Bhutan Journal of Animal Science (BJAS)
Volume 4, Issue 1, Page 121-125, 2020

Full length paper

ASSESSMENT OF POULTRY FARM BIO-SECURITY MEASURES IN SOUTHERN BHUTAN

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ABSTRACT: The farm biosecurity measures adopted by poultry rearing farmers in five southern districts of Bhutan was assessed. The data were gathered from 96 respondents purposively selected, through face-to-face interview using semi-structured questionnaire. The data gathered were descriptively analyzed and association amongst variables were measured using Chi-square and Pearson's correlation. The study recorded majority (74 %) of the poultry sheds being constructed within 50 meters distance from the residential area, and 66.8 % of respondents did not have any biosecurity fencing. The study recorded use of foot dip at the entrance of the poultry shed as the main biosecurity measures, and about 90% of the respondents interviewed did not maintained visitors record. There was no significant association between the education level and biosecurity measures being adopted ($p = 0.98$). However, a significant difference was observed on the use of personal protective equipment ($p < .05$) among the five districts. The study concludes that the majority of the respondents are not aware on the importance of poultry farm biosecurity measures. The study recommends creating adequate awareness on the importance of farm biosecurity measures to minimize diseases outbreak and enhance production and financial strength.

Keywords: Biosecurity; disinfectants; education level; personal protective equipment.

1. INTRODUCTION

Infectious agent significantly reduces the productivity, profitability and financial viability of the farm in long term. Therefore, farm biosecurity measures are implemented.to reduces the risk of introducing and transmitting disease agents (Mahmoud et al. 2014) or organisms into a flock or herd (Dorea et al. 2010). Bio-security encompasses a range of measures when properly implemented serves to protect the health of poultry from diseases, pests and pathogens. Noremark et al. (2014) reported a role in spreading both endemic and exotic diseases through indirect contacts from visitors. Biosecurity is achieved by maintaining minimum entry of pathogenic organisms such as bacteria, viruses and rodents in the farms (Wijesinghe et al. 2017). Implementation of biosecurity measures will not only significantly reduce the introduction of diseases but will enhance the financial strength (Dorea et al. 2010) and increase competitive edge of the farms. Today about 1078 households' rear improve poultry ranging between 200 to 10,000 bird in Bhutan, and had achieved 100 % egg self-sufficiency since 2012, with no import of eggs. The poultry population recorded in Bhutan was 1.067 million numbers, with native poultry accounting to about 11.83 % (RNR Statistics 2017). Majority of the country's poultry population (68.67 %) and the larger poultry farmers are concentrated in five southern dzongkhags (districts). Many farmers had venture into commercial poultry farming since 2010 after the ban imposed on import of eggs after the outbreak of Highly Pathogenic Avian Influenza. The growth of commercial poultry sector was much faster than other livestock commodities; and in parallel if adequate bio-security measure are not put in place the risk of disease incursion and outbreaks are expected to increase by manifolds. Such disaster if occurred might impact the growth of poultry sector in the country. Thus, to reduce and prevent the risks of introducing poultry diseases and outbreaks necessitate having good biosecurity. Currently there is no empirical information on adoption of biosecurity measures by the poultry farmers and different farm sizes in Bhutan.

Therefore, this study was planned to assess the existing biosecurity measures adopted by farmers and different sizes of poultry farm in five southern districts of Bhutan.

2 MATERIALS AND METHODS

2.1 Study sites and respondents

The study sites Gelephu, Dekiling, Samtenling and Sompangkha gewogs (sub-districts) under Sarpang dzongkhag (district); Goserling, Tsholingkhar, Kilkhorthang and Dunglagang gewogs under Tsirang dzongkhag; Tashiding and Dagapela under Dagana; Phuentsholing and Samphelling gewog under Chukha dzongkhag and Norbugang and Samtse gewogs under Samtse dzongkhag were purposively selected based on existence of high number of poultry rearing farmers and farms. Further, amongst the existing poultry farms, a total of 96 households rearing more than 200 poultry birds were again purposively selected for the study. The climatic condition of study sites ranges from warm sub-tropical to warm temperate.

