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Productive and reproductive performances of indigenous chicken in the rural condition of Bangladesh

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Abstract

The study was aimed at investigating the productive and reproductive performances of the rural chicken in Bangladesh. A total of 200 indigenous chickens in the villages of Sherpur district in Bangladesh was used in this study to collect the data on body weight at hatch (BWH), body weight at sexual maturity (BWS), body weight gain up to sexual maturity (BSBG), body weight gain from sexual maturity to one year of age (BYSG), body weight at one year of age (BWY), age at sexual maturity (AGSX), eggs per clutch (EGC), clutches per year (CLY), hatchability (HATCH) and survivability (SURV). The data showed that cap headed (CH) chickens were good meat producer (1027.14±25.32g meat at one year of age), and Non-Descript Deshi (ND) chickens were good egg producer with 12.03±0.11 eggs per clutch and 4.15±0.07 clutches per year, respectively. The effects of village, sex and type of birds on AGSX of indigenous chickens were significant but, only the effects of chicken type on EGC were significant ($P<0.01$). At present study, most of growth and reproductive traits found positively correlated and this might be suggestive that selection for one trait would affect the other positively. These results could be used as a guideline for planning, conservation and improvement of indigenous chickens of Bangladesh.

Key words: productive and reproductive performance, indigenous chicken, Bangladesh

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Introduction

Poultry, mainly indigenous chickens are the standby money generator of marginal village women in Bangladesh. Total poultry population of Bangladesh is approximately 296.26 million and among them chicken population is approximately 249 million in the year 2012-2013. Total egg production of Bangladesh in the year 2012-2013 was 7617.38 million in number (MoFL, 2013). Islam *et al.* (2012) found the average number of chickens per household to be 9.5 and 89% of rural household reared poultry and supplied 20.8% of the country's total egg and 37.3% of meat (BBS, 2009). It was the main species of economic concern for a large proportion of poor households (HHs) in the villages (Shahjahan *et al.,* 2011). The Non-descript Deshi chicken, also known as 'Murgi' have undergone for unknown periods of natural selection and are a reservoir of excellent genetic diversity (Bhuiyan *et al.,* 2009). Among indigenous chicken genetic resources, Non-descript Deshi, Aseel and Naked Neck varieties are noteworthy. Bhuiyan (2011) reported that the national share of commercial and family poultry in terms of egg production probably almost equal and that of meat production was 60:40.

Efforts were initiated to conserve (Ali *et al.,* 2003) and evaluate (Kosba and Abd El-Halim, 2008) the available superior germplasm of the Indigenous chickens in Egypt. In Bangladesh, many efforts were completed to sustain commercial hybrid broiler and layer chicken farming under intensive and semi-intensive production models but with the indigenous Deshi chickens improvement and conservation programme at the smallholder village levels (*in-situ*) yet to be tested (Bhuiyan *et al.,* 2005). Bright prospects of the Indigenous chickens of Bangladesh as family poultry under low-input, low-output production systems observed (Chowdhury, 2012). Researchers should be given the responsibility to identify, characterize and improve native stocks (Singh *et al.,* 2011). So, it is important to improve indigenous village chickens using selected superior indigenous birds (male, female) *in-situ*. Selection for egg or meat production in purebred native chickens has been carried out in many places of the world, and it is clear that considerable improvement is possible (Bhuiyan *et al.,* 2005), which is very important from the stand point of conservation and livelihood of the rural people of Bangladesh. Keeping these views into consideration, the present research work was undertaken to analyze the productive and reproductive performances of

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indigenous chicken *in- situ, and to* study relationship among the said productive and reproductive performances of indigenous chicken.

Materials and Methods

Materials used

To collect experimental data, weighing balance up to 3 kg of weight was preferred to take precise weight of the birds. A weight difference up to 10-20 g was easily pointed out with that weighing scale. A piece of rope was used to tie the birds during weighing so that birds by struggling could not create problem while taking the actual reading. Data were collected with the help of an in-depth data collection format developed by GEF-ILRI Asia project (BSPIMSM, 2010) by door to door visit.

