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PRODUCTION PERFORMANCES, MEAT AND EGG QUALITY, AND SERUM BIOCHEMICAL PARAMETERS OF THREE NATIVE CHICKEN GENOTYPES: LAYING AT SEVENTH GENERATION

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ABSTRACT

The present study was conducted to assess the comparative laying performances of three native chicken genotypes under intensive management. Egg production was recorded up to 280 days. For Kadaknath (K), a total of 500 pedigree hatched day old chicks were identified individually by wing band. In seventh generation, 26.19%, 10.89% and 18.18% birds of Non-descript Deshi (ND), Hilly (HI) and Naked Neck (NN) had laid egg ranged 80-89%. Chick weight was not affected ($p>0.05$) by genotype. Fertility of ND, HI and NN was 88.96%, 87.03% and 86.67%, respectively. Significantly ($p<0.001$) the highest hatchability (90.85%) was found in ND compared to HI (89.25%) and NN (83.94%). The highest egg production number of ND, HI and NN were 79.08, 69.33 and 74.86, respectively. In this study, the average HDEP% of ND, HI and NN were found to be 56.48, 49.52 and 53.47, respectively. Body weight at first lay is 1111.0g and at 8th week is 685.4g. FCR at 0-8 week is 3.0. Significantly ($p<0.05$) the lowest glucose content was found in K chicken (4.34mMol/L) compared to HI (7.34mMol/L)), NN (5.88mMol/L) and ND (5.76mMol/L). Iron content of blood was non-significantly highest in K chicken compared to other three native chickens. Haemoglobin content of blood was non-significantly highest in HI chicken. ND was superior for egg production, fertility and hatchability traits. No extra ordinary result was found in case of Kadaknath chicken.

Keywords: Native chicken, genotype, generation, performance, Kadaknath chicken

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INTRODUCTION

Bangladesh's poultry industry is thriving and has the ability to quickly reduce poverty by generating revenue and opening up job opportunities. Employment opportunities for rural farmers, service providers, retailers, traders, etc. are developed as commercial poultry farming becomes more and more popular (Ali, 2020; Ali and Islam, 2021). The existing chicken production system in Bangladesh can be divided into four basic categories including traditional rural backyard scavenging systems; semi-scavenging systems; commercial farming systems; and contract farming or integrated systems Uddin et al., 2015). In present, Native chickens farming become more popular due its meat test, texture and demand (Rashid et al., 2020; Rahman et al., 2018). Bangladesh Livestock Research Institute (BLRI) has started the improvement of indigenous chicken since 2010. For improvement of indigenous chickens of Bangladesh, establishment of suitable foundation stock was a crying need. BLRI since its inception in 1984 adapted programs for the conservation and development of Indigenous Chicken through several poultry development projects (Faruque et al., 2015). As a part of selection and improvement of Indigenous Chicken, the Poultry Production Research Division of BLRI from its inception to date collected 5 types of Indigenous Chicken namely Aseel, Naked Neck, Hilly, Non-descript Deshi, Yasine. Along the length of those improvement program selection was based mainly on the phenotypic characteristics of birds. The individuals were not selected on the basis of their selection index value and/or breeding value. On account of that long-term study was planned. The first step was to establish a foundation stock. This stock was established in 2010 from the existing stock of BLRI as well as by incorporating variation through screening of wider Indigenous Chicken gene pool of Bangladesh (Paul et al., 2017). A selective breeding program was conducted at BLRI, under controlled conditions. After 7 generation of selection, the egg production was increased from 110 to 180 eggs per year and on-going research revealed positive genetic changes over generations. Therefore, this study was undertaken with the objectives (i) to assess the laying performances of three native chicken genotypes under intensive management, ii) To study the comparative performances of three native chickens and Kadaknath chicken.

MATERIALS AND METHODS

The present study was constructed at Bangladesh Livestock Research Institute, Savar, Dhaka, Bangladesh.

