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Research Article

Loss of Domestic Poultry Due to Flood and the State of Veterinary Care Services in Flood-Prone Areas of Bangladesh

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Abstract

Background and Objective: Bangladesh is extremely vulnerable to climate change. Poultry flocks maintained by families in Bangladesh can adversely be affected by flood. The purpose of this study was to investigate the loss of family poultry flocks due to flood damage as well as veterinary care services given to domestic poultry in Bangladesh. **Materials and Methods:** A total of 1,985 households that maintained poultry flocks were enrolled from forty villages located in four flood-affected districts in Bangladesh. Data were collected from face-to-face interviews, focus group discussions (FGDs) and direct observations. Data were expressed in terms of frequency and analyzed using descriptive statistics to determine significance of differences between groups. A two-sample t-test was used to test the significance of differences in price for poultry sold during the flood period and the rest of the year. **Results:** Among the study households, around 80% of poultry shelters were damaged due to flooding and 44% of the poultry was lost. The selling price of poultry during the flood fell significantly ($p < 0.05$) compared to the period after the flood. Lack of feed, clean water and shelter for the poultry were major problems encountered by farmers in Bangladesh during the flood period. After the flood, insufficient veterinary care services, disease outbreaks and lack of money to rebuild flocks were prime problems faced by domestic poultry farmers. The rates of vaccination (2-4% for chicken and ducks respectively), adequate treatment (2-3%) and de-worming (2-4%) were all low for domestic poultry. Mostly pharmacists provided the veterinary health care services and few households engaged the services of registered veterinarians for care of poultry. **Conclusion:** The study provided a basis to define flood-related problems encountered by domestic poultry farmers in Bangladesh and the state of veterinary care services for the domestic poultry sector.

Key words: Domestic poultry, flood damage, poultry shelter, price fall, service provider, veterinary service

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Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

Household poultry represents an asset that can provide benefits for the poor people of rural areas. Meat and eggs from domestic poultry can help improve family nutrition and food security in addition to augmenting the income of resource-poor families¹⁻³. Poultry production in villages also helps break the cycle of poverty⁴. In Bangladesh, poultry ownership empowers women by creating self-employment opportunities^{5,6}. However, domestic poultry productivity can be adversely affected by a variety of climatic and non-climatic factors. Bangladesh is particularly vulnerable to climate change due to its geographical location, population growth and poor governmental regulation⁷. The negative impact of global climate change in Bangladesh is pronounced and is already manifested as increased frequency of floods and droughts⁸. These changes have seriously affected food security, household livelihoods and agricultural sustainability of the country. Poor and resource-poor farmers living in drought and flood-prone areas are especially affected by climate change⁹.

Traditional poultry houses in Bangladesh are weakly constructed and often cannot withstand flooding without sustaining significant damage. Poultry farming in Bangladesh does not follow standard husbandry practices and disease outbreaks among local flocks due to virus, bacteria and parasite infections are common due to inadequate disease control measures¹⁰. Annual outbreaks of Newcastle disease (ND), locally known as 'Ranikhet' disease^{11,12}, is a major cause of chicken mortality in Bangladesh^{13,14}. Access to veterinary services and support is essential for the success and sustainability of domestic poultry but in Bangladesh, such services are inadequate¹⁵.

In addition to the need for improved husbandry practices, agro-climatic zone-specific adaptation and mitigation strategies must be implemented to develop domestic poultry production practices that can respond to climate change and particularly large-scale floods. Despite many attempts to enhance native poultry production through various development projects, limited progress has been made in meeting the basic requirements of free-ranging village poultry production in Bangladesh. Moreover, major development initiatives have not addressed the impacts of floods on domestic poultry production and provision of veterinary services among domestic poultry farmers in flood-affected areas has not been assessed, which could have negative consequences for the success of development programs. Thus, strategies are needed to improve productivity of the domestic poultry sector in Bangladesh and its ability to

respond to climate change as well ensure delivery of adequate veterinary services in flood-affected areas. The current study examined losses of domestic poultry flocks during and after a flood in Bangladesh and the reasons for these losses. The study also assessed veterinary service delivery to the domestic poultry sector in flood-prone areas.