2.2 Data collection and analysis

The data were collected from identified poultry rearing farmers through face to face interview using a semi-structured questionnaire from November to December 2018. The data gathered were descriptively analyzed and association amongst variables were measured using Chi-square and Pearson's correlation in Statistical Package for the Social Sciences (SPSS) Version 23 (IBM n.d.).

3. RESULTS AND DISCUSSIONS

3.1 Profile of respondents

The study recorded 65.6 % male and 34.4 % female respondents. Majority of respondents were literate against 28.1 % illiterate respondent recorded. It was observed that about 71.9 % of the respondents had education level higher than primary education or had attended non-formal education (NFE). The respondents with primary and secondary level qualification comprises of 35.4% and 24%, respectively.

3.2 Poultry farming and farm type

Figure 1 presents different poultry farm types owned by the respondents in this study. The study recorded 71.9 % and 18.8 % of the respondents involved in commercial layer and broiler farming for egg and chicken production, respectively. About 9.4 % of the respondents were found rearing both layer and broiler. Similarly, Maduka et al. (2016) reported more layer farms than broiler in their study.

There was no significant association between the education level of respondents and farm type (p = 0.79) owned in this study.

Farm with flock size of 500-1000 birds (39.6 %) were the most common enterprise, followed by 1001-5000 (32.3 %), less than 499 (19.8 %) and 5001-10,000 (8.3 %) birds. This finding indicates that majority of the respondents are into either semi-commercial or commercials poultry farming. In the Bhutanese context, poultry farm with birds between 500-1000 numbers and above 1001 birds are considered a semi-commercial and commercial farm, respectively. All respondents in this study had an open-sided house of deep litter system. The Day-Old-Chicks (DoCs) demand for the layer farms were met from the government farms. Whereas, the majority of broiler DoCs were supplied to interested farmers by private entrepreneur through import from neighbouring states of India. The government farm also produces and supply small numbers of broiler DoCs.

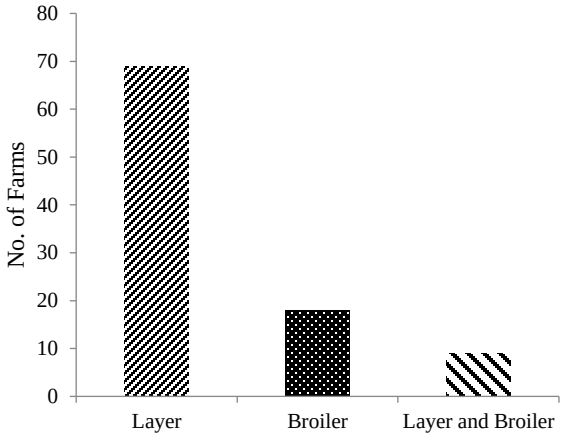

Figure 1: Poultry farm types owned by farmers

The study recorded that about 74% of respondents have constructed poultry sheds within 50 m distance from the residential areas. Whereas, about 12.5 % and 7.3 % of respondents have constructed poultry sheds beyond 100 m and between 51- 60 m, respectively. Alabi et al. (2014) and Martindah et al. (2014) also found that majority of the poultry sheds in Nigeria and Indonesia are constructed within 100m owing to ease of the management.

The biosecurity guidelines requires the commercial poultry farms to be constructed away from the residential areas and public roads to avoid direct contact for biosecurity reasons in Bhutan (BAFRA 2015); however, the actual distance requirement is not specified. With most farms constructed within proximity to residential areas in the study sites, there's a very high possibility of disease occurrence and transmission during outbreaks.

Biosecurity fencing, as a physical barrier, plays a crucial role in preventing entry of unwanted visitors and spreading of pests and diseases. However, the study

recorded only 31.2 % of the farms with established biosecurity fencing (Table 1).

Table 1: Adoption of bio-security fencing at Farms

Dzongkhag	Bio-security fencing (No.)		Total
	Yes	No	
Tsirang	2	20	22
Dagana	0	6	6
Sarpang	23	33	56
Chukha	3	2	5
Samtse	2	5	7
Total	**30**	**66**	**96**

Most poultry farms in Sarpang district had the bio-security fencing and it could be mainly because of having experienced poultry farmers in the district.

