

Prevalence of Avian Pox Disease in Gombe State, Northeastern Nigeria: A Six – Year Retrospective Study (2008 – 2013)

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Abstract

Avian pox disease remains one of the major avian viral diseases of concern in the poultry production enterprise in Nigeria. It is very common among the indigenous and exotic commercial poultry with frequent outbreaks among this population of birds. A six year retrospective study to establish the prevalence of avian pox disease in relation to other poultry diseases diagnosed at the major Veterinary Clinics in Gombe State was conducted. The prevalence rate of 48.5% was recorded during the period of the study. Considering the risk factors to the disease, avian pox disease affects both sexes of birds of different species with high prevalence among the younger and growing birds as compared to adults. The disease occurred more in turkeys and chickens as well as other domesticated birds especially the indigenous breeds. Avian pox disease is endemic with higher prevalence during the rainy season in Gombe State. However, the disease seems to occur more in unvaccinated domesticated poultry. It is well established that a successful vaccination programme reduces the severity of the infection in commercial poultry industries. Farmers should therefore adhere to routine fowl pox vaccinations and avoid factors that predispose poultry to avian pox disease such as destruction mosquitoes and other vectors breeding places especially during the rainy season.

Keywords: Avian pox disease; Poultry; Retrospective study; Prevalence; Risk factors; Gombe Northeastern Nigeria.

Introduction

Poultry keeping is the dominant form of poultry production in the developing countries [1]. The Poultry industry occupies an important position in the provision of animal protein (meat and egg) to man and generally plays a vital role in the national economy as a revenue provider [2]. Unfortunately, the incidence of infectious diseases is one of the greatest constraints to the development of successful expansion and increased productivity of poultry in smallholder and commercial poultry industries resulting to

high economic losses in terms of mortality and morbidity [3]. Avipoxviruses (APVs) are among the largest and most complex viruses known to affect poultry, with a brick shape, ranging in size from 200 to 400nm long and 170 to 200nm wide [4]. Fowl pox or avian pox is an infectious, contagious viral disease that may infect virtually any order of birds, either wild or domesticated [5, 6]. The disease has a worldwide distribution and is caused by a double stranded DNA virus of the genus *Avipoxvirus*, subfamily *Chordopoxvirinae* of the family *Poxviridae* that multiply in the cytoplasm of the host cell [4, 5, 7].

Avian pox has been described in chickens, turkeys, pigeons, ostriches, quails, pheasants, canaries, and a lot of other avian species [6, 8]. Infections have also been reported in a number of endangered species or species in captive breeding recovery programs [9 – 11]. Fowl pox is a slow-spreading virus disease of chickens and turkeys in which two forms of the disease are associated with different routes of infection [8]. The disease can occur as a mild cutaneous form (dry pox) characterized by the development of proliferative lesions, ranging from small nodules to spherical wart-like masses on the skin of the comb, wattle and other unfeathered areas with low mortality or as a diphtheritic form (wet pox) which can be more severe or both [5, 12, 13]. In the diphtheritic form, slightly elevated white opaque nodules develop on the mucous membranes. They rapidly increase in size to become a yellowish diphtheritic membrane. Lesions occur on the mucous membranes of the mouth, esophagus, upper respiratory and digestive systems [14, 15]. The mortality rate is higher in the diphtheritic form than in the cutaneous form, sometimes nearing 50% particularly in young birds [16, 17]. Proliferating lesion involving the nasal passages, larynx or trachea can result to respiratory distress and death from suffocation [8, 9]. APVs are transmitted through direct contact or by mechanical vectors, primarily mosquitoes and other sucking flies [13]. The disease can also be transmitted via aerosols and are usually named on the basis of the bird species from which the virus was first isolated and characterized [9]. Its incidence is variable in different areas because of differences in climate, management and hygiene or the practice of regular vaccination. Diagnosis of fowl pox is not difficult and can be made on the basis of clinical signs and lesions [18], while confirmation is by histopathology or immunology or virus isolation [19, 20]. There is paucity of information on the prevalence of avian pox infection in poultry species reared in Gombe Northeastern Nigeria; hence this study was designed to evaluate their prevalence retrospectively and to proffer responsive management measures that will limit the disease in the study area.

