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EVALUATION OF THE PERFORMANCE OF NATIVE CHICKEN AND ESTIMATION OF HERITABILITY FOR BODY WEIGHT

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ABSTRACT

The study was conducted to compare the performance of chickens of non-descript desi (ND), hilly (H) and naked neck (NN) genotypes. Data were analyzed by GLM procedure of SPSS in a CRD. The highest hatchability was found in third hatch of ND (86.38%). The chick weight was influenced ($p < 0.05$) by the egg weight. The average initial body weight of day-old chicks differed significantly ($p < 0.001$) by genotypes. The lowest and highest mean body weight gain per bird were recorded for ND (329.38 ± 3.32 g) and NN (351.56 ± 5.08 g) genotypes, which indicated that there were an average daily growth rate of 5.88 ± 0.05 and 6.27 ± 0.09 g per bird per day at their 8th weeks growth phases, respectively. Calculated heritability for 12th week body weight of ND, H and NN were 0.16 ± 0.39, 0.50 ± 0.05 and 0.73 ± 0.25, respectively and for 16th week body weight of H and ND were 0.72 ± 0.15 and 0.35 ± 0.15, respectively. Naked neck is genetically superior to non-descript Desi and Hilly in terms of productive and reproductive parameters.

Key words: Native chicken, Genotype, Performances, Heritability

INTRODUCTION

Poultry is one of the fastest growing segments of the agricultural sector in Bangladesh. It is estimated that there are about 21.81 million fowls and ducks in commercial production system and 166.59 million in subsistence production system in the total population of 188.40 million fowls and ducks in Bangladesh (Year Book of Agricultural Statistics of Bangladesh 2005). Barua and Howlider (1991) stated that naked neck chickens are better performer compared to their normal counterpart of full-feathered local chicken of Bangladesh. Under intensive rearing system, indigenous hens laid 100 - 110 eggs from starting to ten months of laying (Faruque and Salah Uddin 2009). By proper selection programme egg production of desi hen could be increased up to 135 eggs per year (Khan 1983). Productivity of indigenous chicken breeds may be doubled with improved diets and management conditions (Chowdhury *et al.* 2006). The indigenous chickens have not attained their full production potential due to exposure to risks that influence against their survival and productivity under extensive management conditions.

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So, Bangladesh Livestock Research Institute (BLRI) is conserving three types of native chicken, namely ND, H and NN in *ex situ* system. However, the research works under intensive management system on the productive parameters like body weight, egg production, egg weight and reproductive parameters like age at sexual maturity, fertility and hatchability of indigenous chickens are scanty. Therefore, the purpose of this study was to compare and evaluate the productive and reproductive performance, as well as heritability of body weight of indigenous chickens under intensive management system.

MATERIALS AND METHODS

The study was conducted at the Research Farm under Poultry Production Research Division (PPRD), Bangladesh Livestock Research Institute (BLRI), Savar, Dhaka, Bangladesh. The population under study arose from the insemination of 173 hens (ND = 110, H = 34, NN = 29) with semen from cocks (ND = 23, H = 12, N = 5). Insemination was done twice a week and semen of each cock was introduced to some hens. Chicks were obtained from three hatches, one or two weeks apart from January to March, 2010. Pedigree chicks were leg-banded at a-day-old. After 14 days leg-band was pulled out from leg and applied to wings. Birds were vaccinated against diseases according to the vaccination schedule. Body weights were recorded at day of hatching (Day-0) and at 8, 12 and 16th weeks of age. Birds were weighed individually on an electronic balance, within 0.1 g precision. Some dams either did not lay or had no chicks at hatching and records from chicks that lost their wing bands were not included. Only data on birds having proper identified number (Pedigree and performance) were used to estimate heritability for the considered traits. After data editing, a total of 991 chicks of 32 sires and 164 dams were available for heritability estimation.

Statistical analysis: Data used in this study varied from class to class and sub-class to sub-class. Hence a non-orthogonal factorial experiment was done. Data were analyzed by 3 × 3 (3 genotypes; 3 hatches) factorial arrangement using univariate GLM procedure of SPSS 10.0 for Windows (SPSS Inc.1998) computer programme in a CRD. Correlation and regression analyses were done according to Snedecor and Cochran (1989). The differences in means were tested using Least Significant Difference (LSD) method. Variance and covariance components of the body weight traits were estimated using Residual Maximum Likelihood (REML) approach by VCE4 computer program (Groeneveld 1998). The animal model for 12 and 16 week-body-weight included the fixed effects of hatch number and sex of the chicken and birds itself as a random effect. The analysis was done in a single trait animal model.