3.3 Disinfectant programs and downtime period

The study revealed that the majority 87(90.6 %) of the poultry farms had foot dip at the entrance of the shed against 9.4 % respondents without foot dip facility. The majority of the respondents used lime ($CaCO_3$) as a main disinfectant in the sheds while potassium permanganate and Kohrsolin-Th (Glutaraldehyde) are also used at the entrance of the sheds. In contrast, Negro-calduch et al. (2012) revealed that phenol-based products were mostly used as a disinfectant, followed by lime.

Also, 65 % of the respondents did not use hand sprayer for disinfection at the farm. A similar result was also observed by Tenzin et al. (2017) where the majority of the respondents did not use hand sprayer rather they use soap and water.

The current study did not find any significant association between education level and disinfectant program (p = 0.98). It was revealed that 77 (80 %) of the respondents use disinfectants in the farm. Whereas, in Libya only 20 % of the farms use disinfectant at the entry with likely increase risk of poultry farm exposure to the pathogen (Kammon et al. (2017) .

In the study areas, all respondents reported having kept the downtime of different durations (Table 2). It was recorded that 57.3 % (55) of the respondents had kept the downtime of more than one month, followed by 17.7% downtime of 21-30 days, 13.5% for 10-15 days, 7.3% for less than 10 days and 4.2% for 16-20 days. Mohammed et al. (2016) observed that rest period between production cycles was found to be kept at 4-7 days. In normal circumstances, a minimum downtime duration of two weeks is recommended (Hy-line International 2018).

Table 2: Duration of downtime by respondents

Duration downtime	Number of Respondent	Percent of respondent
Less than 10 days	7	7.3
10-15 days	13	13.5
16-20 days	4	4.2
21-30 days	17	17.7
More than 30 days	55	57.3
Total	**96**	**100**

3.4 Cleaning of sheds and equipment;

In the study areas, it was revealed that 74 (77.1 %) of the respondents cleaned the poultry sheds once in a cycle, followed by two and four times with 9 (9.4 %) each. Tenzin et al. (2017) reported that the cleaning of poultry shed was done daily, weekly and monthly basisThe cleaning and disinfection are key components of routine farm biosecurity and decontamination that is expected to kill all pathogenic organisms that are present in the farm.

The study recorded that about 64 respondents clean the water drinkers on daily basis. Whereas, about 17 and 11 respondents claim to clean the water drinkers on a weekly and monthly basis, respectively. The study also recorded 49 (51 %) of the respondents cleaning the poultry feeders every month, while 25 (26%) and 22 (22.9%) of the respondents have reported cleaning the feeders on daily and weekly basis, respectively (Figure 2). Negro-calduch et al. (2012) in their findings also revealed that cleanliness of water drinkers and other equipment was poorly managed in Egyptian farms.

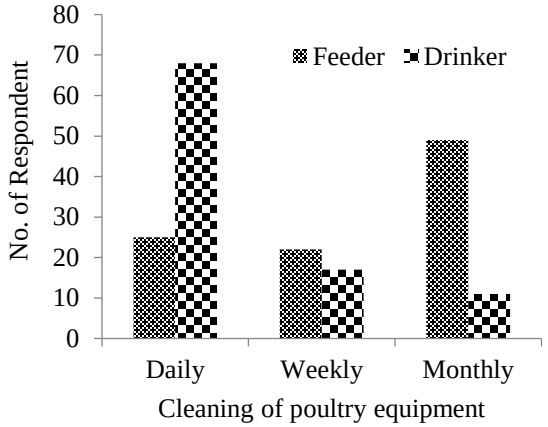

Figure 2: Percent respondent cleaning of drinkers and feeders

3.5 Feed and Feeding

The study observed that all respondents used commercial poultry feed from different feed company such as Karma feed, MAHA, Samrat feed and BMG. The study found that about 80.2 % (77) of the respondents purchased the feed on weekly basis as to avoid feed contamination or spoilage. It was also recorded that about 10.4 % of the

respondent purchased feed on monthly basis and feeds are stored in a separate feed store by about 80.2 % of the respondents in the study areas.