Data collection procedure

Birds were individually identified using leg and wing bands. Data on BWH, BWS, BSBG, BYSG, BWY, AGSX, EGC, CLY, HATCH and SURV were collected from four villages namely Rangtia, Shalchura, Dudhnoi and Bangaon of Jhenaigati upazilla under Sherpur district in Bangladesh during January 2012 to June 2013. Farmers were given orientation on the use of data collection sheet on egg laying and hatching information and periodical visits were performed to check the information. Body weight and other information were collected by direct visit to farmer's house.

Analysis of data

SAS (2003) software was used for analyzing data on body weight, production and reproduction performances. Mean comparison of traits was performed using Duncan's Multiple Range Test and Least square means done by GLM procedure of SAS.

Results

Productive traits of indigenous chicken

Effect of sex on body weight and average daily body weight gain

The effects of sex (Table 1) on BWH, BWS, BWY, BSBG and BYSG of Indigenous chickens were non-significant (P>0.05) whereas the effects of sex on AGSX of indigenous chickens were highly significant (P<0.01). The mean BWH, BWS, BWY, BSBG and BYSG for male and female chickens were 24.62±0.14 and 24.40±0.21, 809.43±9.36 and 786.00±12.57, 1004.63±10.42 and 1023.25±15.99, 4.00±0.04 and 3.88±0.06 and 1.12±0.03 and 1.21±0.03 g, respectively. The AGSX was 26.93±0.09 and 24.07±0.24 weeks for male and females, respectively.

Table 1. Least squares means ± standard errors of body weight and growth traits of Indigenous chickens

Factor	Trait					
	BWH	BWS	BWY	BSBG	BYSG	AGSX
Type	NS	NS	NS	NS	NS	**
NN (14)	24.78±0.29	782.85±31.56	967.85±25.38	3.86 ±0.16	0.97 ±0.06	25.07^{a}±0.41
ND(172)	24.55±0.13	805.46±8.60	1010.12±9.95	3.98 ±0.04	1.15 ±0.03	26.45^{b}±0.12
CH (14)	24.64±0.40	817.85±26.48	1027.14±25.32	4.04 ±0.13	1.17 ±0.10	26.50^{b}±0.51
Sex	NS	NS	NS	NS	NS	***
Male (40)	24.62±0.14	809.43±9.36	1004.63±10.42	4.00 ±0.04	1.12 ±0.03	26.93^{b}±0.09
Female (160)	24.40±0.21	786.00±12.57	1023.25±15.99	3.88 ±0.06	1.21 ±0.03	24.07^{a}±0.24
Type × Sex	NS	NS	NS	NS	NS	NS
Village	NS	NS	NS	NS	NS	*
Rangtia (50)	24.86± 0.30	831.40±19.50	1027.80±22.84	4.11±0.09	1.09^{b}±0.06	26.46^{c}±0.20
Shalchura(50)	24.60±0.26	813.80±16.82	997.00±15.95	4.02±0.08	1.01^{c}±0.04	26.28^{b}±0.23
Dudhnoi(50)	24.40±0.18	772.80±12.09	969.40±14.66	3.81±0.06	1.09^{b}±0.05	26.00^{a}±0.26
Bongaon(50)	24.46±0.19	801.00±13.07	1039.20±15.60	3.96±0.06	1.35^{a}±0.04	26.72^{d}±0.24
Sex×Village	NS	NS	NS	NS	**	NS

Note: NS = Not significant (P>0.05), (**) = significant at 1% level of probability (P<0.01), (***) = significant at 0.1% level of probability (P<0.001). .^{abc}Means with the different superscripts differed significantly within the column (P<0.05). Figures in the parenthesis indicate the number of observations. BWH-body weight at hatch, BWS- body weight at sexual maturity, BSBG- body weight gain up to sexual maturity, BYSG- body weight gain from sexual maturity to one year of age, BWY- body weight at one year of age, AGSX- age at sexual maturity, NN- Naked Neck, ND- Non-descript Deshi, CH-Cap headed.

