

## Assessment of biosecurity measures of poultry farmers in commercial poultry farms in Ikot-Ekpene and Uyo LGA, Akwa-Ibom State

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### ABSTRACT

Biosecurity is an important part of any successful poultry production system. This study was conducted to assess the biosecurity practices of poultry farmers in commercial poultry farms in Uyo and Ikot-Ekpene LGA of Akwa-Ibom State, Nigeria. Fifty (50) poultry farms were selected for this study and their biosecurity practices were assessed using structured questionnaires administered to the commercial poultry farm owners. Descriptive statistics and inferential statistics such as odd's ratio at 95% confidence interval and chi-square were used to analyze and present the results. Results of the study revealed that most of the respondents (62%) were males, larger percentage (72%) were married and (36%) were in the age category of 41-50 years. There was no significant association ( $P>0.05$ ) between age, gender, informal education, and the level of compliance with biosecurity measures. Formal education (secondary and tertiary education) had a significant ( $P\geq 0.05$ ) association with the use of biosecurity measures. Non-compliance with biosecurity practices has been related to inadequate training and education of farmers and limited communication between farmers. There is a need for qualified professionals to train poultry farmers, managers, and attendants on proper biosecurity practices.

**Keywords:** Biosecurity, commercial poultry farmers. Descriptive statistics, personnel sanitation,

### INTRODUCTION

Poultry farming in Nigeria contributes about 6-8% of the country's annual GDP and it offers a reliable source of animal protein in the form of meat and eggs (Nmadu *et al.*, 2014). Animal protein, income, employment, industrial raw materials, manure, and financial security are all key benefits of poultry production. Nigerians typically raise ducks, guinea fowls, chicken, ostriches, turkeys, quail, peafowl, and pigeons among other varieties of poultry (Omorodion, 2016). The most economically significant poultry species, however, is the chicken (Manyelo *et al.*, 2020). Over 70% of poultry in Nigeria is chicken, and 10% of Nigerians are poultry farmers (Ekunwe and Akahomen, 2015). Due to the high demand rate, low cost, lack of significant religious restrictions, high digestibility, nice flavor, and low-calorie content of chicken, consumption is anticipated to rise yearly (Raphulu *et al.*, 2015). Nigerians eat a lot of chicken, which is one of the main sources of protein in the country. (Omorodion, 2016).

Some of the factors that could adversely affect the quantity and quality of the supply of animal protein are environmental factors and farm diseases. The fastest way to close the

current protein deficiency gap in Nigeria, according to agriculturalists and nutritionists, is to boost the country's chicken business (Omodele and Okere, 2014). To stop the introduction and spread of both endemic and epidemic diseases in flocks, it is crucial to implement appropriate biosecurity measures along with effective management methods (Eze *et al.*, 2017). Biosecurity is important for One health as it leads to the reduction or prevention of infectious diseases and improves public health. According to Sadiq and Mohammed (2017), the annual revenue loss brought on by disease outbreaks is significant. Government agencies and poultry breeders concentrate their attention mostly on devastating clinical disease outbreaks like avian influenza. However, several illnesses, including coccidiosis, salmonellosis, colibacillosis, infectious bronchitis, infectious bursal disease, and Newcastle disease, can become serious over time. This study's goal was to evaluate the extent to which poultry farmers in Akwa Ibom State's Ikot Ekpene and Uyo Local Government Areas adhere to biosecurity regulations.

## MATERIALS AND METHODS

### STUDY AREA

The study was carried out in Akwa Ibom State, Nigeria. It is located in the coastal southern part of the country, lying between latitudes 4°32'N and 5°33'N, and longitudes 7°25'E and 8°25'E.

The state is located in the South-South geopolitical zone and is bordered on the East by Cross River State, on the West by Rivers State and Abia State, and the South by the Atlantic Ocean and the Southernmost tip of Cross River State. The state has a tropical climate with two distinct seasons - the wet season (April - October) and the dry season (October - March).

There are thirty-one Local Government Areas in Akwa Ibom state which are further grouped into six Agricultural zones namely Oron, Abak, Ikot Ekpene, Etinan, Eket, and Uyo. This study was purposively carried out in Uyo and Ikot Ekpene Local Government Areas. The major livestock commonly kept in Nigeria including Akwa Ibom State is poultry (Akintunde *et al.*, 2015). The majority of the farmers also engage in secondary occupations like trading and civil service jobs.

