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Research Article

Productive and reproductive traits of free-range indigenous chicken under different agro-climatic conditions of Assam

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Abstract

A survey study was conducted covering 200 farmers from four different agro-climatic zones of Assam to evaluate different productive and reproductive traits of indigenous chicken under free-range condition. Data were collected in a pre-structured interview schedule and were analyzed using SPSS (Windows version 25) software. Analysis of data revealed no significant difference in body weight at different ages across zones. Mortality rate significantly ($P<0.05$) varied across zones after 20 weeks of age; however, there was no significant difference in mortality rate up to 20 weeks of age in different zones. The mean age of the first egg was recorded as 6.45±0.06 months and annual egg production as 51.40±0.91 numbers per bird in all zones. There was no definite clutch size due to the erratic pattern of egg production. The mean fertility and hatchability percentage under natural incubation condition was recorded as 89.73±0.44 and 83.45±1.04 on total egg set basis respectively. Though the productivity of indigenous chicken is poor, productivity could be improved by proper management such as feeding, housing, health care and selection, which in turn enhance the livelihood and nutritional security of poor rural masses.

Key words: Agro-climatic zones, Indigenous chicken, Productive traits

Highlights

- The body weights of indigenous chicken did not differ significantly across different agro-climatic zones of Assam.
- The traits like body weights at different ages and annual egg production of indigenous chicken showed a much lower trend, which could be improved substantially by proper management and feeding.
- The mortality rate of indigenous chicken was much higher during the early part of their life, which might be due to improper brooding management. Proper brooding management of chicks could remarkably reduce chick mortality.
- The rate of fertility and hatchability also did not differ significantly across zones. The fertility and hatchability rate could be improved further through proper nutritional management.

INTRODUCTION

More than 80% of the population of Assam lives in rural areas whose primary occupation is agriculture and allied sectors. Along with agriculture, most of them rear few livestock and poultry like cattle, buffalo, goat, pig, sheep, chicken and duck in their household to support their livelihood and nutritional security. Each and every rural tribal household in Assam keeps indigenous chicken at their backyard to meet their day-to-day petty expenses, for home consumption, to entertain guests and for customs and festivals (Islam *et al*., 2021). Indigenous chicken farming also helps in

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empowering women and utilizes family labour efficiently in rural areas of Assam. The state has a total poultry population of 46.7 million and contributes 5.48 per cent of the country's poultry population (Livestock Census, 2019). More than 96 per cent of total poultry in Assam are reared under backyard system (BAHS, 2016). The total egg production in Assam is 51.48 crores, out of which 50.32 crores (92.36%) are contributed by indigenous chicken (BAHS, 2020). Thus, indigenous chicken plays a significant role in egg and meat production in Assam. Low inputs associated with indigenous chicken might be the reason for inferior productivity. Indigenous chicken meat and egg are the primary sources of protein in rural North-east India, where more than 70 per cent of children have been suffering from protein deficiency diseases, and most of the pregnant women are suffering from anaemia. To reduce the peril of malnutrition, particularly in rural areas, backyard poultry farming can be one of the best options. However, very little information is available on the productive performances of indigenous chicken of Assam. The present study was conducted extensively to evaluate the productivity of indigenous chicken covering four agro-climatic zones of Assam, which would form the basis for the formulation of strategies to improve indigenous chickens' productivity.

MATERIALS AND METHODS

Selection of location: The study was conducted from March 2018 to February 2019 to know the different productive and reproductive traits of indigenous chicken of Assam under field condition. Four agro-climatic zones viz. Upper Brahmaputra Valley Zone (UBVZ), Lower Brahmaputra Valley Zone (LBVZ), Central Brahmaputra Valley Zone (CBVZ) and North Bank Plain Zone (NBPZ) were selected from six agro-climatic zones of Assam. One district from each zone, thus a total of four districts viz. Sivasagar, Dhubri, Nagaon and Sonitpur were selected on the basis of the indigenous chicken population. The district with the highest indigenous chicken population within an agro-climatic zone was taken into account. Further, ten numbers of villages were identified from each zone with the help of the Animal Husbandry and Veterinary Department, Govt. of Assam of the respective district.

