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Outbreaks of Highly Pathogenic Avian Influenza (H5N1) in Bauchi State, Nigeria

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Abstract: Natural outbreaks of highly pathogenic avian influenza disease were recorded in 19 farms in Bauchi State, Nigeria, between February and May, 2006. The disease was diagnosed by the National Veterinary Research Institute, Vom, Nigeria and the Food and Agriculture Organisation Reference Laboratory in Padova, Italy. Nine avian species of different ages and sexes involved in the outbreaks included commercial and local chickens, ostriches, emus, guinea fowls, geese, pigeons, turkeys, ducks and crowned cranes. A total number of 176,426 birds were lost, which constituted about 1.5% of the total poultry population in the state. Of these, 67,058 (38%) died naturally of the disease, while 109,368 (62%) were destroyed in order to stamp out the disease. Clinical signs and post-mortem findings of the disease included cyanotic comb and wattles, dyspnoea, subcutaneous haemorrhages, regression and necrosis of ovaries. All blood samples obtained from personnel involved in the containment of the disease in the state and screened for H5N1 virus were negative. In conclusion, the potential risk of human infection by the virus in the state exists and the present outbreaks caused serious socio-economic damage, which adversely affected the livelihood of poultry farmers and the poultry business in the state.

Key words: Avian influenza, H5N1, Bauchi state

Introduction

Avian influenza (AI), commonly known as "Bird Flu" is an infectious disease of birds caused by specified viruses that are members of the family *Orthomyxoviridae* and placed in the genus *influenza virus* A. There are three influenza genera, A, B and C; only influenza A viruses are known to infect birds. Although birds are thought to be susceptible to infection with AI viruses, many wild bird species carry the viruses without any clinical manifestation of the disease. Chickens, quails and turkeys are especially susceptible while ducks more commonly show no disease, but act as a reservoir for the virus (Martin *et al*., 2006). Other poultry species, including guinea fowls, pheasants and ostriches can become affected. At present AI in poultry manifests itself in two distinct forms, the common and mild form, known as the low pathogenic avian influenza (LPAI) and the rare, but highly lethal form referred to as highly pathogenic avian influenza (HPAI). The HPAI was first identified in Italy in 1878 (Bankowski, 1981; WHO, 2006). However, the disease occurs worldwide. The disease attracted public health interest when the first documented case of human infection with the virus occurred in Hong Kong in 1997 and coincided with the epidemic of HPAI H5NI in birds. Eighteen people were affected and six of them died. Genetic studies indicated that the virus was transmitted to humans from birds (WHO, 2006). Also in 2003, H7N7 strain caused the death of one veterinarian and mild illness in other 83 people in the Netherlands (Umoh, 2004). Since the emergence of AI in Southeast Asia in 2003, the disease has swept across Asia, Europe and Eurasia and Africa. Over 220 million birds have died from the disease, either through infection or culling efforts to contain and prevent further spread of H5N1 virus (USAID, 2008). This poses a serious threat to the livelihood of poultry farmers, economic growth and overall sustainable development. Due to the rapid spread of the H5N1 virus, there is a growing concern that the disease could develop into a global human pandemic with the potential to kill people in millions. As at December 4, 2007, there were 336 confirmed human cases of AI (H5N1) reported to WHO from different countries, including Azerbaijan, Cambodia, China, Djibouti, Egypt, Indonesia, Iraq, Laos, Nigeria, Thailand, Turkey and Vietnam; of these cases, 207 (61.6%) people had died. Avian influenza H5N1 has been detected in wild birds and poultry populations in 57 countries on three continents, with recent outbreaks in Korea, Thailand, Vietnam, the UK, Turkey, Pakistan, Hungary and Russia (Centers for Disease Control and Prevention (CDC), 2007a,b; World Organisation for Animal Health (OIE), 2007). The United States, the WHO, FAO, OIE, other governments and the World Bank are currently and closely working on Global Programme for AI and human pandemic preparedness and response, GPAI (USAID, 2008).

