Alexandria Journal of Veterinary Sciences
www.alexjvs.com

AJVS. Vol. 56 (2): 107-113. Jan. 2018
DOI: 10.5455/ajvs.287584

Assessment of Biosecurity Measures Applied in Infected Broiler Farms with Avian Influenza

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Key words:
Assessment, Biosecurity, Measures, Broiler, Avian, Influenza

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ABSTRACT

Questionnaire survey and observational study was conducted to collect data on biosecurity measures to investigate the relationship between the application of biosecurity measures and the prevalence of avian diseases (AI was an example) in broiler farms. A total of 100 small scale broiler farms located in Qaliobiya province were included in the current study where data were collected through direct observation and interviews made with owners and workers using a structured-questionnaire during the period extended from January to December 2016. Also, five cloacal swabs were obtained from each farm to be investigated for the presence of HPAI by application of rapid avian influenza virus antigen test kit. Finally, the application of different biosecurity measures and the prevalence of AI was related and analyzed statistically. Detection of avian influenza virus antigen was carried out by using rapid avian influenza virus antigen test kit (ANIGEN® Animal Genetics, Inc. Korea). It was recorded that the total prevalence of AI was 34%. Statistical analysis showed that there was a significant difference between the prevalence of AI in the five investigated districts of Qaliobiya province. The broiler farms located in Qaliob district scored the highest prevalence (50%) followed by broiler farms located in Toukh district (40%) then El Khanka (35%) then Banha (25%) and lastly El Qanater (20%). Chi-square analysis of the obtained results showed that there was a significant association between the application of traffic control measures and the prevalence of AI. Also, it was noticed that there was a significant association between the application of sanitation measures and the prevalence of AI. On contrary, there was non-significant association between isolation of the diseased houses and the prevalence of AI. Moreover, there was a significant association between the application of prophylactic measures and the prevalence of AI. At the end, it was observed that the prevalence of AI was higher in broiler farms showed relaxed biosecurity measures compared to other farms with strict biosecurity measures.

1. INTRODUCTION

Poultry industry represents an important sector in agricultural industry, particularly in developing countries where small commercial and backyard systems are often extensive and dominating the industry. In Egypt, about 70% of broilers are produced by medium to large-scale commercial farms with the remaining 30% produced by small-scale village farms (Kaoud, 2007). The growth rate of poultry production was increasing fast and the local production of poultry meat was sufficient to satisfy home consumption and about two million birds were exported annually before the Highly Pathogenic Avian Influenza (HPAI) H_5N_1 outbreak in 2006 (El Nagar and Ibrahim, 2007). However, this increase in production and the number of poultry farms and other associated establishments was not according to a well-defined long term plan that resulted in high proportion of medium to small scale farms were not under the supervision of the official authorities and

consequently monitoring and early detection of poultry diseases are not possible. According to the Food and Agriculture Organization (FAO), poultry production systems are classified into four sectors based on the production scale and the level of biosecurity. Sector 1 consists of integrated broiler and breeder farms with clear production goals and clearly defined and implemented standard operating procedures for biosecurity. It is an industrial integrated system with high-level biosecurity where birds/products are marketed commercially. Sector 2 is commercial poultry production system with moderate to high biosecurity, birds/products are usually marketed commercially, and strict prevention of contact with other poultry or wildlife exists. Sector 3 is commercial poultry production system with low to minimal biosecurity, and birds/products usually enter the live bird markets. Sector 4 consists of village, household or backyard production with minimal biosecurity, and birds/products consumed locally or may be sold at the live bird markets (FAO, 2004). While sectors 1 and 2 farmers observe varying levels of bio-security the sector 3 and 4 farmers practice less if any. In Egypt, poultry production system doesn't seem to have this clear classification particularly in sectors 3 and 4 in which many farms don't apply strict biosecurity measures and not registered with the official authorities and consequently disease outbreaks cannot be monitored and early detected (Abdel Wahhab and Hafez, 2011). Since February 2006, the Egyptian poultry production sector has been severely damaged by continuous outbreaks of highly pathogenic avian influenza (HPAI) caused by the Influenza A (subtype H5N1) virus (Kayali et al., 2011). Studies have also shown that live infected domestic poultry can produce virus for several days or weeks without clear clinical signs. Infected domestic birds are the most dangerous source of virus and inanimate objects (fomites) contaminated with secretions (in particular faeces) from infected birds are the next most dangerous source of virus and air-borne spread is not significant. The disease is mostly spread by the actions of man, moving either infected birds or contaminated materials. It was reported that, low or inadequate biosecurity measures in addition to poor disease control strategies would result in high levels of baseline mortality due to infectious diseases (Abd el- Qader et al., 2007). Biosecurity is the implementation of measures that reduce the risk of the introduction and spread of disease agents. Biosecurity requires the adoption of a set of attitudes and behaviours by people to reduce risk in all activities involving domestic, captive exotic and wild birds and their products. The details of how biosecurity is applied will depend on the type of poultry production unit in question: for farms and villages, for example, the emphasis should be on "bioexclusion" (keeping disease agents out), for markets it should be on "biocontainment" (keeping disease agents in), and for duck flocks it is a question of both. In addition to lack of planning, supervision and effective notification system, there are insufficient biosecurity measures in most of small to medium scale poultry farms. In poultry farms, biosecurity comprises of a comprehensive range of measures to minimize or prevent the introduction of potential infection into poultry premises. The implementation of biosecurity measures requires training, awareness, resources and the perception of higher risk and loss of profit (Conan et al., 2012). So the current work was planned to determine the prevalence of AIV in broiler farms and assess the effect of application of biosecurity measures on the prevalence of AIV in Qaliubiya province.

