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Retrospective studies on pullorum disease in chickens in Zaria, Nigeria

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Abstract

A twelve-year study (January, 1995 - December, 2006) of case reports on Pullorum disease (PD) and other poultry diseases diagnosed at the Ahmadu Bello University Veterinary Teaching Hospital, Zaria, was conducted. A total of 3, 265 outbreaks were documented with 173 (5.3%) of the outbreaks diagnosed as PD. The annual increase in the number of PD outbreaks implied a decline in the hygienic standards of hatcheries where the first cycle of transmission should be broken. It was observed that chickens raised between June and August, layers and broilers, chicks under 4 weeks of age, and chickens raised under intensive system of management were at greatest risk of suffering from PD outbreaks. It is imperative that regular blood testing of parent stocks for S. Pullorum infections be conducted routinely to eliminate carriers. There is also the need for poultry farmers to institute and intensify biosecurity measures on their farms to minimize horizontal transmission of PD.

Key Words: Pullorum disease, outbreaks, Zaria.

Introduction

Pullorum disease (PD) continues to be a serious economic threat to the poultry industry in Nigeria, resulting in reduced egg production, excessive numbers of dead-in-shell chicks, deaths shortly after hatching, increased flock mortality and morbidity, and loss of eggs whether breeding or edible (Abdu, 2002; Orji *et al.*, 2005). The result of serological survey conducted in 1984 for Salmonella pullorum antibodies in chickens in Zaria, Nigeria, indicated an overall prevalence of 37.1% for all the different management systems (Adesiyun *et al.*, 1984).

The disease is worldwide in distribution and is seen predominantly in chicks less than 3 weeks of age (Wray *et al.*, 1999). PD is caused by Salmonella pullorum, a bacterium belonging to the family Enterobacteriaceae. The disease can be transmitted in several ways. The infected bird (reactor and carrier) is by far the most important means of perpetuation and spread of the organism (Shivaprasad, 1997). Egg transmission may result from contamination of ovum. Transmission through egg penetration, feed and water contamination, cannibalism of infected birds, and wounds have also been reported (Shivaprasad, 1997). Wild birds, mammals and flies may be important mechanical transmitters of the organism (McMullin, 2004; Desai, 2005).

Materials and Methods

All the case record books of the Avian Clinic of Ahmadu Bello University Veterinary Teaching Hospital, (ABUVTH), Zaria, Nigeria, from January, 1996 to December, 2007 were examined. Information on PD outbreaks in chickens as found in each case was extracted and the rest of the non-PD outbreaks were considered as a group. A case of an outbreak was defined as the sudden occurrence of a poultry disease reported and diagnosed on the basis of flock history, clinical signs, necropsy findings and laboratory results. The data obtained was reduced into tables with respect to frequency of PD and non-PD according to annual distribution, season (monthly), breed, type of bird, age, and management system. The odds ratio (OR) for each were also calculated to determine whether or not associations exist between the factors and PD. A 95% confidence interval (CI) on OR was also calculated for each factor to determine if the association between the variables and PD was significant. The age of chickens were considered in weeks. The types of birds were considered in terms of use or purpose of keeping the birds viz: broilers, layers, cockerels, breeders or mixed. Management system was restricted to intensive (confinement), semi-intensive and extensive (free range systems). The chickens were also grouped into local and improved (exotic) breeds. The seasonal (monthly) variation in the distribution of PD for the period of study (1995-2006) was determined by reducing the twelve-year data to one year, using the 12-monthly ratio-to-moving average method (Harnett and Murphy, 1974).

Results

PD outbreaks in chickens were observed every year in the Avian Clinic of ABUVTH, Zaria, throughout the period of study (1996 – 2007) with the highest prevalence rate (9.1%) recorded in 2006. A total of 3, 265 outbreaks of poultry diseases were documented with 173 (5.3%) of the outbreaks diagnosed as PD. The annual distribution of PD showed that chickens are at an increasing risk of suffering from PD, with high specific rates observed in years 2004, 2005 and 2006 as 8.5%, 7.3% and 9.1%, respectively (Table 1). The monthly distribution showed that chickens are at greater risk of suffering from PD in the months of June, July and August with specific rates of 6.3%, 7.9% and 8.8%, respectively (Table 2). The breed distribution of PD outbreaks compared to other poultry diseases revealed that improved (exotic) breed were 2.62 times more at risk of PD outbreaks compared to local birds. The breed specific rate was also higher in improved breed (5.2%) of birds than in local chickens (2.3%) (Table 3). PD and non-PD outbreaks observed in the various types of chickens showed that layers were 1.47 times more likely to have PD followed by broilers (1.29 times). Mixed type of birds were significantly (P<0.05) at low risk of suffering from PD. The type specific morbidity rates for PD showed that layers had the highest rate (5.8%) followed by broilers (5.1%). While cockerels and mixed type had the lowest (4%) (Table 4). The distribution by age of PD outbreaks showed that chickens less than 4 weeks of age had the greatest risk of suffering from PD (29.16 times) followed by chickens between 5-8 weeks of age (5.68 times). Chickens between 9-20 weeks of age were least at risk of coming down with PD (Table 5). The age specific rate of PD showed that chickens less than 4 weeks of age had the highest rate (20.8%) followed by chickens 5-8 weeks old (4.7%), while the lowest was recorded in chickens 9-20 weeks old. The distribution of PD and non-PD outbreaks according to management system indicated that chickens reared under the intensive management were at greater risk of PD outbreaks than birds raised on free range (extensive) system (Table 6).

