PRACTICE OF BIOSECURITY MEASURES IN POULTRY FARMS IN THE MUNICIPALITY OF MAN, IN WESTERN IVORY COAST

ABSTRACT

A study was carried out in the municipality of Man, in western Côte d'Ivoire, involving 45 poultry farmers to assess biosecurity measures on poultry farms. The objective was to help evaluate biosecurity measures on modern poultry farms to combat avian diseases and protect public health. The method used was convenience sampling, a non-probability sampling technique in which individuals are selected based on their accessibility and availability. The results showed that 29% of farmers had fenced their farms, and 89% of poultry houses had footbaths that were not in working order. No farm had a sign prohibiting people from entering or vehicles from parking near the farms. Regarding the marketing of broiler chickens and eggs, 53% of farmers invited wholesale and retail traders to their farms. After cleaning the chicken coops, 33% of farmers left the litter in the farmyard, 27% left it behind the fence, and 40% disposed of it off-farm. However, 71% of farmers understood the value and importance of this litter by converting it into compost for crop production.

Keywords: Biosecurity, poultry farms, avian diseases, manure, Côte d'Ivoire

INTRODUCTION

The modern poultry sector has experienced significant growth, with chicken meat consumption rising from 1.47 kg per capita per year in 2012 to 2.62 kg per capita per year in 2019, representing an increase of 78.23%, and from 34 eggs per capita per year in 2012 to 45 eggs per capita per year in 2019, an increase of 32.3%. This sector has exceeded the initial consumption target for chicken meat, estimated at 2 kg in 2021, by 31%. As for eggs, it achieved only an 80 % progress rate towards the target of 56 eggs per capita per year in 2021 [1]. As such, it was the best-performing sector in the sub-region, generating an annual turnover of 40 billion CFA francs and providing 10,000 permanent jobs [2]. Despite the poultry sector's growth, it has nevertheless faced enormous problems, particularly of a

pathological nature, the most significant of which is the outbreak of Highly Pathogenic Avian Influenza (HPAI) that emerged in Côte d'Ivoire in February 2006 [3]. This outbreak has had adverse effects on trade and the economy, as significant as the fear it has instilled in the public [4, 5]. Consequently, it seemed appropriate to reduce the risk factors or triggers for avian diseases by assessing the biosecurity practices in place on modern poultry farms with a view to improving them. It is against this backdrop that this study was launched, the overall aim of which is to contribute to the assessment of the biosecurity measures in place on modern poultry farms, with a view to combating avian diseases and safeguarding public health in the municipality of Man, in western Côte d'Ivoire.

1. MATERIALS AND METHODS

1.1. Study area

The town of Man is the administrative centre of the Tonkpi region in western Côte d'Ivoire. It has a population of 241,969 within the municipality, which is predominantly rural and agricultural in character. The climate is of the mountainous type, with an equatorial regime characterised by two dry seasons (a long dry season from November to March and a short dry season from July to the end of August) and two rainy seasons (a long rainy season from March to June and a short rainy season from September to October). The terrain is relatively monotonous, with scattered hills and numerous low-lying areas featuring saturated ferralitic soils and hydromorphic soils [6].

1.2. Sampling

Out of a total of 82 modern poultry farms, 45 were selected using the convenience sampling method, a non-probabilistic sampling technique in which farmers were chosen on the basis of their accessibility and availability. This represented 55 % of active farms. The farms are of the semi-intensive and intensive types. The farmers' willingness to participate in the study also had to be taken into account. The selected farms comprise 30 large farms (more than 1000 chicks) and 15 small farms (1000 chicks).

1.3. Data collection

The survey involved distributing a questionnaire to each poultry farmer in order to determine the extent to which biosecurity measures were being implemented on farms. It enabled an assessment of the current situation to be carried out, whilst gathering information based on the questionnaire. With regard to biosecurity, the focus was on the three main components

essential to assessing biosecurity on farms, namely isolation, movement control and sanitation.

1.4. Data processing and analysis

The data collected were processed using Microsoft Office Excel 2013. This enabled the creation of tables and figures. Statistical analyses were carried out using the statistical software R Version 3.4.0, and the chi-squared test was performed with a significance level set at 5% ($p < 0.05$).

2. RESULTS

2.1. Isolation

Isolation measures include fenced farms, protective fencing, building doors that must be kept closed, functional footbaths in front of buildings and farm entrances (Table 1). Of the 45 farms, 13 were fenced (29%) but did not have footbaths at the entrance. All of the farms visited had protective fencing against pests. However, 89% of the livestock buildings had footbaths that were not functional. A comparison of the results revealed a highly significant difference among the components of isolation (p=0.001).

Table 1 : Main Components of Farm Isolation

Evaluation Criteria	**Number of Farms**	**Proportion of Farms (%)**
Fenced Farms	13	29
Protective Fencing	45	100
Closed Building Doors	45	100
Footbaths at Each Building Entrance	40	89
Functional footbaths	0	0
Footbaths at the farm entrance	40	89
p-value	0,001	
Significance	HS	

HS = Highly significant($p<0.05$)

2.2. Movement Control

No farms regulate visits, maintain visitor logs, or provide visitors with special clothing to control movement within the premises. Regarding the requirement for workers to wear special

clothing and footwear, only sixteen (16) farms complied with this requirement. Only 49% of poultry farmers arrange for the delivery of poultry products (eggs and broiler chickens) to poultry retailers (Table 2). A comparison of the results revealed a significant difference in the criteria for controlling movement within farms (p=0.02).

