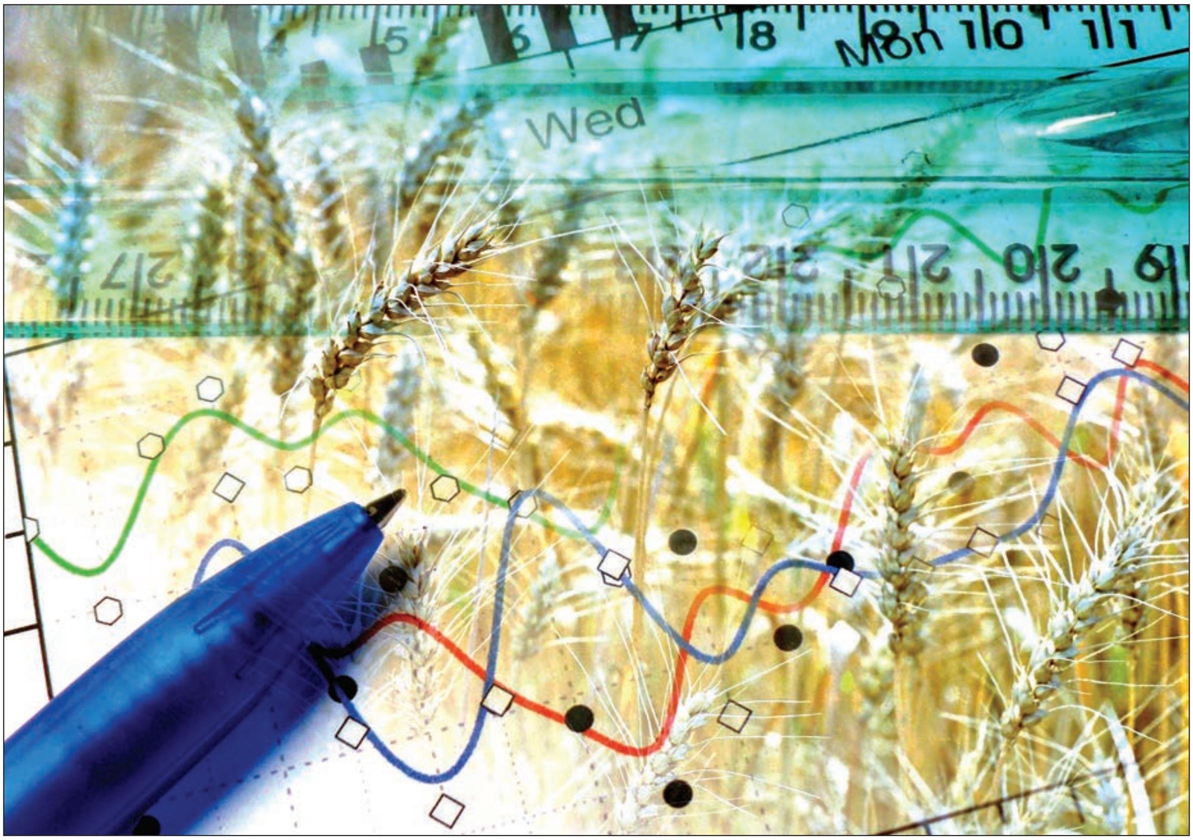

Trends in Agricultural Economics

ISSN 1994-7933

science alert

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Trends in Agricultural Economics 7 (2): 41-56, 2014
ISSN 1994-7933 / DOI: 10.3923/tae.2014.41.56

Assessment of Factors Affecting the Level of Poultry Disease Management in Southwest, Nigeria

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ABSTRACT

Poultry diseases remain one of the major threats to poultry production in Nigeria. A disease outbreak could result in severe economic losses within the shortest possible time before its medicated recovery is ensured. In the light of this, this study was designed to estimate the level of poultry disease management and its determinants in poultry egg production in Southwest, Nigeria. Primary data was obtained with the aid of structured questionnaire from a cross section survey of 403 poultry farmers drawn through multi-stage sampling procedure. Descriptive statistics, Fuzzy logic model and Multinomial Logit model were used to analyze data obtained. The results of the analysis showed that majority (81.4%) of the poultry egg farmers were males. Majority (85.6%) were married with an average household size of 5±1.68 members. The average age and mean years of experience were 45±9.08 and 10±5.05 years, respectively with majority of them had formal education. Majority (68%) of the poultry egg farmers in the study area operate at low level of poultry disease management. The study further revealed that the factors influencing the level of poultry disease management in the study area include gender, years of formal education, household size, years of poultry farming experience, access to credit, livestock insurance, livestock extension services, stock size and poultry system. The study recommended that, improved extension services and the government should formulate a policy that will improve the level of poultry disease management in the study area.

