Research Article

Natural Incubation and Broody Hen Management Practices in Barishal District, Bangladesh

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Abstract | Family poultry production greatly depends on clutch size, the number of eggs per clutch, and the incubation success. After laying a clutch of eggs, the broody hen sits on the eggs and incubates them to get chicks. The study was carried out to know the natural incubation and broody hen management practices in the selected areas of Barishal district, Bangladesh. We randomly selected 150 farmers (50 broody hens/Upazila) practicing natural incubation from three Upazilas in the Barishal district. The results show that mainly females (93.3%) were engaged in family poultry production and they used indigenous hens to incubate eggs. An average egg number per clutch was 12.6 and farmers set 12.3 eggs per broody hen for incubation purposes. The hatching egg weight was 37.3 g with egg hatchability of 87.9%. We found a significantly low body weight of broody hens after egg incubation. A high percentage of farmers (42%) preferred the spring season compared to the summer and rainy seasons to incubate eggs. For the selection of broody hens, 66.7% of farmers preferred hens aged 1-2 years. We did not find noticeable significant differences in parameters among the three Upazilas. Although egg hatchability by broody hens was high, major farmers (82.7%) did not practice creep feeding which is important for a high chick growth rate and quick return of hens to start egg-laying again after the incubation period. The chick viability rate after one month was also low (63.7%) which might be due to faulty management practices. In these circumstances, proper training of farmers, management of poultry accordingly with a balanced diet, and creep feeding to chicks may improve overall poultry production in rural areas.

Keywords | Broodiness, Chick rearing, Egg incubation, Hatching eggs, Management

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INTRODUCTION

Poultry is a sub-sector of agriculture that contributes greatly to fulfilling protein requirements worldwide. Indigenous non-descriptive chickens are a major part of the poultry population in many developing countries like Bangladesh (Chowdhury, 2013; Desta 2020). In Bangladesh, maximum rural households rear indigenous poultry traditionally to fulfill protein requirements and earn additional income (Volpenhein et al., 2022). The Indigenous chickens lay two or three clutches per year and are well known for their broodiness characteristics. The broodiness character is usually suppressed in commercial layers but dominant in indigenous female chickens. Due to this natural instinct, production is probably hampered in chicken (Jiang et al., 2010). But, broodiness is mandatory to pro-

duce chicks by broody hens. Moreover, there is a benefit for rural farmers to incubate eggs by broody hens without electricity facilities. Broody hens also play an important role for their young chicks teaching them how to procure feed and deal with challenging situations like protection from predators (Shimmura et al., 2015). Thus, the broody hen does a fantastic job of hatching the chicks and might be suitable for family poultry production (Sarkar, 2022).

As broody hens work like an incubator, the selection and management of broody hens are important for the high hatchability of eggs. In this regard, the investigation of broody hen management practices and incubation procedures need to be investigated in rural poultry farming conditions. The production of chicks from indigenous, Fayoumi, and cross-breed were studied by broody hens to know the hatching percentage (Roy et al., 2004). The hatching performance of village poultry has also been performed in different countries (Assefa and Ewunetu, 2020). Studies on natural incubation and broody hen management around the nation are limited, especially in the coastal region of Bangladesh has been given little attention in this regard. To our knowledge, farmers' knowledge about the broody hen management and incubation process has not been studied extensively and has enough scope to improve the management practices. The major objective of this study is to investigate broody hen management practices and look into the farmer's perspective on managing broody hens. This research will help to know the management practices, problems, and potentiality of broody hens.

MATERIAL AND METHODS

Ethical approval

Oral consent was taken from the farm owners before handling and measuring various parameters of chicken. The birds were not sacrificed and were handled carefully by the animal production experts.

Data collection

The study was conducted in three Upazilas (Babuganj, Bakerganj, and Barishal Sadar) of the Barishal district, Bangladesh. We randomly selected 50 farmers practicing egg incubation by broody hens from each Upazila. A total of 150 farmers were selected and data were collected from 150 broody hens with a pretested questionnaire, direct measurement, and observation during the study period. The respondents' socioeconomic status was collected to know gender participation, marital status, education, and their source of income. Incubation and management practices were recorded based on the information of respondents and direct observation during data collection.