To control movement outside the farm, no farm has signs prohibiting people from entering or vehicles from parking near the farms. With regard to the collection of livestock products on the farm (chickens and eggs), 53% of farmers use the services of wholesalers and retailers (Table 3). A comparison of the results revealed a significant difference in the criteria for controlling movements outside the farms (p=0.001).

Table2 : Control of Movement Within the Farm

Evaluation Criteria	**Number of Farms**	**Proportion of Farms (%)**
Regulated visits	0	0
Visitor log	0	0
Wearing of protective equipment and clothing during visits	16	36
Workers assigned to specific buildings	9	20
Delivery of chickens and eggs by the farmer	22	49
Special clothing and footwear for workers	2	4
Controlled Access Zone (CAZ)	0	0
Restricted Access Zone (RAZ)	0	0
p-value		0,02
Significance		SS

SS= Statistically significant($p<0.05$)

Table3 : Control of Movement Outside the Farm

Evaluation Criteria	**Number of Farms**	**Proportion of Farms (%)**
No Entry Sign	0	0
No Visitor Access	0	0
Feed supplied by breeders	45	100

Chicks supplied by breeders	45	100
No-parking sign for vehicles	0	0
Products collected by retailers	24	53
p-value	0,001	
Significance	HS	

HS= Highly significant($p<0.05$)

2.3. Sanitation

Cleaning the chicken coop involves removing the soiled bedding, which will be used as manure in crop production. However, storage locations vary from one farm to another. Thus, 33.33% of farmers leave the litter in the farmyard (Figure 1), and 26.67% of farms leave it outside the fence (Figure 2). However, 40% of farmers dispose of it off-farm. As for poultry carcasses, 66.67% of farmers bury them, while 24.44% dispose of them in cesspools and 8.89% dispose of them in the open. A comparison of the results revealed a highly significant difference between the various locations where litter is disposed of ($p=0.001$).

The methods used to dispose of bedding vary from farm to farm. The data showed that 71.11% of farmers turn this bedding into manure, 28.89% sell it to vegetable growers, and 26.67% dispose of it in the environment (Table 4). A comparison of the results revealed a highly significant difference between the various uses of farm bedding ($p=0.001$).

Figure 1 : Dirty litter inside the poultry farm

Figure 2: A bag of dirty litter left behind the fence

Table4: Exposure and Disposal of Bedding

Evaluation Criteria	Surveyed Farms (n)	Affected Farms (n)	Proportion of Farms (%)
Bedding Disposal			
Bedding disposed of in the farmyard	45	15	33,33
Bedding disposed of behind the fence	45	12	26,67
Bedding disposed of off the farm	45	18	40
Bedding discarded in the wild	45	0	0
Burying poultry carcasses	45	30	66,67
Disposing of poultry carcasses in wells	45	11	24,44
Disposing of poultry carcasses in the wild	45	4	8,89
p-value			0,001
Significance			HS
Destination of the bedding			
Conversion of the bedding into manure	45	32	71,11
Sale of bedding to vegetable growers	45	13	28,89
Discharge of bedding into the environment	45	12	26,67
p-value			0,001
Significance			HS

n = number of farms; HS = highly significant($p<0.05$)

3. DISCUSSION

The modern Ivorian poultry industry is the largest source of animal protein. It meets 100% of the country's egg consumption needs and 96% of its poultry meat needs [1]. However, the

sector faces organizational challenges, the most significant of which is poor biosecurity practices at various farming sites [7]. A survey was conducted to collect information based on a questionnaire. The focus was on the three main components essential to assessing biosecurity in poultry farming: isolation, movement control, and sanitation.

With regard to isolation, fencing is essential on a poultry farm. It was found that 72% of farms do not have fencing. Nevertheless, they use protective netting and keep the doors to the chicken coops securely closed. Our findings are similar to those of Kaboret [8], who noted that keeping the doors of the chicken coops securely closed helped prevent the intrusion of poultry predators (snakes, ants, etc.) as well as pathogenic germs into the poultry house. The presence of poultry such as ducks and turkeys roaming near broiler or layer chicken houses increases the risk of contamination [4]. It should be noted that signs prohibiting visitor entry or vehicle parking are absent on poultry farms. This constitutes a biosecurity deficiency and a health risk for both the poultry and the staff. In fact, infections with the low-pathogenic A (H7N9) virus were also reported in humans in China in 2013. Since then, this virus has spread among the country's poultry populations and has resulted in more than 1,500 human cases and numerous deaths [9].