Key words: Poultry, disease management, fuzzy sets, multinomial logit, Southwest Nigeria

INTRODUCTION

In Nigeria, the poultry sector accounts for about 58.2% of total livestock production (Amos, 2006). The poultry sub-sector offers the quickest returns to investment outlays in livestock enterprise by virtue of its short gestation period, high feed conversion ratio alongside being one of the cheapest, commonest and best sources of animal protein in the country (Ojo, 2002). This indicates the crucial role it holds in the livestock industry. Poultry production is the most efficient and cost-effective way of increasing the availability of high-protein food, as eggs are known to provide the most perfectly balanced food containing all the essential amino acids, minerals and vitamins (Branckeart *et al*., 2000). In Nigeria, production of eggs and poultry birds occupies a prime position for improving animal protein consumption of both rural and urban households. Poultry products (meat and eggs) have assumed the role of providing much needed animal protein to human populace (Aihonsu and Sunmola, 1999). In Nigeria, poultry contributes about 15% of the total annual protein intake with approximately 1.3 kg of poultry products consumed per head per annum (Ologbon and Ambali, 2012).

In the past decades, there has been a recorded improvement in poultry production in Nigeria with its share of the Gross Domestic Product (GDP) increasing in absolute terms. It was reported that the contribution of poultry egg and meat to the livestock share of the GDP increased from 26% in 1995 to 27% in 1999 with an increase in egg production alone accounting for about 13% during the period (Ojo, 2003). It contributed approximately 4.45% of the total livestock contribution to the agricultural Gross Domestic Product (GDP) in 2004 (CBN, 2004). In spite of the significance of the poultry industry to the national economy, poultry farms face challenges inimical to the growth of the industry. Poultry production in general is facing low capital base, inefficient management, disease and parasite, housing and marketing problems, etc. (Alabi *et al.*, 2000).

Diseases remain one of the major threats to boosting poultry production in Nigeria (Adewole, 2012). The major diseases are the Newcastle disease, Avian Influenza, Avian pox, Infectious Bursal Disease, Colisepticeamia, Coccidiosis and worm infestation (Usman and Diarra, 2008) with, Newcastle Disease being the most recognized by poultry farmers (Adene and Oguntade, 2006). Diseases reduce the productivity of a sick animal resulting in less meat, less milk or fewer eggs. It provides less draught power and poorer-quality food and fibre. In economic terms, output declines, costs rise and profits fall (Farooq *et al.*, 2000). Mohamadou *et al.* (2010) estimated economic analysis annual financial burden of livestock diseases that amounts to 29.2 billion in Nigeria. Also, economic losses experienced by poultry farmers for the years 2009-2011 amounted to over three billion Nigerian currency due to Infectious Bursal Disease outbreaks alone (Musa *et al.*, 2012).

Poultry disease management involves taking steps to ensure good hygiene and increasing the standards of cleanliness as well as containment to reduce the risk of introducing disease into a flock (Fasina *et al.*, 2012). Application of standard biosecurity measures is vital in protecting poultry birds from any disease (Dorea *et al.*, 2010). Biosecurity is security from transmission of infectious diseases, parasites and pests (Zavala, 2011). Biosecurity has focus on maintaining or improving the health status of animal and preventing the introduction of new disease pathogens by assessing all possible risks to animal health (Fraser *et al.*, 2010; Julien and Thomson, 2011). Augustine *et al.* (2010) reported that the implementation of sound biosecurity measures will go a long way in minimizing the problems of disease outbreak and spread in the Nigerian poultry industry and also maintain consumers' confidence in Nigerian poultry products.

Available analytical works in Nigeria on management issues associated with poultry disease are mostly descriptive (Etuk *et al.*, 2004; Usman and Diarra, 2008; Ameji *et al.*, 2012). Contrary to these previous studies, this study employed the use of fuzzy logic model to examine the relative contribution of poultry disease prevention, control and mitigation to the level of poultry disease management. Also, literature is vast with the economic analysis of poultry production in Nigeria (Akpabio *et al.*, 2007; You and Diao, 2007; Obi *et al.*, 2008; Fasina *et al.*, 2008; Ajetomobi and Adepoju, 2010; Bawa *et al.*, 2010). However, none of these studies has taken into account the assessment of level of poultry disease management as well as factors influencing it. It is against this background that the study assessed the level of poultry disease management in Southwest, Nigeria. The specific objectives are to:

- Estimate the level of poultry disease management
- Determine the factors affecting the level of disease management

MATERIALS AND METHODS

Study area: The study was carried out in Osun and Oyo states, Southwest, Nigeria. Osun State has 30 Local Government Areas with an estimated population of 3.4 million (NPC, 2006) and land area of 14,875 km^2 on latitude 5°N and 8°N; between longitude 4°E and 5°E. The climate is humid tropical type with a mean annual temperature of about 28°C and a mean annual rainfall of over 1600 mm. Oyo State has 33 Local Government Areas with an estimated population of 5.6 million (NPC, 2006). The land area is 35,743 km^2 located within latitude 3°N and 5°N; between longitude 7 and 9.3°E. The average temperature is between 24 and 25°C. Rainfall figures over the state vary from an average of 1200 mm at the onset of heavy rains to 1800 mm at its peak in the southern part of the state to an average 800 and 1500 mm at the northern part of the state. There are two distinct ecological zones in both states; the rainforest and derived savannah zones. Major crops found in these states are yam, cassava, maize, rice, vegetables and cash crops like cocoa, rubber, kolanut and citrus. Rural households in the states rear sheep, goats, local chickens and pigs. Also, intensive rearing of cockerels, layers and broilers exotic birds have become popular in the study area.