Table 1: Farms and avian species affected in 2006 outbreaks of Highly Pathogenic Avian Influenza in Bauchi State, Nigeria

		Chickens													
Farms	Date of reporting	Layers	Parent stock	Chicks	Growers	Local chickens	Turkeys	Guinea fowls	Ducks	Pigeons	Geese	Ostr-iches	Emus	Crown cranes	Total of birds on farm
F1	11/02/06	66,804	-	13,063	52,217	-	-	-	-	-	-	-	-	-	132,084
F2	15/02/06	-	-	-	-	310	-	47	4	-	-	-	-	-	361
F3	17/02/06	-	9,250	-	-	-	-	-	-	-	-	-	-	-	9,250
F4	17/02/06	-	-	-	5,000	-	-	-	-	-	-	-	-	-	5000
F5	23/02/06	126	-	-	-	-	-	-	-	-	-	-	-	-	126
F6	15/03/06	1,906	-	1000	-	62	56	-	83	-	-	-	-	-	3,107
F7	22/03/06	850	-	-	-	-	-	-	-	-	-	-	-	-	850
F8	23/03/06	830	-	-	-	150			30	-	-			-	1,010
F9	24/03/06	-	-	-	-	-	1	2	-	-	2	10	18	5	38
F10	05/04/06	2,250	94	3,180	-	-	-	-	-	-	16	5	-		5,545
F11	10/04/06	-	-	-	-	-	-	-	-	20	-	-	-	-	20
F12	14/04/06	-	-	-	-	-	-	-	-	100	-	-	-		100
F13	17/04/06	-	-	-	16,228	-	-	-	-	-	-	-	-	-	16,228
F14	23/04/06	1,082	-	-	-	-	-	-	-	-	-	-	-	-	1,082
F15	30/04/06	570	-	-	-	-	-	-		-	-	-	-	-	570
F16	04/05/06		-	-	-	5	-	-	-	-	-	-	-	-	5
F17	05/05/06	193	-	-	-	-	-	-	-	-	-	-	-	-	193
F18	05/05/06	-	-	-	-	-	-	-	-	350	-	-	-	-	350
F19	14/05/06	-	-	-	507	-	-	-	-	-	-	-	-	-	507
Total		74,611	9,344	17,243	73,952	5270.3	57	49	117	47	18	15	18	5	176,426
Percent of total		42.34	5.3	9.8	41.9	0.03	0.03	0.03	0.07	0.3	0.01	0.01	0.01	0.003	100

Serious global attention was focused on Africa when the first case of highly pathogenic influenza. A subtype H5N1 was officially documented and confirmed in Kaduna State, Nigeria in February, 2006. Up to December, 2007, there was only one officially recorded human case of HPAI in Nigeria. The potential devastation from emergence of a pandemic strain in Africa has led to a sudden shift of public health focus to pandemic preparedness (Breiman *et al*., 2007).

The aim of this case report was to highlight the practical experience encountered in handling the HPAI outbreaks in Bauchi State of Nigeria by presenting vital clinical and post-mortem signalment of the disease, provide epidemiological data and the husbandry practice that accompanied these outbreaks and also to stress the public health significance of the HPAI. This is in accordance with the recommendations of the FAO and OIE which stated that "data collected on disease outbreaks, spread and transmission, as well as surveillance and ecology data should be coordinated by a central body and be openly shared and easily accessible" (FAO and OIE, 2006).

Materials and Methods

Description of outbreaks area and case history: The affected area is Bauchi State of Nigeria, comprising twenty (20) local government areas, located at 9°15/E - 10°43/E and 9°5/N - 12°45/N in the Northern Guinea and Sudan Savannah Zones of Nigeria. The state has an estimated population of 4.5 million people, with an annual rainfall of between 875 - 1,075mm. Most of the rain falls between June and September, although the rainy season begins actually in May. The hottest month is April, that is, just before rainfall. Maximum shed temperature recorded was 39.6°C (Ruben, 1978). The state has an estimated poultry population of 11.6 million according to the Nigerian Federal Department of Livestock and Pest Control (FDLPC, 2006) and the major economic activities in the area are farming and livestock production.

The first suspected case of HPAI outbreak in Bauchi state occurred in Toro local government area and was reported on February 11, 2006 directly to the Veterinary Directorate at the Headquarters of the Ministry of Agriculture and Natural Resources, located in Bauchi town. Subsequent cases from all over the state were reported to the Area Veterinary Officers or directly to the Ministry Headquarters. The data on the report were compiled and then classified according to farms, bird species and their uses, month and week of outbreak. Due to legislative and private reasons, all the names and respective addresses of affected farms were encoded as farm 1-19 (Table 1).