### SURVEY TOOL AND QUESTIONNAIRE

The survey tool used for this study was a well-structured questionnaire. The questionnaire used for the study had different sections and was arranged so the participants could easily comprehend. This comprised the demographics and questions to assess the level of compliance with biosecurity measures by the participants in their poultry farms. These biosecurity measures include; fencing of poultry farms, floor type, poultry waste management, rodent control, poultry by-product disposal, exclusion of other livestock on farm, 1km distance from other poultry farms, 1km distance from other livestock farms, use of foot dips, frequent replacement of disinfectants used in foot dips, presence of wire mesh in doors, windows and other openings in the pens, presence of changing room, presence of lavatory, use of specific foot wear, use of specific clothing, maintenance of specific workers, removal of cobwebs, workers personal hygiene and state of the feeding and water trough.

### STUDY PARTICIPANTS AND SURVEY

In this study, a cross-sectional epidemiological design was adopted. A sampling frame was used to determine the number of functional poultry farms in Uyo and Ikot Ekpene Local Government Areas and a total of fifty poultry farms were selected. The questionnaire was administered to the consenting respondents who were the owners of each poultry farm selected by the survey team.

## DATA ANALYSIS

Data analysis was carried out using the Statistical Package for Social Science (SPSS) software. Demographic variables were presented using descriptive statistics. Inferential analysis; Chi-square was used to test for associations and logistic regression to measure associations of the variables. The significant difference was measured at P value  $\leq 0.05$

## RESULTS

### SOCIODEMOGRAPHIC CHARACTERISTICS OF THE RESPONDENTS AND AWARENESS OF POULTRY DISEASES

In this study, a total number of fifty (50) poultry farm owners consented to participate in the study. The results showed that most of the respondents (62%) were males and 38% were females. The majority of the respondents (72%) were married, four percent (4%) had only informal education while 96% had formal education. 38% of the respondents had poultry farming experience of up to five years and the primary occupation of 34% was civil service (Table I).

**Table I: Socio-demographic characteristics of participants**

Variable	Frequency (N=50)	Percentage (%)
<b>Age</b>		
20 – 30	7	14
31 – 40	13	26
41 – 50	18	36
Above 50	12	24
<b>Gender</b>		
Male	31	62
Female	19	38
<b>Marital Status</b>		
Married	36	72
Single	13	26
<b>Education</b>		
Informal/Adult	2	4
Primary	3	6
Secondary	9	18
Tertiary	37	74
<b>Occupation</b>		
Poultry Farmer	15	30
Civil Servant	17	34
Private Sector	11	22
Other	7	14
<b>Poultry Farming Experience</b>		
Less than 1 year	5	10
Up to 5 years	19	38
Up to 10 years	2	4
More than 10 years	9	18

**THE RELATIONSHIP BETWEEN GENDER AND THE LEVEL OF COMPLIANCE WITH BIOSECURITY MEASURES**

The results showed that there was no significant association between the gender of the respondents and the level of compliance with biosecurity measures in their poultry farms (Table III & IV).

**Table II: The relationship between age (20 – 30 years) and the level of compliance to biosecurity measures**

Characteristics	Freq.	Per (%)	Odds ratio	C.I	P. value
Farm fencing	3	16	0.4	0.08 – 2.04	0.27
Management of dead birds	7	14	-	-	0.69
Vaccination	7	14	-	-	0.56
Floor-type	6	12	0.46	0.04 – 5.20	0.53
Poultry waste management	6	12	1.17	0.12 – 1.25	0.89
Poultry by-product disposal	6	12	0.97	0.10 – 9.57	0.98
Rodent control	5	10	2.39	0.42 – 3.67	0.32
Absence of other livestock on the farm	4	8	0.71	0.14 – 3.62	0.69
Absence of other poultry farms within a 1km radius	4	8	1.73	0.34 – 8.85	0.51
Absence of wild birds on the farm	4	8	2.25	0.45 – 1.37	0.32
Absence of other livestock farms within a 1km radius	2	4	1.75	0.29 – 0.70	0.55
The presence of foot dips at the entrance of houses	2	4	0.46	0.08 – 2.64	0.38
Monthly replacement of disinfectants used in the foot dips	0	0	0	-	0.06
The presence of wire mesh in all openings of the houses	1	2	0.19	0.02 – 1.73	0.11
The presence of a changing room on the farm	1	2	0.19	0.02 – 1.73	0.11