Source and type of data: The primary data was obtained with the aid of well-structured questionnaire that captured socio-economic/demographic characteristics of poultry farmers and farm characteristics. These include age of the poultry egg farmer, gender, level of education, poultry farming experience, household size and sources of credit. It also includes information about practice of various biosecurity measures; routine vaccination and medication by the poultry farmers in the study areas.

Data collection and sampling technique: A multistage sampling technique was employed in selecting the poultry farmers in the study areas. The first stage was the purposive selection of Osun and Oyo States from the six states that made up the Southwest, Nigeria; based on the highest exotic-poultry population distribution in Southwest, Nigeria (FDLPCS., 2007). The second stage involved purposive selection of six Local Government Areas (LGAs) from Osun State and eight local governments from Oyo State. The size of the local governments chosen from each state was based on available records of number of registered members of the Poultry Association of Nigeria (PAN) in which Oyo State has the highest number of poultry farmers than Osun State. The purposive selection of the local governments in each state was based on those with the highest number of registered members of the Poultry Association of Nigeria (PAN). They are Iwo, Ejigbo, Irewole, Ayedire, Irepodun and Ilesa West in Osun State and Afijio, Egbeda, Lagelu, Akinyele, Atiba, Oyo East, Ona Ara and Oyo West in Oyo State.

The third stage was the random selection of two hundred and forty and one hundred and eighty poultry farmers selected from Oyo and Osun States respectively. The number of poultry farmers selected in each selected Local Governments Area is proportionate to the size of registered members of the Poultry Association of Nigeria (PAN) in each LGAs. In all, total of four hundred and twenty poultry farmers. However, responses from four hundred and three questionnaires were used while others were discarded for incomplete information.

Fuzzy logic model: Fuzzy logic model was adopted to estimate the poultry disease management level. The term fuzzy was proposed by Zadeh (1965), when he published the famous paper on

Fuzzy Sets. The fuzzy set theory is developed to improve the oversimplified model, thereby developing a more robust and flexible model in order to solve real-world complex systems involving human aspects. In this approach, an element can belong to a set to a degree k ($0<k<1$), in contrast to classical set theory, where an element must definitely belong or not belong to a set. Fuzzy sets was used to estimate the farm's level of poultry disease management index based on poultry farmers' decisions in the use of biosecurity measures for poultry disease prevention; medications (prevention and control) and insurance for mitigation.

For a brief mathematical exposition of the fuzzy set theory, following Dagum and Costa (2004) and Appiah-Kubi *et al.* (2007) to proceed as follows: Let X be a set and x an element of X. A fuzzy subset P of X can therefore be defined as follows:

$$P = \{x, F_p (X)\}, \text{ for all } x \in X \quad (1)$$

where, F_p is a membership function which takes its values in the closed interval (0, 1). In other words, the fuzzy sub-set P of X is characterized by a membership function $F_p(x)$ associating a real number in the interval (0, 1) to each point of X. The value F_p represents the degree of belonging to P. That is, each value F_p (x) is the degree of membership of x to P.

In a simple application to measure the level of poultry disease management, let X be a set of n poultry farms (i = 1, 2, 3... n) and P, a fuzzy subset of X, the set of low. In the fuzzy approach $F_p(x)$, the membership function of the level of poultry disease management of exotic-layer chicken farm i is defined as:

- $x_{ij} = 1$; if exotic-layer chicken farm i is of high level poultry disease management
- $0 \le x_{ij} \le 1$; if exotic-layer chicken farm i reveals a partial degree of level of poultry disease management

Following Costa (2002), the degree of membership to the fuzzy set P of the a_i-th exotic-layer chicken farm (i =1, 2... n) with respect to the j-th attribute (j = 1, ..., m), is stated as follows:

$$Fp = (a_i)j = X_j (a_i) = x_{ij} \quad (2)$$

where, $X_j(a_i)$ is the m order of attributes that will result in a state of poultry disease management if totally or partially owned by the a_i-th farm.