Egg production traits

Egg production was recorded up to 280 days. Hen-day egg production (%) was calculated on the basis of total eggs produced per day divided by total number of hens available on that day. For Kadaknath (K), a total of 500 pedigree hatched day old chicks were identified individually by wing band. A total of 85 males and 200

females were selected at the age of 8 and 16 weeks on the basis of pedigree records and phenotypic characteristics. Finally, 17 males and 85 females were selected at 38 weeks of age on the basis of selection index to produce next generation. At the age of 280 days, 120 eggs were collected randomly from Kadaknath, Hilly, Naked Neck and Non-descript Deshi. The eggs were numbered according to genotypes for identification. At first the weight of eggs were taken with the help of electronic balance to the nearest of 0.01 g. The length and width of eggs were measured with the help of Vernier calipers to the nearest of 0.01 cm. The shape index was calculated as the ratio of egg width to the egg length as given by Olawumi and Ogunlade (2008).

Shape index = (Egg width ÷ Egg length) × 100.

The albumen index was calculated by the following formula given by Olawumi and Ogunlade (2008).

Albumen index = (Height of albumen ÷ Width of albumen) × 100.

Yolk index was calculated as per formula given by Olawumi and Ogunlade (2008).

Yolk index = (Height of yolk ÷ Width of yolk) × 100.

The breaking strength (kg/cm) of egg was measured by eggshell intensity tester. Individual Haugh unit (Haugh, 1937) score was calculated using the egg weight and albumen height (Doyon et al., 1986).

The Haugh unit values were calculated for individual egg using the following formula:

HU = 100 log ($H-1.7W^{0.37}+7.6$); Where HU= Haugh Unit, H=Observed height of the albumen in mm, W=Weight of egg in g.

Meat production traits

At 10 weeks of age, a total of 24 birds **(**Naked Neck, Hilly, Non-descript Deshi and Kadaknath chicken) (6 birds in each genetic group, 3 males and 3 females) were randomly selected. All chickens were kept off feed overnight before slaughtering but drinking water was provided ad libitum. Birds were slaughtered following 'halal' method (Singh et al., 2003) by severing the jugular vein allowed to bleed completely and then plucked and weighed to determine blood and feather losses (Kotula et al. 1960; Pandey and Shyamsunder, 1990). Pre-slaughter live weight, blood loss weight, eviscerated weight, breast meat weight, thigh plus drumstick weight etc. were recorded. All weight related to carcass characteristics were expressed as the percentage of live weight. Carcasses were dissected according to Singh et al. (2003) except that birds were not scalded. Peripheral blood samples (2-3 ml) were obtained by wing vein puncture.

Serum biochemical parameters

Serum biochemical parameters were analyzed. Glucose, Haemoglobin, Iron content were measured on a Humalyzer 2000 chemistry (Germany) using a turbidimetric method as described by the manufacturer.

Statistical analysis

The data of egg production, meat production and serum biochemical profiles were analyzed in CRD by General Linear Model (GLM) Univariate Procedure in SPSS Computer Program (IBM Corp, 2016).

