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Evaluation of Biosecurity Practices in Broiler Poultry Farms in Algabal Alakhdar Region, Libya

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Abstract

This study evaluated the biosecurity measures practiced in Algabal Alakhdar areas including Albeada, Alguba, Algygab, and Shahat. A total of 54 broiler poultry farms were investigated by a mean of a cross sectional survey. In these farms, ranges of biosecurity practices were determined by using biosecurity scoring system. These included other animals, wild birds, visitor's hygiene, location of farms, house management, as well as disease management. Data were analyzed using descriptive analysis and Chi- square (X^2) for significance. The results showed that the poor practiced biosecurity measures were the ones associated with the lack of wild birds proofing store (**96.3%**), presence of pets (**94.5%**), improper carcasses disposal (**90%**),vaccination programs (**81.4%**), presence of other animals on farms (**76.3%**) . The results, also detected that (**69.0%**) of farms practiced all in all out management system. Among the surveyed farms, only (**58.4%**) had rodents control, and only (**56.3%**) had visitors hygiene. Based on odd ratio calculation, the association between the presence of pets, other animals, and overcrowding was higher in the open system than in the close system. It is concluded from the present study that the implementation of biosecurity measures in broiler farms was very week.

Key words: *Biosecurity, Broilers, Housing System, Libya.*

Introduction

Poultry farming is considered as a new practice during the last three decades in Libya. There is tremendous demand for poultry meat in the country, due to changing in food habits **(Nagi, 2008)**. Where poultry meat has become attributing approximately by 44.3% of the total animals protein in the Libyan country **(Nagi, 2008 and Elshierf, 2005)**. However, poultry health management, poultry diseases, as well as zoonotic diseases are considered to be the emerging issue **(Sharma, 2010)**. Poultry diseases not only increase mortality, but also can lead to slower growth, slower egg production **(Oladele and Ayodele, 2014)**. Significantly, poultry birds represent major source of zoonotic diseases transmission chain such as *avianinfluenza* and *salmonella***(Sharma, 2010 and Abdelgadir, 2014)**. For thatthe chain from farm to fork should be hygienic and free of the disease. In order to perform clean and hygienic poultry production, good biosecurity measures must be practiced in poultry farms **(Sharma, 2010)**. Moreover, hygienic poultry introduction can give a better income and sustainable development in long term along with a good biosecurity level **(Tabidi *et al*., 2014)**. Biosecurity, in fact, is identified as all measures that are

applied to minimize the risk of introduction and the spread of the disease to poultry farms. It includes a set of management and physical procedures designed based on the concept of five Bs: bioexclusion (to reduce the risk of introduction), biocompartmentation (to reduce the risk of the transmission of the disease agents within the same poultry flock, biocontainment (to minimize the dissemination of the pathogens outside the flock), biocontamination bioprevention (to prevent the survival and the contamination of the environment with pathogens) **(Chaber and Saegerman, 2015)**. Due to that biosecurity level is appropriate preventive measure to the control of the disease outbreaks and consequently protects human health **(Sarrazin *et al.*, 2014)**. The objective of this study was to evaluate whether or not biosecurity measures are well implemented in broiler poultry farms in Al jabal al akhdar region.

Materials and Methods

Data were collected between May and December 2015 from 54 broiler farms from different locations in Al jabal al Akhdar areaincluding, Albeada, Alguba, Shahat, and Algygab, Pertaining to their demographic, management practices, prophylactic procedure, and concurrent diseases.

A cross sectional survey was conducted by means of a structured questionnaire regarding biosecurity measures which were known or hypothesized to influence the occurrence of the disease problems in broiler sector. Questions for biosecurity measures were according to a form available on online biosecurity questionnaire for poultry farm **Gelaude *et al.* (2014).** The questionnaire was filled by conducting personal interview with the owners, managers of the flocks, and sometimes the workers. The questionnaire included both binary and opened questions in total consisting of 7 pages.