Table 1: Annual distribution of PD and non-PD outbreaks in Zaria (1996 – 2007)

Year	Outbreaks		Year	O.R.	95% C.I.
	PD	Non-PD	Specific rates (%)		
1996	07	279	2.5	0.99	0.43-1.66
1997	14	283	4.7	1.04	0.59-1.96
1998	09	296	3.0	1.01	0.57-1.83
1999	08	291	2.7	1.01	0.54-1.76
2000	08	264	2.9	1.01	0.56-1.89
2001	13	241	5.1	1.06	0.67-1.93
2002	17	235	6.7	1.10	0.74-1.96
2003	12	236	4.8	1.06	0.64-1.95
2004	22	235	8.5	1.81	0.86-2.13
2005	20	252	7.3	1.76	0.91-1.87
2006	24	237	9.1	1.91	0.94-1.89
2007	19	243	7.3	1.87	0.82-1.94
Total	173	3, 092			

Table 2: Monthly distribution of PD and non-PD outbreaks in Zaria (1996 – 2007)

Month	Outbreaks		Monthly	O.R.	95% C.I.
	PD	Non-PD	Specific rates (%)		
January	8	215	3.4	0.82	0.29-1.68
February	11	228	4.6	0.91	0.43-1.87
March	13	239	5.1	1.04	0.54-2.01
April	12	287	4.0	1.01	0.49-1.98
May	15	262	4.4	1.32	0.78-2.03
June	22	326	6.3	1.46	0.89-2.14
July	25	292	7.9	1.68	0.39-2.01
August	28	289	8.8	1.96	0.34-1.94
September	14	256	5.1	1.04	0.54-2.24
October	11	235	4.4	0.93	0.46-1.88
November	6	247	2.3	0.78	0.31-1.97
December	8	216	3.6	0.84	0.32-2.27
Total	173	3, 092			

Table 3: Distribution of PD and non-PD outbreaks according to breed in Zaria (1996 – 2007)

Breed	Outbreaks		Specific rates (%)	O.R.	95% C.I.
	PD	Non-PD			
Improved (exotic)	164	2, 703	5.2	2.62	1.29-5.53
Local	9	389	2.3	0.38	0.18-0.78
Total	173	3, 092			

Table 4: Distribution of PD and non-PD outbreaks in Zaria, according to type of birds (1996 – 2007)

Bird type	Outbreaks PD	Outbreaks Non-PD	Specific rates (%)	O.R.	95% C.I.
Broilers	45	835	5.1	1.92	0.55-2.62
Layers	106	1732	5.8	1.47	0.78-2.84
Cockerels	10	237	4.0	1.01	0.40-2.56
Mixed	12	288	4.0	0.99	0.39-2.51
Total	173	3, 092			

Table 5: Age distribution of PD and non-PD outbreaks in Zaria (1996 – 2007)

Age (Wks)	Outbreaks PD	Outbreaks Non-PD	Specific rates (%)	O.R.	95% C.I.
0-4	125	475	20.8	29.16	11.39-81.45
5-8	43	878	4.7	5.8	2.14-16.35
9.12	-	502	0.0	0.00	0.00-1.29
13-16	-	351	0.0	0.00	0.00-1.84
17-20	-	332	0.0	0.00	0.00-1.95
>20	05	554	0.9	0.18	0.06-0.49
Total	173	3092			

Table 6: Distribution of PD and Non-PD outbreaks in Zaria, according to management system (1996-2007)