Selection of farmers: A total of five farmers from each village, 50 numbers of farmers from each zone; thus, a total of 200 farmers were selected for the study. The farmers, who had a minimum of 5 years of experience in rearing indigenous chicken under the traditional system, were considered for the survey.

Collection of data: A well-structured interview schedule was developed containing all relevant information pertaining to the productive and reproductive traits of non-descript indigenous chicken under field condition. Then the schedule was pre-tested under the field condition, and suitable modifications were made before its final use. The data were collected by personal interviews of the farmers and also by observation and discussion. The response of the farmers was immediately recorded in the schedule. For the recording of data at the farmers' level, different formats were developed for different variables and were distributed among the selected farmers. After proper training and discussion, the farmers were asked to record the data in the given formats. Data regarding body weight and mortality are at different ages, age at first egg, clutch size, annual egg production, egg weight and hatchability were recorded in the format. The investigator candled the eggs with an electric bulb to record fertility. The body weights and egg weights were recorded by the farmers with the help of a digital weighing balance supplied to them. The investigators finally collected the formats filled with raw data from the farmers and were tabulated, compiled and processed for further use.

Analysis of data: The data collected on different parameters were compiled, tabulated,

systematically classified and subjected to appropriate statistical analyses using SPSS (Windows version 25) software. Means were expressed as mean±SE of mean (SEM). Means were compared within the same software at P<0.05.

RESULTS

Productive traits of indigenous chicken

Body weights (g) at different ages: The mean body weights of non-descript indigenous chicken of Assam at first week, 5 months and at 10 months of age are presented in Table 1. The body weights at first week, 5 months and 10 months of age did not differ significantly among different zones (Table 1). The overall mean body weight of straight run chicks at first week was recorded as 32.06±0.26 g. The mean overall body weight of male and female chicken at 5 months of age was found as 752.50±3.99 and 637.15±2.87 g respectively. Similarly, the corresponding figures at 10 months of age were 1082.48±6.27 and 899.75±4.09 g respectively.

Mortality rate at different ages: The results revealed that the mean per cent mortality rate during the chick and grower stage did not differ significantly among the four agro-climatic zones of Assam. However, the mean mortality per cent at 20 and above weeks of age was significantly (P<0.05) higher in LBVZ than other zones.The overall mortality percentage during chick (0-9 weeks), grower (10-20 weeks) and adult (20 weeks and above) was 18.97±0.28, 10.00±0.46 and 5.38±0.17 respectively.

Reproductive traits of indigenous chicken

The reproductive traits of indigenous chicken of Assam are presented in Table 2. The mean age at first egg of non-descript indigenous

Table 1. Mean body weights (g) and mortality rate of indigenous chicken at different ages

Variables	Sex	Agro-climatic zones				Overall	P-value
		UBVZ (N=50)	LBVZ (N=50)	CBVZ (N=50)	NBPZ (N=50)		
Bodyweight (g)							
1st week	Straight run	31.16 ±0.53	31.90 ±0.49	32.50 ±0.54	32.68 ±0.54	32.06 ±0.26	0.17
5 months	Male	761.00 ±7.64	753.81 ±8.13	750.80 ±8.17	745.20 ±8.08	752.50 ±3.99	0.57
	Female	627.38 ±7.03	638.30 ±5.22	643.30 ±5.36	639.60 ±5.06	637.15 ±2.87	0.23
10 months	Male	1094.60 ±10.26	1085.86 ±13.46	1067.30 ±12.10	1082.14 ±14.08	1082.48 ±6.27	0.48
	Female	904.30 ±9.31	892.94 ±7.34	898.66 ±8.03	903.10 ±8.11	899.75 ±4.09	0.76
Mortality rate (%)							
Chick (0 to 9 weeks)		19.12 ±0.60	20.13 ±0.53	18.17 ±0.52	18.45 ±0.55	18.97 ±0.28	0.06
Grower (10 to 20 weeks)		9.90 ±0.42	9.75 ±0.41	10.08 ±0.40	10.28 ±0.46	10.00 ±0.46	0.83
Adult (20 weeks and above)		5.62^{ab} ±0.34	6.26^{a} ±0.33	4.93^{b} ±0.34	4.72^{b} ±0.31	5.38 ±0.17	<0.001

