

Research article

Analysis of poultry waste management system among selected farmers of Bagmara upazila, Rajshahi, Bangladesh

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A R T I C L E I N F O

Article history:

Received: 28/04/2021

Accepted: 28/06/2021

Keywords:

Poultry, waste management, public health, environmental pollution

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A B S T R A C T

This study was undertaken to evaluate the waste management practices among the poultry farmers of Bagmara Upazila, Rajshahi, Bangladesh. A total of 31 commercial poultry farm was considered for this study. A structured questionnaire was developed to obtain information on farmers' demographic characters, farm management, biosecurity, waste management practices. The majority of the farm owner used cage rearing (87.10%) systems for the layer. Broiler and turkey were reared in shelf (9.68%) and floor (3.23 %) systems, respectively. Most (96.77%) of the farm owners were male, and among them, 58.1 % had a secondary school certificate. Around 38.7% of farmers age was between 25 to 36 years. There was no foot bath in 97.77% of the farms. A majority (61.29%) of the farm owners threw dead birds near the farm, while only 32.26% buried the dead birds. There was no proper sewage disposal system in the majority of the (96.2%) farms. Farmers did not receive any training about farm management and biosecurity practices. A majority percentage of farmers were unaware of the risk of water (80.6%) and soil pollution (83.9%) from poultry waste. The educational level of farmers influenced ($P<0.021$) their practice of dead bird management. In conclusion, the waste management system and biosecurity procedures of the studied farms were inadequate. This study also indicates that farmer's academic qualification may affect their attitude toward waste management practices.

To cite this paper: D. Sarker, N. Akter and M. Akter, 2021. Analysis of poultry waste management system among selected farmers of Bagmara upazila, Rajshahi, Bangladesh. *Bangladesh Journal of Veterinary and Animal Sciences*, 9(1):17-22.

1. INTRODUCTION

Poultry farming is a very significant livestock industry, especially in developing countries. In Bangladesh, villagers raise poultry to fulfill their family's food needs and use it as an extra income source. Approximately 40% of the total animal protein comes from poultry meat and egg (DLS, 2020). The current meat and egg production can only meet 68% and 64% needs of the consumers, respectively (Hamid et al., 2017). The demand for meat and egg products

has increased dramatically because of the change in income, population growth, urbanization, and dietary structure. The total poultry population of Bangladesh is 0.3563 billion (DLS 2019-20). With the growing trend of intensive poultry farming, environmental and public health issues are becoming a great challenge for poultry industry. Poultry wastes can be used as fertilizer as it contains different essential plant minerals (C, N, P, K, S, Ca, Mg, B, Cu, Fe, Mn, Mo and Zn) (Simpson, 1991; Edwards and Daniel, 1992). Poultry waste plays

a vital role in improving soil condition and consequently crop profitability (Hargreaves et al., 2008). However, irrational landfill use of poultry waste in the land can cause soil disintegration or surface run-off during rain leading to water pollution (Akanni and Benson, 2014).

Improper handling of litter and waste of poultry farms may breach the farm biosecurity management and increases the incidence of different diseases, and consequently affect the public health welfare. Poultry waste can have serious ramifications for the environment like odor and noise issues, the attraction of insects and pests, groundwater pollution, surface water spillover, weakening of organic design of the earth, and disastrous spills (Sakar et al., 2009). Grant and Marshalleck (2008) noticed that water contamination due to waste defilement frequently initiates fights among the nearby resident because of the skin infection caused by polluted stream water, just as the undesirable smell. Bangladesh has no regulations for handling poultry farm waste. There are no well-informed reports on the waste management of poultry farms in Bangladesh and its impact on the environment and public health. Therefore, this study aimed to evaluate the waste management practices, biosafety, and public health issues of poultry farmers.

2. MATERIALS AND METHODS

Study area

The study was conducted in Bagmara Upazila, Rajshahi, Bangladesh, from 8th to 28th December 2018. The study sites were selected based on the poultry farms' availability and willingness of farmers to participate in this study. A total of 31 farms of layer (27), broiler (3), and turkey (1) were included in this experiment.

Questionnaire and data collection

A structured questionnaire containing both open- and closed-ended questions was developed to obtain information from the farmers. The farmers were interviewed to collect information related to demographic status and different aspects of farm characteristics, farm management, biosecurity, waste management practices, and risk of

improper poultry waste management. The data were collected individually from farm owners through face-to-face interviews.

Statistical analysis

Data were entered into the MS Excel 2013 and then exported to SPSS software V. 16 for performing statistical analysis. Descriptive analysis and chi-square test were done, and the results were expressed in frequency numbers and percentages. The P-value less than 0.05 was considered significant.