2. MATERIALS AND METHODS

2.1. Study area and period:

Qaliubiya province, as many provinces in Egypt, has been facing the problem of spreading of small poultry flocks with capacity ranging from the number of 500 to 10,000 birds. One hundred broiler farms were investigated for application of biosecurity measures and the presence of AIV during the period extended from January to December 2016.

2.2. Assessment of biosecurity measures in broiler farms:

Questionnaire survey and observational study was conducted to collect data on biosecurity measures and problems associated with small scale poultry farms in Qaliobiya Province, a total of 100 small scale broiler farms were included in this study. Data were collected through direct observation and interviews made with owners and workers using a structured-questionnaire. Questions about existing biosecurity measures such as isolation, traffic control and sanitation as defined by FAO, (2008) were asked using different variables and other management practices.

Table (1): Questionnaire model for farm visit specially designed to evaluate biosecurity practices in poultry farms

(I) Farm description:
1. Governorate:
2. District:
3. Farm capacity:
4. Breeding system:
(II) Bio-security practices:
A. Traffic control measures:
1. Access to predators and rodents. (Yes or No)
2. Contact with village chicken and wild birds. (Yes or No)
3. Sharing of equipment's. (Yes or No)
4. Open for authorized visitors. (Yes or No)
5. Separate cloth and shoes. (Yes or No)
B. Sanitation practice:
1. Foot bath at the gate. (Yes or No)
2. Poultry house disinfection before entry. (Yes or No)
3. Method of disinfecting. (Fumigation, Spraying or non- applicable).
4. Dead birds' disposal (Throwing, burial or burning).
C. Isolation practice:
1. All in all out practice. (Yes or No)
2. Quarantine method for new comers (Yes or No).
3. Keeping of different age groups together (Yes or No).
4. Isolation pen for diseased chicken (Yes or No).
D. Disease preventive measures:
1. Vaccination. (Yes or No).
2. Used vaccines (AI, Newcastle, Infections bronchitis, Marek's and Gumboro).
3. Using of prophylactic antibiotics.

2.3. Determine the prevalence of AIV in broiler farms:

Cloacal swabs were collected from the investigated broiler farms. Up to five cloacal swabs from a single poultry flock may be pooled in the same viral transport media. Detection of AIV antigen was carried out by using rapid avian influenza virus antigen test kit (ANIGEN® Animal Genetics, Inc. Korea).

3.4. Statistical analysis:

Collected data from the questionnaire were entered into Microsoft excel program spread sheet and analyzed using SPSS version 16. Descriptive statistics were computed and expressed in terms of frequency and percentages.

3. RESULTS and DISCUSSION

Poultry represents an important sector in animal production, with backyard flocks representing a huge majority, especially in the developing countries. In these countries, villagers raise poultry to meet household food demands and as additional sources of incomes. Over the last decade, avian influenza has emerged as an animal disease of concern for veterinary and human health organizations across the world (Jutzi 2005). This is primarily because of its ability to cause illness and death in poultry and humans, disrupt poultry trade, threaten the food security of resource-poor countries and the high costs associated with control measures (McLeod et al. 2004). Rapid antigen assays developed for use in humans and other animal species may be used as screening tests for avian influenza infection during outbreaks. These tests have been designed to detect avian influenza A nucleoproteins, antigens that are common to all type A influenza viruses (Bai et al. 2006).