MATERIALS AND METHODS

Study area and participant selection: The study was carried out in 2017 in the households of farmers living in forty villages located in four flood-prone districts (Kurigram, Gaibandha, Bogra and Sirajganj) in northern Bangladesh. The survey was conducted between 5-15 days after ending of significant flooding in "August 2017. A total of 1,985 households that maintained backyard poultry flocks were enrolled in the study. A purposive sampling technique was used to select districts, villages and households for the study. A non-random selection method was used to identify "most willing" and "most readily available" persons in the households for inclusion as respondents. These individuals owned the poultry and were primarily responsible for the care of the birds.

Data collection: A number of data collection techniques, both quantitative and qualitative, were applied throughout the study period. With the help of key informants, poultry-keeping households were identified via door-to-door visits to houses located in the selected flood-affected areas. The survey questionnaire included both open and close-ended questions in addition to ranking questions. Quantitative data were collected from information collected from face-to-face interviews conducted using a survey questionnaire. The qualitative data were collected from key informant interviews (KIs), focus group discussions (FGDs) and direct observation. FGDs provided better insight into household situations and allowed validation of survey data. Direct observation by study researchers was used to obtain information about current situations. To ensure the appropriateness, meaningfulness and usefulness of the data, the instruments were pretested on both professionals and representative respondents. Data collectors received training on the data collection tools used in this study. Triangulation was conducted to reduce investigator biases arising from the use of different tools for data collection. Verbal consent was obtained from all study participants prior to data collection. The average ranking of multiple answer questions (Z) was calculated as follows:

$$Z = \frac{x_1w_1 + x_2w_2 + x_3w_3 + \dots + x_nw_n}{\text{Total respondents}}$$

Where

w = Weight of ranked position

x = Response count for a given answer choice

Weights were applied in reverse, wherein the respondent's most preferred choice was ranked as #1 and had the largest weight and the choice ranked last had a weight of 1. Weights of 1, 2, 3 and 4 were assigned for choices 4, 3, 2 and 1, respectively.

Data handling and analysis: Data obtained from individual interviews, FDGs and direct observations were analyzed according to needs and context. Quantitative data were checked and normalized for analysis. Descriptive statistics in the form of tables, means and percentages were used to establish the general characteristics of the study sample. A two-sample t-test was used to assess the significance of differences between poultry selling prices during and after the flood. An alpha level of 0.05 was used in statistical analyses for testing significant differences.

RESULTS

Composition of poultry species and loss of family poultry due to flooding:

Among the 1,985 households surveyed for this study, the average number of chicken and ducks present per household during the site visit before the flood period was 9 and 4, respectively. There was a roughly equal distribution of young (i.e., chicks and ducklings) and mature birds (Table 1). The estimated loss of poultry by each household due to flooding was averaged across the different areas considered in this study. On average, the households lost 44% of their total birds (chicken and ducks) to flood damage (Table 1). Notably, nearly half of both chicks and chicken were lost, whereas fewer ducks, particularly ducklings, were lost to the flood. This difference may be due to the ability of ducks to swim.

Fall of price of birds during the flood: The average selling price for poultry fell significantly during the flood period compared to that for the remainder of the year (Table 2). The price for both chicken and ducks fell by nearly 70% relative to

the price for the rest of the year. The price might have fallen due to more birds and fewer customers at market during the flood periods.

Poultry housing and flood damage: Mud was the primary building material for the majority (74%) of poultry shelters in the study households (Fig. 1). Meanwhile, only 15% of poultry shelters were built using brick or concrete and the remaining 11% used materials other than mud, brick, or concrete. Nearly 90% of the poultry shelters sustained some degree of damage and around 37% were completely destroyed (Fig. 2). Only 14% had no flood-related damage and this fraction is consistent with the frequency of shelters built from brick or concrete that could have made them more resistant to damage due to flooding.

