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Knowledge and constraints in the adoption of bio-security measures among smallholder poultry farmers in Namakkal District of Tamil Nadu

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Abstract

The present study was conducted in the Namakkal district of Tamil Nadu as the district had highest poultry population among other districts of Tamil Nadu. Ex-post facto research design was adopted for the study. The interview schedule was pretested, primary data collected, statistically analyzed and interpreted. Regarding knowledge level of bio-security measures all the farmers had knowledge about disposal of carcass and prevention of entry of wild animals and medium level of knowledge observed with other bio-security measures. With regarding to constraints in adoption, institutional constraints perceived as the most serious constraints by the smallholder poultry farmers. There is a need for targeted training, accessible resources and supportive policies to strengthen bio-security practices to not only safeguard the poultry industry but also contribute to national food security and public health.

Keywords: Bio-security measures, constraints, knowledge, poultry farmer

1. Introduction

Poultry farming is one of the fastest-growing sectors of Indian agriculture, contributing substantially to food and nutritional security, rural employment and livelihood generation through the production of eggs and meat. Backyard poultry farming is typically characterized by small flock sizes and limited implementation of bio-security measures. In many developing countries, backyard poultry accounts for nearly 80 per cent of the total poultry population (Sonaiya F 2007; Pym *et al.*, 2006) ^[1, 2]. Animal protein deficiency affects rural health and poultry products provide an affordable source of quality protein that improves nutrition, food security, women's empowerment and poverty reduction (Dinesh *et al.*, 2024) ^[3]. The rapid expansion and intensification of poultry production have increased the risk of infectious disease outbreaks, resulting in considerable economic losses and public health concerns. Several poultry diseases, including salmonellosis, avian influenza and Newcastle disease, adversely affect poultry production and some possess zoonotic potential, threatening both animal and human health (WOAH, 2018; DADH, 2023–24) ^[4, 5]. In addition, the indiscriminate use of antibiotics in poultry production has contributed to the emergence of antimicrobial resistance, which is recognized as one of the major global public health challenges (Sen *et al.*, 2022) ^[6].

Although India's poultry sector has experienced significant growth over the past four decades, this expansion has largely been driven by commercial production. In contrast, backyard poultry farming remains a household-based

activity managed primarily by rural women and is increasingly recognized for its potential to improve rural livelihoods, reduce poverty and meet local demand for eggs and poultry meat (Dinesh *et al.*, 2024) ^[3]. Smallholder poultry production contributes significantly to developing economies by supporting household food security, generating income and improving the livelihoods of small farmers, thereby helping reduce poverty (Sambo *et al.*, 2015) ^[7].

According to the World Organisation for Animal Health (WOAH, 2018) ^[4], bio-security comprises a set of management and physical measures designed to minimize the risk of introduction, establishment and spread of animal diseases within and between animal populations. Effective bio-security practices include proper sanitation, cleaning and disinfection, isolation of sick birds, regulated movement of people and vehicles, appropriate disposal of carcasses and farm waste and control of wild birds and rodents (Dewulf and Immerseel, 2019) ^[8]. The successful implementation of these measures largely depends on farmers' knowledge and understanding of recommended bio-security practices.

Knowledge is considered the foundation for behavioural change and informed decision-making in agricultural production systems. Farmers with adequate knowledge are more likely to recognize disease risks, appreciate the benefits of preventive measures and make appropriate management decisions (Rogers, 2003) ^[9]. Understanding farmers' perceptions of disease prevention is essential, as it provides insight into their willingness to adopt recommended bio-security practices and modify their farm

management practices accordingly (Richens *et al.*, 2018) ^[10]. However, several studies have reported inadequate awareness and knowledge of recommended bio-security measures among smallholder poultry farmers, particularly in developing countries, limiting effective disease prevention (Fasina *et al.*, 2012; Laconi and Subasinghe, 2023) ^[11, 12]. Identifying existing knowledge gaps is therefore essential for designing need-based extension programmes, training interventions and policy initiatives to strengthen farm bio-security. Therefore, the present study was undertaken to evaluate their knowledge level on bio-security measures and constraints perceived in adoption of bio-security measures with the following objectives.

- To study the level of knowledge on bio-security measures among the smallholder poultry farmers
- To examine the constraints perceived by the smallholder poultry farmers in adoption of bio-security measures

Methodology

Namakkal district was purposively selected, as the district

had highest poultry population among other districts of Tamil Nadu (20th Livestock Census, 2019) ^[13]. From this Devarayapuram village of Erumapatty block and Vaiyappamalai village of Mallasamudram block were selected through random sampling. Respondents were selected from among marginal or landless farmers rearing 50–180 birds and depending primarily on family labour for the managerial work. Thus, totally 40 smallholder poultry farmers were selected as the respondents for the study. The study adopted ex-post facto research design.

