics

The carcass characteristics of indigenous Tarai fowl revealed distinct sex-wise differences as presented in Table 6. Male birds were slaughtered at an average age of 56 weeks with a range of 49–63 weeks, whereas females were

slaughtered slightly later at an average age of 58 weeks with a range of 51–67 weeks. The average hot carcass weight was higher in males at 875 g with a range of 852–891 g than in females at 675 g with a range of 631–688 g. Similarly, the average cold carcass weight was 857 g with a range of 832–876 g in males and 643 g with a range of 617–664 g in females. The average hot dressing percentage was 57.56%, ranging from 42.37% to 68.21% in males, and 55.78%, ranging from 48.21% to 71.39% in females. The corresponding average cold dressing percentage was 56.38%, ranging from 46.21% to 67.54% in males, and 53.14%, ranging from 39.87% to 71.39% in females. The average meat-to-bone ratio was higher in males at 1.79 than in females at 1.62, indicating superior carcass yield and meat recovery in male Tarai fowl.

Mortality Pattern

The age-wise mortality pattern of Tarai fowl is presented in Table 5. The highest mortality ($35.0 \pm 1.8\%$) occurred during the first week after hatching. Mortality subsequently decreased with advancing age, recording $12.0 \pm 1.2\%$ during the 1–8 week age group and $7.0 \pm 0.9\%$ during the 8–20 week age group. These observations indicate that the early brooding period represents the most critical stage for chick survival under backyard production systems.

Utility and Adaptive Characteristics

Tarai fowl were primarily maintained as a dual-purpose indigenous chicken for household egg production and meat. The birds exhibited excellent adaptability to low-input scavenging production systems and demonstrated efficient foraging ability, tolerance to prevailing environmental conditions, and apparent resilience to commonly encountered poultry diseases. Farmers consistently reported that the birds required minimal management inputs while maintaining satisfactory production and reproductive performance under traditional backyard conditions.

Table 1: Growth performance of indigenous Tarai fowl under backyard production system

Age (weeks)	Sex	Mean body weight (g) $\pm$ SE	Range (g)	N
Hatch		31 $\pm$ 0.08	23–38	207
8	Male	285.0 $\pm$ 2.6	255–305	450
	Female	257.0 $\pm$ 2.3	248–298	632
12	Male	425.0 $\pm$ 3.1	406–488	1200
	Female	397.0 $\pm$ 2.9	364–429	1058
24 (Adult)	Male	775.0 $\pm$ 2.4	739–810	1156
	Female	765.0 $\pm$ 2.1	715–775	1384
52 (Adult)	Male	1750.0 $\pm$ 5.6	1500–1900	505
	Female	1455.0 $\pm$ 4.8	1315–1575	678

Table 2: Egg production characteristics of indigenous Tarai fowl

Traits	Mean $\pm$ SE	Range	N
Age at first egg (days)	205 $\pm$ 1.3	180–214	755
Annual egg production (no./hen/year)	87 $\pm$ 1.1	60–98	930
Clutch size (days)	8.5 $\pm$ 0.4	7–14	650
Clutch interval (days)	18.0 $\pm$ 0.6	18–27	735
Laying cycle (months)	12.0 $\pm$ 0.5	9–17	735
Age at culling (months)	22.0 $\pm$ 0.7	20–28	394

Table 3: Egg quality traits of indigenous Tarai fowl

Trait	Average	Range	N
Egg weight (g)	41.75	36–52	480
Shell weight (g)	3.98	3.07–5.00	480
Albumen weight (g)	15.37	10.12–19.6	480
Yolk weight (g)	13.32	11.20–16.30	480
Shell thickness (μ)	0.59	0.38–0.82	480
Specific gravity	1.07	1.04–1.10	480
Albumen index	65.70	59.57–89.96	480
Yolk index	0.28	0.21–0.37	480
Haugh units	67.00	59.57–89.96	480
Shell colour (white/brown/cream or tinted/other)	Brown- 20% & Cream- 80%		480
Albumen quality (thick / thin)	Thick- 7%, Thin- 93%		380
Egg inclusion bodies (Blood spots/meat spots)	Blood Spot- 3.33%, Meat Spot- 13.33%		480