Egg incubation, hatching, and chick viability

The weights of hens (11 hens/Upazila) were recorded before and after the onset of broodiness to make a comparison of weight during incubation. Egg number and weight were recorded to measure the clutch size and hatching egg weight, respectively. The number of eggs set by the farmers was recorded and monitored the incubation process on a routine basis. The hatchability was calculated on the basis of the number of eggs set per broody hen by the following equation:

$$\text{Hatchability (\%)} = \frac{\text{Number of chicks obtained per broody hen}}{\text{Total number of eggs set per broody hen}} \times 100$$

Chick viability was calculated after one month of the rearing period. It was calculated on the basis of the following equation:

$$\text{Chick viability after one month (\%)} = \frac{\text{Number of chicks viable after one month of rearing period}}{\text{Total number of day} - \text{old chicks hatched}} \times 100$$

The separation of chicks from the mother hens after completion of the broody cycle was also recorded in this study.

Data analysis

The frequency and percentage (%) data were based on the basis of total observations (n=150). Data represents as means ± standard deviation. Data were analyzed using the IBM SPSS version 20. Chi-square tests between variables of descriptive statistics were performed for getting significant levels. Differences between Upazilas were analyzed by using Tukey's honestly significant difference test and the significance level was declared based on $P< 0.05$.

RESULTS

Socioeconomic status of the selected farmers

The sex, marital status, education, and income of the selected farmers are presented in Table 1 to know their socioeconomic status. It was found that female participation was high (93.3%) and mainly married women (71.3%) were engaged in family poultry production. The Farmers had various educational qualifications and their dependency on poultry farming as the sole source of income was only 6%. A comparison among the three Upazilas found significant differences in the parameters of farmers' income ($\chi 2 = 24.591$; $p = 0.0004$).

Egg incubation practices

Management practices adopted by the farmers during egg incubation are presented in Table 2. The farmers were almost familiar with egg incubation as 76.7% of farmers had

Table 1: Socioeconomic status of the selected farmers

Variables (n=150)	Parameters	Frequency (%)				χ^2	*P*-value
		Babuganj	Bakerganj	Barishal Sadar	Overall		
Sex	Male	2 (4%)	2 (4%)	6 (12%)	10 (6.67%)	3.43	0.18
	Female	48 (96%)	48 (96%)	44 (88%)	140 (93.3%)		
Marital status	Married	38 (76%)	34 (68%)	35 (70%)	107 (71.3%)	0.896	0.93
	Unmarried	5 (10%)	7 (14%)	6 (12%)	18 (12%)		
	Widow	7 (14%)	9 (18%)	9 (18%)	25 (16.7%)		
Education	None	9 (18%)	5 (10%)	11 (22%)	25 (16.7%)	6.18	0.40
	Primary (1-5)	18 (36%)	21 (42%)	23 (46%)	62 (41.3%)		
	Secondary (6-10)	12 (24%)	16 (32%)	11 (22%)	39 (26%)		
	Higher (>10)	11 (22%)	8 (16%)	5 (10%)	24 (16%)		
Income	Agriculture	17 (34%)	21 (42%)	6 (12%)	44 (29.3%)	24.5	0<.001
	Poultry	4 (8%)	2 (4%)	3 (6%)	9 (6%)		
	Business	15 (30%)	20 (40%)	13 (26%)	48 (32%)		
	Others	14 (28%)	7 (14%)	28 (56%)	49 (32.7%)		