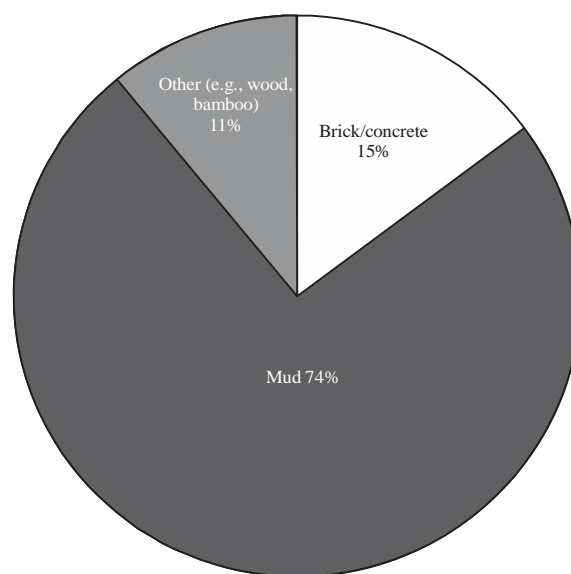


Fig. 1: Frequency of key materials used to construct poultry shelters

Table 1: Birds owned per household before and after the flood

Type of bird	Average number of birds per household		
	Before flood	After flood	Change (%)
Chicks	9.98	5.08	-49
Mature chicken	8.00	4.16	-48
Ducklings	2.77	1.73	-37
Mature Ducks	4.31	2.33	-45
Total	25.06	13.30	-44

Table 2: Change in price of birds during the flood period and remainder of the year

Outcome	Price (Mean ± SD)		95% CI for mean difference	r	t	df	p-value	
	During flood	Rest of the year						
Chicken	139.67 ± 54.43	197.55 ± 61.39	-82.20	-33.57	0.85*	-4.733	86.75	8.5 x 10 ⁻⁶ *
Ducks	148.46 ± 66.81	211.15 ± 78.47	-121.77	-3.61	0.90*	-2.193	44.00	0.0385*