Management of outbreak: When each case was reported, a rapid response team, consisting of 6 persons: 3 veterinary doctors, medical personnel, livestock superintendent and a labour worker, was mobilized and sent to the affected area with the appropriate personal protective equipment and other logistics as recommended by the WHO (2006). Faced with a presumed AI outbreak, all necessary precautions were taken on visitation to sites of outbreaks. Farms were carefully observed for elements of biosecurity such as fencing, footbaths with disinfectants and general management practice. Affected birds were physically examined for signs of the disease, while up to 5 dead and moribund birds (chicken, duck, turkey, pigeon, emu and ostrich) were collected for post-mortem examination. A sample of 3-5 dead birds was immediately collected in ice-packed Coleman-boxes and sent to the Viral Diagnostic Laboratory, National Veterinary Research Institute (NVRI), Vom, Nigeria for diagnosis. At the same time, an "Avian Influenza Epidemiological Inquiry Form" was issued to the

Fig. 1: Sudden high mortality from HPAI.

Fig. 2: Swollen and cyanotic comb and wattles in HPAI infected layer.

affected farmers for data collection. The form was a 12-paged questionnaire on information about a farm. It included type and location of farm, number of birds and species, type of hatchery, source of birds, debeaking operations, housing system, other birds and animal species (captive or free) present on site, movement of birds, eggs, people, vehicles in and out of the farm and relationship with other farms. Other required information included history of diseases, vaccinations and treatment and also records of mortality in the farm.

Decision to depopulate stock was based on a six-statement case definition: The mortality rate in poultry higher than 50% in two days; death of other birds on the farm (geese, ducks, pigeons, guinea fowls, turkeys, etc); several wild birds or water fowl found dead in the neighbourhood over the past week; death of chickens vaccinated against Newcastle disease over the last six months; presence of other cases of mortality in chickens in the same village over the past week; declaration of the disease in the state (FDLPC, 2006). Whenever three or more of the above statements were "true", a tentative diagnosis of HPAI was made and decision to depopulate stock, decontaminate farm and compensate owners was taken. Suspected farms were quarantined until laboratory results were received or until further notice. If only one or two statements were true, farms were not depopulated but treated accordingly.

Birds were depopulated mainly by slaughter or were placed in polythene bags (if less than 4 weeks of age) and transported to burial sites. Decontamination of affected areas was conducted at an interval of 3-7 days after depopulation. Surfaces were cleaned of organic materials (litter, manure, feathers, egg shells, etc). Disinfectants such as Diskol® and Morigad® were applied according to instructions of the manufacturer, using portable or back pack sprayers.

All further control measures taken were in accordance with the manual "HPAI Standard Procedures", published and issued in February, 2006 by the Federal Ministry of Agriculture and Rural Development in conjunction with the National Animal Diseases Information System (NADIS) and the Pan-African Programme for the Control of Epizootics (PACE), Abuja, Nigeria.

Clinical signs: The clinical signs observed generally appeared to be in 3 systemic forms, the respiratory, enteric and reproductive forms. Some birds died without premonitory signs or with minimal signs of depression, inappetence, abnormal silence in flocks, huddling, ruffled feathers and fever (Fig. 1). The prominent clinical signs in most outbreaks were cyanotic and oedematous eyes, combs and wattles. The wattles were in some cases extremely enlarged, while others showed either necrotic or had petechial or ecchymotic haemorrhages at their tips (Fig. 2). The signs observed were in agreement with the findings of Geering *et al.* (1995), Adene *et al.* (2006) reported similar observations in another outbreak of HPAI disease in Kaduna State, Nigeria. Dyspnoea, sneezing and coughing with nasal and ocular discharges were prominent. Sinusitis was particularly common in turkeys and ducks with mucoid ocular-nasal discharges. There was also profuse watery greenish or yellowish diarrhoea. Discolouration of the shank and feet was readily seen. Hens layed at first soft-shelled eggs followed by sudden drop in egg production and later total cessation of laying. In broilers, the signs of the disease were less conspicuous, but severe