Biosecurity Scoring System

The biosecurity scoring system was done according to the system followed by **(van steenwinkel *et al*., 2011 and Maduka *et al*., 2016)**. The biosecurity measures were divided into categories and each category consists of different variables. Each variable was coded into a score of (0) for the total absence of biosecurity measure or full presence of the risk and (1) for the presence of the preventive measure or total absence of the risk. The main biosecurity indicators of interest were other animals, wild birds, farm density, hygiene visitors, the location of the farms, dead birds disposal, as well as health birds management **(Sarrazin *et al.*, 2014).**

Statistical Analysis

All data were analyzed according to **S.P.S.S. (1997)** by using SPSS software. Descriptive statistics was used to obtain the frequency and percentage of each variable. Chi - Square (X^2) test was performed to assess the significance of each variable.

Results

Results from this survey revealed that the distance to nearest poultry farms was less than 1km in **16** (**29.6 %**) farms. In **27 (50%)** farms the distance was between 1 to 2km and **8 (14.8 %)** farms were far from the nearest farm by a distance of 5 to 6 km (**Table 1**).

Table (1). Location of farms and the distance to the nearest farms

Location of farms/ Distance to neighboring farms	Valid	Number (%) of farms	Chi- sequare value
Less than 0.5 km	54	10(18,51)	24.370**
0.5 km to less than 1km		16(29.6)	
1-2 km		27(50)	
3-4km		3(5.5)	
5-6km		8(14.8)	

There are two types of housing systems recorded in this survey, most of the surveyed farms **(74%)** found to be with an open system and **(26%)** have a close system. A strong association was found between the housing system and some biosecurity measures, where the odd ratio (OR) for the presence of pets, overcrowding, and other animals was 12.8, 3.12, and 6respectively (**Table 2, 3, 4**). Dead birds disposal methods varied from thrown to rubbish and feeding to pets in **50 (90,9%)** of farms to burning in **4 (7.2 %)**. Our results indicated that the veterinary supervision of farms is infrequently. The percentage of the adoption of veterinary supervision was significantly low **19 (34.5%)** and **35 (64.8%)** of farms were not managed by veterinarians. In this survey, a total of **10 (18.5%)** of respondents farms had vaccinated their flocks; whereas **44 (81.4%)** of farms had no vaccination procedures which is significantly high. Furthermore, In addition to the percent of having pets **52 (94.5%)** and other animals **42 (76.3%)** was found to be significantly high, Rodent control procedures were only practiced in **31 (58.4%)** of farms. This survey investigated that significantly high percent of broken biosecurity measure were obtained for the absence of wild bird proofing store **53 (96.3%)**. In addition to that most of the respondents farms **30 (62.5%)** reported to have no wild birds proofing house. Only **31 (56.3%)** of farms implemented hygiene measures for visitors. It was also noticed that overcrowding was significantly high in most farms **38 (96.0%)** and proper ventilation was only accepted in about **24 (43.0%)** of respondents. The majority of farms **38 (69.0%)** practiced all in all out system and **17 (30.0%)** had multiage flocks (**Table 5**).

Table (2). The association between the housing system and the presence of pets in poultry farms (odd ratio):

Housing system	Pets		Total
	yes	no	
open system	A32	B1	33
close system	C5	D2	7
Total	37	3	40

Odd ratio= A×D/B×C= (**12.8)**

Table (3). The association between the housing system and overcrowding in poultry farms (odd ratio):

Housing system	Overcrowding		Total
	yes	no	
open system	25A	B8	33
close system	C3	D3	6
Total	28	11	39

Odd ratio= A×D/B×C= (**3.12)**

Table (4). The association between the housing system and the presence of other animals in poultry farms (odd ratio):

Housing system	Other animals		Total
	yes	no	
open system	27A	B6	33
close system	C3	D4	7
Total	30	10	40

Odd ratio= A×D/B×C= (**6)**

Table (5). Frequency and percentage of `biosecurity events in broiler poultry farms:

Indicators of biosecurity practice	Valid	Number (%) of (no) responded farms	Number (%) of (yes) responded farms	Chi- square value
Other animals				
No other animals	55	42(76.3)	13(23.6)	15.291**
No pets	55	52(94.5)	3(5.45)	43.655**
Rodent control	53	22(41.5)	31(58.4)	0.126 N.S
Wild bird				
Wild bird proofing house	48	30(62.5)	18(37.5)	3.000
Wild bird proofing storage	55	53(96.3)	2(3.6)	47.291**
House management				
No overcrowding	54	38(69.0)	16(29.0)	8.963**
Proper ventilation	44	20(36.3)	24(43.6)	0.546 N.S
Visitors hygiene	55	24(43,6)	31(56.3)	0.891 N.S
All in All out	55	17(30,9)	38(69.0)	8.018**
Disease management				
Veterinary care	54	35(64.8)	19(34.5)	4.741*
Vaccination program	54	44(81.4)	10(18.5)	21.407**
Proper carcasses disposal	54	50(90.9)	4(7.2)	39.185**

Discussion

Our results indicated that several farms had no preventing access of visitors into poultry flocks. Similar results were obtained by **(Tabidi *et al*., 2014)**.Thismay raise the risk of being humans can be mechanical vectors of different pathogens **(Vangroneweghe *et al*., 2009)**. Humans movement between farms has been implicated in the spread of high pathogen *avian influenza* in the Netherlands **(Gelaude *et al*., 2014)**. Therefore, the number of visitors should be restricted to necessary issue **(Gelaude *et al*., 2014)**.

In fact, disease management including vaccination programs of susceptible birds, dead birds disposal, and veterinary services are fundamental for disease prevention **(Gelaude *et al*., 2014; Agbenohevi *et al*., 2015).** Our results showed that the role of veterinary supervision was not effective **(34.5%)**. This is agreed with the results of Maduka ***et al*.** **(2016)** in Nigeria. This practice can influence on the notification of the disease developing in their flocks **(Anderson, 2010)**. This also poses another risk as prophylactic treatment is adapted for poultry in order to eliminate infections, often without any consulting veterinarians **(Igbokwe, 1988)**. The adverse consequence of such practice can be the development of antimicrobial resistance as well as antibiotics residues **(Kabir *et al*., 2009 and Maduka *et al*., 2016)**. Surprisingly, Birds disposal practice in this study was found to be mostly by throwing away and feeding to

pets , which is similar with the studies conducted by **Ali *et al*., (2014) andAgbenohevi *et al*., (2015).** This practice may raise the risk of pathogen spread as birds often die as a result of infection and consequently act as a source of infection (**Gelaude *et al*., 2014)**. Furthermore, dogs can eat the carcasses and act as mechanical vector of transmission for pathogens between poultry farms and between backyard poultry farms **(Eltholth *et al*., 2016)**.

In terms of vaccination, large numbers of boiler flocks were not vaccinated **(81.4%)**. Even though, **10(18.4%)** of farms vaccinated their chickens, vaccination was applied without consistency. They only administrated the initial dose of vaccine, where the booster doses are required for some disease for strengthen and prolonging protection. It was obvious for investigators that the surveyed farms had no constant vaccination protocol. Because when performancea vaccination program, the type of the used vaccine, the immune status, the required protection, as well as the diseases statue of the birds under local condition should be considered **(Allan *et al*, 1978)**. One of the reasons for such practice could be either the cost or lack of poultry vaccine on the market. In fact, vaccines are not provided by the local government, so farmer trended to the privet sector to obtain the vaccines, which may pose the risk of introducing different strains of pathogens. The reason can be poor understanding of the link between the vaccination and poultry health. It is already known that the weakness of immunization protocol has adverse consequence on the spread of the disease **(Negro-Calduch *et al*, 2012)**. Major used vaccinesare for Newcastle disease (ND), Infectious bronchitis (IB), and Infectious bursal disease (IBD) **(General Authority of animal wealth, 2002).** However; it is unknown whether the vaccination is applied based on epidemiological study of poultry disease in the region or not. The only diseases that have been identified in the area of study are Newcastle and Salmonellosis **(Adam, 2006 and Adam, 2011)**.

Overcrowding and ventilation are acting as predisposing factors for many of poultry problems. They induce stress, which results in immunosuppressant. This ultimately increases the susceptibility and exposure of birds to infections influencing the severity of outbreak (**Sims, 2007 and Pandurang *et al.*, 2011)**. Other adverse effects of overcrowding are poor growth and feed conversion ratio in broilers **(Lokhande *et al*., 2009 and Adam *et al*., 2016)**.