*p<0.05

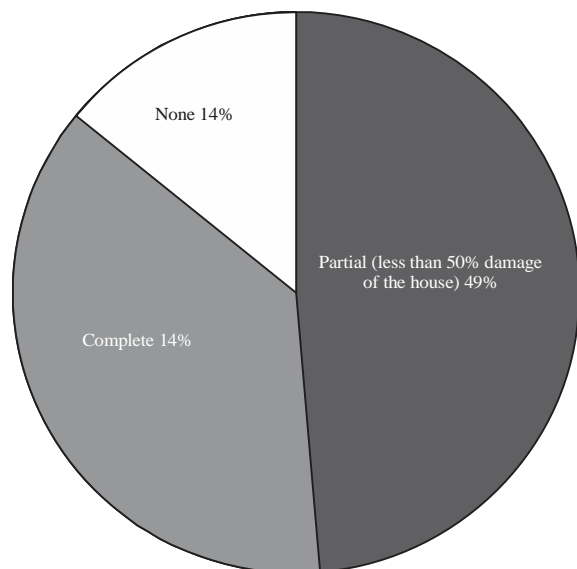


Fig. 2: Degree of damage to poultry shelters due to flooding

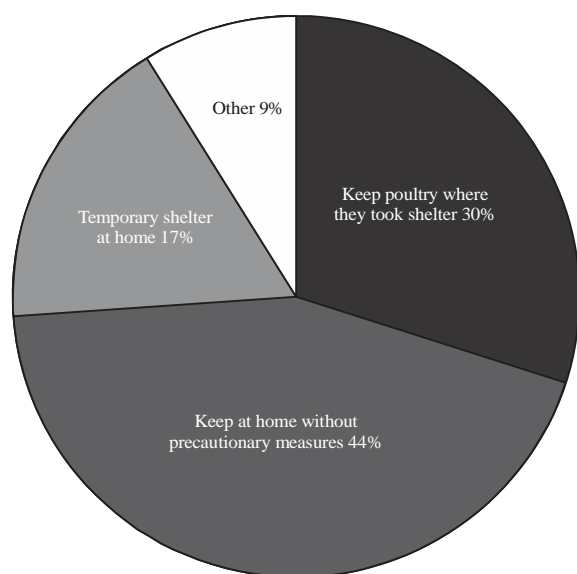


Fig. 3: Types of shelter for domestic poultry during the flood

Maintenance of poultry during the flood: This study also investigated whether poultry flocks were moved during the flood. The majority (44%) of households that maintained domestic poultry kept the birds at their home and took no precautionary actions to ensure that the birds had adequate shelter (Fig. 3). The survey results revealed that 17% of the families built temporary shelter at their homes in which the birds could take refuge during the flood. Around one-third (30%) of farmers sheltered their birds at an alternate site during the flood period.

Flood-related problems encountered by poultry keepers:

Domestic poultry farmers encountered a range of problems during and after the flood period. A lack of feed and access to clean water during the flood was the primary issue reported by the farmers, followed by lack of shelter (Table 3).

An inability to rescue birds that were trapped by flood water was also a cause of poultry loss. In addition to these issues, inadequate veterinary care services for poultry ranked high among the concerns of farmers. This lack of veterinary care was likely related to the frequency of disease outbreaks, which ranked second among poultry-related issues reported by surveyed households (Table 3).

Veterinary services for domestic poultry:

Overall, the vaccination coverage for domestic poultry during and after the flood was low. Indeed, only 2-4% of households regularly vaccinated their chickens and ducks (Table 4). The rates for routine treatments and de-worming were similarly low. These rates declined somewhat relative to the basic rate in non-flood periods and the rate of de-worming fell significantly (Table 4). For those poultry that did receive veterinary care, pharmacists were the most common practitioners used for delivery of vaccines and treatments for chickens (Table 5). Meanwhile, for ducks, vaccination was more commonly delivered by para-veterinarians or non-governmental organizations (NGOs). NGOs were also the most common sources of de-worming services for both chickens (64%) and ducks (62%).

DISCUSSION

Bangladesh is one of the most vulnerable countries to disaster in the world. Every year floods in Bangladesh cause substantial losses for rural farmers, including loss of livestock and poultry. The majority (80%) of rural households in Bangladesh maintain small flocks of poultry that have on average 5-7 birds housed in traditional structures^{16,17}. The current study revealed that families with domestic poultry flocks in flood-affected areas lost approximately 50% of their birds due to flood.

Backyard poultry structures in Bangladesh vary by region and materials used to build these shelters also vary according to the availability of local materials and facilities¹⁸. In this study, the majority of poultry shelters were damaged by flooding due to the frequent use of mud, bamboo and wood as building materials.

Although, disease is a major limitation for domestic poultry production at all times in Bangladesh, the rates of certain diseases are higher during flood periods¹⁹⁻²¹. Thus,

Table 3: Problems encountered during and after the flood

Problems during the flood	1	2	3	4	Score
Rescue of trapped birds	21.91% (435)	18.89% (375)	26.49% (526)	32.69% (649)	2.30
Safe transfer of birds during the flood	17.22% (342)	22.06% (438)	29.01% (576)	31.69% (629)	2.24
Lack of feed and clean water during the flood	24.08% (478)	27.46% (545)	36.68% (728)	11.78% (234)	2.63
Lack of shelter	30.83% (612)	21.91% (435)	23.53% (467)	23.72% (471)	2.62
Problems after the flood					
Insufficient veterinary care services	46.20% (917)	15.76% (313)	21.05% (418)	16.97% (337)	2.91
Disease outbreaks	27.05% (537)	25.03% (497)	15.36% (305)	32.54% (646)	2.46
Lack of money to rebuild flock	20.76% (412)	17.38% (345)	20.50% (407)	41.36% (821)	2.17
Scarcity of feed after the flood	0.00% (0)	14.96% (297)	21.76% (432)	63.27% (1256)	1.51