Ordinal or categorical discrete variables are those that present several modalities (more than two values). The lowest modality is denoted as c_{infj} and the highest modality as $c_{sup,j}$, then, following Cerioli and Zani (1990), Costa (2002) and Dagum and Costa (2004) to express the membership function of the a_i-th poultry farm as:

$$F_p(a_i) = 1 \text{ if } 0 < c_{ij} \le c_{inf,j}$$

$$F_p(a_i) = \frac{c_{sup,j} - c_{ij}}{c_{sup,j} - c_{inf,j}} \text{ if } C_{inf,j} < C_{ij} < C_{sup,j} \quad (3)$$

$$F_p(a_i) = 0 \text{ if } c_{ij} \ge c_{sup,j}$$

The poultry disease management index of the a_i-th poultry farm, $F_P(a_i)$ (i.e., the degree of membership of the a_i-th poultry farm to the fuzzy set P) is defined as the weighted average of x_i:

$$F_p = \frac{\sum_{i=1}^{n} F_p(a_i)n_i}{\sum_{i=1}^{n} n_i} \tag{4}$$

where, F_p is the poultry disease management index for the population of poultry farms studied:

$$F_p = \frac{1}{n}\sum_{i=1}^{n} F_p(a_i)n_i \tag{5}$$

The degree of attainment of the selected poultry disease management is express by Eq. 4 and 5. It is conceptualized as:

$$F_p = \frac{\sum_{j=1}^{m} x_{ij}w_j}{\sum_{j=1}^{m} w_j} \tag{6}$$

where, w_j is the weight given to the j-th attribute:

$$W_j = \log\frac{n}{\sum_{i=1}^{n} x_{ij}n_i} \geq 0 \tag{7}$$

Equation 8 expresses the degree of poultry disease management of the j-th attribute for the entire population of n poultry farms:

$$F_p = \frac{\sum_{i=1}^{n} F_p(a_i)n_i}{\sum_{i=1}^{n} n_i} = \frac{1}{n}\sum_{i=1}^{n} F_p(a_i)n_i \tag{8}$$

$$F_p x_j = \frac{\sum_{i=1}^{n} x_{ij}n_i}{\sum_{i=1}^{n} n_i} \tag{9}$$

From Eq. 9, the poultry disease management index of the population F_P is expressed as a weighted average of $F_P(X_j)$ with the weight w_j as defined in Eq. 7.

The poultry disease management level was generated from the poultry disease management index. The level of poultry disease management was categorized following Lestari *et al*. (2011) as (1) Low level (0 up to 0.33), (2) Moderate level (0.34-0.66) and (3) High level (0.67-1.0). The three dimensions (Biosecurity practices, Medications and Insurance) and attributes as shown on Table 1 was selected following Ritz (2011).

Multinomial logit model: A multinomial logistic regression was used to analyze the factors affecting the level of poultry disease management by poultry egg farmers. The dependent variable reflects the three level of poultry disease management: Low, moderate and high level. The

Table 1: Dimensions and attributes for poultry disease management index measurement

Dimeusious and attributes	Categories
Biosecurity practices (prevention)	
Location of farm	Poultry farm's distance from public roads, from the next poultry farm and from a pond or lake
Traffic on and off the farm	Poultry farm has a gate; poultry farm is surrounded by a fence and disinfection of vehicles that come to the poultry farm
Pest management of other livestock and animals	Rodent control plan, keeping grass and weeds trimmed around the poultry house, regular checking and repairing of wire screening on the sides of the house and control of other livestock within 50 metres of the poultry houses
Poultry house cleaning and disinfection	Total clean out of facility, the time interval of litter removal, litter that is removed is stored in a covered shed, litter is composting in an approved composting facility, spreading of litter on fields adjacent to the poultry houses and regular cleaning and disinfection of feed bin and boot
Poultry farmer's personal hygiene	Wearing the street clothes or shoes in the poultry houses, separate cap and pair of coveralls for each house, separate pair of boots for each house, disinfectant dip pans at every poultry house entrance, the time interval of changing the disinfectant and visitors who wish to enter the poultry houses must wear clean, sanitized caps, coveralls, gloves and boots
Flock Health Care and Monitoring	Taken time to learn more about the types of diseases that affect poultry, stocking multiple age groups of birds on the farm and specific employees caring for different age group
Medications (prevention and control)	
Vaccination	Vaccination of birds for agents known to have caused problems on the farm in the past and vaccination of day old chicks is done at hatchery
Vaccination programmes	Application of Immncox vaccine at 1-5 days, Marek vaccine at 1 day old, Newcastle Disease Vaccine 1/0 at one day old chicks, 1st Gumboro vaccine at 8-10 days old and 2nd vaccination a week after, Newcastle Disease Vaccine Lasota at 2nd week and 5th week, vaccination against Fowl Pox at 8 weeks, Newcastle Disease Vaccine Komorov at 12th week and routine Newcastle Disease Vaccine Lasota every month
Drngs	The time interval of routine deworming, time interval of routine application of antibiotics and weeks at which delousing is done
Veterinary services	Contact with veterinary doctor and regular examination of sick or dead birds
Iusurance (Mitigation)	Use of livestock iusurance