RESULTS AND DISCUSSION

Fertility percentage: The fertility percentage ranged from 84.95 to 97.57 in different genotypes. The highest fertility was observed in first hatch of H (97.57%) genotype as compared to remaining two genotypes (Table 1). Islam *et al.* (1981) reported that the fertility of upgraded indigenous chicken was 83%, which was lower than the present study. Khatun *et al.* (2005) reported that the fertility was 94.86, 88.40 and 88.09%, respectively in ND, H and NN genotypes, which was more or less similar to the present findings. Uddin *et al.* (1995) and Islam *et al.* (1981) observed higher fertility (80.79%) of Bangladeshi local chicken when compared to exotic breeds. Fertility is influenced by genetic, physiological, social and environmental factors, male-female ratio, egg production rate, nutritional status, preferential mating, lighting, sperm quality and age of hen. Kirk *et al.* (1980) observed that fertility declined approximately 11% from 34 to 60 weeks of hen age.

Table 1. Fertility and hatchability of native chicken eggs.

Genotypes	Hatch	No. of eggs set	Infertile eggs (No.)	Fertile eggs (No.)	Dead in germ (No.)	Fertility (%)	Hatchability on fertile eggs (%)
H	First	165	8	157	4	97.57	79.61
	Second	110	10	100	-	90.91	82.00
	Third	318	34	257	27	89.30	77.82
NN	First	140	13	127	6	95.00	60.62
	Second	145	19	128	2	89.65	65.07
	Third	226	34	183	9	84.95	68.85
ND	Third	803	45	698	60	94.39	86.38

*Hatchability percentage***:** The highest hatchability was found in third hatch of ND (86.38%) and the lowest hatchability was found in all hatches of NN genotype (Table 1). Khatun *et al.* (2005) showed that the hatchability on fertile eggs ranged from 78.33 to 90.79% in different genotypes with the overall percentage of 85.99, which was much higher than the present findings. This result may be attributed by fluctuated humidity of incubator machine as it was maintained manually. Hatchability of fertile eggs is influenced by genetic environmental factors like storage temperature and humidity, care of egg, quality of eggs, age and nutrition of layers and season etc. (Olsen and Hyne 1984).

Chick-egg ratio: Egg weights prior to setting and subsequent chick weights were determined from three types of native chicken genotype namely ND, H and NN. Egg weight means were 43.50, 43.24 and 45 49 g, respectively for ND, H and NN genotypes. Chick weights were 29.12, 29.42 and 31.08 g, respectively for ND, H and NN genotypes. The data on chick-egg ratio have shown that newly hatched chicks in the NN genotype had higher percentage (68.40) than chicks in the ND (67.02) and H (68.13) (Table 2) as chick weight was influenced ($p < 0.001$) by egg weight.

Table 2. Least squares means with standard deviation for egg weight, chick weight and chick-egg weight ratio at hatch of native chickens.

Genotype	Egg weight (g)	Chick weight (g)	Chick-egg weight ratio
ND	$43.50^{b} \pm 3.86$	$29.12^{b} \pm 3.20$	$67.02^{b} \pm 5.26$
H	$43.24^{b} \pm 4.34$	$29.42^{b} \pm 3.27$	$68.13^{b} \pm 4.92$
NN	$45.49^{a} \pm 4.25$	$31.08^{a} \pm 3.47$	$68.40^{a} \pm 5.65$
Level of sig.	***	***	***

^{ab}Mean ± Sd within a column with no common superscripts differ significantly ($p < 0.001$).
***= Highly significant ($p < 0.001$), Sd = Standard deviation.

Body weight and body weight gain: Body weights, body weight gain, feed consumption and feed conversion ratio from a-day-old to 8th weeks of age are shown in Table 3. The average initial body weight of a-day-old chicks of ND, H and NN was 29.14 ± 0.13, 27.46 ± 0.17 and 29.46 ± 0.20 g, respectively and the difference was significant ($p < 0.001$). While the body weight of chicks at 8th weeks did not differ significantly ($p > 0.05$) for ND, H and NN genotypes.

Table 3. Effect of genotype on growth performance of native chicken under intensive rearing system (0 - 8 weeks).