Materials and Methods

Study Area

The study was conducted in Gombe metropolis Veterinary Clinics, which are in the state capital. The state is located in the Northeastern region of Nigeria with mean annual rainfall of 818.5mm, temperature range of 12 – 37°C and relative humidity of 94% in August and 10% in December. Cold harmattan starts in October while rains begin in April. The climate and adaptive factors such as seasonality, temperature

and climate favor crop and livestock production [21]. The season in Gombe like in most parts of Northeastern Nigeria, were categorized as follows: Dry season (January - March), Pre-rainy season (April - June), Rainy season (July-September) and Pre-Dry season (October – December).

Data Collection

Data were collected from the state Veterinary Clinics' record in Gombe from January 2008 to December 2013. Information on avian pox in poultry only was extracted from the clinic records and the non-avian pox cases were considered together as a group. A case of avian pox was defined as a farm that reported an outbreak of the disease and diagnosed based on history, clinical signs and post mortem findings in the two veterinary clinics in Gombe metropolis. The clinical signs that served as the main basis for the disease diagnosis were consistent with those signs outlined in Samour [22] and Vegad [23].

Data Analysis

Descriptive analyses were conducted by Microsoft office Excel spread sheet, odds ratio at 95% CI on OR were calculated to determine strength and significance of associations between variables and prevalence of Newcastle disease using Graphpad prism® version 5.01 for windows (GraphPad Software, Inc., San Diego, California, USA) computer based program. The seasonal variation in the distribution of Newcastle disease for the period 2004 – 2013 was determined by reducing the 10 – year data to one year using the 4 season's ratios to moving average method [24].

Results

Table 1 shows the yearly distribution of avian pox diseases in Gombe State from the year 2008 to 2013. Out of the total 8671 poultry diseases cases recorded at the Pantami and Tashan Dukku area Veterinary Clinics of Gombe State during the study period. Of these cases, 4206 (48.5%) were diagnosed as avian pox. The Year Specific Rates (YSR) of avian pox ranged from 45.8% in 2012 to 53.2% in 2013. High number of avian pox cases total 771 (YSR 52.7%) and 766 (YSR 53.2%) were recorded in the year 2009 and 2013 respectively while moderately lower number of avian pox cases total 640 (YSR 46.2%) and 658 (YSR 47.1%) were recorded in the year 2008 and 2011 respectively. The odd ratios for all the years were not statistically significant at 95% CI ($P > 0.05$).

Table 1. Yearly distribution of avian pox disease in Gombe State, Northeastern Nigeria (2008 – 2013)

Year	Total no. of cases	AP cases ^a	YSR (%) ^b	OR ^c	95% CI ^d
2008	1384	640	46.2	1.0	0.30 – 1.74
2009	1463	771	52.7	1.3	0.47 – 2.17
2010	1510	695	46.0	1.0	0.30 – 1.74
2011	1398	658	47.1	1.1	0.35 – 1.85
2012	1477	676	45.8	-	-
2013	1439	766	53.2	1.4	0.57 – 2.23
All years	8671	4206	48.5		47.45 – 49.55*

^a Avian Pox Disease; ^b Year Specific Rates (%); ^c Odds ratio; ^d 95% Confidence Interval on the OR

* 95% Confidence Interval on the overall YSR (48.5%)

