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Effect of Creep Feeding on Productive and Reproductive Performance of BLRI Improved Non-Descript Deshi Chicken Under Semi-scavenging Rearing System

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ABSTRACT

The study was conducted to evaluate the effects of creep feeding on productive and reproductive performance of BLRI improved Non-descript Deshi (ND) chicken and their chick's growth up to 8th week of age under semi-scavenging conditions at three different locations of Bangladesh. Two groups of farmers were selected from each location having the BLRI improved ND birds where one group used creep feeder and followed improved management practices, called creep feeding (CF) group. Another group of farmers rear ND chicken traditionally without using creep feeder, termed as non-creep feeding group (NCF) or control group. In CF trial, feeding groups had significant effects on hen weight loss during incubation, resume of laying, clutch size and clutch length ($p<0.001$). Hen weight loss was significantly lower in CF group (180g) than the NCF group (291g) during brooding of chicks. Hence, hens of CF group resume of laying about 2 weeks (13 days) earlier than the NCF group. Subsequently, the hens of CF group laid 29 eggs per clutch (37 days) in contrast to 23 eggs (38 days) by hens of NCF. However, the fertility and hatchability were insignificant ($p>0.05$) between the groups but higher in CF group than the NCF group as 82 and 76%, and 76 and 70%, respectively. Notably, the 8th week chick weight was 200g more in CF group than NCF group and the mortality was significantly ($p<0.01$) higher in NCF group (16%) than CF group (11%). However, feed intake of chicks didn't differ significantly between the two feeding groups. In conclusion, CF found to be potentially contributed in better adaptation and efficient production performance of BLRI improved ND varieties under farmer's condition and could be disseminated this management approach to farmers' level for mass scale utilization.

Introduction

Family chicken is an integral part of rural household among the least developed countries including Bangladesh. Anonymous (1991) reported that rearing of indigenous chicken gives maximum return with minimum cost by efficient conversion of agricultural by products, kitchen wastes, grains and seeds, garden left-over, insects and all other human refusals that would otherwise go wastes. In Bangladesh, there are about 282.14 million chickens in the commercial and subsistence production systems (DLS, 2018). The national share between commercial strains of chicken and indigenous poultry for egg production is almost equal (50:50) and that of meat production is 60:40 (Bhuiyan, 2011). Bhuiyan *et al.* (2013) stated that about 89% of rural households rear indigenous chicken having the average flock size of 5.33 per holding which signifies the contribution of indigenous chicken in Bangladesh under backyard scavenging system. Indigenous chickens are comparatively lower in productivity but are well adapted to adverse tropical climate and fluctuating nutritional conditions compared to exotic chicken (Islam *et al.*, 1981; Ferdaus *et al.*, 2016). Bangladesh Livestock Research Institute (BLRI) has undertaken a planned and systematic indigenous chicken improvement program since 2000 and the productivity of three chicken varieties Non-descript Deshi (ND), Naked Neck (NN), Hilly (HI) has already increased remarkably over the generations of selection under intensive management condition (Faruque *et al.,* 2015). The annual egg production of BLRI improved ND, HI and NN increased up to 150-160, 130-140 and 175-190, respectively and egg weight increased by 2-3 g under standard feeding and management conditions

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Moreover, the age at sexual maturity decreased to 154 days from 168 days (Faruque *et al.,* 2015). However, the improved genotypes most often do not perform satisfactorily under low input or subsistence level farming condition and should be judged by validating their performances under farmers' condition.

Previously various interventions were undertaken to improve the productivity of indigenous chicken by reducing chick's mortality, enhancing chick's growth through feed supplementation as well as reducing the time of post-brooding activities of hen. Hossen (2010) stated that management interventions in indigenous chickens like separation of chicks and creep feeding of chicks helped to increase annual egg production from 45 to 96 per hen and chick's livability increased from 43 to 87% in a year. Improvement of management practices like early separation and creep feeding of chicks, and supplementation of hens during incubation had the significant effects on production performance and profitability of the farmers (Huque et al., 1990; Sarker and Golam, 2009). Sonaiya (1995) reported that the low productivity of scavenging chickens is mainly due to the problems associated with management system rather than inherent genetic potentials. Egg production of indigenous chickens could simply be doubled through intervening in management practices (Sarkar and Bell, 2006). However, all of the above-mentioned interventions were employed using available indigenous chickens of Bangladesh and no research has yet been conducted with the BLRI improved chicken varieties under farmers conditions with better management intervention like creep feeding. On the other hand, on station-based better performed BLRI improved indigenous chicken varieties needs *in situ* performance study to get a comprehensive information on productivity and adaptability at farmer's house. Therefore, the objectives of the present study were to know the effects of creep feeding on productive and reproductive performances of BLRI improved ND chicken as well as chick's performance under semi-scavenging rearing system.