Table 2: Egg incubation practices

Variables (n=150)	Parameters	Frequency (%)				χ^2	*P*-value
		Babuganj	Bakerganj	Barishal Sadar	Overall		
Experience (years)	< 5	7 (14%)	10 (20%)	18 (36%)	35 (23.3%)	13.7	0<.001
	5-10	18 (36%)	14 (28%)	21 (42%)	53 (35.3%)		
	> 10	25 (50%)	26 (52%)	11 (22%)	62 (41.3%)		
Source of hatching eggs	Own	50 (100%)	50 (100%)	50 (100%)	150 (100%)		
	Neighbor	0 (0%)	0 (0%)	0 (0%)	0 (0%)		
	Local market	0 (0%)	0 (0%)	0 (0%)	0 (0%)		
Incubation season	Spring	15 (30%)	25 (50%)	23 (46%)	63 (42%)	6	0.42
	Summer	8 (16%)	4 (8%)	8 (16%)	20 (13.3%)		
	Rainy	2 (4%)	1 (2%)	1 (2%)	4 (2.67%)		
	No preference	25 (50%)	20 (40%)	18 (36%)	63 (42%)		
Bedding materials of broody hen	Ash	5 (10%)	7 (14%)	8 (16%)	20 (13.3%)	9.56	0.29
	Straw	12 (24%)	14 (28%)	4 (8%)	30 (20%)		
	Cloth	3 (6%)	3 (6%)	9 (18%)	15(10%)		
	Leaf	5 (10%)	1 (2%)	3 (6%)	9 (6%)		
	Mixed	25 (50%)	25 (50%)	26 (52%)	76 (50.7%)		
Use of dummy eggs	Yes	5 (10%)	6 (12%)	6 (12%)	17 (11.3%)	0.13	0.94
	No	45 (90%)	44 (88%)	44 (88%)	133 (88.7%)		
Egg turning	Yes	2 (4%)	1 (2%)	3 (6%)	6 (4%)	1.04	0.59
	No	48 (96%)	49 (98%)	47 (94%)	144 (96%)		
Candling	Yes	8 (16%)	10 (20%)	10 (20%)	28 (18.7%)	0.35	0.84
	No	42 (84%)	40 (80%)	40 (80%)	122 (81.3%)		

experienced more than 5 years. Generally, the farmers set the eggs of a clutch under a broody hen for incubation purposes and the source of hatching eggs was their own farm. They do the incubation throughout the year, but a high preference was found during the spring (42%) season. As bedding material of broody hens, they used ash, straw, clothes, and leaves either as single or mixed (50.7%). The practice of dummy eggs (11.3%), egg turning (4%), and candling (18.7%) were limited in the study areas. Representative pictures of the incubation practices are presented in Figure 1.

Table 3: Broody hen management practices

Variables (n=150)	Parameters	Frequency (%)				χ^2	*P*-value
		Babuganj	Bakerganj	Barishal Sadar	Overall		
Hen	Indigenous	50 (100%)	50 (100%)	50 (100%)	150 (100%)		
	Breed/Variety	0 (0%)	0 (0%)	0 (0%)	0 (0%)		
Age (years)	< 1	7 (14%)	4 (8%)	8 (16%)	19 (12.67%)	1.813	0.770
	1-2	33 (66%)	36 (72%)	31 (62%)	100 (66.67%)		
	>2	10 (20%)	10 (20%)	11 (22%)	31 (20.67%)		
Feed	Pellet/Balanced	6 (12%)	7 (14%)	17 (34%)	30 (20%)	19.473	0.003*
	Handmade	20 (40%)	21 (42%)	13 (26%)	54 (36%)		
	Kitchen waste	21 (42%)	13 (26%)	19 (38%)	53 (35.33%)		
	No feed	3 (6%)	9 (18%)	1 (2%)	13 (8.67%)		
Water source	Natural	21 (42%)	19 (38%)	13 (26%)	53 (35.33%)	3.034	0.219
	Supplied drinking water	29 (58%)	31 (62%)	37 (74%)	97 (64.67%)		
Chick separation	Natural	39 (78%)	45 (90%)	40 (80%)	124 (82.67%)	2.885	0.236
	Creep feeding	11 (22%)	5 (10%)	10 (20%)	26 (17.33%)		

* *P*<0.05

Table 4: Egg hatchability and viability of chicks

Parameters	Babuganj	Bakerganj	Barishal Sadar	Overall
Clutch size	12.3±1.94[a]	12.2±2.08[a]	13.4±2.23[b]	12.6±2.15
Number of eggs sets per hen	13.1±3.56[a]	11.4±2.41[b]	12.3±2.20[ab]	12.3±2.86
Weight of hatching eggs (g)	33.5±3.60[a]	37.9±4.39[bc]	41.1±4.35[c]	37.3±5.29
Hatchability (%)	85.7±15.8[a]	87.9±15.9[a]	90.4±9.81[a]	87.9±13.9
Chick separation from hen (days)	53.9±25.1[ab]	57.9±31.2[a]	44.9±22.1[b]	52.3±26.8
Chick viability after one month (%)	63.9±22.5[a]	61.3±22.1[a]	65.8±13.9[a]	63.7±19.8

Data are expressed as mean ± standard deviation; [a,b,c] meaning significant differences among three Upazilas within the same row. *P*<0.05.