Adapted from Ritz (2011)

dependent variables thus take three levels (1, 2 and 3), 1 represents the low level, 2 represents the moderate level and 3 represents the high level of poultry disease management. To estimate this model there is need to normalize in one category, which is referred to as the "reference state". The reference state chosen for this study is the "Low poultry disease management" option which is the least desirable option. According to Maddala (1983), the model makes the choice of probabilities on individual's characteristics of the respondents (poultry egg farmers). Given three choice categories, s = 1, 2, 3, the multinomial logit model assigns probabilities P_{is} to events characterized as "i-th poultry egg farmers s-th category". The vector of the characteristics of the farmer is denoted by z. The chance of choosing an alternative is equal to the probability that the utility of that particular alternative is greater or equal to the utilities of all other alternative in the choice set. Following Babcock *et al.* (1995), the multinomial logit for choice across the poultry farms (s = 1, 2, 3) can then be specified as:

$$P(Y = s) = \frac{e^{\beta jZ}}{1+\sum_{j=2}^{s} e^{\beta jZ}} \text{ for s not equal to 1} \quad (10)$$

$$P(Y=1) = \frac{e^{\beta jZ}}{1+\sum_{j=2}^{s} e^{\beta jZ}} \quad (11)$$

In this study, X_1 to X_{13} are independent variables that influenced the poultry disease management level of poultry egg farmer. The explanatory variables included in the model are similar to those used in previous related studies (Ojo, 2003; Oladeebo and Ambe-Lamidi, 2007; Adepoju, 2008; Olagunju and Babatunde, 2011; Isiorhovoja, 2013).

Where the parameters are defined as follows:

Poultry egg farmer characteristics:

- X_1 = Age of poultry farmers (years)
- X_2 = Years of formal education of the exotic-chicken egg farmers (years)
- X_3 = Gender (dummy = 1 if female, 0 otherwise)
- X_4 = Household size (number of persons)
- X_5 = Hired labour (man-days)
- X_6 = Poultry farming experience (years)
- X_7 = Access to Extension services (dummy = 1 if yes, 0 otherwise)
- X_8 = Access to Credit (dummy = 1 if yes, 0 otherwise)
- X_9 = Use of Insurance (dummy = 1 if yes, 0 otherwise)

Poultry farm characteristics:

- X_{10} = Poultry system (dummy = 1 if battery cage, 0 otherwise)
- X_{11} = Stock size (number of birds)
- X_{12} = Age of birds (weeks)
- X_{13} = Mortality rate (%)

Statistical analysis: Data was subjected to descriptive, fuzzy sets and Multinomial logit regression analyses.

RESULTS

Socio-economic characteristics of poultry egg farmers: Table 2 presents socio-economic characteristics of poultry egg farmers. Majority (70.5%) of the poultry farmers were below 50 years of age with an average age of 45±9.08 years. Majority were mostly male (81.4%). Most of the poultry farmers were married (85.6%) with average household size of 5±1.68 persons. Majority had secondary education (45.2%) followed by those with tertiary education (36.7%). More than half (56.3%) of the poultry farmers had between 5-10 years of poultry farming experience with the mean years of experience being 10±5.05 years. Majority (70%) of the poultry farmers had an access to credit while the remaining (30%) were discovered not to have access to any source of credit. Only 12% of the poultry egg farmers insured their poultry farms.

Level of poultry disease management: The degree of membership for each attribute is determined and the weights for the attributes were calculated as presented in Table 3. The weight

Table 2: Socio-economic characteristics of poultry farmers

Characteristics	Frequency	Percentage
Age (years)		
<30	33	8.2
30-39	99	24.6
40-49	152	37.7
≥50	119	29.5
Mean = 45	S.D = 9.08	
Gender		
Male	328	81.4
Female	75	18.6
Marital statns		
Married	343	85.1
Single	37	9.2
Divorced	7	1.7
Widowed	16	4.0
Honsehold size		
1-3	44	10.9
4-6	290	72.0
>6	69	17.1
Mean = 5	S.D = 1.68	
Level of edncation (years)		
No formal education	7	1.7
Adult education	4	1.0
Primary education	62	15.4
Secondary education	182	45.2
Tertiary education	148	36.7
Poultry farming experience (years)		
<5	36	8.9
5-10	227	56.3
11-16	105	26.1
>16	35	8.7
Mean = 10	S.D = 5.05	
Access to credit		
No	121	30.0
Yes	282	70.0
Use of livestock insnrance		
No	355	88.1
Yes	48	11.9
Access to livestock extension		
No	105	26.1
Yes	298	73.9

Field survey data (2013)

was calculated as the natural logarithms of membership function. The contribution of each dimension to the multidimensional poultry disease management index shows that biosecurity practices related dimension contributed largely (82%) to explaining overall degree of poultry disease management as shown on Table 4. Medications dimension contributed 16% while contribution of livestock insurance was the lowest in the category being (2%).