3. RESULTS

Farmers demographic characteristics

Table 1 summarizes the demographic characteristics of farmers under this study. Most of the farm owners (30) were male, whereas only one farm owner was female. Among 31 farmers, 58.1 and 25.8% had the secondary and higher secondary qualification, respectively, while a small percentage (6.5) completed graduation. Around 45.16% of farmers fall under the age range of 25 to 36 years, while 38.7% of farmers' age was between 36 and 45 years. The age of the rest (16.1%) of the farmers ranges from 49 to 60 years.

Table 1. Farmers demographic characteristics

Factors	Category	N (31)	%
Gender	Male	30	96.77
	Female	1	3.23
Educational status	Primary	3	9.7
	SSC	18	58.1
	HSC	8	25.8
	Graduate	2	6.5
Age	25-36 years	14	45.16
	37-48 years	12	38.7
	49-60 years	5	16.1

Farm characteristics

Table 2 shows that majority of the farmers (87.10 %) used a cage system for layer rearing, while 9.68 and 3.23% of broiler and turkey were reared on shelf and floor, respectively. Around 97.77% of farmers did not use litter materials. Only 3.23% of farmers used straw as litter material on the floor.

Table 2. Farm characteristics of the study farms (N=31)

Factor	Category	N	%
Type of poultry	Broiler	3	9.68
	Layer	27	87.10
	Turkey	1	3.23
Rearing system	Case	27	87.10
	Shelf	3	9.68
	Floor	1	3.23
Litter materials	No	30	97.77
	Straw	1	3.23

Biosecurity of farm

In the study farm, about 87.10 and 93.55% of the farm had long tree and bush surroundings the farm, respectively (Table 3). Only one of the farms used a footbath containing potassium permanganate at the entrance of shade. The majority (83.9 %) of the farmers used disinfectant with water for cleaning the farm, while the rest of the farmers (16.1%) used only water. All the farmers changed or removed the litters at two days intervals.

Strategies of waste management in the study farms

In the study area, 93.55% of the farmers used litter materials as fish feed, 3.23% used as fertilizer, and 3.23% used as biogas production (Table 4). The majority (61.29%) of farm owners threw dead birds near the farm. Around 32.26% of the farmers buried dead birds, while 3.23% used dead birds either in biogas plant or in fish culture. Similarly, 29.03% of farmers buried the damaged eggs, 58.06% of them throw with garbage, 3.23% of them used in a biogas plant, and 9.68% of them used rotten eggs with litter as fish feed. There was no proper sewage disposal system in the majority of the (96.2 %) poultry farms. The farmers did not treat the litter before disposal. None of the farmers had received any training on farm management and biosecurity.

Farmer's knowledge and awareness about the effect of poultry waste on the environment and public health

Only 19.4% of farmers were aware of the risk of water pollution by improper waste management,

while a majority (80.6%) of them did not know about that (Table 5). Similarly, 83.9 % of the

Table 3. Status of biosecurity in study farms (N=31)

Factors	Category	N	%
Long tree	Yes	27	87.10
	No	4	12.90
Bush	Yes	29	93.55
	No	2	6.45
Long tree and bush	Yes	25	80.65
	No	6	19.35
Footbath	Yes	1	3.2
	No	30	96.8
Use sanitizer during cleaning	Yes	26	83.9
	No	5	16.1
Change of litter material every two days interval	Yes	31	100

Table 4. Waste management practices among the poultry farmers (N=31)

Factors	Category	N	%
Management of litter	Fish Feed	29	93.55
	Fertilizer	1	3.23
	Biogas	1	3.23
Management of dead birds	Buried	10	32.26
	Throw up	19	61.29
	Biogas	1	3.23
Management of damaged eggs	Fish feed	1	3.23
	Buried	9	29.03
	Throw up	18	58.06
Sewage disposal	Biogas	1	3.23
	With litter	3	9.68
	Yes	1	3.2
Chemical treatment of litter before disposal	No	30	96.8
	Yes	0	0
Training on farm management and biosecurity	No	31	100
	Yes	0	0

farmer was not aware of the possible soil pollution due to poultry waste. The majority of (54.84%) the farmers reported noise and smell produced by the poultry farmers, while 29.03 and 16.13% complained about noise and smell, respectively.

Table 5. Knowledge and awareness of poultry farmers about the impact of poultry waste on the environment and public health

Factors	Category	N	%
Water pollution	Yes	6	19.4
	No	25	80.6
Soil pollution	Yes	5	16.1
	No	26	83.9
Public health concern	Noise	9	29.03
	Smell	5	16.13
	Noise and smell	17	54.84

Association between variables analyzed by Chi -square test

The educational level of farmers negatively ($P < 0.021$) influenced the dead bird management practice (Table 6). The association between farmers' educational qualification and footbath use tended ($P = 0.065$) to be significant.