Table 4: Reproductive performance of indigenous Tarai fowl

Traits	Mean $\pm$ SE	Range	N
Fertility (%)	70.0 $\pm$ 2.1	55–89	165
Hatchability on fertile egg basis (%)	85.0 $\pm$ 1.9	72–96	105
Hatchability on total egg basis (%)	64.0 $\pm$ 2.3	53–78	175
Broodiness behaviour	Usual	—	—

Table 5: Age-wise mortality (%) of indigenous Tarai fowl

Age group	Mortality (%) $\pm$ SE	Range (%)	N
0–1 week	35.0 $\pm$ 1.8	29–41	75
1–8 weeks	12.0 $\pm$ 1.2	8–16	102
8–20 weeks	7.0 $\pm$ 0.9	3–12	217

Table 6: Carcass characters of indigenous Tarai fowl

Carcass characters	Male			Female		
	Avg.	Range	N	Avg.	Range	N
Age at slaughter (week)	56	49–63	75	58	51–67	110
Weight (g)	Hot 875	852–891	75	675	631–688	110
	Cold 857	832–876	75	643	617–664	110
Dressing %	Hot 57.56%	42.37–68.21	75	55.78%	48.21–71.39	110
	Cold 56.38%	46.21–67.54	75	53.14%	39.87–71.39	110
Meat: Bone ratio	1.79%	1.57–1.72	75	1.62%	1.47–1.78	110

Discussion

The present investigation represents the first comprehensive scientific characterization of the indigenous chicken population traditionally reared in the Tarai region of the Eastern Himalayan foothills of India. The study revealed a relatively uniform phenotypic profile, moderate growth and reproductive performance, and remarkable adaptability under low-input backyard production systems. Collectively, these findings demonstrate that Tarai Fowl constitutes a valuable locally adapted poultry genetic resource with considerable importance for sustainable rural poultry production and biodiversity conservation.

Phenotypic Characteristics and Population Identity

Phenotypic characterization is the fundamental step in identifying and documenting animal genetic resources and provides the basis for breed recognition, conservation planning, and genetic improvement (FAO, 2011) [3]. The predominance of red-and-black plumage in males and light

brown plumage in females, together with yellow skin, whitish shanks, red earlobes, and the predominance of the walnut comb, indicates a relatively stable and recognizable phenotypic profile within the Tarai fowl population. The consistency of these qualitative traits across the surveyed districts suggests prolonged adaptation under similar ecological conditions coupled with continuous farmer-mediated selection.

The humid subtropical climate of the Eastern Himalayan foothills, characterized by high rainfall, dense vegetation, and year-round scavenging opportunities, may have contributed to the maintenance of these characteristic phenotypes through natural selection. Plumage coloration may provide improved camouflage against predators in semi-forested environments, while morphological traits such as skin pigmentation, comb morphology, and feather characteristics are often associated with adaptation to local climatic conditions and disease pressures. Similar patterns of phenotypic stabilization have been reported in indigenous chicken populations from Asia and Africa that have evolved under prolonged geographical isolation and traditional backyard management systems (Miao *et al.*, 2005; Padhi, 2016) ^[13,15]. The observed phenotypic uniformity therefore supports the recognition of Tarai Fowl as a distinct locally adapted indigenous chicken population in accordance with the characterization principles recommended by FAO (2011) ^[4].

Growth Performance

The growth performance recorded in the present study reflects the biological characteristics typically associated with indigenous chickens maintained under scavenging production systems. Although the adult body weight of Tarai Fowl (775 g in males and 765 g in females) is considerably lower than that of specialized commercial broiler strains, it falls within the range reported for several indigenous chicken populations reared under extensive management systems worldwide (Halima *et al.*, 2007; Islam *et al.*, 2014) ^[8,12].

The relatively slow growth rate is not necessarily a limitation but rather represents an adaptive strategy developed under resource-constrained environments. Indigenous chickens allocate available nutrients not only towards body growth but also towards survival, disease resistance, reproductive fitness, and maintenance under fluctuating nutritional conditions. Such physiological adaptation enables them to perform efficiently despite irregular feed availability and minimal management interventions. Similar observations have been reported for indigenous Indian breeds including Aseel, Ghagus, and Nicobari, which exhibit comparatively lower growth rates than commercial breeds while maintaining superior survivability, longevity, and adaptability under backyard conditions (Rajkumar *et al.*, 2021) ^[17].