Materials and Methods

Location and lay out of the experiment

The present study was conducted at three different locations of Bangladesh namely Nakla, Sherpur; Dinajpur Sadar and Dumuria, Khulna to investigate the effects of creep feeding on the performances of both BLRI improved ND chicken and chicks under semi-scavenging condition. The duration of the study was from incubation of eggs up to 8 weeks performance of chicks. Two groups of farmers were selected from each location having the BLRI improved ND birds where one group used creep feeder and followed improved management practices, called creep feeding (CF) group. Another group of farmers did not use creep feeder and rear ND chicken traditionally, called non creep feeding group (NCF). A total of 23 CF farmers (8 from each of Nakla and Dinajpur, 7 from Khulna) and 20 NCF farmers (7 from Nakla, 5 from Dinajpur and 8 from Khulna) were selected from 3 locations for this study. One representative broody hen was selected from each farmer. Hatching eggs were collected by the respective farmers and a total of 342 hatching eggs were incubated by CF group (120, 120 and 102 eggs were from Sherpur, Dinajpur and Khulna, respectively) while 298 eggs were set by NCF group (105, 75 and 118 eggs from the above stated locations). The supplementary feed at the rate of 60 g/hen/day and clean water was provided in front of broody hens during incubation period for CF group only. A total of 258 and 210 chicks were hatched in CF and NCF group, respectively. The chicks were brooded 3 weeks providing extra care to the chicks in creep feeder and were supplied *ad libitum* feed during brooding. The chicks were separated from the hens after 3 weeks and provided 25 g supplementary feed increasing 5 g per week up to 8th week of age. Same amount of supplementation was provided for both CF and NCF chicks and similar vaccination schedule was followed (Table 1). However, extra managemental care for broody hens and hatched chicks were taken in CF group while the NCF group reared chicks traditionally by their own management practices.

Table 1. Vaccination schedule for chicks

Age (days)	Name of vaccine*	Route	Dose
6	BCRDV live	Eye/oral	One drop
21	BCRDV live (booster)	Eye/oral	One drop
35	Fowl pox	Wing web	2 punches
45	ND Clone 30	Drinking water	As per quantity

*BCRDV= Baby Chick Ranikhet Disease Vaccine; ND = New Castle Disease.

Traits under study

The following traits were measured during the experimental period; hatching egg weight, fertility and hatchability % of hatching egg, body weight of broody hens before and after incubation, onset of relaying (day), clutch length (day), clutch number, day old chick weight (g), average feed intake (g/chick/day), weekly live weight of chicks (g) and mortality. Data were collected on spot measurement in the farmers premises and were recorded accordingly.

Statistical analysis

The collected data were compiled, adjusted and analyzed by Generalized Linear Model (GLM) procedure using Statistical Analysis System (SAS) 9.1.3 version, SAS

Institute Inc. (2005), USA. Duncan's multiple range test (DMRT) was used for mean comparisons.

Results and Discussion

Effect of creep feeding on hen's productive and reproductive performances

Egg weight (g), day-old chick weight (g), fertility and hatchability (%) on total eggs between two different feeding systems are shown in Table 2 and 3. The egg weight was almost similar in both CF and NCF groups, but the hatched chick weight varied significantly ($p<0.05$). The fertility and hatchability (%) were not affected ($p>0.05$) by feeding systems and interaction between feeding systems and locations (Table 3). However, fertility and hatchability were found higher in CF group as 82 and 76%, respectively than that of NCF group to be 76 and 70%, respectively. Hossen (2010) reported that hatchability in CF and traditionally managed flocks of indigenous chicken were 88.0±3.0 and 84.1±13.4%, respectively. This result is higher than the current study. Sonaiya (2005) stated that the hatchability of Indigenous chicken's egg was 86% in Nigeria and is also higher than the present findings. In another study, Sarker and Golam (2009) reported 50 to 100% hatchability of indigenous hens and 83-95% hatchability in a CF managed flock of indigenous chicken. This result mentioned a broader range where the current findings are within the valued range. However, there are limited information available in literature regarding the fertility and hatchability of eggs considering such type of genetically improved indigenous chicken to compare with the current study. Fertility and hatchability are non genetic traits and variations among the findings might be due to care and management of the broody hens, cock hen ratio and other associated management and environmental factors.