Means in rows not sharing a common superscript differ significantly (P<0.05)

Table 2. Various reproductive traits of indigenous chicken under different agro-climatic zones of Assam

Zones	Age at first egg (Months)	Annual egg production per hen (Numbers)	Egg weight (g)	Fertility (%)	Hatchability (%) on TES
UBVZ	6.54±0.13	50.56±2.04	32.73±0.36	89.40±0.81	83.20±1.05
LBVZ	6.42±0.12	47.58±1.77	32.57±0.41	89.70±0.90	84.40±1.02
CBVZ	6.38±0.07	52.68±1.57	32.770.35	90.40±0.76	82.40±1.09
NBPZ	6.46±0.13	54.68±1.77	32.13±0.36	88.90±1.09	83.80±1.04
All zones	6.45±0.06	51.40±0.91	32.57±0.19	89.73±0.44	83.45±1.04
P-value	0.78	0.061	0.60	0.60	0.58

chicken of Assam was found as 6.45±0.06 months, and the values did not differ significantly among different zones. No definite clutch size could be recorded due to the erratic pattern of egg production. However, three laying cycles were recorded per year. The mean annual egg production of non-descript indigenous chicken of Assam did not differ significantly among different zones, and the overall value was recorded as 51.40±0.91 number per hen. The overall mean egg weight of the four zones was 32.57±0.19g. The overall mean per cent of fertility and hatchability on total egg set basis under natural incubation using broody hen was 89.73±0.44 and 83.45±1.04 respectively.

DISCUSSION

The mean bodyweight recorded at first week was in close proximity to Kalita *et al.* (2009), who reported that the body weights of non-descript indigenous chicken of Assam at hatch ranged from 24.89±0.23 to 26.27±0.23 g in different zones of Assam. The numerical variation of bodyweights at different ages might be attributed to different management practices and the genetic makeup of the birds across zones. The findings of the present study corroborated with the findings of Roy *et al.* (2018), who reported the average body weight of indigenous chicken at day-old as 29.44±1.54 g under the backyard system in West Bengal. Jahan *et al.* (2017) recorded the bodyweight of non-descript indigenous chicken at hatch as 24.55±0.13 g in Bangladesh. The present values of bodyweight of indigenous chicken at 5 months of age were comparable with the findings of Kalita *et al.* (2009).

Contrary to the present findings, in Ethiopia, Milkias *et al.* (2019) reported higher bodyweights in non-descript indigenous hen and cocks at 6 months of age. The present values of bodyweights of indigenous chicken at 10 months of age were numerically lower than the reports of Roy *et al.* (2018), who recorded 1269.95 g at 40 weeks of age in indigenous chicken of West Bengal. The difference in bodyweights might be due to differences in genetic makeup, management conditions and scavenge feed resources available.

The mortality rate from 0 to 9 weeks of age indicated that there was no significant (P>0.05) difference in mortality per cent among zones. The lower mortality per cent in CBVZ in comparison with other districts might be due to better brooding management and season of hatching. Contrary to the present findings, Kalita *et al.* (2012) reported that lower mortality rate in chicks ranged from 6 to 10 per cent in non-descript indigenous chicken in Assam. Roy *et al.* (2018) also recorded a mortality rate of 6.66 per cent in non-descript indigenous chicken during 0-5 weeks of age in West Bengal under the backyard system of rearing. The mortality rate of grower chicken (10 to 20 weeks) showed that there was a slight numerical difference in mortality per cent across zones; however, there was no significant (P>0.05) difference in mortality per cent between zones under study. In contrast to the present results,

Deka *et al*. (2017) reported 6.22±1.51 and 2.07±0.23 per cent mortality at 2 and 8 months of age respectively in indigenous chicken under the backyard rearing system in the Dhubri district of Assam. The higher per cent of mortality in the present study might be due to poor healthcare and disease outbreak in the study areas. The values of mortality rate at above 20 weeks of age were significantly ($P<0.05$) higher in UBVZ than in LBVZ (Table 1). Similarly, the mortality in LBVZ was significantly ($P<0.05$) higher than in CBVZ and NBPZ. The differences in mortality rates in different zones might be due to occurrences of infectious diseases across the zones. The present results corroborated the findings of Kalita *et al*. (2012), who reported that mortality in adults ranged from 0 to 5% respectively in non-descript indigenous chicken in Assam. Contrary to the present findings, Alam *et al*. (2014) reported higher mortality of non-descript indigenous chicken ranging from 10-37% with an average of 27.82% in some selected areas of the Mymensingh district of Bangladesh.