Reproductive traits of indigenous chicken

Table 2. Least square means ± standard error of reproductive traits of indigenous chicken

Factor		Trait			
		EGC	**CLY**	**HATCH**	**SURV**
Type	NN	11.04^{c}±O.32	3.98±0.29	76.67±4.22	61.78± 8.57
	ND	12.03^{b}±0.11	4.15±0.07	73.28±1.29	50.16±2.30
	CH	12.89^{a}±0.33	3.74±0.23	70.31±5.89	48.86±8.34
		**	NS	NS	NS
Village	Rangtia	12.44±0.22	4.12±0.13	70.25±2.45	48.03±4.19
	Shalchura	11.70±0.22	4.14±0.14	75.69±2.56	56.02±3.99
	Dudhnoi	11.53±0.19	4.13±0.14	73.25±2.63	54.19±4.35
	Bongaon	12.46±0.18	4.07±0.15	73.86±2.11	44.41±4.55
		NS	NS	NS	NS

Note: NS= Not significant (P>0.05), (**) = significant at 1% level of probability (P<0.01). ^{abc}Means with the different superscripts differed significantly within the column (P<0.05). Figures in the parenthesis indicate the number of observations. EGC-egg per clutch, CLY- clutches per year, HATCH- hatchability, SURV- survivability, NN- Naked Neck, ND- Non-descript Deshi, CH- Cap headed.

Effect of type of birds

The effects of chicken type (Table 2) on EGC of Indigenous chickens were significant (P<0.01). However, the effects of type on CLY, HATCH and SURV of indigenous chickens were non-significant. HATCH varied from 70.31 to 76.67% in the present finding.

Effect of villages of birds on egg production

The effect of village (Table 2) on EGC, CLY, HATCH and SURV of indigenous chickens were non-significant (P>0.05). However, EGC varied from 11.53±0.19 to 12.46±0.18b eggs while CLY varied from 4.07±0.15 to 4.14±0.14.

Correlation among body weight and growth trait of indigenous chicken

Correlations (Table 3) between AGSX and BWH, BWS, BWY, BSBG, BYSG of age were 0.15±0.07, 0.13±0.07, 0.14±0.07, 0.14±0.07 and 0.21±0.07, respectively. Correlations between BWH with AGSX, BWS, BWY, BSBG and BYSG were 0.15, 0.34±0.07, 0.25±0.07, 0.34±0.07 and 0.14±0.07, respectively. Correlations between BWS with AGSX, BWH, BWY, BSBG, and BYSG were 0.13±0.07, 0.34±0.07, 0.83±0.03, 0.99±0.03 and 0.05±0.07, respectively. Correlation between BWY with AGSX, BWH, BSBG and BYSG were 0.14±0.07, 0.25±0.07, 0.83±0.03, 0.84±0.03 and 0.48±0.06, respectively.

Correlations between BSBG with AGSX, BWH, BWS, BWY and BYSG were 0.14±0.07, 0.34±0.07, 0.99±0.03, 0.84±0.03 and 0.05±0.07, respectively. Correlations between BYSG with AGSX, BWH, BWS, BWY and BSBG were 0.21±0.07, 0.14±0.07, 0.05±0.07, 0.48±0.06 and 0.05±0.07, respectively. Highly significant correlations between BWH and BWS; BWH and BWY; BWH and BSBG; BWY and BWS; BWY and BSBG; BWY and BYSG were reported. Moreover, significant correlations between AGSX and BWS; AGSX and BWY; AGSX and BSBG; AGSX and BYSG; BWH and BYSG; BWS and BWH; BWS and BWY, BWS and BSBG; BSBG and BWH; BSBG and BWY were also documented.

Correlation among reproductive traits of indigenous chicken

Correlations (Table 4) of EGC with CLY, hatchability and survivability were 0.52±0.06, 0.73±0.05 and 0.30±0.07, respectively. Correlations between CLY with EGC, hatchability and survivability were 0.52±0.06, 0.54±0.06 and 0.25±0.07, respectively. Correlations between HATCH and SURV was 0.13±0.07.