On the other hand, other parameters like hen weight, hen weight loss, resume of laying, clutch size and clutch length were highly influenced ($p<0.001$) by feeding system and interaction of feeding system and location (Table 4). Feeding system also had significant influence on the aforesaid traits among three different locations except resume of laying (Table 2). Hen weight was found higher in CF group (1580g) than the NCF group (1476 g). More hen weight loss was observed in NCF group (291g) than the CF group (180 g) during brooding of chicks. Due to proper care and management ensured in the CF group the hens start relaying about two weeks (13 days) earlier than the NCF group. Subsequently, the hens laid more eggs that means larger clutch size about 29 eggs than the NCF group (23 eggs) with the 2 days shorter clutch length in CF group. Hossen (2010) stated 420g weight loss in a control group of hens during incubation period and is much higher than the current study. Sarker and Bell (2006) reported that weight loss of indigenous chicken during incubation under traditional management was 380.0 ± 64.0 g which is also higher than this finding (291.40±11.04). The finding of this study on resume of laying is similar with the result of Hossen (2010) who reported 84 days in a control group of hens needs for relaying. It is notable to mention that there is no available data or limited information in literature to compare the clutch size and clutch length of improved indigenous chicken varieties along with improved management conditions. Sarker and Golam (2009) reported 3-4 clutches of indigenous hens and 12-17 eggs per clutch. However, with early weaning interventions, they found 13-22 eggs /hen/clutch and 17-26 days for length of clutch in flock. The results are partially agreed to the current findings. Hossen (2010) reported maximum of 23 eggs/hen/clutch for an early weaning group of hens and is close to the current findings (28 eggs /clutch/hen). He also reported the clutch length of 27 days which is lower than the current findings (37 days). The probable explanation could be that the hens with improved genetic merits produce eggs continuously with minimum gap for few days which is somehow difficult to count as pause or clutch. Sarker and Bell (2006) reported that early weaning of chicks significantly increased productivity of indigenous chickens in five southern districts of Bangladesh where the average number of clutches per year, number of eggs per clutch and annual egg production per hen to be 5.33, 18 and 99, respectively. These reported values are lower than the present findings. The annual egg production could be doubled in indigenous chicken if their chicks are separated and fed in a creep feeder after hatching and thereby hens get more laying time (Gunaratne *et al*., 1993). Altogether, the differences between present and previous findings might be attributed with genotype of the birds, number of samples investigated as well as with management interventions like early weaning of chicks, amount of feed supplementation to chicks and broody hens and feeding system.

Effect of creep feeding on feed intake and growth of chicks up to 8 weeks of age

Feed intake between CF and NCF group at 1st, 2nd, 4th, 6th and 8th week of age was non-significant by the feeding system and the interaction between feeding system and location, except at 2nd week of age where it was influenced ($p<0.05$) by the feeding system (Table 5). The average feed intake by both groups at 1st, 4th and 8th week of age were 5, 18 and 37g/bird/day, respectively. On the other hand, the chick weight at 1st, 2nd, 4th, 6th and 8th week of age was affected highly ($p<0.001$) by the feeding system and the interaction of feeding system and location (Table 6). The chick weight at 1st, 4th and 8th week of age was 56 and 45 g; 237 and 113 g; 576 and

374 g, respectively for creep feeding versus non-creep feeding group. The results clearly indicated that supplying same amount of feed to the birds of either groups weight gain differed significantly between the groups. At 8th week of age about 200 g more weight recorded per bird for CF group by supplying on an average 37g feed supplementation per day per bird for both the groups. Hossen (2010) reported 9 weeks of marketing age with a live weight of 462±39 g in a CF managed group of indigenous chicken. In another study, Sarker and Golam (2009) reported the live weight was 462 g under CF management flock at 9 weeks of marketing age. The chicks of the current study attained 100g more live weight even one week earlier than the finding of Hossen (2010), Sarker and Bell (2006) and Sarker and Golam (2009). The genotype of the chicks, and quality and quantity of supplementation under CF condition might be associated with higher growth rate obtained in this study compared to previous findings. On the contrary, in NCF group the feed supplied to the birds getting more wastage and/or could not use or intake properly by the chicks due to presence of heterogenous groups together. Therefore, creep feeding interventions have a paramount importance on the efficient utilization of feed and better productivity of indigenous chickens in village conditions.