The prevalence of AI in broiler houses in Qaliobiya province was recorded in Table (2). It was recorded that the total prevalence of AI was 34%. Also, it was observed that the broiler houses located in Qaliob district scored the highest prevalence (50%) followed by broiler houses located in Toukh district (40%) then El Khanka (35%) then Banha (25%) and lastly El Qanater (20%). Statistical analysis of the obtained results by Chi-square ($P > 0.05$) showed no significant association ($P = 3.94$) between the prevalence of AI in the investigated five districts of Qaliobiya Province. The recorded prevalence of AI in the current study was nearly similar to that recorded by Afifi et al., (2012) who found that the total prevalence of AI in 1,225 examined serum samples was 34 %.

Table (2): Prevalence of AI in broiler farms in Qaliubiya province (n=20 farm/district)

District	Positive	%
Banha	5	**25.0**
Toukh	8	**40.0**
El khanka	7	**35.0**
Qaliob	10	**50.0**
El Qanater	4	**20.0**
Total	34	**34.0**
Chi-square value and significance	**12.33****	

** = Significant at (P < 0.01).

Table (3): Distribution of AI seropositive and the relevance with traffic control measures

Variables	Category	Number	Positive		Chi^2
			No.	%	
Access to predators and rodents	**Yes**	16	12	**75.0**	**4.25****
	No	84	22	**26.2**	
Contact with wild birds	**Yes**	12	12	**100**	**5.40****
	No	88	22	**25.0**	
Sharing of equipment	**Yes**	12	9	**75.0**	**4.32****
	No	88	25	**28.4**	
Open for non - authorized visitors	**Yes**	76	28	**36.8**	**5.24****
	No	24	6	**25.0**	
Separate cloth and shoes	**Yes**	76	11	**14.5**	**5.22****
	No	24	23	**95.8**	

** = Significant at (P < 0.01). No.: means the number of positive samples

Table (4): Distribution of AI seropositive and the relevance with sanitation practices

Variables	Category	Number	Positive		Chi^2
			No.	%	
Foot bath at the gate	**Yes**	80	14	**17.5**	**4.25***
	No	20	20	**100**	
Poultry house disinfection before entry	**Yes**	88	22	**25.0**	**6.55****
	No	12	12	**100**	
Methods of disinfection	**Fumigation**	48	12	**25.0**	**8.55****
	Spraying	40	10	**25.0**	
	Non-applicable	12	12	**100**	
Disposal of dead birds	**Throwing**	56	14	**25.0**	**10.66****
	Burning	8	5	**62.5**	
	Burial	36	15	**41.7**	

* = Significant at (P = 0.05). ** = Significant at (P < 0.01).

Table (5): Distribution of AI seropositive and the relevance with major isolation practices

Variables	Category	Number	Positive		Chi^2
			No.	%	
All in all out practice	**Yes**	83	19	**22.9**	**6.42****
	No	17	15	**88.2**	
Isolation for diseased houses	**Yes**	32	11	**34.4**	**1.55NS**
	No	68	23	**33.8**	
Separate attendants for diseased houses	**Yes**	24	10	**41.7**	**4.22****
	No	76	24	**31.6**	

NS = Non-significant at (P > 0.05) *** = Significant at (P = 0.05)** **** = Significant at (P < 0.01)**

Table (6): Distribution of AI seropositive and the relevance with prophylactic measures

Variables	Category	Number	Positive		Chi^2
			No.	%	
Vaccination against AI	**Yes**	85	19	**22.4**	**8.22****
	No	15	15	**100**	
Use of prophylactic antibiotics	**Yes**	80	21	**26.3**	**6.23****
	No	20	13	**65.0**	

**** = Significant at (P < 0.01)**

On other hand, it was higher than recorded by Aly, et al., (2008) (1.17 %), Fasina et al. (2008) (1.16 %), Ayaz, (2010) (9%), Ghazi et al., (2011) (5%) and Shita (2012) (12.9 %). From the previously mentioned results, it was clear that AI was detected in broiler farms emphasized the continuous spreading of the disease in the investigated province that threatening poultry industry and human health in Qaliobiya Province. This finding was in agreement with WHO, 2012 who reported that Egypt was currently one of the most infected countries in Africa and in the world.