Furthermore, increasing consumer preference for naturally reared, slow-growing chickens with superior meat flavour and texture has renewed interest in indigenous poultry genetic resources. Consequently, the moderate growth performance of Tarai Fowl should be viewed within the context of sustainable poultry production rather than intensive commercial farming.

Egg Production and Reproductive Performance

The annual egg production of approximately 87 eggs per hen indicates satisfactory laying performance under traditional backyard management. This production level compares favourably with reports from many indigenous chicken populations maintained under similar scavenging systems in Africa and South Asia, where annual egg production generally ranges from 40 to 80 eggs per hen (Gueye, 2005; Dessie *et al.*, 2011) ^[6,2]. Comparable performance has also been documented in indigenous chickens reared in eastern India and neighbouring regions under low-input management systems (Padhi *et al.*, 2015; Singh *et al.*, 2018) ^[15,18].

The age at first egg (205 days) observed in the present study is consistent with the delayed sexual maturity commonly observed in indigenous chickens. Unlike commercial layer strains selected primarily for early maturity and high egg production, indigenous chickens exhibit a reproductive strategy that emphasizes sustained production, prolonged reproductive life, and enhanced adaptability to environmental variability.

The high hatchability observed on a fertile egg basis (85%) further demonstrates the excellent reproductive efficiency of Tarai Fowl under natural incubation. Strong broodiness, effective maternal behaviour, and efficient chick rearing are characteristic attributes of indigenous chickens and are particularly advantageous under village production systems where artificial incubation facilities are unavailable. These traits considerably reduce dependence on external inputs while ensuring flock replacement through natural reproduction.

Carcass Characteristics

The carcass characteristics observed in the present study indicate that indigenous Tarai Fowl possesses satisfactory meat production potential under backyard production systems. Male birds exhibited higher hot and cold carcass weights, dressing percentages, and meat-to-bone ratios than females, reflecting normal sexual dimorphism in indigenous chickens. This superior carcass performance is primarily attributed to greater body weight, faster growth, and enhanced muscle development in males. Similar sex-related differences in carcass traits have been reported in indigenous chicken breeds such as Aseel, Kadaknath, Nicobari, and Ghagus, as well as native chickens of Bangladesh and Ethiopia (Haunshi *et al.*, 2011; Rajkumar *et al.*, 2016; Islam and Nishibori, 2009; Dana *et al.*, 2010) ^[9,17,11,1].

The dressing percentages obtained in the present study are comparable to those reported for other indigenous chicken populations reared under backyard systems, indicating acceptable carcass yield despite slower growth than commercial broilers. The higher meat-to-bone ratio in males further suggests superior edible meat recovery. Combined with their adaptability, efficient scavenging ability, and low management requirements, these carcass attributes highlight the potential of Tarai Fowl as a valuable dual-purpose indigenous genetic resource for sustainable backyard poultry production and conservation.

Mortality Pattern and Adaptive Capacity

The elevated chick mortality during the first week after hatching observed in this study is consistent with findings reported from traditional backyard poultry systems worldwide (Gueye, 2005; Dessie *et al.*, 2011) ^[7,2]. Early chick losses are primarily attributable to environmental exposure, predation, nutritional deficiencies, and limited access to preventive health care rather than inherent genetic weakness.

A progressive decline in mortality with advancing age indicates that surviving birds acquire considerable resilience to prevailing environmental challenges. Farmers consistently reported that adult Tarai Fowl required minimal veterinary intervention and remained productive under extensive scavenging conditions. Such adaptability is likely the cumulative outcome of long-term natural selection under the humid and disease-challenged conditions of the Eastern Himalayan foothills. The ability to efficiently utilize locally available feed resources while maintaining satisfactory production under low-input management constitutes one of the principal strengths of indigenous poultry genetic resources.