Management system	Outbreaks PD	Outbreaks Non-PD	Specific rates (%)	O.R.	95% C.I.
Intensive	164	2916	5.3	1.10	0.54-2.34
Extensive (Free range)	9	176	4.7	0.91	0.43- 1.87
Total	173	3092			

Discussion

The annual distribution of PD outbreaks has increased in recent times (Table 1). The number of outbreaks has almost doubled within the short period of 2004-2007 as compared to the longer period of 1996-2003, with the highest year specific rate (9.1%) observed in the year 2006. This scenario might have been due to a decline in the hygienic standards of hatcheries that produce these chicks. The cycle of transmission is supposed to be broken at the hatchery level by maintaining the highest standard of hygiene (Shivaprasad, 1997). However, it has been recognized that the greater the number of infected birds in breeding stock, the greater will be the number of infected chicks on farms (Parry and Porter, 1981).

Chickens were observed to be at greater risk of suffering from PD during the months of June, July and August in this study. This might be explained by the fact that in Zaria, most poultry farmers tend to stock their farms between the months of May and August, (period with moderate environmental conditions) which are ideal for brooding day-old chicks. This is in order to avoid the cold windy harmattan period in (November - February) and the hot period (March – April) in Zaria, which usually result into early chick mortality. Invariably, this practice leads to an increase in the population of chicks at risk on farms around Zaria

Improved breeds of chickens are at greatest risk of suffering from PD than the indigenous breeds. This might be attributed to these reasons; improved breed of chickens are more commonly kept in Zaria, health problems involving these birds are presented to the ABUVTH, Zaria, more than the indigenous chickens because of the higher economic value of the former, and the intensive system of management (with high stocking density and poor ventilation) under which these birds are raised might also favour the spread of the disease (Hafez, 2005). Layers were observed to be at greatest risk of suffering from PD outbreaks followed by broilers (Table 4). This might be attributed to the fact that layers and broilers are the most common types of birds kept within Zaria, hence the high number of PD outbreaks recorded. Breeders and mixed type of birds were found to be at lowest risk with fewer outbreaks of PD recorded. It is most likely that due to high economic importance of breeders, farmers pay more attention to disease prevention among them than other types of birds hence the low PD outbreaks recorded. For the mixed type of birds, since most of them are local birds, the free roaming and scavenging habit might have enable them to pick Salmonella organism early in life and developed antibodies which provoked flock immunity thereby reducing the probability of severe outbreaks (Parry and Porter, 1981).

The distribution by age of PD outbreaks revealed that chicks less than four weeks of age were at greater risk of suffering from PD outbreaks (Table 5). A similar finding was reported by other workers (Shivaprasad, 1997; Wray *et al.*, 1999). It is possible that the disease could have been transmitted to chicks within these ages from infected parent stock via egg yolk, or via contamination of the outside of egg shell (Wray *et al.*, 1999). In addition, young chicks are particularly more susceptible to Salmonella pullorum infections (Parry and Porter, 1981). Although maternally derived antibodies from yolk provide some protection from systemic infection, the apparent lack of maternal protection of the neonatal gut suggests that the young chick is ill-equiped to deal with early mucosal colonization of Salmonella pullorum (Parry and Porter, 1981).

Similarly, chickens raised under intensive system of management were at greater risk of PD outbreaks (Table 6). This might be due to the fact that most of the birds are overcrowded, coupled with lack of adequate biosecurity measures which might increase the probability of severe PD outbreaks (Wray *et al.*, 1999). The conditions and practices of intensive poultry production are considered to be optimal for disease outbreaks; factors that make intensive poultry facilities such ideal breeding grounds for disease include poor ventilation, high stocking density, poor litter conditions, poor hygiene, high ammonia level, concurrent diseases and secondary infections (Hafez, 2003).

Conclusions and recommendations

The results of the current study do explicitly indicate the significant role that PD could play in lowering poultry productivity in the area, thereby highlighting the need for effective health programmes to boost poultry production. Regular blood testing and depopulation of infected flocks have enormously reduced the prevalence of S. Pullorum in other countries, but this approach is hardly practicable in Nigeria presently. Perhaps, the most feasible way to start on an eradication programme is for hatcheries which supply day-old chicks to small scale farmers, to break the disease cycle at their level. Since the most frequent spread of PD occurs from the breeding female to its progeny via the egg, it is highly imperative that regular blood testing of parent stocks for S. pullorum infections be conducted routinely to eliminate carriers. There is also the need for poultry farmers to institute and intensify biosecurity measures on their farms to minimize horizontal transmission of PD. Until control programmes are embarked upon, PD may continue to have a negative effect on the economy of poultry production in Nigeria.

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