With regard to distribution channels, 52% of poultry farmers accepted poultry dealers on their farms, compared with 48% who delivered their poultry products to the market[10]. This could be explained by a lack of training for farmers on the importance of how the virus spreads and survives, which is essential for implementing effective biosecurity measures aimed at preventing the emergence of new epizootics. Various studies to date suggest that the spread of infection between farms occurred primarily through close contact and appeared to be mainly linked to the movement of animals, vehicles, or personnel between farms—movements that were significantly more intense within the fattening waterfowl sector than within the Gallus sector [11].

In terms of sanitation, farmers consistently clean and disinfect chicken coops, feeders, and waterers after each batch. However, significant negligence on the part of farmers was observed regarding waste management, particularly with regard to soiled litter, which must be composted off-farm before being used as organic fertilizer [4]. It was found that 71.11% of poultry farmers convert this litter into manure, 28.89% sell it to vegetable growers, and 26.67% dispose of it in the environment. It is in the best interest of poultry farmers to be aware of these risks in order to limit the potential for the development and spread of diseases[8].

CONCLUSION

The Ivorian authorities have taken steps to improve biosecurity measures through awareness-raising and training for stakeholders in the poultry sector, organized into biosecurity groups. This followed the outbreak of avian influenza in Côte d'Ivoire. Unfortunately, poor biosecurity practices at various poultry farms are a result of organizational issues within the poultry sector in the municipality of Man.

At the conclusion of the study, 52% of farmers allowed poultry dealers onto their farms, while 48% delivered their poultry products to the market. Furthermore, 72% of the farms lack fencing. However, they do have protective wire mesh and keep the doors to the chicken coops securely closed. It should be noted that farmers properly clean and disinfect the chicken coops, feeders, and waterers as part of their sanitation protocols.

However, 71.11% of poultry farmers converted the litter into manure. It is important to make stakeholders in the poultry industry understand that biosecurity is currently the most effective and least costly way to combat all emerging diseases.

FUNDING

This study received no external funding.

DATA AVAILABILITY STATEMENT

The data presented in this study are available on request from the corresponding authors.

ACKNOWLEDGEMENTS

The authors would like to thank the Regional Director and staff of MIRAH n the Tonkpi Region, as well as the anonymous reviewers, for their contributions.

DECLARATION OF AUTHORS' CONTRIBUTIONS

The study and the drafting of the manuscript were carried out collaboratively. However, as detailed below, ABN, ACM and SKA were involved in the design and planning of the study. ABN and ACM collected the data and drafted the first version of the manuscript. ABN, ACM and SKA carried out the statistical analyses and data interpretation, as well as the critical review of the manuscript.

CONFLICTS OF INTEREST

The study was conducted without any conflicts of interest

REFERENCES

1. MIRAH (Ministère de la production Animale et des Ressources Halieutiques). Politique nationale de développement del'élevage, de la pêche et de l'aquaculture (PONADEPA 2022-2026). MIRAH, Côte d'Ivoire,2022 ; 178 p
2. Dje K. Impact économique de l'influenza aviaire sur les marchés des produits avicoles en Côte d'Ivoire (3-7). In : séminaire sur la biosécurité dans les fermes et les marchés de volailles vivantes, Grand Bassam, Côte d'Ivoire, du 26-28 septembre 2007; 120 p
3. OIE. Avian Influenza (Infection with Avian Influenza Viruses). Chapter 2.3.4." 2015. http://www.oie.int/fileadmin/Home/eng/Health_standards/tahm/2.03.04_AI.pdf. Consulted on 14 February 2026
4. IPRAVI. Rapport moral et financier 2004, 2005 et du premier semestre 2006 in : La Lettre Avicole. Abidjan, pp 2-6
5. FAO. Biosecurity in the Fight against HPAI: Promoting and Supporting Measures to Reduce Risk. Rome, FAO, 2008; 12p
6. INS. Résultats globaux, recensement général de la population et de l'habitat2021. Site : https : www.plan.gouv.Consulted on 10 March 2025
7. MIPARH (Ministère de la production Animale et des Ressources Halieutiques),. Actions d'amélioration de la biosécurité dans la filière avicole en Côte d'Ivoire. Projet de mission.-DSVAbidjan, 2008 ; 7p
8. Kaboret Y. Biosécurité dans le contexte de la prévention de la lutte l'IAHP en Côte d'Ivoire (2-3) in : séminaire national sur la biosécurité dans les fermes et les marchés de volailles vivantes, Grand Bassam, Côte d'Ivoire, 2007; 22 p.
9. WHO. WHO Annual Report 2018: Towards strengthening the health system through the management of health emergencies and epidemics. World Health Organisation, Madagascar, 2018; 40 p.
10. Boka E. E. J,. Pratique des mesures de biosécurité dans les marches de volailles vivantes en Côte d'Ivoire : cas du District d'Abidjan. Thèse de doctorat, Ecole Inter - Etats Des Sciences et Médecine Vétérinaires *(E.I.S.M.V.)* DE DAKAR, 2009 ; 133 p.
11. Guinat, C., Nicolas, G., Vergne, T., Bronner, A., Durand, B., Courcoul, A., Gilbert, M., Guerin, J.-L., Paul, M.C., Spatio-temporal patterns of highly pathogenic avian influenza virus subtype H5N8 spread, France, 2016 to 2017. Euro Surveillance 23, 2018;11 p.