Table 2 shows the risk factors associated with Avian Pox disease in Gombe State from the year 2008 to 2013. Out of the total of 4026 avian pox diseases cases recorded at the Veterinary clinics 1922 (YSR 45.7%) and 2284 (YSR 54.3%) were male and female respectively. The recorded avian pox cases among the sexes showed no statistical significant difference ($P > 0.05$) in prevalence rates (Table 2). Moreover, out of the total of 4026 avian pox diseases cases recorded at the Veterinary clinics, 580 (YSR 13.8%) were adult birds, 1746 (YSR 41.5%) were growers while 18880 (YSR 44.7%) were young birds. The recorded avian pox cases among the ages of birds showed no statistical significant difference ($P > 0.05$) in prevalence rates (Table 2). However, out of the 4026 avian pox disease cases recorded at the veterinary clinics, 1115 (YSR 26.5%) were exotic breeds while 3091 (YSR 73.5%) were local breed birds. The recorded avian pox cases among the breeds showed statistical significant difference ($P < 0.05$) in prevalence rates (Table 2). The prevalence of avian pox disease according to avian species affected out of the total 4026 avian pox cases as recorded at the veterinary clinics indicated that 2368

(YSR 56.3%) turkeys and 1312 (YSR 31.2%) chickens are the most affected bird species, 482 (YSR 11.5%) pigeons are moderately affected while avian pox cases in 32 (YSR 0.8%) duck and 12 (YSR 0.3%) other species of birds were also recorded. The recorded avian pox cases among the species of birds showed statistical significant difference ($P < 0.05$) in prevalence rates (Table 2). Out of the total of 4026 avian pox diseases cases recorded at the Veterinary clinics, 1136 (YSR 27.0%) and 3070 (YSR 73.0%) avian pox cases were recorded in the dry and rainy seasons respectively. The recorded seasonality of avian pox cases between the two seasons showed statistical significant difference ($P < 0.01$) in prevalence rates (Table 2). However, out of the total of 4026 avian pox diseases cases recorded at the Veterinary clinics, 736 (YSR 17.5%) are flocks with avian pox vaccination history while 3470 (YSR 82.5%) are flocks without avian pox vaccination history. The recorded avian pox cases between the avian pox vaccinated and non-vaccinated flocks showed statistical significant difference ($P < 0.01$) in prevalence rates (Table 2).

Table 2. Risk factors associated with Avian Pox disease in Gombe State, Northeastern Nigeria (2008 – 2013)

Risk Factors	Total cases	AP cases (%)	Odds Ratio	95% CI
Sex				
Male	3957	1922 (45.7)	-	-
Female	4714	2284 (54.3)	1.0	0.72 – 1.28 $P > 0.05$
Age				
Adults	1361	580 (13.8)	-	-
Growers	3481	1746 (41.5)	1.4	1.01 – 1.79
Young	3829	1880 (44.7)	1.3	0.94 – 1.66 $P > 0.05$
Breed				
Exotic	3828	1115 (26.5)	-	-
Local	4843	3091 (73.5)	4.3	3.73 – 4.87 $P < 0.05$

Species				
Others*	46	12 (0.3)	-	-
Ducks	115	32 (0.8)	1.1	0.81 – 3.01
Pigeons	557	482 (11.5)	18.2	15.00 – 21.4
Chickens	4860	1312 (31.2)	1.0	0.71 – 1.29
Turkeys	3093	2368 (56.3)	9.3	8.28 – 10.32 <i>P</i> < 0.05
Season				
Dry	4697	1136 (27.0)	-	-
Rainy	3974	3070 (73.0)	10.7	9.69 – 11.61 <i>P</i> < 0.01
Vaccination status				
Vaccinate flock	3476	736 (17.5)	-	-
Not vaccinate flock	5195	3470 (82.5)	7.5	6.78 – 8.22 <i>P</i> < 0.01
Total	8671	4206 (48.5)		47.45 – 49.55**

* Other species of birds such as Quails, Guinea fowl and Canary

** 95% Confidence Interval on the overall Prevalence of Avian Pox disease (48.5%)

Discussion

The major clinical signs observed for tentative diagnosis of sick birds suffering from avian pox infections ranged from small to large wart-like nodules most commonly found on featherless areas of the skin, usually on the feet and legs, comb and wattle or on the eyelids and base of the beak or to large tumorous growths that completely covered both eyes which may be big enough to impair vision. This report is in agreement with the major clinical signs of avian pox disease in poultry as also reported by Ladds [25]; Young and VanderWerf [26] and Samour [22] who confirmed similar signs as tentative in the diagnosis of avian pox disease in infected birds. Ladds [25] further stated that the lesions may extend into the oral cavity and involve the tongue and palate. Ulceration, hemorrhage and necrosis of the lesions may lead to myiasis and secondary bacterial infections.