The presence of a lavatory on the farm	3	6	0.65	0.13 – 3.27	0.61
Cleaning and disinfection of poultry houses after depopulation	5	10	0.86	0.15 – 5.08	0.87
Daily cleaning of the poultry farm surroundings	6	12	9.18	1.01 – 83.11	0.02*
The poultry house left empty for a month after the previous flock	2	4	0.56	0.10 – 3.19	0.51
Daily drinker maintenance	7	14	-	-	0.34
Weekly feeder maintenance	3	6	1.73	0.34 – 8.85	0.51

\*Significant association is P≤0.05

C.I- 95% confidence interval

**THE RELATIONSHIP BETWEEN EDUCATION AND THE LEVEL OF COMPLIANCE WITH BIOSECURITY MEASURES**

The results showed management of dead birds and vaccination were the biosecurity measures that were statistically significant with respondents with primary education (Table V). Farm fencing, management of dead birds, vaccination, floor type, rodent control, presence of changing room on the farm, off-farm management poultry waste, vaccination, concrete floor type, rodent control, presence of changing room on the farm, cleaning, disinfection of poultry houses after depopulation and daily drinker maintenance were the biosecurity measures that were statistically significant with respondents with secondary and tertiary education (Table VI& VII). Therefore, there was a significant association between respondents who had up to secondary and tertiary education and the level of compliance with biosecurity measures in commercial poultry farms.

**Table III: The relationship between gender (male) and the level of compliance to biosecurity measures.**

Characteristics	Freq.	Percentage (%)	Odds ratio	C.I	P. value
Farm fencing	17	34	0.43	0.13 – 1.50	0.19
Management of dead birds	31	62	-	-	0.2
Vaccination	31	62	-	-	0.07
Floor-type	29	58	1.81	0.23 – 14.12	0.57
Poultry waste management	28	56	3.33	0.69 – 16.00	0.12
Poultry by-product disposal	28	56	2.49	0.49 – 12.61	0.27
Rodent control	16	32	0.78	-	0.67
Absence of other livestock on the farm	21	42	1.53	0.47 – 4.98	0.49
Absence of other poultry farms within a 1km radius	7	14	0.32	0.09 – 1.11	0.07
Absence of wild birds on the farm	10	20	0.43	0.13 – 1.39	0.16
Absence of other livestock farms within a 1km radius	5	10	0.54	0.13 – 2.18	0.39
The presence of foot dips at the entrance of houses	14	28	1.13	0.36 – 3.59	0.83
Monthly replacement of disinfectants used in the foot dips	12	24	18	2.01 – 161.1	0.01*
The presence of wire mesh in all openings of the houses	13	26	0.99	0.31 – 3.16	0.99
The presence of a changing room on the farm	15	30	2.03	0.61 – 6.72	0.25
The presence of a lavatory on the farm	17	34	1.35	0.43 – 4.24	0.61
Cleaning and disinfection of poultry houses after depopulation	24	48	1.58	0.44 – 5.71	0.49

Daily cleaning of the poultry farm surroundings	13	26	0.65	–	0.21 0.47
The poultry house left empty for a month after the previous flock	15	30	2.63	–	0.76 0.13
Daily drinker maintenance	27	54	0.38	–	0.04 0.39
Weekly feeder maintenance	8	16	0.48	–	3.63 0.14 0.24

\*Significant association is  $P \leq 0.05$

C.I- 95% confidence interval

## DISCUSSION

This study provided information on the level of compliance with biosecurity measures among commercial poultry farm owners in Uyo and Ikot Ekpene Local Government Areas, Akwa Ibom State. More than half of the respondents in this study were males (62%). This finding is slightly higher than those of Alalade *et al.*, (2018) in Kwara State, Oluwasusi *et al.*, (2018) in Ekiti State, Ajewole and Akinwumi (2014) who reported that 57.3%, 53.6%, and 60.9% respectively of the poultry farmers in their study were males and slightly lower than the findings of Kouam *et al.*, (2018) who reported that 79.29% of poultry farmers were males. This may be because males are seen as the breadwinners in the family by society and have to engage in productive activities to provide for the family's needs. It could also be because poultry farming is very labor-intensive and so might scare women off it (Eze *et al.*, 2017).