Table 3. Correlation among body weight and growth traits of Indigenous chicken

Trait	Correlation ± SE					
	AGSX	BWH	BWS	BWY	BSBG	BYSG
AGSX	1.00	0.15±0.07^{NS}	0.13±0.07 *	0.14±0.07 *	0.14±0.07*	0.21±0.07**
BWH	0.15±0.07 ^{NS}	1.00	0.34±0.07 ***	0.25±0.07 ***	0.34±0.07 ***	0.14±0.07 *
BWS	0.13±0.07*	0.34±0.07***	1.00	0.83±0.03 ***	0.99±0.03 ***	0.05±0.07^{NS}
BWY	0.14±0.07*	0.25±0.07 ***	0.83±0.03 ***	1.00	0.84±0.03***	0.48±0.06***
BSBG	0.14±0.07*	0.34±0.07 ***	0.99±0.03 ***	0.84±0.03***	1.00	0.05±0.07 ^{NS}
BYSG	0.21±0.07**	0.14±0.07 *	0.05±0.07 ^{NS}	0.48±0.06***	0.05±0.07***	1.00

Note: NS= Not significant (P>0.05), (*) = significant at 5% level of probability (P<0.05), (**) = significant at 1% level of probability (P<0.01), (***) = significant at 0.1% level of probability (P<0.001). Figures in the parenthesis indicate the number of observations. BWH- body weight at hatch, BWS- body weight at sexual maturity, BWY- body weight at one year of age, BSBG- body weight gain up to sexual maturity, BYSG- body weight gain from sexual maturity to one year of age. Correlation ± SE = Correlation ± Standard Error of Correlation.

Table 4. Correlation among reproductive traits of indigenous chicken

Traits	Correlation ± SE of correlation			
	EGC	CLY	HATCH	SURV
EGC	1.00	0.52 ±0.06 ***	0.73 ±0.05***	0.30 ±0.07***
CLY	0.52 ±0.06 ***	1.00	0.54 ±0.06***	0.25 ±0.07***
HATCH	0.73 ±0.05 ***	0.54 ±0.06***	1.00	0.13 ±0.07 ^{NS}
SURV	0.30 ±0.07***	0.25 ±0.07***	0.13 ±0.07^{NS}	1.00

Note: NS = Not significant (P>0.05), **(*****) = significant at 0.1% level of probability (P<0.001). EGC- egg per clutch, CLYR- clutch per year, HATCH- hatchability, SURV- survivability.

Correlations between SURV with EGC, CLY and hatchability were 0.30±0.07, 0.25±0.07 and 0.13±0.07, respectively. Highly significant correlations between EGC and CLY; EGC and HATCH; EGC and SURV; CLY and HATCH; CLY and SURV were reported. But, non significant correlations were documented between HATCH and SURV traits of Indigenous chickens.

Discussion

Productive traits of indigenous chicken

Effect of sex on body weight and average daily body weight gain

The effects of sex (Table 1) on BWH, BWS, BWY, BSBG and BYSG of Indigenous chickens were non-significant (P>0.05) and this might be due to the number of observation of male birds were too lower than female birds, feeding and other management issues; whereas the effects of sex on AGSX of Indigenous chickens were highly significant (P<0.001). The results were in agreement with the studies of Kalita *et al.* (2009) for day old chick (24.89 g to 26.27 g), Bett *et al*. (2014) for average body weights of village chicken in Pakistan (1069±24.7 g) and Tabassum *et al.* (2014) in Bangladesh (961.50 ± 17.79 g). However, Vali (2008) found 1416 g body weight at sexual maturity for male and 1058.3 g for female incase of Naked Neck chicken.

Effect of type of birds and interaction between sex and type of birds

The effects of type (Table 1) on BWH, BWS, BWY, BSBG and BYSG of Indigenous chickens were non-significant whereas the effects of type on AGSX of Indigenous chickens were highly significant (P<0.01). However, significant effect

of BW on breed in South Africa (Alabi *et al.,* 2012) reported which disagree with the present study. This result was also similar to the findings of Faruque *et al*. (2007). The interaction between type and sex on BWH, BWS, BWY, BSBG, BYSG and AGSX of Indigenous chickens were non-significant (P>0.05).

Effect of village and interaction between sex and villages

The effects of village on BWH, BWS, BWY, BSBG and BYSG of Indigenous chickens were non-significant (P>0.05) whereas the effects on AGSX of Indigenous chickens were significant (P<0.05). However, Nthimo (2004) reported that mature indigenous male attained body weight 1.5 kg, 1.5 kg, 1.2 kg, 1.8 kg in the Burkina Faso, Chad, Ghana, and Lesotho, respectively where the values were higher than the present study. The interaction between sex and village on BWH, BWS, BWY, BSBG and AGSX of Indigenous chickens were non-significant. But, interaction between sex and villages on BYSG of Indigenous chickens were significant (P<0.01).