The structured pretested interview schedule was prepared; the primary data were collected through direct personal interview method. Knowledge level measured using dichotomous response namely, “correct” and “incorrect”. Positive response (correct) was assigned a score of one, while negative response (incorrect) was assigned a score of zero. The knowledge level was calculated based on the total cumulative score for each bio-security measure and they were categorized from no knowledge to Very high knowledge following the method adopted by Tamizhkumaran (2016) ^[14], as detailed below.

Knowledge level					
No knowledge	Very low	Low	Medium	High	Very high
-	1-10%	11-30%	31-70%	71-90%	Above 90%

The constraints were studied under four components and the five point continuum most relevant to least relevant scoring procedure was adopted. Interpreted based on mean score value. The suitable descriptive and inferential statistics were adopted for the selected variables.

Results and Discussion

This section presents a comprehensive analysis and interpretation of the smallholder poultry farmers' level of knowledge and constraints in adoption of bio-security measures, thereby providing insights into barriers affecting effective bio-security management.

Knowledge of bio-security measures among smallholder poultry farmers

The frequency, percentage distribution, mean scores and standard deviations of respondents' knowledge regarding individual bio-security measures in poultry farming are presented in Table 1.

It was observed from Table 1 that all the respondents (100.00%) possessed knowledge about the importance of proper disposal of dead birds in the farm and prevention of entry of wild animals and birds into the farm, indicating complete awareness of these bio-security practices. This might be attributed to their direct relevance to disease prevention and their frequent emphasis by veterinarians, extension personnel and fellow poultry farmers. A high level of knowledge was also observed regarding the identification of healthy and sick birds (87.50%). This might

be due to the fact that farmers recognize the importance of early disease detection for minimizing economic losses. The findings were not in accordance with the results of (Munazir *et al.*, 2024) ^[15] indicated that poultry farmers exhibited greater awareness of vaccination-related practices, while awareness of several critical bio-security measures, such as disinfection and preventive health management practices, remained relatively limited.

Relatively low levels of knowledge were recorded regarding vaccination of birds (27.50%), deworming practices (25.00%), quarantine period for newly purchased birds (25.00%) and the importance of sunlight for layers (25.00%). These practices require more technical knowledge and are often overlooked by small-scale and backyard poultry farmers. The existing knowledge and adoption gaps identified in the present study highlight the importance of capacity-building programmes, which is supported by the findings of (Alagesan *et al.*, 2025) ^[16], who reported significant improvements in bio-security adoption following targeted training interventions. These findings indicate that while the respondents possessed adequate knowledge about general farm hygiene and disease prevention practices, their awareness of specific disease control and preventive health management measures was comparatively limited. This is also supported by the results of (Dorea *et al.*, 2010) ^[17], who highlighted that growers' compliance with bio-security practices depends on their level of awareness regarding the role of bio-security in disease control.

Table 1: Classification of the smallholder poultry farmers based on their knowledge level on bio-security measures (n=40)

S. No.	Bio-security measures	Mean	Standard deviation	Knowledge (%)	Knowledge level
1	Importance of proper disposal of dead birds in the farm	1	0	100.00	Very high
2	Prevention of entry of wild animals/birds inside the farm	1	0	100.00	
4	Identification of healthy and sick birds	0.875	0.33	87.50	High
5	keeping different age group of birds separately	0.675	0.47	67.50	
6	Orientation of poultry shed	0.65	0.48	65.00	Medium
7	Precautions to be taken during scavenging of the birds	0.625	0.49	62.50	
8	Proper drainage system to prevent disease occurrence	0.60	0.50	60.00	
9	Control of external parasites	0.575	0.50	57.50	
10	All-in-all-out system of rearing	0.55	0.50	55.00	
11	Importance of fencing the farm	0.50	0.51	50.00	
12	Type of flooring for poultry shed	0.45	0.50	45.00	
13	Disinfectant used in poultry farm	0.40	0.50	40.00	
14	Sanitization of hand before handling of birds	0.35	0.48	35.00	
15	Mode of transmission of disease from one bird to another bird	0.35	0.48	35.00	
16	Disposal of manure and farm wastes	0.325	0.47	32.50	Low
	Zoonotic disease transmission	0.30	0.46	30.00	
17	Vaccination of birds	0.275	0.45	27.50	
18	Deworming of birds	0.25	0.44	25.00	
19	Quarantine period for the newly purchased bird	0.25	0.44	25.00	
20	Importance of sunlight for layers	0.25	0.44	25.00	

Constraints perceived by the smallholder poultry farmers

The constraints perceived by the smallholder poultry farmers were studied under four categories as socio-psychological constraints, socio-economic constraints, managerial constraints and institutional constraints and presented in Table 2.