More than half of the respondents (72%) were married. The marital status of farmers has a direct implication on the household size as the increase in the size of the household assists in reducing labor costs as most married persons have children that make up the labor force in poultry production and will yield more profits to provide the needs of the family.

Thirty-six percent (36%) of the respondents were within the ages of 41-50. This is good as it shows that they were still in their productive and active age as is required due to the labor-intensive nature of poultry farming and is essential to be able to implement and maintain the necessary biosecurity measures.

Most of the poultry farmers (96%) in this study were literate. This high level of education is essential as it helps the farmers to adopt biosecurity practices. Education enhances productivity in agriculture as it enables farmers to be able to receive and analyze information necessary for increased productivity (Eze *et al.*, 2017)

**Table IV: The relationship between gender (female) and the level of compliance to biosecurity measures**

Characteristics	Freq	Percentage (%)	Odds ratio	C.I	P. value
Farm fencing	14	28	2.31	0.67 – 7.99	0.19
Management of dead birds	18	36	0	-	0.2
Vaccination	17	34	0	-	0.07
Floor-type	16	32	0.55	0.07 – 4.30	0.57
Poultry waste management	14	28	0.3	0.06 – 1.44	0.12
Poultry by-product disposal	15	30	0.4	0.08 – 2.04	0.27
Rodent control	11	22	1.27	0.41 – 4.08	0.67
Absence of other livestock on the farm	11	22	0.65	0.20 – 2.13	0.49
Absence of other poultry farms within a 1km radius	9	18	3.09	0.90 – 10.59	0.07
Absence of wild birds on the farm	10	20	2.33	0.72 – 7.55	0.16
Absence of other livestock farms within a 1km radius	5	10	1.86	0.46 – 7.53	0.39
The presence of foot dips at the entrance of houses	8	16	0.88	0.28 – 2.80	0.83
Monthly replacement of disinfectants used in the foot dips	2	4	0.06	0.01 – 0.50	0.01*
The presence of wire mesh in all openings of the houses	8	16	1.01	0.32 – 3.20	0.99
The presence of a changing room on the farm	6	12	0.49	0.15 – 1.63	0.25
The presence of a lavatory on the farm	9	18	0.74	0.24 – 2.33	0.61
Cleaning and disinfection of poultry houses after depopulation	13	26	0.63	0.18 – 2.28	0.49
Daily cleaning of the poultry farm surroundings	10	20	1.54	0.49 – 4.85	0.47
The poultry house left empty for a month after the previous flock	5	10	0.38	0.11 – 1.32	0.13
Daily drinker maintenance	18	36	2.67	0.28 – 25.84	0.39
Weekly feeder maintenance	8	16	2.09	0.62 – 7.05	0.24

**Table V: The relationship between education (primary) and the level of compliance to biosecurity measures.**

Characteristics	Freq	Percentage (%)	Odds ratio	C.I	P. value
Farm fencing	2	4	1.24	0.10 – 14.70	0.86
Management of dead birds	2	4	0	-	0.01*
Vaccination	2	4	0.04	0.00 – 0.98	0.01*
Floor-type	2	4	0.14	0.01 – 2.02	0.10
Poultry waste management	2	4	0.35	0.03 – 4.40	0.40
Poultry by-product disposal	2	4	0.29	0.03 – 3.74	0.32
Rodent control	1	2	0.26	0.02 – 3.07	0.46
Absence of other livestock on the farm	1	2	0.26	0.02 – 3.07	0.26
Absence of other poultry farms within a 1km radius	1	2	1.07	0.09 – 12.71	0.96
Absence of wild birds on the farm	1	2	0.74	0.06 – 8.71	0.81
Absence of other livestock farms within a 1km radius	0	0	0	-	0.38
The presence of foot dips at the entrance of houses	1	2	0.62	0.05 – 7.31	0.70
Monthly replacement of disinfectants used in the foot dips	1	2	-	-	0.45
The presence of wire mesh in all openings of the houses	1	2	0.68	0.06 – 7.97	0.76
The presence of a changing room on the farm	0	0	0	-	0.13
The presence of a lavatory on the farm	1	2	0.44	0.04 – 5.19	0.51
Cleaning and disinfection of poultry houses after depopulation	2	4	0.69	0.06 – 8.26	0.77
Daily cleaning of the poultry farm surroundings	1	2	0.57	0.05 – 6.70	0.81
The poultry house left empty for a month after the previous flock	1	2	0.74	0.06 – 8.71	0.81
Daily drinker maintenance	2	4	0.19	0.02 – 2.53	0.17
Weekly feeder maintenance	1	2	1.07	0.09 – 12.71	0.96