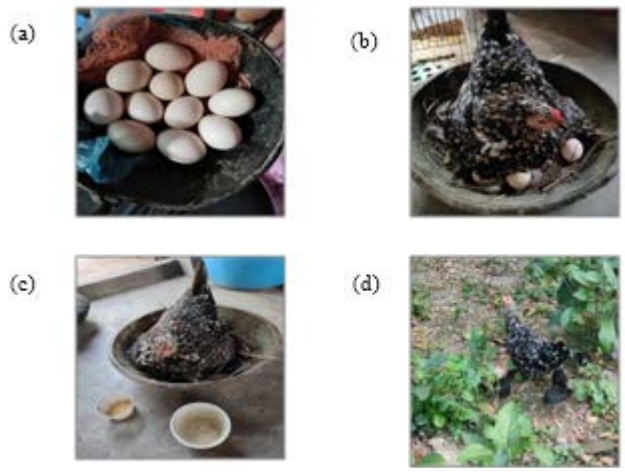

Figure 1: Incubation practices: (a) hatching eggs; (b) broody hen with hatching eggs; (c) providing feed and water to broody hens, and (d) chicks with mother hen after egg incubation

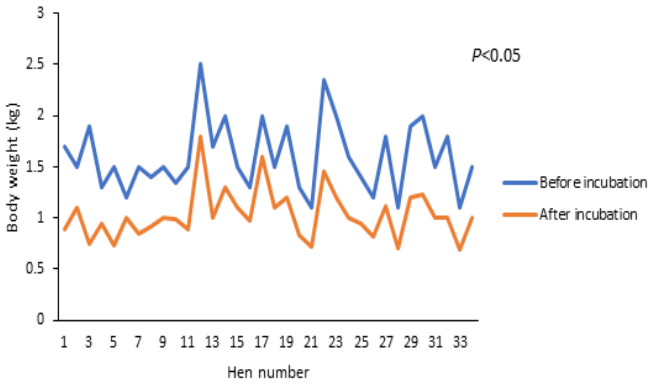

Figure 2: Body weight of the broody hens before and after egg incubation

Broody hen management practices

The practices of broody hen management are demonstrated in Table 3. All the respondents used indigenous hens (100%) for incubation purposes. The selection of broody hens for incubation purposes was high (66.7%) when the hen age was between 1 and 2 years. During the incubation period, they were offered several types of feed ingredients,

handmade feed, and pellet feed. For drinking water, 64.7% of farmers supplied safe drinking water to broody hens, and 35.3% of farmers did not supply water to broody hens. After incubation, chick separation from the hen was usually done by a natural process (82.67%), and the use of creep feeding was the minimum percentage of 17.3%. To know the body condition, we compared the body weight of hens before and after incubation and found a significantly low body weight after the incubation period (Figure 2). We did not find significant differences among the parameters of same variable in the study areas.

Egg hatchability and viability of chicks

Clutch size, number of eggs sets per hen, the weight of hatching eggs (g), hatchability (%), chick separation from hen (days), and chick viability after one month (%) are presented in Table 4. The average number of eggs laid per clutch was 12.6, and the number of eggs set per broody hen was 12.3. It was found a significantly high clutch size at Barishal Sadar compared to the other two study areas. The average weight of hatching eggs was 37.3 g. It was found a significantly high hatching egg weight (41.1 g) at Barishal Sadar compared to Babuganj Upazila. Egg hatchability (%) by broody hen was 87.9. After brooding and rearing, the chick separation process was natural, and the average duration was 52.3 days. The chick viability after one month of the rearing period was 63.7%.

DISCUSSION

In the present study, the average clutch size was 12.6 eggs and almost all eggs (12.3 out of 12.6) were set for incubation purposes. The clutch size and number of eggs set for incubation may vary depending on the size and body condition of the hen. In indigenous chicken, the average clutch size and the number of eggs set per hen have been reported 15 eggs (Hossen, 2010) and 14 eggs (Azharul et al., 2005), respectively. The number of eggs set for incubation purpose was reported to 12.46 in Ethiopia (Tunsisa and Reda, 2022). The clutch size in our study areas seems to be low which may be associated with an inadequate supply of feed in the scavenging environment. Due to the low clutch size, the farmers used almost the same quantity of the laid eggs for incubation purposes. The egg hatchability by the broody hens was 87.9% which seems to be similar to various studies conducted in Bangladesh (Sarkar, 2022). Even the hatchability by broody hens was found higher when compared with an electric and rice husk incubator (Roy et al., 2004). The hatching efficiency of a broody hen might be compared with the commercial egg incubator. Broody chicken has enough experience to manage ideal humidity and temperature levels by themselves and might be acknowledged as natural egg incubator (Sarkar, 2022).