Active surveillance was evaluated by many authors; Webster, (2004) concluded that active surveillance provided information on the continuous evolution of HPAI viruses and the role a market plays in pre-disposing birds to pathogenic viruses and IOM, (2009) emphasized that effective surveillance played an important role in the preservation of animal health by evaluating the risks associated with disease transmission, investigators could implement systems for identifying outbreaks and provided early signals to health officials nationally and internationally for follow-up and response.

The relationship between the prevalence of AI and application of biosecurity measures in the examined broiler farms was investigated. Data presented in Table (3) represented the distribution of the AI seropositive flocks and the relevance with different investigated variables of traffic control measures. Based on the collected data by the used questionnaire, 5 variables were studied including access to predators and rodents, contact with wild birds, sharing of equipment, open for non - authorized visitors and using separate cloth and shoes using (Yes/No) questions where yes: means the presence of the factor while no: means absence of the factor. Statistical analysis showed that there was a significant association between the application of traffic control measures and the prevalence of AI in Qaliobiya province. It was observed that the presence of wild birds influenced the risk of avian influenza introduction. Also, it was reported that outbreaks in Egypt were significantly associated with wild birds and poultry transportation (Kaoud, 2007).

As shown in Table (4), the distribution of AI seropositive broiler flocks and the relevance with sanitation practices clarified that there was significant difference between the prevalence of AI in farms informed that they have no foot bath at the gate (prevalence was 100%) and those informed that there was a foot bath (prevalence was 17.5%). Also, it was observed that the prevalence of AI was higher in farms informed the absence of disinfection procedures before entry when compared to those informing that there was disinfection at the entry point. Moreover, it was recorded that disinfection of farms had a significant effect on the prevalence of AI. The previously mentioned observations confirmed the significant role of application of sanitary practices on the prevalence of Al in broiler farms under investigation. Unfortunately, the distribution of AI seropositive broiler flocks and the relevance with method of disposal of dead birds clarified that the highest prevalence was observed in farms depending on burning as a method of disposal (62.5%) followed by those depending on burial (41.7%) and lastly those threw the dead birds in water ways (25%). This finding may be attributed to few investigated farms informed that they depended on burning (8 farms only) and the large number of farms threw the dead birds (56 farms). It was observed that disposal of dead birds by rendering increased the risk of disease spread (McQuiston et al., 2005) and Unhygienic disposal of dead poultry would increase the probability of maintenance of infectious agents in the environment and consequently the risk of disease transmission (Kandun et al., 2010).

The data presented in Table (5) showed the distribution of AI seropositive broiler flocks and the relevance with major isolation practices. Statistical analysis showed significant association between the prevalence of AI in farms informed that they followed all in all out practice and those did not follow it. On contrary, there was non-significant association

between isolation of diseased houses and the prevalence of AI. It was observed that movements of infected flocks were considered a risk factor for transmission of AI (Marangon and Capua, 2005).

The recorded results in Table (6) showed the distribution of AI seropositive broiler flocks and the relevance with prophylactic measures. Statistical analysis clarified the significant association between the application of prophylactic measures including vaccination and administration of antibiotics and the prevalence of AI in the examined broiler farms. It was found that vaccination could increase resistance to field challenge, reduce shedding of virus and reduce rates of disease transmission of AI (vander Goot et al., 2005). Moreover, vaccination reduced the susceptibility of the population in order to limit or prevent disease spread (Marangon et al., 2008).

It seems that in most of broiler chicken farms in the study area there was a lack of biosecurity measures and the use of technology for production. The results also indicated that, there were discrepancies between the responses of study participants and the observational data, (e.g. presence of special area for poultry disposal, use of protective gloves and masks and the use of special work cloths). This indicated the gap between farmers' knowledge and practices. The same discrepancies were identified by previous studies (Radwan et al., 2011 and NegroCalduch et al., 2013). It was observed that the prevalence of AI was higher in broiler houses showed relaxed biosecurity measures compared to other houses with strict biosecurity measures. This finding was supported by the words of Dekich (1995) who mentioned that biosecurity measures were an important element to prevent AIV transmission from one location to another.

The obtained results could make a useful contribution towards preventing AI in backyard poultry farms and decreasing losses in the poultry industry. More attention should be paid towards implementing a proper control program for AI and more efforts should be directed towards improving the biosecurity program.

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