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BIOSECURITY MEASURES RELATED TO THE PURCHASE AND TRANSPORTATION OF DAY-OLD CHICKS IN POULTRY FARMS IN KHARTOUM STATE, SUDAN

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ABSTRACT

This study was conducted to evaluate the biosecurity measures related to the purchase and transportation of day-old chicks in poultry farms in Khartoum state, Sudan, and to correlate these with the type of production system and density of the farms as well. Seventy four commercial broiler and layer farms throughout the different localities of Khartoum State were randomly selected. Data were collected by on-farm visits, during which direct interviews with farmers and veterinarians in charge were carried out using a questionnaire. The latter comprised questions on day-old chicks and transport biosecurity measures. Scoring system of minimal, moderate or high biosecurity risk was initiated. Final weight and risk-based score was calculated for each biosecurity measure. The study revealed that the geographical distribution of farms was that 33 (44.6%) were located in sparsely populated area, 25 (33.8%) in moderately populated area and 16 (21.6%) in densely populated area. Forty three farms, representing 58.1% of the total farms under investigation, constantly purchased chicks from one supplier, while 31 (41.9%) farms their chicks were bought from different suppliers. No significant difference (P-value =.538) was detected between the sources of day-old chicks. In addition, 60 (81.1%) farms posed hygienic criteria on the transport vehicles before the chicks had been loaded, while others (18.9%) didn't practice any hygienic practices. However, no significance difference (P=0.161) was observed between layer and broiler farms in the

aforementioned hygienic criteria. In regard to the frequency of introducing day-old chicks, 27 (36.5%) farms delivered chicks less than 3 times a year, 3 to 6 times a year in 36 (48.6%) ones and only 11 (14.9%) farms did that more than 6 times a year. The difference between annual frequency of bought-in one day old chicks and types of farms was highly significant (P< .000). In conclusion the results of this study highlighted the major biosecurity points related to the purchase and transportation of day-old chicks and density of poultry farms that need to be strengthened.

Index Terms*:* Farm biosecurity, One day old chicks, Transport vehicles.

INTRODUCTION

Biosecurity refers to the hygiene and management measures taken to minimize the risk of incursion of pathogens onto individual farms and to minimize the risk of onward transmission to other farms if infection occurs.[1]

Poultry production is defined into different systems based on the characteristics of the production methods, especially the biosecurity measures implemented, and the extent of involvement of the farm in the formal market chain.[2] Although large scale poultry farms are often assumed to implement more advanced biosecurity measures, small conventional poultry farms do not have the motivation to implement these measures.[3-4] Nonetheless, intensification of production methods in poultry farming does not always mean that biosecurity practices are in place.[5] For instance, it has been suggested that intensive poultry production can represent a higher risk than scavenging rearing system.[6]

The location of the poultry farm should be at a site where the density of poultry farms is low; as this is an important factor in the transmission of diseases whose prevalence depends on density.[7] To avoid the transmission of airborne diseases between poultry farms, the distance to the nearest poultry farm shall be at least 500 meter and preferably >1 km.[3] A million-fold increase in aerosolized dust has been noted in the air surrounding industrial farm animal production units.[8]

There are three main principles for biosecurity that are involved in management and disease control: isolation of premises and poultry from sources of infection; controlling traffic flow in and out of susceptible areas; and sanitation of equipment, housing, protective clothing for poultry workers, sustaining personal hygiene.[9-10] In this respect, contaminated trucks can aid

in transferring pathogenic agents to one day old chicks. Therefore, all equipment used for delivery of day-old chicks to farms, such as trucks, reusable boxes, and containers, must be washed on the spot or return to the transport company or hatchery to be washed before being used again for a next load.[11] In addition to this, buying one-day old chicks from different sources poses a greater risk of introduction of disease-causing agents.[12]

Searching in the literature showed that little is known about biosecurity practices implemented in poultry farms in Sudan, particularly those practices related to the purchasing of day-old chicks as well as the methods by which they were delivered to farms. Thus, this study was conducted to evaluate the biosecurity levels related to the purchase and transportation of day-old chicks in poultry farms in Khartoum state, Sudan, and to correlate these with the type of production system and density of the farms as well.

MATERIAL AND METHODS

Duration and area of the study: The duration of this study was two years, started in late December 2015 and ended in earlier January 2017.The study covered all Khartoum State districts: Khartoum North; East Nile; Ombada; Omdurman; Jabel Awlya; Khartoum.

Farms population and selection: Seventy four commercial poultry farms (47 broilers and 27 layers) were selected from the lists provided by Ministry of Agriculture, Animal Wealth and Irrigation, Khartoum State.

Data collection technique and questionnaire designing: Farms in this study were investigated during dry and wet seasons in two consecutive years with total of 2 dry and 2 wet seasons. Data were collected by on-farm visits, during which interviews with the farmers and veterinarians in charge of these farms were carried out. The interviews included administration of a questionnaire which designed in a way similar to the approach of Gelaude at al.[13] The questionnaire was planned to describe the biosecurity measures adopted for the purchase of day-old chicks, and transport vehicles. To this end, questions were asked on whether or not a certain preventive measure is applied, or whether a specific situation is present.