Parameters	Genotype			Level of significance
	ND (Mean ± SE)	H (Mean ± SE)	NN (Mean ± SE)	
Mean day-old weight (g/bird)	29.14 ± 0.13	27.46 ± 0.17	29.46 ± 0.20	***
Mean final weight at 8th weeks of age (g/bird)	358.52 ± 3.35	373.45 ± 4.29	381.03 ± 5.11	NS
Mean body weight gain (g/bird)	329.38 ± 3.32	345.98 ± 4.26	351.56 ± 5.08	NS
Mean daily gain (g/bird)	5.88 ± 0.05	6.17 ± 0.07	6.27 ± 0.09	NS
Mean total feed intake (g/bird)	1180.80 ± 49.44	1195.02 ± 50.24	1174.64 ± 48.42	NS
Mean daily feed intake (g/bird)	20.71 ± 0.88	20.95 ± 0.88	20.60 ± 0.88	NS
FCR (feed: gain)	3.58 ± 0.06	3.45 ± 0.06	3.34 ± 0.06	NS

NS = Non significant, ***= Highly significant ($p < 0.001$), SE = Standard error

Khandoker (1993) observed that body weight of native birds at hatching time and at 8th weeks of age were 25.7 and 186.5 g, respectively. Haque (1990) found that the body weight of native birds at hatching time and at 8th weeks were 22.9 and 182.5 g, respectively. Their observations are much lower than the present findings but the findings of Faruque *et al.* (2007) is much higher than the present observation who found the body weight at hatch and at 8th weeks of age for ND, H and NN genotypes were 31.2, 30.5, 31.7 g and 481.9, 449.0 and 476.0 g, respectively.

Feed consumption and feed conversion ratio: Feed consumption from a-day-old to 8th weeks was non-significant ($p > 0.05$). The lowest and highest daily feed intake were recorded by NN (20.60 g) and H (20.95 g). There was a non-significant ($p > 0.05$) variation in FCR among the native chicken genotypes. Growth rate affects feed conversion. The mean total feed intake for the three native chicken genotypes from day-old to 8th weeks of their growth were 1180.80 ± 49.44, 1195.02 ± 50.24 and1174.64 ± 48.42 g, respec-tively for ND, H and NN genotypes. There was non-significant ($p > 0.05$) difference in total feed consumption among three tested genotypes. Khandoker (1993) found that the FCR of indigenous chicken at 8th week of age was 6.36.

The relationship between daily gain and periods of time (weeks) was multiple (Fig. 1; $y = –0.0472 x^2 + 1.2548 x + 0.9853$; $R^2 = 0.6773$) but this relationship was linear up to 11th weeks of age ($y = 0.4937 x + 2.7968$; $R^2 = 0.6031$). These relationships indicated the growth rate of native chicken peaks at 11th weeks of age and then declines.

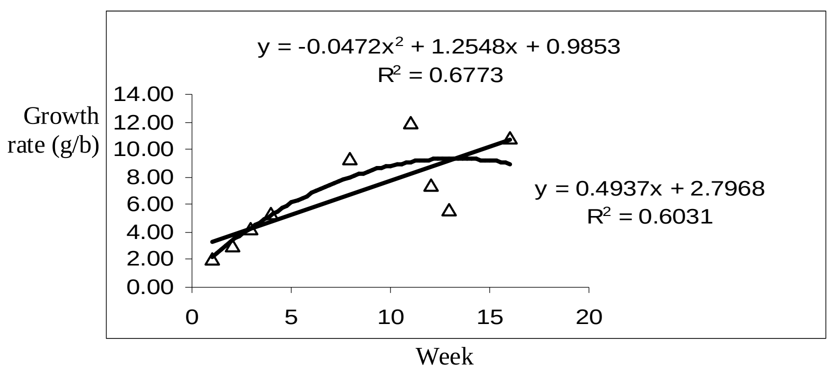

Fig. 1. Patterns of growth of native chicken over the time.

Age at sexual maturity, egg weight and hen weight at maturity: The age at sexual maturity (ASM), egg weight at sexual maturity and hen weight at sexual maturity of ND, H and NN chickens are shown in Table 4. The age at which native chicken birds start laying eggs ranges from 151.8 to 159.1 days. The age at sexual maturity was not significantly ($p > 0.05$) affected by genotype, hatch and genotype × hatch interaction. The birds of Hilly genotype start laying eggs at higher age as compared to naked neck genotype. The age at first egg or age at sexual maturity was comparable with same genotypes of native chicken as reported by Faruque *et al.* (2007). The age at sexual maturity of NN genotype (151 days) was 5 days earlier than that of H (156 days) in their first hatch and age at sexual maturity is not consistent with the observations of Barua (1992*)*, Huque *et al.* (1990) and Sazzad *(*1986). They reported that NN and ND came to sexual maturity at 234 and 175 days, respectively. Hen weight at sexual maturity was significantly affected ($p < 0.05$) by genotype but not affected ($p > 0.05$) by hatch or genotype × hatch interaction. The heavier body weights at sexual maturity were found in H (1228.6 ± 154.1 g) in first hatch or H (1246.2 ± 118.7g) in 2nd hatch and the lowest weight in NN genotype in their first hatch (1154.8 ± 95.2 g) and in 2nd hatch (1217.6 ± 145.3 g). These findings are in agreement with the findings of Faruque *et al.* (2007) who found the heavier body weight at sexual maturity in H (1461.2 ± 251.0 g) and the lowest weight in NN (1310.5 ± 136.0 g). Egg weight at sexual maturity was significantly affected ($p < 0.001$) by genotype but not affected by hatch or genotype × hatch interaction. Egg weight at sexual maturity ranges from 25.8 to 27.1 g. Faruque *et al*. (2007) found that egg weight at sexual maturity in H (28.4 g) and in NN (29.1 g) which is a little bit higher than the present findings.