RESULTS AND DISCUSSIONS

As it is indicated in Table 1 hatching egg weight was not significantly ($p>0.05$) affected by genotype. Hatching egg weight of ND, HI and NN was 46.29g, 46.68g and 46.52g; respectively**.** Chick weight was not affected ($p>0.05$) by genotype. Under intensive management system, observed mean weight at hatch for ND, HI and NN was 31.48g, 31.60g and 30.96g; which is in line with the findings of Faruque et al. (2007), Faruque et al. (2015), and Faruque et al. (2017). Fertility of ND, HI and NN was 88.96%, 87.03% and 86.67%; respectively which was little bit lower than that reported by Khatun et al. (2005) and more or less similar to the findings of Faruque et al. (2015). Significantly ($p<0.001$) the highest hatchability (90.85%) was found in ND compared to HI (89.25%) and NN (83.94%). The lowest hatchability reported in NN (83.94%) could be due to the highest egg shell thickness and stronger breaking strength of NN eggs. Faruque et al. (2015) reported that the hatchability was 89.0%, 85.6% and 77.5%, respectively in ND, HI and NN genotypes, and was more or less similar to the present findings. Egg production (20-40 weeks) number was significantly ($p<0.001$) affected by genotype. The highest egg production number (20-40 weeks) of ND, HI and NN were 79.08, 69.33 and 74.86, respectively. The effects of genotype on hen-day egg production (HDEP%) of native chicken is presented in Table 1. HDEP% observed in the present study was affected significantly ($p<0.001$) by genotype. In this study, the average HDEP% of ND, HI and NN were found to be 56.48, 49.52 and 53.47, respectively. Significant effect of genotype on HDEP% found in this study confirms with the result of previous report by Faruque et al. (2017) who found that genotype had significant ($p<0.001$) effect on hen-day egg production. In this study, the highest HDEP% was found in ND genotype (56.48) at 20-40 weeks of age. This finding is in agreement with the finding of Faruque et al. (2017) who found the highest HDEP% in ND genotype (62.85) at 22-28 weeks of age.In seventh generation, 26.19%, 10.89% and 18.18% birds of ND, HI and NN had laid egg ranged 80-89% (Fig.1).

Table 1. Performances of three native chicken genotypes

Parameter	Genotype			Level of significance
	ND (Mean ±SE)	HI (Mean ±SE)	NN (Mean ±SE)	
Hatching egg wt (g)	46.29±0.39	46.68±0.39	46.52±±0.35	NS
Chick wt (g)	31.48±0.22	31.60±0.22	30.96±0.20	NS
Fertility (%)	88.96±1.35	87.03±1.35	86.67±1.21	NS
Hatchability (%) of fertile eggs	90.85^{a}±1.32	89.25^{a}±1.32	83.94^{b}±1.19	p<0.001
EP (no.) (20-40 wks)	79.08^{a}±1.19	69.33^{c}±1.31	74.86^{b}±1.17	p<0.001
HDEP% (20-40 wks)	56.48^{a}±0.85	49.52^{c}±0.93	53.47^{b}±0.83	p<0.001

ND=Non-descript Deshi; HI=Hilly; NN=Naked Neck; HDEP=Hen day egg production; least squares means without a common superscript along the row within a factor differed significantly (p<0.001).

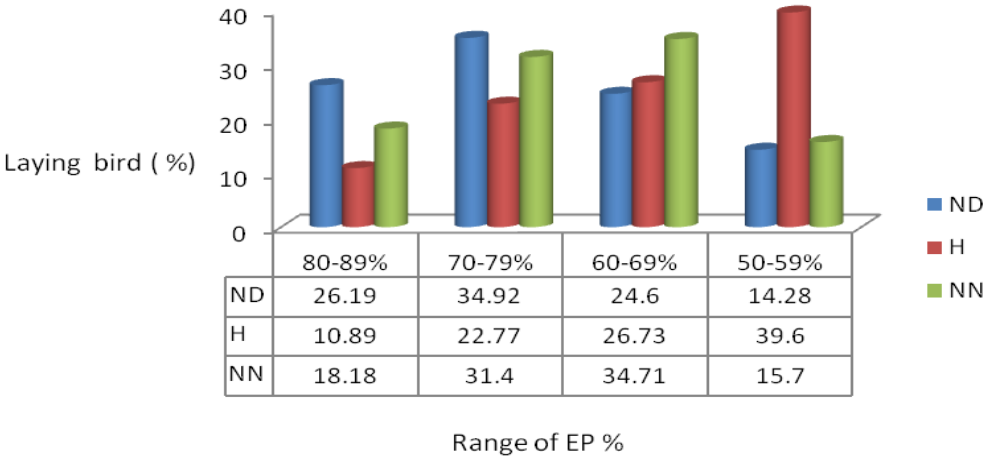

Figure 1. Relationship between the range of egg production (%) and laying bird (%).