Prioritization of different biosecurity measures: Prioritization of different biosecurity measures was done based on risk assessment according to the guidelines set by CDFA.[14]

The responses for both external and internal biosecurity measures and practices were rated as Minimal Biosecurity Risk, Moderate Biosecurity Risk, or High Biosecurity Risk.

Analytical Techniques: Statistical analysis was applied utilizing Statistical Packaging for the Social Sciences software (SPSS/PC version 21 for windows). The collected data were coded and analyzed using Descriptive Statistical Analysis. Chi-square was used with the hypothesis that the compliance with biosecurity measures is uniform among all poultry farms. P value <0.05 was considered significant.

RESULTS

Table (1) shows that the geographical distribution of farms in Khartoum State. Thirty three farms (44.6%) were located in sparsely populated area, 25 (33.8%) in moderately populated area and 16 (21.6%) in densely populated area.

Table 1: Geographical distribution of farms within different localities in Khartoum State.

Characteristics	Response	Frequency	%
Farms density measurement	Sparsely populated poultry farm area	33	44.6
	Moderately populated poultry farm area	25	33.8
	Densely populated poultry farm area	16	21.6
	Total	**74**	**100.0**

Regarding the source of day-old chicks, forty three poultry farms, representing 58.1% of the total farms under investigation, constantly purchased chicks from one supplier, while 31 (41.9%) farms their chicks were bought from different suppliers. No significant difference (P>.05) was detected between the sources of day-old chicks (Table 2).The results also showed that only 16 (37.2%) of the layer farms purchased their one day old chicks from only one supplier, while 11 (35.5%) of them did that from different suppliers. In addition, 27 (62.8%) of the broiler farms purchased their one day old chicks from one supplier, while 20 (64.5%) of them did that from different suppliers.

Table. 2: The source of purchased day-old chicks in different farms in Khartoum State.

Source of day-old chicks	Type of farm		Total	P-value
	Layer	Broiler		
Always from the same supplier	16 (37.2%)	27 (62.8%)	43 (58.1%)	**0.54**
From different suppliers	11 (35.5%)	20 (64.5%)	31 (41.9%)	
	27 (100%)	**47 (100%)**	**74 (100%)**	

***P-value considered significant at less than 0.05**

Table (3) shows the pattern of one-day old chicks distribution by transport vehicles to different poultry farms. Most of the layer farms 25 (92.6%) answered YES in that their chicks were first delivered to them before other farms, while only 2 (7.4%) of them answered SOMETIMES. The pattern of chick transportation in broiler farms was different in that only 34 (72.3%) of them answered YES in that their chicks were first delivered to them before other farms, while 11 (23.4%) and 2 (4.3%) of them answered SOMETIMES and NO, respectively. The difference was not significant (P<.10) between layer and broiler farms in respect of the pattern by which day-old chicks distributed by transport vehicles.

Table. 3: Pattern of one-day old chicks distribution by transport vehicles to different types of farms.

Response	Type of farms		Total	P-value
	Layer	Broiler		
Yes	25 (92.6%)	34 (72.3%)	59 (79.7%)	**0.10**
Sometimes	2 (7.4%)	11 (23.4%)	13 (17.6%)	
No	0 (0.0%)	2 (4.3%)	2 (2.7%)	
Total	**27 (100%)**	**47 (100%)**	**74 (100%)**	

***P-value considered significant at less than 0.05**

Table (4) displays the commitment of poultry producers to pose biosecurity measures on the transport vehicles used for transportation of day-old chicks. As it can be seen, most of the layer farms (88.9%) answered YES in that they posed biosecurity measures on the transport vehicles, while only 11.1% of them answered NO. Concerning broiler farms, 36 (76.6%) of them answered YES in that they posed biosecurity measures on the transport vehicles, while only 11 (23.4%) of them answered NO. The difference between layer and broiler farms in applying biosecurity measure on transport vehicles before loading chicks was insignificant (P>0.16).

Table. 4: Biosecurity measures implemented by poultry farms on the transport vehicles before loading day-old chicks.

Response	Type of farms		Total	P-value
	Layer	Broiler		
Yes	24 (88.9%)	36 (76.6%)	60 (81.1%)	**0.16**
Sometimes	0 (0.0%)	0 (0.0%)	0 (0.0%)	
No	3 (11.1%)	11 (23.4%)	14 (18.9%)	
Total	**27 (100%)**	**47 (100%)**	**74 (100%)**	

***P-value considered significant at less than 0.05**

Table (5) demonstrates the number of times a year that one day old chicks were delivered to the different types of farms. The results indicate that 22 (81.5%) of the layer farms received one day old chicks <3 times a year, 4 (14.8%) of them received one day old chicks 3-6 times a year and only 1 (3.7%) of them received one day old chicks >6 times a year.