Socio-economic Importance and Conservation Implications

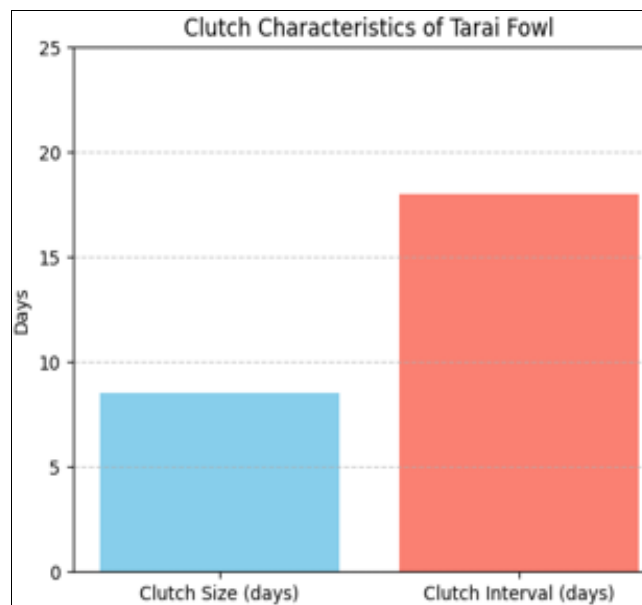
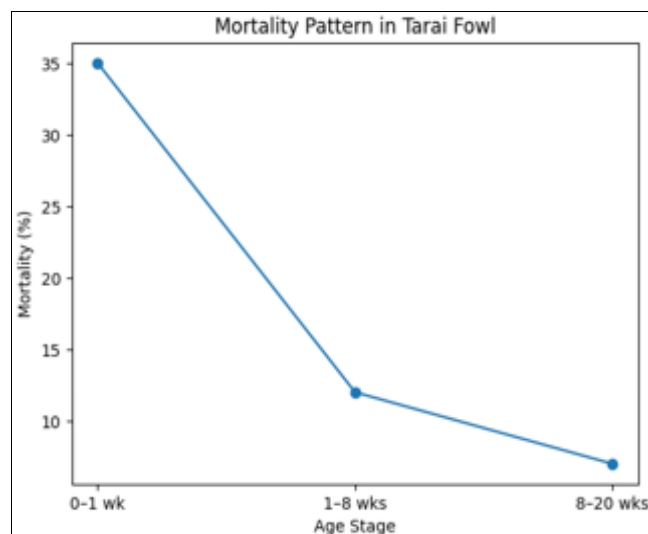
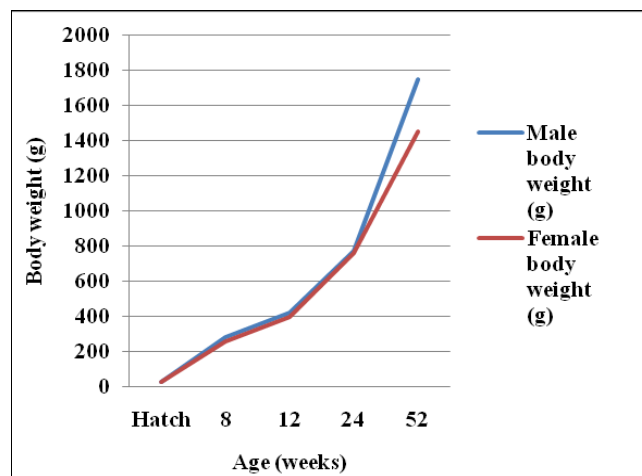
Beyond their biological attributes, Tarai Fowl play an important socio-economic role in rural livelihoods. The birds provide a continuous source of eggs and meat for household consumption while generating supplementary income through the sale of live birds and eggs. Their low production costs, minimal management requirements, and ability to utilize scavenged feed resources make them particularly suitable for smallholder households and women-managed backyard poultry enterprises.