Table 4. Age at sexual maturity (d), hen weight at maturity (g) and egg weight at maturity (g).

Trait	Hatch	Genotype		Genotype (G)	Hatch (H)	G × H
		H Mean ± Sd	NN Mean ± Sd			
Age at sexual maturity (d)	1st	156.2 ± 19.5 (48)	151.8 ± 9.2 (17)	NS	NS	NS
	2nd	159.1 ± 7.0 (44)	156.1 ± 8.1 (29)			
Hen weight at maturity (g)	1st	1228.6 ± 154.1 (48)	1154.8 ± 95.2 (17)	*	NS	NS
	2nd	1246.2 ± 118.7 (44)	1217.6 ± 145.3 (29)			
Egg weight at maturity (g)	1st	26.7 ± 1.2 (48)	26.0 ± 1.6 (17)	***	NS	NS
	2nd	27.11 ± 1.9 (44)	25.8 ± 1.3 (29)			

NS = Non significant, *= Significant at 5% level ($p < 0.05$), ***= Highly significant ($p < 0.001$), Sd = Standard deviation.

Heritability for body weight trait: Calculated heritability for 12th week body weight of ND, H and NN were 0.16 ± 0.39, 0.50 ± 0.05 and 0.73 ± 0.25, respectively and for 16th week-body-weight of H and ND were 0.72 ± 0.15 and 0.35 ± 0.15, respectively. In case of H (72.0%) and of NN (35.0%) variation of 16th week –body-weight was due to heredity and rest is controlled by environment. Differences in heritability estimates could be attributed to method of estimation, genotype, environmental effects and sampling error due to small data set or sample size.

Table 5. Heritability estimates for body weight.

Genotype	Parameter	Mean	Sd	$h^2 \pm SE$
ND	Body weight at 12 weeks (g)	623.83	61.19	0.16 ± 0.39
	Body weight at 16 weeks (g)	-	-	-
H	Body weight at 12 weeks (g)	629.54	145.46	0.50 ± 0.05
	Body weight at 16 weeks (g)	1053.85	204.99	0.72 ± 0.15
NN	Body weight at 12 weeks (g)	587.98	137.84	0.73 ± 0.25
	Body weight at 16 weeks (g)	1067.06	199.88	0.35 ± 0.15

Mortality: There were 603, 405 and 285 chick records in ND, H and NN genotypes, respectively. NN genotype (4.21%) had significantly ($\chi^2 = 8.27$; $p < 0.01$) higher chick mortality than ND (1.65%) and H (1.23%) at brooding period (0 - 4 weeks, Table 6). There were 203 and 150 chick records of H and NN, respectively at growing period (5 - 13 weeks). Surprisingly, there was no significant ($\chi^2 = 0.765$; $p > 0.05$) difference between H and NN genotype on chick mortality, which was 6.89 and 4.66%, respectively (Table 7). There were 202, 164 and 927 chick records on 1, 2 and 3rd hatches, respectively. Chick mortality did not affected ($\chi^2 = 3.416$; $p > 0.05$) by hatch (Table 8).

Table 6. Effect of genotype on chick mortality (%) at brooding period (0 - 4 weeks).

Genotype	ND	H	NN	χ^2 (df = 2)	p-value
Mortality (%)	1.65	1.23	4.21	8.27	p < 0.01

Table 7. Effect of genotype on chick mortality (%) at growing period (5 - 13 weeks).

Genotype	H	NN	χ^2 (df = 2)	p-value
Mortality (%)	6.89	4.66	0.765	NS

Table 8. Effect of genotype on chick mortality (%) at brooding period (0-4 weeks).

Genotype	ND	H	NN	χ^2 (df = 2)	p-value
Mortality (%)	2.97	0.61	1.51	3.416	NS

CONCLUSION

It may be concluded that naked neck is genetically superior to non-descript desi and hilly in terms of above reproductive parameters like age at sexual maturity and fertility and productive parameters like egg weight, chick weight and body weight. Medium to high heritability suggests that genetic selection for body weight may be effective to improve this trait. Further study for the conservation and development of native chickens to be continued which can lead to start selection or breeding programmes in native chicken genotypes.

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