Following the Lestari *et al.* (2011), the poultry disease management index using the fuzzy set analysis was classified. The level of poultry disease management was categorized

Table 3: Average membership functious and weights for attributes of poultry management index

Parameters	Membership functions $\left(\frac{n}{\sum_{1=1}^{n} x_{1j} n_1}\right)$	Weights $\left(\log \frac{n}{\sum_{1=1}^{n} x_{1j} n_1}\right)$
Biosecurity practices (prevention)		
Poultry farm's distance from public roads	1.9190	0.2831
Poultry farm's distance from the next poultry farm	2.0277	0.3070
Poultry farm's distance from a pond or lake	2.0509	0.3119
Poultry farm has a gate that restricts vehicle access	4.0300	0.6053
Poultry farm is surrounded by a fence	4.1122	0.6141
Disinfection of vehicles that come to the poultry farm	2.8889	0.4607
Rodent control plan	3.1484	0.4981
Keeping grass and weeds trimmed around the poultry house	1.5773	0.1979
Regular checking and repair of wire screening on the sides of the house	1.5788	0.1983
Control of other livestock within 50 m of the poultry houses	1.5208	0.1821
Recent total cleanout of facility	1.2030	0.0803
Time interval of litter removal	1.6584	0.2197
Litter that is removed is stored in a covered shed	7.6038	0.8810
Composting litter in an approved and properly managed composting facility	8.5745	0.9332
Litter is not spread on fields adjacent to the poultry houses	1.2713	0.1042
The feed bin, boot, and auger are regularly cleaned and disinfected	1.6415	0.2153
Wearing of street clothes or shoes in the poultry houses	2.2389	0.3500
Separate cap and pair of coveralls for each house	6.7167	0.8272
Separate pair of boots for each poultry house	6.7167	0.8272
Disinfectant dip pans at every poultry house entrance	1.2324	0.0908
The time interval of changing the disinfectant	1.9032	0.2795
All visitors who enter poultry houses must wear clean, sanitized caps, coveralls and gloves	6.3968	0.8060
The time taken to learn more about poultry diseases	1.7278	0.2375
Multiple age groups of birds on the farm	1.8898	0.2764
Specific employees carimg for different age group	4.7412	0.6759
Medication (prevention and control)		
Birds are ouly vaccinated for agents known to have caused problems on the farm in the past	2.3161	0.3648
Vaccination of day old chicks is done at hatchery	1.1352	0.0551
Application of Immucox vaccine at 1-5 days	1.0387	0.0165
Application of Marek vaccine at 1 day old	1.0203	0.0087
Newcastle Disease Vaccine 1/0 at one day old chicks:	1.0215	0.0093
Vaccination of 1st Gumboro vaccine at 8-10 days old and 2nd vaccination a week after	1.0373	0.0159
Application of Newcastle Disease Vaccine Lasota at 2nd week and 5th week	1.0268	0.0115
Vaccination against Fowl Pox at 8 weeks	1.0209	0.0090
Application of Newcastle Disease Vaccine Komorov at 12th week	1.0254	0.0109
Routine Newcastle Disease Vaccine Lasota every month	1.0183	0.0079
Time interval of routine deworming	1.1241	0.0508
Time interval of routine application of antibiotics	1.0248	0.0106
Weeks at which delousing is done	1.1457	0.0591
Frequency of contact with veterinary doctor	2.2296	0.3482
Regular examination of sick or dead birds	1.5992	0.2039
Use of livestock insurance (Mitigation)	9.5952	0.9821

Field survey data (2013)

Table 4: Absolute and relative contributions to poultry disease management index by attributes

Attributes	Absolute contributious	Relative contributions
Biosecurity practices (prevention)		
Poultry farm's distance from public roads	0.0117	3.4514
Poultry farm's distance from the next poultry farm	0.0120	3.5425
Poultry farm's distance from a pond or lake	0.0120	3.5588
Poultry farm has a gate that restricts vehicle access	0.0119	3.5143
Poultry farm is surrounded by a fence	0.0118	3.4940
Disinfection of vehicles that come to the poultry farm	0.0313	9.2565
Rodent control plan	0.0125	3.7016
Keeping grass and weeds trimmed around the poultry house	0.0099	2.9359
Regular checking and repair of wire screening on the sides of the house	0.0099	2.9393
Control of other livestock within 50 metres of the poultry houses	0.0095	2.8011
Recent total cleanout of facility	0.0053	1.5610
Time interval of litter removal	0.0105	3.0996
Litter that is removed is stored in a covered shed	0.0092	2.7110
Composting litter in an approved and properly managed composting facility	0.0086	2.5465
Litter is not spread on fields adjacent to the poultry houses	0.0065	1.9186
The feed bin, boot, and auger are regularly cleaned and disinfected	0.0104	3.0681
Wearing of street clothes or shoes in the poultry houses	0.0124	3.6580
Separate cap and pair of coveralls for each house	0.0098	2.8814
Separate pair of boots for each poultry house	0.0098	2.8814
Disinfectant dip pans at every poultry house entrance	0.0058	1.7230
The time interval of changing the disinfectant	0.0116	3.4359
All visitors who enter poultry houses must wear clean, sanitized caps, coveralls and gloves	0.0100	2.9480
The time taken to learn more about poultry diseases	0.0109	3.2160
Multiple age groups of birds on the farm	0.0116	3.4223
Specific employees caring for different age group	0.0113	3.3355 (81.60)
Medication (prevention and control)		
Birds are ouly vaccinated for agents known to have caused problems on the farm in the past	0.0125	3.6848
Vaccination of day old chicks is done at hatchery	0.0038	1.1352
Application of Immucox vaccine at 1-5 days	0.0013	0.3711
Application of Marek vaccine at 1 day old	0.0007	0.1997
Newcastle Disease Vaccine 1/0 at one day old chicks:	0.0007	0.2120
Vaccination of 1st Gumboro vaccine at 8-10 days old and 2nd vaccination a week after	0.0012	0.3590
Application of Newcastle Disease Vaccine Lasota at 2nd week and 5th week	0.0009	0.2613
Vaccination against Fowl Pox at 8 weeks	0.0007	0.2059
Application of Newcastle Disease Vaccine Komorov at 12th week	0.0008	0.2490
Routine Newcastle Disease Vaccine Lasota every month	0.0006	0.1812
Time interval of routine deworming	0.0036	1.0577
Time interval of routine application of antibiotics	0.0008	0.2428
Weeks at which delousing is done	0.0040	1.2064
Frequency of contact with veterinary doctor	0.0123	3.6543
Regular examination of sick or dead birds	0.0101	2.9833 (16.00)
Use of livestock insurance (Mitigation)	0.0081	2.3947 (2.40)
Total	0.3383	100%