The results of age at first egg of the present study corroborated the findings of Kalita *et al.* (2011), Chutia *et al*. (2012), Dutta *et al*. (2013) and Sankhyan *et al*. (2013) in Assam, Bangladesh and Himachal Pradesh respectively. However, the higher mean values for age at first egg were reported by Magothe *et al.* (2012), Khan *et al*. (2016) and Srinivas and Swathi (2018) in Kenya, West Bengal and Telangana respectively. Chutia *et al*. (2012) also reported that the non-descript indigenous chicken exhibited 3 laying cycles per year in the Dhemaji district of Assam. However, Kalita *et al*. (2011) reported that number of clutches per hen per year was 4 in Assam. No definite clutch size was found in the present study due to the erratic pattern of egg production. However, Kalita *et al*. (2011) and Chutia *et al*. (2012) reported the clutch size values as 11.18±0.48 to 15.49±0.45 and 15.97±0.08 numbers respectively. The difference in clutch size in different places might be due to differences in hereditary factors, management, nutrition and age of the birds. The annual egg production values of different zones of Assam were lower than the findings of Kalita *et al*. (2011) and Chutia *et al*. (2012), who reported mean annual egg production as 55.00 and 56.25 numbers respectively in Assam. The variation in egg production in different zones might be due to variation in the genetic makeup of the birds, management and nutrition followed by different farmers in different locations. The mean egg weights recorded in the present study were in close proximity to the findings of Kalita *et al*. (2009), Kalita *et al*. (2011), Chutia *et al*. (2012) and Islam *et al*. (2014). However, comparatively higher egg weights were recorded by Magothe *et al*. (2012), Alam *et al*. (2014) and Uddhav *et al*. (2016). The comparatively lower egg weights in the present study might be due to the genetic makeup of the birds, poor management and nutrition.

The mean fertility per cent of the present study was comparable with the results of Islam *et al.* (2014), Deka *et al*. (2017) and Sarma *et al*. (2018). They reported the fertility per cent as 90.40, 91.62 and 90.40 respectively during their studies. However, a lower per cent of fertility was observed by Msoffe *et al*. (2004), who reported that the overall egg fertility was 70% and ranged between 15 to 100% in free-range local domestic ecotypes in Tanzania. The difference in per cent fertility in different locations might be due to different agro-climatic conditions, feeding and management. There was no significant ($P>0.05$) difference in the values of hatchability between zones under the present study. The results of the present study were in accordance with the results of Kalita *et al.* (2009), Chutia *et al*. (2012) and Dutta *et al.* (2013). A lower per cent of hatchability was reported by Msoffe *et al*. (2004) and Uddhav *et al*. (2016). They reported that the overall mean hatchability was 62% and ranged from 11 to 100% and 74±1.4% in Tanzania and Nepal respectively. This might be due to differences in agro-climatic conditions selection of eggs for hatching and feeding.

From the study, it could be concluded that the productivity of indigenous chicken is much lower under the free-range system of rearing. Under the free-range system, chickens of all age groups are fed together by scavenging with irregular and inconsistent supplementation (mostly cereals) and housing night at farmers' dwelling houses. Moreover, frequent attacks of different diseases (mainly Ranikhet disease), predation, faulty brooding management etc. could hinder productivity. The productivity could be improved to a greater extent by providing extra effort in management in the area of housing, feeding, healthcare and proper genetic selection under field condition. Proper brooding management during the early stage of life might also improve the chick's survival rate.

Conflict of interest: Authors have no conflict of interest in this study.

Author's contribution: RI: Conduct research work and development of manuscript; SI: Development of manuscript and statistical analysis; MR: Conduct of research and bibliography; AKS: Development of manuscript and final checking.

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