For the broiler farms 5 (10.6%) of them received one day old chicks <3 times a year, 32 (68.1%) received one day old chicks 3-6 times a year and 10 (21.3%) of them received one day old chicks >6 times a year. The difference between annual frequency of bought-in one day old chicks and types of farms was found highly significant (P< .000).

Table. 5: Annual frequency of introducing day-old chicks to poultry farms in Khartoum State.

Response	Type of farms		Total	P-value
	Layer	Broiler		
<3	22 (81.5%)	5 (10.6%)	27 (36.5%)	**0.00**
3-6	4 (14.8%)	32 (68.1%)	36 (48.6%)	
>6	1 (3.7%)	10 (21.3%)	11 (14.9%)	
Total	**27 (100%)**	**47 (100%)**	**74 (100%)**	

***P-value considered significant at less than 0.05**

<3: Less than three times a year, 3-6: Between three to six times a year, >6: More than three times a year: Table (6) shows different variables of purchased day-old chicks based on biosecurity risk. The number of times a year that one day old chicks are delivered to the farm indicated highly significant difference (P<0.01) between layer and poultry farms. All other variables showed insignificant difference (P>0.05).

Table 6: Biosecurity risk related to the purchase of day-old chicks in broiler and layer farms in Khartoum State.

Biosecurity variables	Type of farms	Biosecurity Risk						P-value
		Minimal		Moderate		High		
		No.	%	No.	%	No.	%	
Are day-old chicks brought from the same supplier or different suppliers?	Layer	16	34.8	11	39.3	27	36.5	**0.4**
	Broiler	30	65.2	17	60.7	47	63.5	
When using the same transport vehicles, are day-old chicks always first delivered to your farm before others?	Layer	25	42.4	2	15.4	0	0.00	**0.10**
	Broiler	34	57.6	11	84.6	2	100.0	
Are there biosecurity measures posed on the transport vehicle (such as cleaning and disinfection) before the chicks are being loaded?	Layer	24	40.0	3	21.4	27	36.5	**0.16**
	Broiler	36	60.0	11	78.6	47	63.5	
Number of times a year that one day old chicks are delivered to the farm?	Layer	22	81.5	4	11.1	1	9.1	**0.00**
	Broiler	5	18.5	32	88.9	10	90.9	

***P-value considered significant at less than 0.05**

DISCUSSION

It is reported that poultry density plays an important factor for the transmission of those pathogens whose prevalence depends on density.[7]

This study revealed that 25 (33.8%) of the investigated farms were located in moderately populated area and 16 (21.6%) in densely populated area. This high percentage of moderately and densely populated areas may be attributed to the absence of legal requirements to determine buffer zones between poultry farms.

As one-day old chicks may pose a great hazard on poultry enterprise by vertically transmitting pathogens such as *Mycoplasma* spp.,[15] the source of this valuable input must be guaranteed. The sanitary status of the breeder farms shall be appropriately chosen. It was stated that buying animals from different farms implies a greater risk of introduction of disease-causing agents.[12] Regardless of the production system, the present study revealed that about 60% of the farms regularly purchased their one day old chicks from one supplier, while around 40% of them bought their chicks from different suppliers. This may be attributed to economic reasons as prices of day –old chicks differ between breeder companies.

Because they enter many farms, contaminated trucks can aid in transferring pathogenic agents to one day old chicks.[16] Nonetheless, the present study demonstrated that about 20% of the investigated farms were not always committed to deliver their day-old chicks directly from the breeding source. The reason behind difficulties in direct transport of one day old chicks might be attributed to the shortages in modern transport means as well as the small size of consignments demanded by the small commercial farms.

Lister[15] recommended that at least the wheels of the transport vehicle are disinfected before entering the poultry farm. In the present study, the majority of the investigated farms (approximately 80%) implemented biosecurity measures on the transport vehicles before the chicks were loaded. Contrary to the present finding, it has been reported that vehicles drove into farm premises without washing and disinfection in more than 50% of farms in Nigeria.[17] The reason for not posing any hygienic criteria on transport vehicles might be due to the lack of awareness of some animal transporters and the fact that the design of the vehicles makes them difficult to be disinfected.

When a specific indirect contact with a relatively small probability in transmission of disease occurs at a high frequency, this transmission route will pose a substantial risk.[18] The frequency of transporting chicks or depopulating poultry houses is essential in determining whether there is a risk or not from the movement of trucks, equipment and catching teams involved in this process.[19] The high frequency of receiving one day old chicks into some farms may be attributed to the short production cycles as practiced in broiler production. Our results were supported by the findings of Steenwinkel et al.[3] who reported that 53% of the trucks belong to hatcheries in Belgium which distributed chicks, visited two or more farms per day with the same transport vehicle and 50% even used the same vehicle for multiple purposes.

CONCLUSION

In conclusion, the results of this study highlighted the major biosecurity points related to the purchase and transportation of day-old chicks and density of poultry farms that need to be strengthened.

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