The present study revealed an overall prevalence rate of 48.5% of avian pox disease diagnosed during the study period in Gombe State, Northeastern Nigeria. This result is lower than the 80% prevalence reported by Ohore et al. [27] in southwestern Nigeria but higher than the 46.9% prevalence reported by Ameji et al. [28] in Kogi State; 5% prevalence reported by Saidu et al. [29] in Zaria, Northwestern Nigeria and 3.2% prevalence reported by Balami et al. [30] in Maiduguri, Northeastern Nigeria. The difference in the results may be attributed to the periods and type of sample collections as well as the diagnostic techniques applied.

The result of this present study revealed 45.7% fowl pox in male birds and 54.3% in female bird. The recorded avian pox cases among the sexes showed no statistical significant difference ($P > 0.05$) in prevalence rates. This indicates equal chances of infection among both sexes during an outbreak of the infection. Although, it have been previously stated by Alehegn et al. [31] that avian pox disease is more likely to occur in male birds because of their tendency to fight and cause skin damage and where there are vectors of fowl pox such as biting insects that have already harboured the disease, infection can be transmitted onto birds.

The result of this present study also revealed that avian pox disease in turkeys (56.3%) and chickens (31.2%) are mostly reported to the veterinary clinics in the study area when compared to the report of the diseases in other species of birds. This may be due to the fact that the disease is more severe in birds with large comb and wattle which is attributed to both turkey and chickens. However, the result of this study indicated that several avian species are susceptible to fowl pox infection. Alehegn et al. [31] also confirmed that turkeys and domestic chickens are highly susceptible to fowl pox, but the disease also affects other wild birds and to a less extent ducks, geese, pheasants, quail, canaries and hawks.

The result of this study revealed age variations in the prevalence rate of fowl pox disease, the young and growers show prevalence of 44.7% and 41.5% respectively as compared to 13.8% in adult birds.

This finding is in line with previous report by Saidu et al. [29] that reported clinical fowl pox disease in birds less than 10 weeks of age with about 60% of the disease incidence occurring in 2 weeks old chicks with high mortality.

Although fowl pox can occur in all ages of birds, but the younger ones have greater chances of infection during an outbreak as they may not have sufficient antibodies or immunity against the disease and conferred a state of low resistance to the infection which may as well predisposed them to the clinical disease especially where they have close contact with adult infected birds as it is in other infectious avian viral diseases. Okwor et al. [32] have also stated that the period of 7 – 9 weeks of age is the window of age when fowl pox disease can occur if the virus is present in the environment. This is likely the period that the maternally derived antibody has waned away and is no longer protective. Although, other researches have also reported fowl pox disease in adults birds [33].

The result of this study has revealed high prevalence 73.5% of avian pox disease in indigenous breed poultry as compared to 26.5% in exotic breeds. The recorded avian pox cases among the breeds showed statistical significant difference ($P < 0.05$) in prevalence rates. This may be due to the fact that scavenging indigenous or local breeds birds stand the most probable chances of bite from the insect vectors thereby getting the infection since they roam around the bushes around the household as well as stagnant water poles where vectors such as mosquitoes mostly breeds and moreover indigenous poultry are not mostly housed during the nights in most rural settlements. However, Alehegn et al. [31] have stated that fowl pox infection affects lighter poultry breeds as compared to heavier poultry breeds. Moreover, the domesticated indigenous poultry breeds are more likely to be exposed to vectors such as flea because of their poor husbandry systems in rural settlements where majority of farmers rear them.