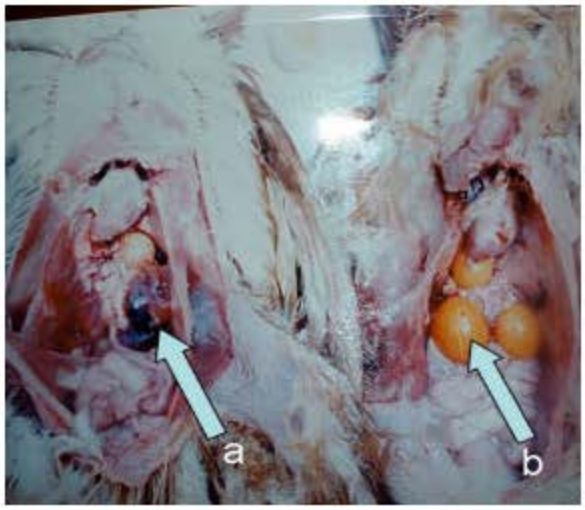

Fig. 3: Regression and necrosis of ovaries in a HPAI infected layer . b) Normal condition of organ.

depression inappetence and high mortality were the most noticeable changes. Sick birds often sat or stood in a semi-comatose condition with little or no response to events around them. Birds with serious difficulty in breathing stretched their necks forward with open mouth and the head sometimes rested on the litter. Younger birds and those that survived the acute phase of the disease showed neurological signs, including ataxia, convulsion and torticollis.

Postmortem findings: Lesions at postmortem examination also varied with systems and organs involved. Birds that died of peracute form of the HPAI showed minimum gross pathologic changes, predominantly congestion of viscera and muscles and sings of dehydration. The larynx and trachea were haemorrhagic or congested with mucoid exudates. The lungs were congested and oedematous with the air sacs cloudy or even darkened. Ecchymotic or pin-point haemorrhages of the epicardial fat and the proventricular junction were observed prominently. Extensive subcutaneous haemorrhage around the entire breast muscle and some featherless parts of the body was evident in many carcasses of the affected birds. There were remarkable petechial and ecchymotic haemorrhages of the abdominal fat and serosal surface of the intestines. The liver and spleen were fragile with grey or yellow necrotic foci and in some cases were enlarged. These findings were also reported by Martin *et al.* (2006). The kidneys were congested and swollen. The ovarian follicles showed a great deal of regression and some ovaries were necrotic with presence of whitish exudates in the oviduct (Fig. 3). Soft-shelled or shelless eggs were occasionally found in the oviduct.

Diagnosis: The disease was diagnosed initially by the NVRI, Vom, Nigeria and later by the FAO Reference Laboratory in Padova, Italy. All laboratory results from NVRI, Vom, were sent to the AI Management Crisis Centre in Abuja, Nigeria and a copy to the Headquarters of Ministry of Agriculture and Natural Resources in Bauchi State.

Results and Discussion

For the period when this report was compiled (February-May, 2006), only 4 out of the 20 LGAs of the state were affected, namely Bauchi, Katagum, Tafawa Balewa and Toro (Fig. 4). Nineteen affected farms were recorded during the outbreaks in the State. A total of 176,426 birds of different ages and species were affected in the outbreaks. These included commercial and local chickens-99.58 %, ostriches-0.01 %, emus-0.01 %, guinea fowls-0.03 %, geese-0.01 %, pigeons-0.3 %, turkey - 0.03 %, ducks - 0.07 % and cranes - 0.003 % (Table1). Of these, 67,058 of the birds died naturally while 109,368 (38%) were destroyed. The highest occurrence rate of the disease was noted in the second, seventh and twelfth weeks of outbreaks (3 cases each) while in some weeks of the crisis period, there were no reported cases (Fig. 5). There was no significant difference in the pattern and course of the disease in the affected local governments, possibly because of the similar husbandry practice in all affected farms in the areas.