Table 6. Relationship between educational status and dead bird management practice

Educational status	Dead bird management (%)				P-value
	Burly	Throw up	Biogas	Fish feed	
Primary	2 (66.7)	1 (33.3)	0 (0)	0 (0)	
SSC	3 (16.7)	15 (83.3)	0 (0)	0 (0)	0.021
HSC	3 (37.5)	3 (37.5)	1 (12.5)	1 (12.5)	
Graduate	2 (100)	0 (0)	0 (0)	0 (0)	
Footbath (%)					
Educational status	Yes		No		0.065
Primary	0 (0)		3 (100)		
SSC	0 (0)		18 (100)		
HSC	0 (0)		8 (100)		
Graduate	1 (50)		1 (50)		

4. DISCUSSION

In this study, 87.10% of farmers reared layer birds, and most of them were in small scale ranges from 250 to 2000, which could be due to the profit in layer business with low risk in small-scale rearing. Those who reared in cage and shelf, none of them use litter material as this system does not require bedding materials. This study revealed that most of the farm is operated

by the male while female helps them with their household works. Similarly, Oduwaiye et al. (2017) reported around 80% of poultry farmers were male. In rural areas, women or children mainly maintained the small-scale family poultry (Nwanta et al., 2006; Sonaiya, 2007). All the farms under this study were commercial type. Therefore, it is reasonable to have more male farmers than female, as commercial poultry farms require more physical labor than family poultry farms. The current study observed that older (40 to 60 years) people were more interested in poultry farming than younger people. The minimum and maximum age of the farmer under this study were 25 and 50 years, respectively while the average age of the farmers was 37 years, which fall under the active age bracket (25 -59 years) mentioned by FAO (1997).

In this study, many farmers gathered waste materials at the farm and kept them ready to reach a certain amount and then use or sell the waste materials to buyers. Around 93.33% of

farmers used litter as feed fish. Moreover, the farmers also threw the dead birds (61.29 %) and spoiled eggs (58.60 %) in the water body or open space. Applying litter materials and other poultry wastes in the water body can cause water pollution (Edwards and Daniel, 1992). The pathogenic microorganisms like coliform and *Escherichia coli* from poultry waste may cause groundwater and surface water pollution (Edberg et al., 2000). In this study, a majority

(80.6%) of the farmers were not aware of the possible threat of poultry waste on the environment and public health.

In the current study, most of the farmers did not maintain proper biosecurity around the farm. Farmers were reluctant to dispose of litter frequently. This practice can cause an increase in house moisture and relative humidity levels, subsequently elevates the nitrogen content of the litter materials. These conditions have the potential to increase the NH₃ concentrations in poultry houses. A high concentration of NH₃ in the farm could be hazardous to the bird's health, production performance, and environment (Ritz et al., 2004).

Most of the farms were located beside the house or road. The undesirable smell of excessive ammonia gas and noise from poultry farms affects the well-being of nearby families and passerby. Being non-substantial, acute noise does not cause any permanent health impairments, whereas chronic noise exposure from poultry farms can increase the risk of public health hazards (Ising and Kruppa, 2004). On the verge of the scarcity of electricity and gas, the world is thriving for a new energy source. In this quest, developed countries are successfully converting poultry farm waste into valuable biogas (Sarker et al., 2009). In contrast, farmers of developing countries like Bangladesh are not very familiar with biogas production by utilizing poultry farm waste. In this study, only 3.23% of farmers used poultry waste for biogas production. This finding agrees with the experiment conducted in Nigeria (Iheke, 2016), where 8.33% of farmers indicated the benefit of biogas production from poultry farm waste.

The farm owners in this study were educated and completed secondary (58.1%) and higher secondary education (25.8%). Only 6.5% of farmers had a graduate degree. Moreover, this study observed that the educational status of farmers significantly influenced their attitude towards dead bird's management practices. The use of footbath tended ($P = 0.065$) to be affected by the farmer's education level. Education plays a vital role in farmers' awareness and perception about new techniques and innovations related to farm management (Oduwaiye et al., 2017). This observation is in line with the present study

findings where farmers with higher educational qualifications were more willing to manage the poultry waste properly.

The farmers under this study had no training in poultry rearing and biosecurity practices. They acquired the idea of poultry farming by observing the others farmer's activities. Most of them threw dead birds or damaged eggs near the farm or gather them with garbage materials and threw them later. This inappropriate practice of waste management could be due to their inadequate knowledge and awareness regarding this issue.

5. CONCLUSION

This study observed that the farmers (58-60%) did not know the proper management of poultry waste and its impact on public health and the environment. Besides, farmers under this study had no training in poultry farming. Around 58 to 60 % of farmers threw dead birds or rotten eggs in open space. Using litter as fish feed (93.5%) was the most popular practice among farmers. The farmer's educational qualification had a significant impact on the management practice of damaged eggs. Therefore, the government should provide training to the farmers in a different area related to poultry farm management, biosecurity, and waste management practice to minimize the environmental and public health risks from poultry farm waste.

ACKNOWLEDGEMENTS

We would like to acknowledge the kind cooperation of the poultry farmers of Bagmara Upazila, Rajshahi, Bangladesh.

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