Field survey data (2013)

as follows: (1) Low level (0-0.33), (2) Moderate level (0.34-0.66) and (3) High level (0.67-1.0). Table 5 revealed that majority (68%) of the poultry farmers operate at low level of poultry disease

Table 5: Distribution of level of poultry disease management

Poultry disease	Management level	Frequency	Percentage
Low	(0-0.33)	274	68.0
Moderate	(0.34-0.66)	106	26.3
High	(0.67-1.0)	23	5.7
Total		403	100.0

Field survey data (2013)

Table 6: Results of the multinomial logit model of determinants of level of poultry disease management

	Level of poultry disease management					
	Moderate			High		
Explanatory variables	Marginal effect	Std. error	t-value	Marginal effect	Std. error	t-value
Age of poultry farmers	-0.0871	0.3833	-0.227	-0.1264	0.0942	-1.342
Gender	-0.1413**	0.0620	-2.279	-0.0249**	0.0127	-1.961
Years of formal education	0.0111*	0.0067	1.659	0.0002	0.0017	0.118
Household size	0.0437**	0.0185	2.362	0.0081*	0.0044	1.841
Years of poultry farming experience	0.0127**	0.0059	2.153	0.0033**	0.0015	2.200
Access to credit	0.1226**	0.0513	2.390	0.0222*	0.0124	1.790
Use of livestock insurance	0.2296**	0.1009	2.276	0.1225	0.0790	1.551
Access to livestock extension	0.1055*	0.0544	1.939	-0.0148	0.0187	-0.791
Hired labour	-0.0007	0.0030	-0.233	0.0008	0.0006	1.333
Age of bird	-0.1561	0.6028	-0.259	-0.1487	0.1050	-1.416
Poultry system	0.0931	0.0793	1.174	0.1000*	0.0505	1.980
Stock size	0.1964**	0.0947	2.074	-0.0033	0.0191	-0.173
Mortality rate	0.0284	0.1099	0.258	-0.0042	0.0237	-0.177

Field survey data (2013), *Significant at 10%, **Significant at 5%, ***Significant at 1%, No. of obs = 403 LR $\chi^2(26) = 142.83$ Prob>$\chi^2 = 0.0000$, Log likelihood = -248.3317 Pseudo $R^2 = 0.2234$

management, 26.3% of the poultry farmers practise at moderate level of disease management while a few (5.7%) of the farmers operate a high level of disease management.

Factors affecting the level of poultry disease management: The factors affecting the level of poultry disease management are presented in Table 6. The level of poultry disease management is categorized as high, moderate and low, with the low level being the reference category. Results show that the gender of the poultry farmer had low probability of attaining a moderate level of disease management relative to low level while other factors such as years of formal education, household size, years of poultry farming experience, access to credit, use of livestock insurance, access to livestock extension services and stock size had high probability of attaining a moderate level of disease management relative to a low level. The results also show that the gender of the poultry farmer had a negative effect while other factors such as household size, years of poultry farming experience, access to credit and poultry system had a positive significant effect on the probability of attaining a high level of disease management relative to a low level.

DISCUSSION

Poultry farmers were mostly male (81.4%) which implied that modern poultry farming is still predominantly a male occupation because of the high level of risk involved, labour intensive and other husbandry processes which are not attractive to most women. Consistent with this finding are the studies of Lawal *et al*. (2009), Adisa and Akinkunmi (2012) and Uzokwe and Bakare (2013). Most of the poultry farmers had above the minimum primary education level which is expected to affect their attitude towards adoption of scientific techniques to improve their level of poultry disease management. Similar findings were reported by Bamiro *et al*. (2013). About 12% of the poultry egg farmers insured their poultry farm which indicates a preponderance of low participation in agricultural insurance by the poultry farmers in the study areas. Also, majority (73.9%) of the poultry farmers had access to livestock extension services. This implies, that majority of these poultry farmers had access to advisory services and adequate information on improved disease management techniques.