Analysis of serum biochemical profile is shown in Table 2. Statistically significant difference in cholesterol, low density lipoprotein (LDL) and triglyceride (TG) content was observed in three genotypes. Hilly genotype showed the lowest cholesterol (212mg/dl), LDL (125 mg/dl) and TG (232mg/dl) values compared to other three genotypes. Sharmin (2020) found the lowest values of cholesterol, LDL and TG in different treatment groups using Moringa oleifera leaf and Spirulina platensis

compared to these findings. Significantly ($p<0.05$) the lowest glucose content was found in K genotype (4.34 mMol/L) compared to HI (7.34 mMol/L), NN (5.88 mMol/L) and ND (5.76 mMol/L) (Table 2). Iron content of blood was non-significantly highest in K chicken compared to other three native genotypes. For haemoglobin concentration (Hb) with respect to genotypes, the results showed that Hb values ranged from 11.56 to 12.88 (g/dl) for ND and HI, respectively. The differences were not statistically significant. However, Hb value of HI was slightly higher compared to other three genotypes.

Table 2. Serum biochemical parameters of different chicken genotypes

Parameters	Kadaknath	Hilly	Naked Neck	Common Deshi	SEM	P value
Cholesterol (mg/dl)	229.00^{bc}	212.00^{c}	304.00^{a}	274.00^{ab}	10.90	0.002
HDL(mg/dl)	41.40	41.20	38.20	41.60	0.53	0.059
LDL(mg/dl)	156.40 ^{ab}	125.90^{b}	188.40^{a}	170.40^{ab}	8.46	0.046
TG(mg/dl)	254.80^{ab}	232.40^{b}	375.40^{a}	309.60^{ab}	18.95	0.021
Glucose(mMol/L)	4.34^{b}	7.34^{a}	5.88^{ab}	5.76^{ab}	0.361	0.0187
Creatinine(mg/dl)	0.92	0.96	0.98	0.94	0.021	0.801
Albumin(g/dl)	42.20	42.80	42.40	42.40	0.554	0.987
Protein(mg/dl)	6.78	6.76	6.76	6.76	0.028	0.994
Calcium(mg/dl)	8.14	8.26	8.22	8.38	0.055	0.520
Iron(µg/dl)	138.00	128.20	129.80	129.80	3.089	0.707
Phosphorus(mg/dl)	3.16	3.10	3.12	2.94	0.039	0.217
PCV%	45.00	40.66	42.20	42.06	0.906	0.415
ESR(mm)	27.00^{ab}	17.60^{b}	33.40^{a}	31.40^{a}	2.039	0.021
Haemoglobin (g/dl)	11.98	12.88	11.70	11.56	0.211	0.104
RBC (M/µl)	4.46	4.50	4.52	4.70	0.055	0.452
Humoral immune response						
IgG(mg/dl)	774.80	780.00	774.00	788.60	7.036	0.895
IgA(mg/dl)	183.00	144	160.20	116.80	10.24	0.129

Table 3 represents the data on carcass characteristics of Kadaknath and three indigenous chickens. Among the genotypes HI genotype showed highest live weight (1735.83g), carcass weight (1331.33g) as well as thigh meat weight (10.49%) as percentage of carcass weight. Significantly ($p<0.05$) the highest dressing percentage (76.47%) and breast meat weight (10.37%) were observed in HI genotype followed by other three genotypes (Table 3)**.** The lowest dressing percentage (65.40%) was observed in Hilly genotype by Faruque et al. (2017). The results showed that meat

color (L*, a*, b*) values were influenced by genotype. Genotype had non-significant effect on drip loss, cooking loss and p^H. The p^H is one of the important parameters for quality profiling of meat. In the present experiment, HI genotype increased meat p^H indicating better meat quality that was characterized by lower protein damage and increased meat color (a*) which confirms the results obtained by Hassan et al. (2016) in B lighting group.