Effect of creep feeding on mortality of chicks up to 8 weeks of age

The mortality rate up to 8 weeks of age was significantly ($p<0.01$) influenced by the feeding system while it was not affected ($p>0.05$) by their interaction (Table 6). The mortality was found higher in NCF group (16%) than CF group (11%). Predation, low hatched weight of chicks and improper care and management by brooding hens were main associated reasons for the said mortality (data not shown). Sarker and Bell (2006) reported the survival rate of Indigenous chicken in Noakhali, Laxmipur and Feni districts of Bangladesh up to 10 weeks of age was 88.0±6.0% under CF condition and is similar to this study. Hossen (2010) reported 91.0±2.3 and 87.0±5.0 % survivability up to 5 and 10 weeks of age, respectively for CF managed flock of indigenous chicken. That means the mortality at 5 and 10 weeks of age was 9 and 13%, respectively. On the other hand, Sarker and Golam (2009) reported 10 and 12% mortality at the age of 5 and 12 weeks, respectively in a CF managed flock. The above-mentioned results also corroborate the current findings. Dolberg (2003) stated that feed supplementation of indigenous chicken containing 26% crude protein drastically reduced mortality from 50% to 20%. In addition, Gunaratne et al. (1993) reported that the rate of chick mortality could be reduced significantly by the use of creep feeders but need to ensure supplementary feed with sufficient protein for increasing the growth rate and supports the present findings. However, the variations in mortality might be attributed to the care and management of the chicks during brooding, feeding system, housing condition, vaccination and medication, predation etc. Assessment of local versus commercial feed resources for the first 4-6 weeks under creep feeding management reduced mortality of chicks remarkably (FAO, 2004). Moreover, feed supplementation of chicks improves the growth of chicks and in parallel build up chick's immune system for better resistance to infection and parasites. At the same time, it reduces the movement of the birds and thus minimizes the risk of predation. Taken together, creep feeding ensures supplementary feed to the young chicks during the vulnerable period as well as significantly increased growth and survival rate of the chicks.

Table 2. Effect of feeding system on location-wise productive and reproductive performances of ND chicken variety

Parameter	Feeding system[1]	Location			Level of sig.
		Nakla (Mean ±SE)	Dinajpur (Mean ±SE)	Khulna (Mean ±SE)	
Egg weight (g)	CF	45.87^{ab}±0.23 (120)	44.12^{b}±0.23 (120)	47.00^{a}±0.53 (102)	***
	NCF	45.42^{b}±0.29 (105)	43.40^{c}±0.51 (75)	46.75^{a}±0.45 (98)	
Fertility (%)	CF	78.37±1.70 (94)	85.87±2.64 (103)	82.57±4.02 (84)	NS
	NCF	79.00±1.00 (83)	84.00±2.63 (63)	77.50±7.64 (76)	
Hatchability (%)	CF	73.37^{b}±1.74 (69)	85.87^{a}±2.64 (88)	68.57^{c}±5.63 (58)	***
	NCF	78.00^{b}±1.29 (65)	84.00^{a}±2.63 (53)	54.50^{c}±7.45 (42)	
Chick weight (g)	CF	34.00^{a}±0.60 (81)	27.75^{c}±1.01 (63)	31.28^{b}±0.68 (57)	***
	NCF	33.14^{a}±0.59 (63)	24.20^{c}±0.37 (50)	31.62^{b}±0.46 (55)	
Reduction in hen weight (g)	CF	185.75^{b}±5.84 (8)	207.37^{a}±13.21 (8)	144.28^{c}±9.74 (7)	***
	NCF	344.85±6.24 (7)	274.80±11.91 (5)	255.00±13.29 (8)	
Resume of laying (day)	CF	69.12±1.18 (8)	75.12±0.83 (8)	69.14±0.91 (7)	NS
	NCF	85.00±1.77 (7)	79.60±1.36 (5)	86.75±1.41 (8)	
Clutch size (no.)	CF	29.00^{b}±1.03 (8)	24.50^{c}±0.46 (8)	33.14^{a}±0.74 (7)	**
	NCF	12.57^{b}±0.65 (7)	14.80^{a}±0.37 (5)	11.37^{b}±0.70 (8)	
Clutch length (day)	CF	35.00^{b}±0.82 (8)	34.50^{b}±0.63 (8)	41.42^{a}±1.66 (7)	**
	NCF	24.14^{b}±0.98 (7)	30.00^{a}±0.71 (5)	25.12^{b}±0.89 (8)	