**Table V: The relationship between education (primary) and the level of compliance to biosecurity measures.**

Characteristics	Freq.	Perc (%)	Odds ratio	C.I	P. value
Farm fencing	2	4	1.24	0.10 – 14.70	0.86
Management of dead birds	2	4	0	-	0.01*
Vaccination	2	4	0.04	0.00 – 0.98	0.01*
Floor-type	2	4	0.14	0.01 – 2.02	0.10
Poultry waste management	2	4	0.35	0.03 – 4.40	0.40
Poultry by-product disposal	2	4	0.29	0.03 – 3.74	0.32
Rodent control	1	2	0.26	0.02 – 3.07	0.46
Absence of other livestock on the farm	1	2	0.26	0.02 – 3.07	0.26
Absence of other poultry farms within a 1km radius	1	2	1.07	0.09 – 12.71	0.96
Absence of wild birds on the farm	1	2	0.74	0.06 – 8.71	0.81
Absence of other livestock farms within a 1km radius	0	0	0	-	0.38
The presence of foot dips at the entrance of houses	1	2	0.62	0.05 – 7.31	0.70
Monthly replacement of disinfectants used in the foot dips	1	2	-	-	0.45
The presence of wire mesh in all openings of the houses	1	2	0.68	0.06 – 7.97	0.76
The presence of a changing room on the farm	0	0	0	-	0.13
The presence of a lavatory on the farm	1	2	0.44	0.04 – 5.19	0.51
Cleaning and disinfection of poultry houses after depopulation	2	4	0.69	0.06 – 8.26	0.77
Daily cleaning of the poultry farm surroundings	1	2	0.57	0.05 – 6.70	0.81
The poultry house left empty for a month after the previous flock	1	2	0.74	0.06 – 8.71	0.81
Daily drinker maintenance	2	4	0.19	0.02 – 2.53	0.17
Weekly feeder maintenance	1	2	1.07	0.09 – 12.71	0.96

**Table VI: The relationship between education (Secondary) and the level of compliance with biosecurity measures**

Characteristics	Freq.	Perc (%)	Odds ratio	C.I	P. value
Farm fencing	1	2	0.04	0.00 – 0.33	0.00*
Management of dead birds	7	14	0	-	0.02*
Vaccination	7	14	0	-	0.01*
Floor-type	6	12	0.1	0.01 – 0.75	0.01*
Poultry waste management	7	14	0.6	0.10 – 3.61	0.58
Poultry by-product disposal	7	14	0.49	0.08 – 3.03	0.44
Rodent control	2	4	0.18	0.03 – 0.10	0.04*
Absence of other livestock on the farm	4	8	0.37	0.09 – 1.62	0.18
Absence of other poultry farms within a 1km radius	3	6	1.08	0.23 – 4.50	0.93
Absence of wild birds on the farm	5	10	17	0.50 – 9.33	0.30
Absence of other livestock farms within a 1km radius	3	6	2.43	0.49 – 12.11	0.27
The presence of foot dips at the entrance of houses	2	4	0.3	0.06 – 1.62	0.15
Monthly replacement of disinfectants used in the foot dips	1	2	0.54	0.03 – 9.99	0.68
The presence of wire mesh in all openings of the houses	2	4	0.33	0.61 – 1.79	0.19
The presence of a changing room on the farm	1	2	0.13	0.02 – 1.14	0.04*
The presence of a lavatory on the farm	0	0	0	-	0.00*
Cleaning and disinfection of poultry houses after depopulation	4	8	0.19	0.04 – 0.89	0.03*
Daily cleaning of the poultry farm surroundings	2	4	0.27	0.05 – 1.47	0.12
The poultry house left empty for a month after the previous flock	2	4	0.37	0.07 – 1.98	0.23
Daily drinker maintenance	5	10	0.03	0.00 – 0.34	0.00*
Weekly feeder maintenance	4	8	1.93	0.44 – 8.47	0.38