The finding of this study has revealed that the relative contribution of biosecurity practices (disease prevention) to disease management is highly relative to medication and insurance. The reason is that biosecurity practices are routine management which are easily practised by the poultry farmers in which the minimal cost is incurred unlike medication and insurance that requires high cost of operation.

The diagnostic statistics revealed that the chi-square distribution which was used to test the overall model adequacy was significant at 1% ($\chi^2 = 142.83$, $p<0.0000$). The marginal effect estimate of effect of gender implied that the probability of female poultry farmer to attain moderate level relative to a low level of poultry disease management reduces by 14%. This result indicates that the probability of female poultry farmers to attain moderate level of poultry disease management is low. The probability of attaining a moderate level of disease management relative to the low level increases as the years of education of the poultry farmer increases. As years of formal education of poultry farmer increased by one year increases the probability of poultry farmer attaining moderate level of disease management rather than being at low level by 1%. This implies that the more educated the farmers are the higher the probability of improvement in disease management practices as increased years of education is expected to increase the rate of adoption of modern poultry disease management practices.

Household size had a positive significant effect on the on the level of poultry disease management. The probability of attaining a moderate level of disease management relative to a low level increases by 4% as the number of household members increases. As years of experience of the poultry farmer increases the probability to attain a moderate level of disease management rather than a low level by 1%. This finding is consistent with the study of Ezeh *et al*. (2012) who posited that the longer the years of farming experience, the more exposed and efficient the farmer becomes. Probability of poultry farmer attaining a moderate level of disease management relative to the low level increases with the poultry farmer's access to credit by 12%. Also, the use of livestock insurance and access to livestock extension services increases the probability of attaining a moderate level of disease management by about 23 and 11%, respectively relative to a low disease management level. It is expected that poultry farmers with access to extension services will have a better knowledge of disease prevention and modern husbandry practices. The stock size had a positive significant effect on the level of disease management. An additional increase in stock size increases the probability of poultry farmer attaining moderate level of disease management relative to low level by 19%.

The probability of female poultry farmer to attain high level relative to a low level of poultry disease management reduces by 2%. An additional increase in household size by one person increases the probability of poultry farmers to attain high level of disease management rather than being at low level by 0.8%. Also, as years of experience of the poultry farmer increases the probability to attain a high level of disease management rather than a low level by 0.3%. Access to credit and poultry system increases the probability of attaining high level of disease management by about 2 and 10%, respectively relative to a low disease management level.

CONCLUSION

The empirical findings emanating from the study revealed that poultry farming is mostly dominated by male. Most of the poultry egg farmers were in their active and productive years. Also, the level of literacy of poultry farmers was high in the study area and most of the poultry farmers had an average period of poultry farming experience of ten years. Majority of the poultry egg farmers had an access to livestock extension services while few of them made use of livestock insurance policy. The analysis of the contribution of each attribute to the multidimensional poultry disease management index showed that biosecurity practices dimension contributed largely to explaining overall degree of poultry disease management in Southwest, Nigeria. Also, the findings of this study revealed that majority of the poultry egg farmers manage their farms at low level of poultry disease management while a few farmers operate at high level.

Gender of the poultry farmer had a negative effect while other factors such as years of formal education, household size, years of poultry farming experience, access to credit, use of livestock insurance, access to livestock extension services and stock size had a positive significant effect on the probability of attaining a moderate level of disease management relative to low level.

The study recommends that policy focus should be geared towards enlightenment campaigns on the significance of biosecurity as a crucial component of poultry disease management. It can therefore be recommended that extension agency should be mandated to disseminate improved biosecurity practices and better medication techniques that will improve the present level of poultry disease management in the study area. Also, it is recommended that government should train poultry farmers on regular basis based on biosecurity, disease prevention and the adoption of modern husbandry practices. Mitigation option through the use of livestock insurance policy is very low amongst the poultry farmers in Southwest, Nigeria.

Recommendations of the study therefore includes that the government should formulate a policy that will make livestock insurance more affordable to poultry farmers by increasing the present level of subsidy granted for livestock insurance cover. Also, adequate dissemination of knowledge on the benefits of livestock insurance by extension agents is crucial to increase the level of particitpation of poultry farmers in the use of livestock insurance to mitigate against disease outbreak in poultry enterprise.

ACKNOWLEDGMENT

The authors are grateful to Mr. Phillip Oni of office of FADAMA, Oyo State, Nigeria state headquarters, Mr. Salawu Ismail of Department of Agriculture and Food Security, Oyo state Local Government Civil Service Commission and Mr. Adelakun of ADP, Osun state for their assistance in field survey and technical assistance.

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