Regarding socio-psychological constraints, resistance to changing traditional farming practices was perceived as the most important constraint by the poultry farmers, with a mean score of 3.85. Among the socio-economic constraints, limited financial resources for investing in bio-security infrastructure and inadequate public policies related to bio-security were identified as the most critical constraints, each recording a mean score of 3.80. With respect to management-related constraints, difficulty in adhering to the

recommended deworming schedule and lack of adequate knowledge regarding bio-security measures emerged as the major constraints, both with a mean score of 3.82. Among the institutional constraints, the weak extension system was perceived as the most severe constraint, registering the highest mean score of 4.10. These results were also in agreement with the results of (Jibrin *et al.*, 2021) ^[18] who reported that lack of government policies, high cost of disinfectants were perceived as major constraints by the farmers.

Considering the overall dimensions of constraints affecting the adoption of bio-security measures, institutional constraints were perceived as the most important barrier, with a mean score of 3.83, followed by socio-economic constraints (3.74), management-related constraints (3.70) and socio-psychological constraints (3.69).

Table 2: Constraints perceived by the smallholder poultry farmers to adopt bio-security measures (n = 40)

S. No.	Constraints perceived	Mean score	Rank
I.	Socio-psychological constraints		
1	Resistance to change from traditional practices	3.85	I
2	Negligence of farmers	3.75	II
3	Questionable efficacy of bio-security	3.70	III
4	Lack of know-how among farmers	3.67	IV
5	No appreciation for taking risk	3.65	V
6	Previous experiences	3.62	VI
7	Lack of co-operation from others	3.62	VI
	Mean score	3.69	
II.	Socio-economic constraints		
1	Limited financial resources to invest infrastructure	3.80	I
2	Inadequacy of public policy on bio-security	3.80	I
3	Lack of access to credit	3.77	III
4	Lack of social interaction	3.67	IV
5	Increased cost for purchasing preventive equipment	3.65	V
	Mean score	3.74	
III.	Managerial constraints		
1	Difficulty in following correct deworming schedule	3.82	I
2	Lack of knowledge on bio-security measures	3.82	I
3	Lack of awareness on bio-security measures	3.60	III
4	Insufficient labour to carry out bio-security measures	3.75	IV
5	Difficulty in following all bio-security measures in management of poultry birds	3.75	IV

6	High cost of feed materials	3.72	VI
7	Lack of appropriate housing facilities on farm	3.67	VII
8	Most measures are difficult to follow daily	3.67	VII
9	Inconsistency due to multiple works	3.65	IX
10	Lack of time to follow bio-security measures	3.60	X
	Mean score	3.70	
IV	Institutional constraints		
1	Weak extension system	4.10	I
2	Lack of motivating agencies	3.87	II
3	Lack of veterinary influence or interest in promotion of bio-security	3.82	III
4	Lack of adequate media publicity on disease control measures	3.80	IV
5	Limited access to get resources to adopt bio-security measures	3.77	V
6	Lack of flock specific information	3.75	VI
7	Lack of education for attitudinal change	3.72	VII
	Mean score	3.83	
	Total mean score	3.74	

The overall constraint (3.74) felt by the farmers in the adoption of bio-security measures were relevant to more relevant constraint. This might be attributed to the predominance of older farmers with low to medium income levels, limited information-seeking behaviour, inadequate awareness and knowledge of bio-security measures, and dependence on farming as their primary livelihood. The low adoption of several bio-security practices might be attributable to inadequate access to technical information, as information access has been identified as a major determinant of bio-security adoption by (Otieno *et al.*, 2023) ^[19]. This is also supported by (Dorea *et al.*, 2010) ^[17] who suggested that regular monitoring, extension support and increased awareness are essential for improving compliance with recommended bio-security practices among poultry farmers.

Conclusion

The study revealed that poultry farmers possessed a moderate level of knowledge on bio-security measures, with considerable variation across different practices. The socio-economic and managerial constraints hindered effective implementation of bio-security measures. Also, the majority of the farmers had not attended any training programmes. It could be observed from this study that knowledge gap exists in bio-security measures among smallholder poultry farmers. Also, constraints should be minimized to implement the bio-security measures. Therefore, targeted training programmes, regular veterinary extension services, institutional support mechanisms, accessible to resources and awareness campaigns are essential to improve farmers' understanding and knowledge of critical bio-security practices for sustainable poultry production and disease control at the smallholder farmers' level.

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