The body weight of the hen decreased significantly after egg incubation. Probably, this phenomenon is common in hens raised under traditional management with an average loss of 35% of initial body weight during egg incubation and gained it back at an average rate of 5 g each day (Hossen, 2010). The loss of body weight might be due to decreases feed consumption during the incubation period, the loss of broody weight is also associated with the number of eggs set for hatching purposes (Azharul et al., 2005). To minimize the loss of body weight, balanced ration and safe drinking water is needed during the incubation process. When the hens had no chicks to raise, the intake after incubation was higher. We investigated the viability (%) of the chicks after one month of the rearing period and found viability of 63.7%. The chick's viability depends on several factors, such as management, diseases, and predators. Chick viability for newly hatched chicks after one week was reported to be 50.7% in Ethiopia (Kassu and Beyero, 2015). According to the research findings of (Hossen, 2010), the average survivability was 43.1% up to the age of 10–12 weeks. In Bangladesh, major rural poultry farmers do not vaccinate their chicks. The major reasons of chick mortality was reported due to outbreak of diseases and attack of predators (Popy et al., 2018). The chick separated from the mother hen was almost 2 months (52.3 days). The average number of days of chick separation was reported as two months in Bangladesh (Hossain, 1993).

The respondents were familiar with poultry farming, with 76.7% of farmers having farming experience over 5 years. Chickens are usually let to forage on insects, earthworms, leftover grain, and greenery around the farm during the day without additional feed supplementation. Some respondents supplied additional feed with the scavenging feed. Very few farmers provide balanced feed to their poultry. The farmers provided only a little bit of supplemental feed in the morning or evening. They left the chicken to scavenge the surroundings of their households and majority of daily nutrient requirements were fulfilled through scavenging. The farmers do not have enough knowledge about egg candling and they usually do not practice the egg candling. Most of the respondents chose the spring season for incubation purposes due to availability of feed and high chick survivability. Though high hatchability was found during the winter season (Islam et al., 2008), the farmers had a preference to incubate eggs during the spring season due to the availability of feed and high chick survivability (Argaw, 2015). The contribution of female respondents in rearing rural poultry was high compared to male respondents. Women in rural households usually rear and manage backyard poultry (Das et al., 2008). The females do this job mainly not as a profession, they do this job with other household activities. Even they do not calculate their labor spent for this purpose. Maximum farm-

ers do not separate chicks from the mother hen (82.7%). The farmers usually depend on the mother hens for the chick separation process. Due to this practice, the mother hen begins to start laying delay, and the production cycle decreases per year. To improve the situation, the production cycle per year needs to be increased. From the above discussion, egg hatching percentage was found satisfactory with the exception of the low number of egg production per year. The practice of balanced feed and creep feeding is recommended to increase chick viability and production performances.

CONCLUSIONS

The farmers traditionally practice egg incubation by broody hens over years. Although broody hens have the limitations of incubating a large number of eggs at a time, they might be acknowledged as a natural egg incubator for efficient and effective egg hatching capacity. To improve egg production per year or broody cycles, the farmers need to be trained by the poultry specialists. The introduction of a balanced diet, proper management, and creep feeding of chicks may improve overall poultry production in rural areas.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

NOVELTY STATEMENT

We found that broody hens incubate eggs efficiently and effectively, but chick mortality was high. To minimize chick mortality, creep feeding may be practiced with improved management interventions.

AUTHORS CONTRIBUTION

Farhana Binte Zalal collected the data from the farmers' households and wrote the manuscript. Prodip Kumar Sarkar planned and designed the research, processed and interpreted the data, prepared graphs and tables, and wrote the manuscript. Mahbuba Sultana, M. H. Kawsar, and Swapon Kumar Fouzder reviewed the paper and made the necessary comments. All the authors confirmed the data and the final manuscript.

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