This result is slightly higher than the findings of Eze *et al.*, (2017), Oluwasusi *et al.*, (2018), Ibekwe *et al.*, (2015), and Tasié *et al.*, (2020) who reported that 95%, 86.8%, 83.32%, and 71.7% respectively of the poultry farmers in their study were literate and disagrees with the findings of Koyenikan (2011) in Delta State and Moges *et al.*, (2010) in Ethiopia who found out that majority of rural household poultry farmers had no formal education. High educational attainment is essential since the practice of biosecurity and disease management requires some level of literacy and technical knowledge, and education enhances the farmers' productivity, accountability, and profitability of the farm business (Tasié *et al.*, 2020). This goes further to show that poultry farming is usually taken up by people who can read and write and as such can follow prescriptions written on poultry drugs, vaccines, and feeds.

significant association on the use of biosecurity. This finding is surprising as it is expected that the older the age, the greater the influence on compliance with biosecurity measures. It is assumed that the older the farmer, the greater the experience gained over the years resulting in compliance with the implementation of biosecurity measures.

Secondary and tertiary education had a significant association with the level of compliance of the respondents to biosecurity measures and this is not surprising as it is expected that a high literacy level will help farmers analyze and understand the rationale of using biosecurity measures. This is contrary to the findings of Eze *et al.*, (2017) who reported that education had no significant association with the use of biosecurity. Lavison (2013) reported that the education of the farmer is assumed to have a positive influence on the farmer's decision to adopt new technology which in this case is the implementation of biosecurity

**Table VII: The relationship between education (tertiary) and the level of compliance with biosecurity measures**

Characteristics	Freq.	Perce ntage (%)	Odds ratio	C.I	P. value
Farm fencing	27	54	6.08	1.52 – 24.23	0.01*
Management of dead birds	37	74	-	-	0.02*
Vaccination	37	74	-	-	0.02*
Floor-type	36	72	12	1.11 – 129.4	0.01*
Poultry waste management	32	64	1.92	0.39 – 9.49	0.42
Poultry by-product disposal	32	64	1.16	0.20 – 6.88	0.87
Rodent control	23	46	3.4	0.95 – 14.29	0.05*
Absence of other livestock on the farm	27	54	4.32	1.14 – 16.37	0.03*
Absence of other poultry farms within a 1km radius	11	22	0.68	0.18 – 2.54	0.57
Absence of wild birds on the farm	13	26	0.46	0.13 – 1.67	0.24
Absence of other livestock farms within a 1km radius	6	12	0.44	0.10 – 1.89	0.26
The presence of foot dips at the entrance of houses	19	38	3.52	0.83 – 14.89	0.08
Monthly replacement of disinfectants used in the foot dips	12	24	0.86	0.07 – 11.26	0.91
The presence of wire mesh in all openings of the houses	17	34	1.91	0.40 – 7.33	0.35
The presence of a changing room on the farm	20	40	14.12	1.66 – 119.1	0.003*
The presence of a lavatory on the farm	25	50	25	2.90 – 215.27	0.0002*
Cleaning and disinfection of poultry houses after depopulation	30	60	3.67	0.94 – 14.40	0.06
Daily cleaning of the poultry farm surroundings	19	38	2.38	0.62 – 9.10	0.2
The poultry house left empty for a month after the previous flock	17	34	2.83	0.67 – 12.00	0.15
Daily drinker maintenance	36	72	16	1.59 – 161.17	0.004*
Weekly feeder maintenance	11	22	0.68	0.18 – 2.54	0.57

Age and gender in this study had no significant association with the level of compliance with biosecurity measures adopted by poultry farmers. This is a contrast to the findings of Aiyedun *et al.*, (2018) and Eze *et al.*, (2017) who reported in their findings that age had a significant association with the use of biosecurity measures but is similar to the findings of Eze *et al.*, (2017) who reported that gender had no

measures to prevent the spread of disease.

Non-compliance with biosecurity practices has been related to inadequate training/education of farmers and limited communication and sharing of knowledge amongst farmers. Low compliance with the standard biosecurity protocols may result in economic losses in the poultry industry due to disease outbreaks (Fasina *et al.*, 2012).

**CONCLUSION**

This study showed that the level of education of poultry farmers is associated with the level of compliance with biosecurity measures. Therefore as poultry farming continues to expand, continuous public education must be done on the importance of adoption and compliance of biosecurity measures in poultry farms. Also due to economic constraints, government economic incentives must be available to enable poultry farmers to properly implement biosecurity measures on their farms

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