Table 3. Meat and carcass characteristics of different chicken genotypes

Parameters		Kadaknath	Hilly	Naked Neck	Common Deshi	SEM	P value
Live wt		1156.17[b]	1735.83[a]	1178.50[b]	1191.17[b]	68.90	0.0016
After slaughter wt		1114.39	1680.67	1133.00	1139.00	68.60	0.0015
Defeathered weight		895.0	1400.33	963.50	939.50	58.22	0.0014
Carcass wt		800.33	1331.33	884.00	888.66	57.78	0.0007
Dressing%		69.40	76.47	75.19	74.67	0.987	0.043
Intestine wt%		3.96	3.73	4.097	3.79	0.116	0.702
Breast meat wt%		7.84	10.37	9.55	9.08	0.312	0.022
Drumstick wt%		9.09	10.45	10.49	9.57	0.182	0.0047
Thigh meat wt%		9.50	10.49	10.24	9.70	0.153	0.069
Wings wt%		6.42	6.23	6.24	6.60	0.091	0.44
Liver wt%		2.35	2.11	2.32	2.28	0.048	0.327
Heart wt%		0.446	0.48	0.48	0.57	0.018	0.664
Spleen wt%		0.219	0.13	0.185	0.24	0.014	0.027
Gizzard wt%		4.248	4.688	4.61	4.99	0.162	0.470
Shank wt%		4.19	4.22	3.53	4.01	0.110	0.085
Head wt%		3.28	3.30	3.76	3.47	0.107	0.404
Meat Color (CIE)	L*	40.99	57.97	48.56	45.35	0.952	0.001
	a*	0.61	3.54	6.13	1.84	0.698	0.019
	b*	5.81	9.76	10.74	10.05	0.496	0.001
Drip loss		23.64	21.72	23.41	25.33	1.308	0.834
Cooking loss		20.80	18.55	22.42	20.09	0.922	0.544
pH		5.31	5.21	5.26	5.23	0.015	0.065

The qualities of the eggs collected from different chickens genotypes kept under intensive rearing system are presented in Table 4.

Table 4. Comparative egg quality performances of three native chicken and Kadaknath chicken

Parameter	Genotype				Level of significance
	K	H	NN	ND	
Egg weight (g)	38.86[b]	41.41[a]	40.41[a]	41.48[a]	p<0.05
Shape Index (%)	76.05	75.40	76.54	77.44	NS
Albumen Index (%)	9.75[b]	11.08[ab]	11.89[a]	12.36[a]	p<0.05
Yolk Index (%)	45.03[b]	48.09[a]	48.97[a]	48.59[a]	p<0.001
ESBS (kg/cm^2)	3.87	3.63	4.21	3.35	NS
Haugh Unit	84.83[b]	89.71[a]	91.03[a]	92.91[a]	p<0.01

K=Kadaknath, ND=Non-descript Deshi; H=Hilly; NN=Naked Neck; ESBS=Egg Shell Breaking Strength; least squares means without a common superscript along the row within a factor differed significantly (p<0.05), NS=Non-significance

The average egg weight was significantly (p<0.05) affected by genotype. The ND genotype eggs were heavier (41.48g) than other three genotypes' eggs. The genetic difference among the breeds for egg weights was reported by Monira et al. (2003). Shape index was highest in ND (77.44%), intermediate in K (76.05%) and NN (76.54%) and lowest in H (75.40%). There was non-significant (p>0.05) difference in shape index among the genotypes. The decreased shape index with increased egg weight was supported by Monira et al. (2003), Reddy et al. (1979). But this finding was not supported by them. Non-significant (p>0.05) variation was found in breaking strength. The internal quality trait such as Haugh unit was significantly (p<0.01) affected by genotype. The Haugh unit in ND was highest (92.91) and lowest in K (84.83). Monira et al. (2003) and Hanusova et al. (2015) found lower Haugh unit for Rhode Island Red eggs as compared to our experiment.

CONCLUSION

From the above study it is concluded that Non-descript Deshi was superior for egg production, fertility, hatchability, egg weight, shape index and Haugh unit traits and Hilly was superior for dressing percentage. No extra ordinary result was found in case of Kadaknath chicken.

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