Value 1-4 refer to choice rank, the total was 1,985 for all categories. Weights were applied in reverse, wherein the respondent's most preferred choice was ranked as No. 1 and had the largest weight and the choice ranked last had a weight of 1. Weights of 1, 2, 3 and 4 were assigned for choices 4, 3, 2 and 1, respectively

Table 4: Regular use of veterinary health care services for chicken and ducks

Services	Rest of the year (rather than flood periods)		Immediate after the flood	
	Chicken (%)	Ducks (%)	Chicken (%)	Ducks (%)
Vaccination	3.16	2.29	3.44	2.29
Regular treatment	2.58	3.73	8.91	2.01
De-worming	2.30	4.31	2.30	2.87

Table 5: Veterinary health care service provider to the domestic poultry

Service provider	Vaccination		Routine treatment		De-worming	
	Chicken (%)	Ducks (%)	Chicken (%)	Ducks (%)	Chicken (%)	Ducks (%)
Medicine shopkeeper	80	7	61	55	24	25
Registered Veterinarian	0	0	0	0	0	0
Veterinary Technician	15	60	32	39	2	13
NGO ^a	5	33	7	16	64	62

^aNon-governmental organization

additional efforts to control disease outbreaks during flood periods are also important. To control disease outbreaks, preventative measures including vaccination, routine treatments and de-worming are critical. The results of this study showed that most households that maintained poultry flocks did not provide sufficient veterinary care for their birds. The low rates of vaccination in particular were consistent with those seen in a study by Alam *et al.*²². Some of the main reasons for poor vaccination coverage of domestic poultry are a lack of awareness among domestic poultry farmers, difficulties in maintaining the cold chain for vaccine handling and transport and a limited number of veterinary service providers²². Our study also indicated that routine treatment and de-worming of domestic poultry were inadequate and infrequent. The differences in rates for all veterinary services between the flood period and non-flood years clearly indicated that flood-affected households have difficulty accessing adequate and quality veterinary services for their domestic poultry. Not only did these households lack

adequate services during the flood but also this situation persisted in the months following the flood period.

In addition to disease, improper veterinary care is another potential limiting factor for chicken productivity²³. In other countries such as India and Kenya, poor households are willing to pay for veterinary health care services and have adequate access^{24,25}. However, the results of this study indicated that households in Bangladesh that keep poultry have difficulty accessing veterinary care, particularly during flood-affected years. Instead of relying on professional veterinarians and para-veterinarians, pharmacists represent the most common outlet for treatment services to domestic poultry farmers, particularly for chicken vaccination and routine treatment of both chicken and ducks. Our results highlighted the importance of para-veterinarians in providing vaccinations, especially for ducks and routine treatments. Meanwhile, domestic poultry farmers in Bangladesh rely on NGOs for de-worming services, although these groups often serve only a limited group of target households¹⁵. Our study showed that

poultry farmers in Bangladesh are vulnerable to loss of birds due to damage and/or disease associated with flooding. Domestic flocks can continue to experience negative effects even after the flooding has ended. Moreover, veterinary service, especially during and after floods, is inadequate in flood-prone regions. The findings highlight the need for increased access to adequate veterinary care and the need for education on construction methods and materials that are less susceptible to flood damage. Together the findings can provide a base to develop policies and educational resources that can help poultry farmers in Bangladesh maintain their flocks to avoid problems associated with increased flooding that may occur due to climate change.

The lack of research studies on characteristics of domestic poultry farmers in Bangladesh hampered the adequate understanding of problems encountered by these households during and after floods. This study had a cross-sectional design and thus longitudinal studies are needed to better understand the effects of flooding on domestic poultry farms. Furthermore, data collection was confined to only four districts in Bangladesh and the replication of the study in different regions would enable generalization of the findings to all of Bangladesh. This study considered only domestic poultry farmers but future studies should involve all stakeholders related to the poultry sector.

CONCLUSION

The findings of this study indicated that considering climate related issues adaptation and mitigation strategies should be formulated and implemented for domestic poultry development. The result also showed that veterinary care services by the livestock extension department are very poor and require improvement to ensure services to the domestic poultry keepers, especially those in flood-prone areas.

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