This study indicated that housing management system were all in all out and multiage by **(69.0%)** and **(30.9%)**, respectively. In fact, all in all out system is an effective procedure to interrupt the infection cycle from older to younger flocks.It ensures the complete cleaning and disinfection between the exit and reception of new flocks. Moreover, inmultiage system, the time for the cleaning and disinfection between production cycles is not enough **(Conan *et al*., 2012 and Eltholth *et al*., 2016)**. Such practice can increase the possibility of disease outbreak, particularly disease caused by organisms that have the ability to persist in the environment **(Conan *et al*., 2012 and Eltholth *et al.*, 2016)**. Keeping different ages of birds increase the possibility of disease transmission from older to younger chickens such as *infectious Coryza* and *Adeno virus* **(Chauhan and Roy, 2007).** Similar observation was found in Egypt **(Eltholth *et al*, 2016)**.

In this study, the percentage of the presence of pets (stray`dogs and cats) and other animals such as domestic animals was found to be high, which could be the source of introducing different pathogen into poultry flocks **(Gelaude *et al*., 2014)**. Some pathogens such as *Salmonella Typhimurium* and *Salmonella Enteritidis* can infect different species; therefore, the transmission between these species cannot be ignored. Also, the transmission of *Campylobacter Jejuni* between poultry has been reported by other investigators (**Boes *et al*., 2005 and Gelaude *et al*., 2014)**. In the present study **(58.4%)** of surveyed farms had rodents control procedures; whereas rodents are needed to be

controlled in **(41.5%)** of the farms. It is clearly approved to be a potential vector of *Salmonella Typhimurium* and *Salmonella Entritidis* **(Liljebjelke *et al*., 2005; Gelaude *et al*., 2014)**. With regards to wild birds, this study linked the possible direct and indirect contact between poultry flocks and wild birds with the presence of wild birds proofing house and store. Very few farms had secure store **(3.6%)** and house **(37.5%)** for poultry. Where the poultry feed was directly stored on the floor and houses windows were unsecure. Thus, the contact between poultry and wild birds are possible. Furthermore, Feed and water can be contaminated via wild birds and become a potential source of several infections including *Salmonella spp*., *Escherichia coli*., *Clostridium spp*., and *Aspergillus* **(Gelaude *et al*., 2014)**. Furthermore, wild birds are also correlated with numerous pathogens such as *Avian Influenza*, *Newcastle disease*, and *Mycoplasma spp* **(Lister, 2008 and Gelaude *et al*., 2014)**.

In this study, most respondents reported a distance to neighboring farms ranging from 500m. to 6 km. Despite this fact, **18.51% (Table, 1)** of studied farms were still hada distance of less than 500m., which cannot be ignored .This distance can be a reason for air disease transmission **(Eltholth *et al*., 2016)**. In order to decrease suchrisk, the distance to the nearest farm should not be less than 500m. A good example of such diseases is Infectious bronchitis virus (IBV), which have been demonstrated to be spread by wind **(Chauhan and Roy, 2007 and Bradburry and Morrow, 2008)**.

Our study found that the open system was widely practiced in broiler farms. It also demonstrated that the association between the open system and the presence of pets, other animals, overcrowding was very powerful. Which means that the chance of having other animals, pets, and overcrowding was 12.8, 3.12 and 6 times greater in the case of open system than of the close one (Table 2, 3 and 4). This reveals that the open system is less secure than the close system and can be a risk factor for many diseases. Overcrowding in open housing system was strongly associated with the prevalence of swollen head syndrome (SHS) in Saudi Arabia **(Al-Ankari *et al*., 2004)**.

Conclusion

This study indicated that the performance of biosecurity on poultry farms ranged between zero to little. Therefore, a specific action from policy-makers in coordinate with farmers should be implemented to mitigate the risk associated with biosecurity in terms of poultry and zoonotic diseases outbreaks. In addition to that the education on the significance of applying biosecurity measures should be enhanced among workers in poultry sectors. Further researches are required to consider biosecurity measures as risk factors for poultry disease outbreaks at farm level. Sundered protocol based on the diseases challenge in the country should be updated. Furthermore, comprehensive studies to determine the level of immune status of chickens in poultry farms in regard to the endemic infectious diseases is highly commendable.

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