[1]CF = creep feeding, NCF = non-creep feeding; values in the parentheses indicate number of observations; different superscripts in the same row represent the level of significance; *** = $p<0.001$; ** = $p<0.01$; NS = $p>0.05$

Table 3. Effect of feeding system on fertility and hatchability of ND chicken variety

Parameter	Trait (Mean ± SE)			
	Egg weight (g)	Hatched out chick weight (g)	Fertility (%)	Hatchability (%)
Creep feeding (n=23)	45.60±0.31 (342)	31.00±0.71 (258)	82.26±1.70 (282)	76.26±2.48 (258)
Non creep feeding (n = 20)	45.45±0.38 (298)	30.30±0.87 (210)	75.65±3.41 (226)	70.10±4.19 (210)
Feeding system	NS	*	NS	NS
Feeding system x Location	NS	*	NS	NS

* = p<0.05; NS = p>0.05; n= Number of farmers in the group; Figures in the parenthesis indicates number of observations.

Table 4. Effect of feeding system on productive and reproductive performances of ND chicken variety

Parameter	Trait (Mean ± SE)				
	Hen weight (g)	Hen weight loss (g)	Resume of laying (days)	Clutch size (No. of eggs)	Clutch length (days)
Creep feeding (n=23)	1579.57±27.36 (23)	180.65±0 .81 (23)	71.21±0.82 (23)	28.69±0.86 (23)	36.78±0.88 (23)
Non creep feeding (n=20)	1476.40±19.85 (20)	291.40±11.04 (20)	84.35±1.08 (20)	22.65±0.47 (20)	38.00±0.74 (20)
Feeding system	***	***	***	***	***
Feeding system x Location	***	***	***	***	***

*** = p<0.001; ** = p<0.01; * = p<0.05; n= Number of farmers in the group; Figures in the parenthesis indicates number of observations.

Table 5. Effect of feeding system on feed intake of chicks up to 8th week of age

Parameter	Trait (Mean ± SE)				
	1st week	2nd week	4th week	6th week	8th week
Creep feeding (n=23)	4.82±0.24 (248)	9.39±0.34 (240)	18.34±0.36 (228)	28.43±0.43 (222)	37.52±0.50 (221)
Non creep feeding (n=20)	4.95±0.34 (200)	8.10±0.38 (192)	17.55±0.27 (177)	27.45±0.50 (172)	37.25±0.57 (170)
Feeding system	NS	*	NS	NS	NS
Feeding system x Location	NS	NS	NS	NS	NS

* = p<0.05; n= Number of farmers in the group; Figures in the parenthesis indicates number of observations.

Table 6. Effect of feeding system on weekly chick weight and mortality (%) up to 8th week of age

Parameter	Chick weight (g/bird) (Mean ± SE)					
	1st week	2nd week	4th week	6th week	8th week	Mortality (%)
Creep feeding (n=23)	55.95±1.8 (248)	100.43±2.14 (240)	236.82±12.17 (228)	419.13±14.85 (222)	575.86±27.60 (221)	11.08±1.66 (27)
Non creep feeding (n = 20)	45.35±1.20 (200)	63.20±2.75 (192)	113.40±5.46 (177)	197.70±6.24 (172)	373.90±9.85 (170)	15.75±1.62 (30)
Feeding system	***	***	***	***	***	**
Feeding system x Location	***	***	***	***	***	NS

***=p<0.001; **=p<0.01; NS=p>0.05; n= Number of farmers in the group; Figures in the parenthesis indicates number of observations.

Conclusion

The findings of the current study revealed that CF system significantly improved both broody hens and chicks' performances. The BLRI improved ND variety performed better in CF system than the NCF system in terms of all productive and reproductive performances under semi-scavenging rearing system. Further research should be designed for validating the results in broader aspects to disseminate the technology in mass scale farmer's fields.

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Conflict of Interests

The authors declare that there is no conflict of interests regarding the publication of this paper.

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