Reproductive traits of indigenous chicken

Effect of type of birds

The effects of chicken type (Table 2) on EGC of Indigenous chickens were significant. It might be due to the variation of genetic merit among the types of birds or feeding and other management could be affected. But, the effects of type on CLY, HATCH and SURV of Indigenous chickens were non-significant. CLY were highly dependent on feed, water, care and husbandry of laying hen, because this hen had to brood and take part in husbandry process of her baby chicks up to a certain age, on the other hand HATCH were dependent on environment temperature, broody hens body health condition and her dedication to incubation process. But SURV were mostly dependent on rearing system, because at young stage of baby chicks, predators were the most harmful factor. However, Moreki (2000) reported an average of 15 eggs /clutch in Botswana which was higher than the present study. But the findings of Khalafalla *et al.,* (2001) and Badubi *et al.* (2006) were in agreement with the present study. Hatchability reported in the present finding was similar to Islam *et al.* (2007) and Desha *et al*. (2015) who found HATCH of N/N chicken 71.80% and 77.52% (Indigenous chicken), respectively. Islam *et al.* (2012) found survivability 83.90% for Naked Neck chicken which differed from the present study.

Effect of villages of birds on egg production

The effect of village (Table 2) on EGC, CLY, HATCH and SURV of Indigenous chickens were non-significant. CLY varied from village (4.07±0.15 at Bongaon) to village (4.14±0.14Shalchura). However, present study was in agreement with Tadella *et al.* (2000) and Shawkat *et al.* (2001).

Correlation among body weight and growth trait of indigenous chicken

Highly significant correlations between BWH and BWS; BWH and BWY; BWH and BSBG; BWY and BWS; BWY and BSBG; BWY and BYSG were reported. Moreover, significant correlations between AGSX and BWS; AGSX and BWY; AGSX and BSBG; AGSX and BYSG; BWH and BYSG; BWS and BWH; BWS and BWY, BWS and BSBG; BSBG and BWH; BSBG and BWY were also documented. Similarly, other research scholars (Alabi *et al.,* 2012; Faruque *et al.*, 2007) also found high degree of correlation between body weight and linear body measurements in Indigenous chickens. However, non significant correlations were documented between AGSX and BWH; BWS and BYSG; BSBG and BYSG. Positive and significantly correlated growth traits might be suggested that, selection for one trait will affect the other positively.

Correlation among reproductive traits of indigenous chicken

Highly significant correlations between EGC and CLY (medium level; 0.52±0.06); EGC and HATCH (medium level; 0.73±0.05); EGC and SURV (low level; 0.30±0.07); CLY and HATCH (medium level; 0.54±0.06); CLY and SURV (low level; 0.25±0.07) were observed. These findings might be indicative that selection for higher positive value of any one of traits like EGC, CLY or HATCH would affect the others positively. But, non significant and low level (0.13±0.07) correlations were found between HATCH and SURV traits of Indigenous chickens. On the contrary, between body weight traits and number of eggs, negative genetic correlation were estimated (Bahmanimehr, 2012). From the above discussions it might be revealed that as significant, positive and medium level of correlations were found among reproductive traits like EGC, CLY and HATCH, so, increase of one trait could increase the other and vice versa.

Conclusion

Cap Headed chickens were good meat producers while Non-Descript Deshi chickens were good egg producer. The effects of village, sex and type of birds on AGSX and the effects of chicken type on EGC of Indigenous chickens were significant. Highly significant correlations between BWH and BWS; BWH and BWY; BWH and BSBG; BWY and BWS; BWY and BSBG; BWY and BYSG; EGC and CLY; EGC and HATCH; EGC and SURV; CLY and HATCH; CLY and SURV were reported. Moreover, significant correlations between AGSX and BWS; AGSX and BWY; AGSX and BSBG; AGSX and BYSG; BWH and BYSG; BWS and BWH; BWS and BWY, BWS and BSBG; BSBG and BWH; BSBG and BWY were also documented. Positive and significantly correlated traits might be suggestive that selection for any of these body parameters would cause direct improvement of the correlated traits. From the results of the above study, it might be concluded that the productive and reproductive performance of indigenous chicken *in-situ* vary with chicken type, sex and location.

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