From this study the seasonal prevalence of avian pox disease in Gombe State Northeastern Nigeria was revealed. It was indicated that the disease is most prevalent during the rainy seasons 73.0% as compared to 27.0% prevalence of avian pox disease in the dry seasons. This may be in connection with the fact that the rainy season creates more favorable breeding habitat for mosquitoes and other biting and sucking flies that can transmit pox virus. It is considered that mosquitoes that feed on birds are the most consistent and efficient transmitters of fowl pox disease. This agrees with similar statement by Medina et al. [14] and Adebajo et al. [13]. It was also noted that mosquitoes can harbor and transmit the virus for a month or longer after feeding on an infected bird [34, 35]. Young and VanderWerf [26], have also observed that fowl pox disease prevalence correlates with rainfall and mosquitoes abundance. Moreover, other blood-sucking insects that are also common mechanical vectors or transmitters of avian pox virus breeds conveniently during a highly humid period of the year, and the rainy season is considered the most favorable season for the breeding of some of these insects especially where there are stagnant water bodies around households where

domesticated poultry are reared. As the birds scavenge for food, they may possibly get bitten by vectors which may have sucked blood of an infected bird. This agrees with similar reports by Mandal and Johri, [36] and Smits et al. [37] who confirmed that avian pox can be transmitted when a blood sucking insects or mosquito feeds on an infected bird that has viremia or pox virus circulating in its blood, or when a mosquito feeds on virus-laden secretions seeping from a pox lesion and then feeds on another bird that is susceptible to that strain of virus. Alehegn et al. [31] also indicated that mosquitoes that feed on birds play the most important role for both disease transmission and long term disease maintenance. Moreover, mosquitoes can harbor and transmit the virus for a month or longer after feeding on an infected bird Alehegn et al. [31].

The result of this present study revealed high prevalence of avian pox disease in unvaccinated birds as compared to the vaccinated ones. This may be due to the fact that vaccinated birds may have developed immunity to the disease after vaccination. Odoya et al. [38] and Okwor et al. [39] have stated that in many parts of Nigeria, commercial poultry flocks are vaccinated against fowl pox either with foreign made fowl pox vaccines or fowl pox vaccines made in Nigeria, while the indigenous scavenging poultry are usually not vaccinated. Vaccination of the commercial flocks has helped to reduce the losses associated with the disease in this population of chickens. Moreover, the fowl pox disease is quite common among the indigenous poultry flocks which are predominantly unvaccinated against the disease [13]. These birds therefore play important epidemiological role in the maintenance and transmission of the virus to the commercial flocks. Unfortunately, in spite of regular vaccination, outbreaks of fowl pox have been reported to occur in some previously vaccinated chicken flocks [31, 40]. Okwor et al. [40] reported that many sporadic outbreaks of the disease in vaccinated poultry flock were attributed to ignorance on the part of the poultry farmers resulting in non-vaccination, improper vaccine storage, and improper administration of the vaccine.

Conclusion and Recommendation

Avian pox is an important relatively slow spreading viral disease that is affecting a wide range of birds worldwide. The primary effect of the disease is that it predisposes birds to secondary diseases by creating opportunities for the introduction of pathogens and weakening the immunity of infected birds. It is also considered an economically important disease in countries like Nigeria in which around 98% smallholder poultry production systems range from backyard semi-intensive to extensive system. The poultry reared under the extensive system are more exposed to the disease because they are in close association with mosquitoes and other vectors especially where the environment provided favorable breeding habitats. The major economic significance of avian pox disease is that of mortality mainly due to secondary bacterial infections and reduction in the productive performance of the birds.

It therefore recommended that ideal poultry husbandry and other management practices should be implemented in poultry production areas to prevent the incidence of the disease by improving the hygiene of birds. Vector transmission should be prevented by controlling mosquitoes and other blood sucking insect vectors breeding habitats. A well-organized avian pox vaccination programme should be practiced in both indigenous and exotic poultry breeds production systems to develop the immunity of birds. However, thorough scientific investigations should be carried out especially on wild strains of avian pox viruses as much of the information on avian pox viruses is limited in poultry production in Nigeria.

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