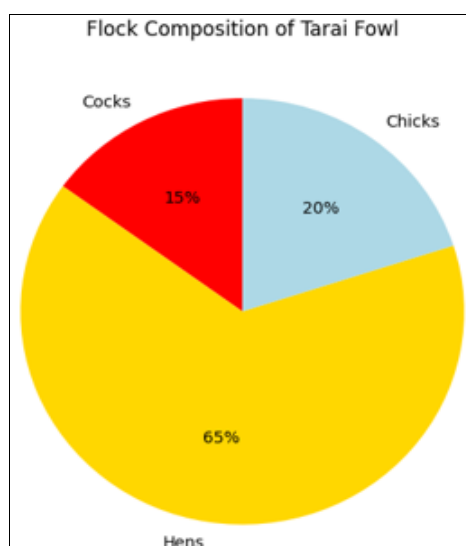
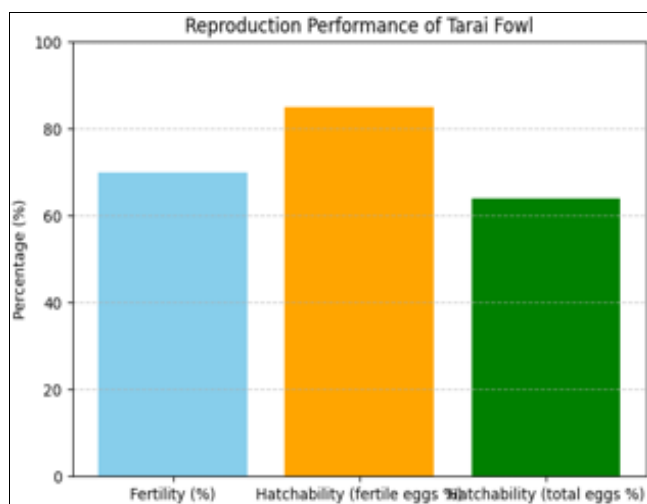
The increasing replacement of indigenous chickens with commercial and improved strains poses a serious threat to the long-term survival of locally adapted poultry populations. Loss of such populations would not only diminish valuable genetic diversity but also reduce the availability of adaptive traits that may become increasingly important under changing climatic conditions. The baseline information generated in the present investigation therefore provides an essential scientific foundation for the documentation and conservation of Tarai Fowl.

Priority should be given to implementing in situ conservation through community-based breeding programmes that actively involve local farmers while preserving the adaptive characteristics of the population. Such programmes may subsequently be complemented by selective improvement strategies aimed at enhancing productivity without compromising the unique adaptive attributes of this indigenous genetic resource. Continued phenotypic evaluation together with molecular genetic characterization would further facilitate the formal recognition of Tarai Fowl and support its sustainable utilization in future breeding programmes.

Overall, the findings demonstrate that Tarai Fowl combines desirable adaptive characteristics, satisfactory reproductive performance, and efficient utilization of low-input production systems, making it a valuable indigenous poultry

genetic resource of the Eastern Himalayan foothills. The relatively uniform phenotypic characteristics observed across the study population provide strong evidence of its distinct identity and emphasize the need for its systematic conservation, genetic evaluation, and sustainable improvement.





Conclusion

The present study represents the first comprehensive phenotypic and performance characterization of the indigenous Tarai Fowl of the Eastern Himalayan foothills of West Bengal, India, generating baseline information on a previously undocumented poultry genetic resource. The findings demonstrate that Tarai Fowl possesses distinct phenotypic characteristics, moderate growth and egg production, satisfactory reproductive and carcass performance, and excellent adaptability to low-input backyard production systems. Its efficient foraging ability, strong broodiness, resilience under humid subtropical conditions, and efficient utilization of locally available feed resources make it a valuable genetic resource for sustainable rural poultry production. Despite its comparatively lower productivity than commercial chicken strains, Tarai Fowl plays an important role in supporting household food and nutritional security, supplementary income, and the conservation of indigenous poultry biodiversity. However, the increasing replacement of native chickens by commercial breeds poses a significant threat to its genetic identity. Therefore, strategic conservation through community-based in situ conservation, selective breeding, and sustainable utilization is imperative. The baseline information generated in this study provides a robust scientific foundation for the formal recognition and registration of Tarai Fowl with ICAR–National Bureau of Animal Genetic Resources (ICAR–NBAGR), Karnal, and serves as a valuable reference for future genetic, genomic, and conservation programmes aimed at promoting climate-resilient and sustainable backyard poultry production.

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