According to the FAO/OIE recommendations (2006), management of HPAI disease caused by H5N1 virus must be based on improved biosecurity and hygiene at the commercial poultry production level and in all other poultry sectors. However, despite the fact that about 70% of the farms were commercial, records of farm activities were defective or unavailable in these farms. Over 90% of the cases were reported between one to five days after birds have started dying in the farms. The onset of the disease was sudden in 80% of the affected farms, recording a mortality rate of up to 70% in 3 days. Only 15.8% of the 19 farms involved in this report had constant veterinary doctors attached to them for professional care and advice. All other farms were self-managed with no expert consultation.

Indiscriminate use of antibiotics, poor vaccination schedule and total absence of the concept of biosecurity were common facts among the farms. Farms 4, 6, 8, 9 and 10 had different species of birds housed on the same site (Table 1). Some of the affected farms, for example 6 and 9, were owned by single individual, who frequently used the same vehicle, feed store and equipment for management of farms despite the long distance between them (up to 20 km). Farms 8 and 9 were located separately at about 1 km distance and were infected within the interval of one day (Table 1).

There was indiscriminate use of egg crates by egg

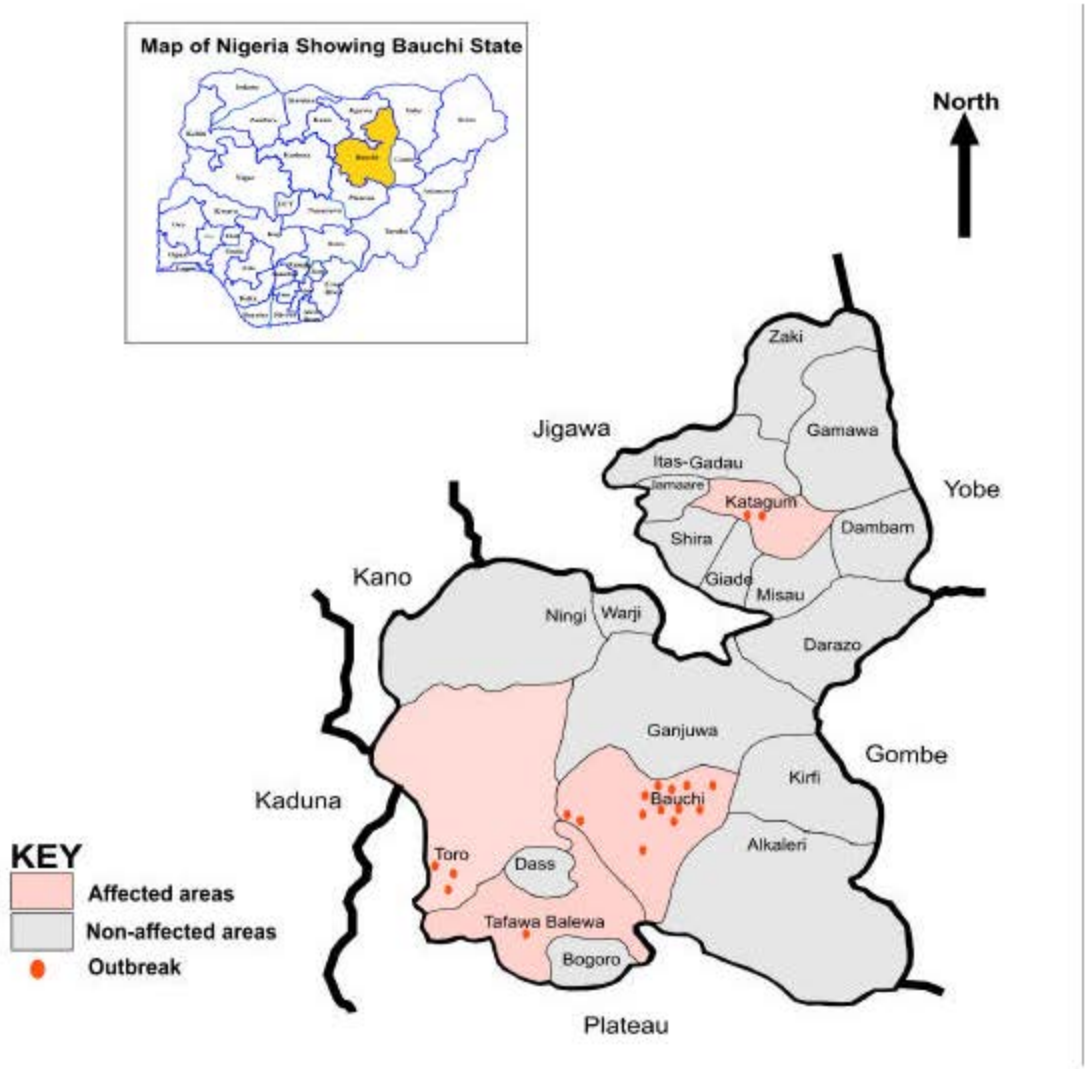

Fig. 4: Geographical distribution of 2006 outbreaks of highly pathogenic avian influenza in Bauchi State, Nigeria. Coloured areas indicate the four affected local governments in the state.

dealers who used their crates between states and farms for eggs. Illegal commercial and local movements of live birds still continued between states even after restriction by law. However, in some farms where biosecurity was in place, birds were protected from the disease despite their closeness to other affected farms (2 km). Many of the farms could not be visited on time even after the report of an outbreak due to lack of logistical support. Depopulation procedures took place between 2-7 days after each report while decontamination usually took longer period (up to 7 days) after stamping out.

Dead birds were disposed at burial sites in pits. The sites were compromise environment as designated by the local authority or at the site of each outbreak. The pit for burial was 2 meter wide and 2 meter deep for every 300 dead birds. Dead birds were burnt first before burial.