3.6 Workers hygiene and visitor records

The study revealed that about 47.9 % (46) of the farms provide clothing for the workers, and the remaining farms did not provide working dresses. It was also observed that only 33.3 % (32) of the farms used footwears while working and the remaining 64.6 % (62) reported not using footwears while working in the farms. Wearing different clothes and footwear while working in the farm will reduce the spread of pests and diseases. The significant difference on the use of Personal Protective Equipment (PPE) amongst the farms in five districts was observed ($p < 0.05$), which contradicts the finding of Dorea et al. (2010). 96 % of the respondents revealed that in a day, about 1-3 workers are allowed to enter the farms. 75 % of the respondents reported that farm attendants visited first from young to old flock while 25 % visited from old to the young flock (Table 3).

The study revealed that 92.7 % of the respondents did not maintain visitor records at the farm. The study revealed that only seven respondents six from Sarpang and one from Samtse districts had maintained visitor records. This indicates that poultry farmers are unaware of the importance of keeping the visitor logbook. If such records are maintained would help poultry farmers to conduct a risk assessment during disease outbreak in the farm. It also indicates that the visitors are allowed to visit the farm without any restrictions unlike implementation of entry restriction to poultry farms. Whereas, Kammon et al. (2017) reported 81 % of the farms in Libya region have entry restriction records to poultry farms. Scott et al. (2018) in their study reported that visitor recording books are used by the majority of the poultry farms in Australia.

Table 3: Sequence of visiting flock

Dzongkhag	Visiting of flock		Total
	Young first	Old first	
Tsirang	15	7	22
Dagana	5	1	6
Sarpang	43	13	56
Chukha	4	1	5
Samtse	5	2	7
Total	**72**	**24**	**96**

3.7 Brooding and isolation pen facilities

Figure 3 presents the brooding and isolation of pen facilities. Brooding of chicks is important to provide extra care after hatching. The study recorded that 51(53 %) of the respondent did not have separate brooding pen in the farm, while about 63.5% (61) of the respondent had maintained an isolation pen to keep sick birds. The sick birds are separated and kept in the same shed after partitioning in farms without isolation pen. Furthermore, the study revealed that 82.3% (79) of respondents had different sheds for the different age group of birds, and the remaining stock the birds of different age groups in the same shed.

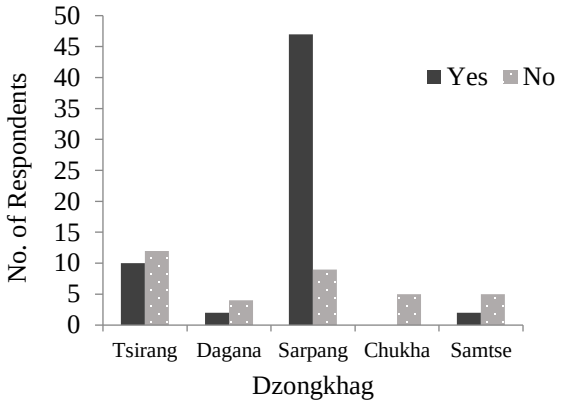

Figure 3: No. of respondents with isolation pen

4. CONCLUSION

Majority of the poultry farmers are more concerned on production aspect and have neglected the minimum biosecurity requirements which plays a vital role in overall farm performance. The possibility of diseases occurrence and transmission during outbreaks within and amongst the poultry farm is very high. Further, the poultry farmers do not have adequate knowledge on biosecurity measures, flock health management and personal hygiene. It is imperative that awareness and education programs on need for an effective farm bio-security measures are imparted amongst poultry farmers in the country to reduce pests incursion, diseases outbreak and transmissions.

ACKNOWLEDGEMENT

Authors would like to thank the Director General, Department of Livestock for fund supports and Dr. Kesang Wangchuk, Principal Research Officer for continuous advice and collaboration. We would also like to thank all the staffs of NPRDC, Sarpang for their assistance in data collection.

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