There was constant monitoring of all people in contact with the affected birds or farms for evidence of any respiratory disease. Blood samples from doctors and other personnel involved in the containment of the HPAI in the State were screened for the H5N1 virus by a team of veterinary and medical experts from CDC Atlanta, USA, who visited the State during the period of the outbreaks. No human case was recorded in the screening exercise, apparently because of the enlightment campaign in the state on the dangers of AI and the use of personal protective equipment by those involved in the handling of the outbreaks.

Conclusion: It was difficult to ascertain the precise source of the disease into Bauchi State. However, epidemiological investigations attributed the introduction

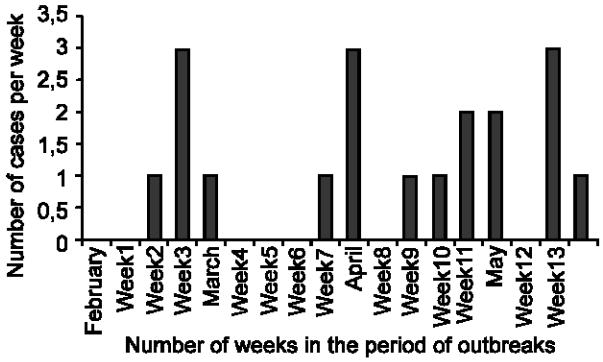

Fig 5: Total weekly confirmed cases of highly pathogenic avian influenza subtype h5n1 infection during the outbreaks of the disease, February to May, 2006 in Bauchi State, Nigeria.

of the H5N1 virus into the state to inter-state poultry trade, coupled with poor sanitation and biosecurity among poultry farms. Before the onset of the present outbreaks, AI was already declared in Kaduna, Kano and Plateau states that share border with Bauchi State (Fig. 4). Due to poor veterinary infrastructure and maiden nature of the HPAI in the state, the lack of structured surveillance programme including surveillance protocols in suspected or high-risk farms, absence of adequate legislation and difficulties of enforcement of existing ones and also the lack of full preparedness against the disease, negatively affected efficient containment of HPAI in Bauchi State. The report by Wee *et al*. (2006) on an outbreak of HPAI in the Republic of Korea similarly indicated poor sanitation in some poultry enterprises, common use of excrement-disposal equipment among farms and the reuse of disposable egg trays as some of the factors that hampered the prevention and control of the disease. The authors also shared the view of Martinot *et al*. (2007) that the strengthening of veterinary infrastructure worldwide will not only minimize the risk of HPAI, but will also provide the early detection and rapid response capabilities for future emerging diseases. All the above mentioned factors might have contributed to the severe nature and rapid spread of the disease in Bauchi State. Despite the lack of human case in this report, the danger of human infection by the H5N1 virus exists in the state and there is an urgent need for more funding, adequate prevention and control measures in order to circumvent the spread of the H5N1 virus in Bauchi state and in Nigeria at large.

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